HEALING AFTER THE FALL

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after the
FALL

Book Four of *THRIVING after the FALL*

Directed and produced by Thomas Schindler

Written by an LLM with the support of humanity

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Preface: Before the First Patient

Put two fingers on the inside of your wrist, just below the thumb, and wait.

You will find it inside ten seconds. Sixty to eighty times a minute, if you are sitting down and well. It has been counted at bedsides for more than two thousand years, by the hand, against the breath, against a sandglass, against the physician's own pulse, and for most of those centuries it was the only instrument in the room. The hand that counts it can also feel whether the skin is hot or cold, dry or wet, and whether a pinch of it falls back at once or stays standing like a tent. Those three things, the count, the warmth and the pinch, are a good half of what a healer needs to know about a sick child, and they cost nothing, and they are in your hand now.

Now follow a tablet of amoxicillin, the one in the blister pack at the back of the bathroom cabinet. Before it reached you it sat in a pharmacy, and before that in a wholesaler's warehouse, and before that in a lorry from a packing plant, and before that it was a white powder made in a fermentation hall in Shandong or Gujarat from a mould that Alexander Fleming noticed on a dish in London in 1928 and that nobody could make in quantity until a team in Peoria, Illinois, found a better strain on a rotting melon in 1943. Between the melon and your cabinet lie a factory, a chemical works, a patent, a regulator, a ship, a road, a fridge and several thousand people you will never meet. Behind the syringe lies a plastics plant. Behind the vaccine lies a cold chain that runs unbroken from a bioreactor to a nurse's fridge. Behind the surgeon lies a hospital, and behind the hospital lies everything.

This is a book about what happens when the chain breaks. It is also, and mostly, a book about what happens next: about how a household, a village and a district look after their sick, their hurt, their labouring, their

frightened and their dying with what is left, which is hands, water, salt, soap, fire, cloth, a garden, a still, whatever was salvaged, and this book.

The premise, once

We had better say the hard thing early and then not keep saying it.

The series this book belongs to takes it as given, on the evidence, that there is a real chance the long chains will not hold through this century. The first book asked how we eat well afterwards. The third asked how we decide. This one asks the question that is waiting in every village on the second day, before the bread and before the vote: who looks after the sick, and with what.

The book does not argue the premise. There are shelves of books that argue it. This one starts on the other side, in a sickroom, with a question that turns out to be more interesting than the one everybody asks.

The question everybody asks is: who will treat us? It has an honest answer, and the answer is nobody, in the sense they mean. There will be no doctor. There will be no pharmacy. There will be no laboratory, no scan, no blood bank and no ambulance. Anyone who tells you otherwise is selling a different book.

The question this book asks is: what can hands do, and how much?

What the hands can do

I want to give you the size of it, because the size is the point, and because numbers set down plainly are calming in a way that adjectives are not.

A village of three hundred people, with no hospital and no medicine, loses between five and nine of its people in a year. Seven to nine in a hot country, five to seven in a cold one. Three or four of them are children, and most of those children die of three things: a chest that breathes too fast, a gut that empties too fast, and a fever. The adults die of birth, of wounds, of the long illnesses and of old age, in roughly that order of how much can be done about them.

The library behind this book, a hundred and sixty-three reports on what has been tried and what the record shows, agrees from several direc-

tions on one figure. Twenty things, most of them done with clean hands, a cup, a watch and a bar of soap, each of them learnable in between eight and forty hours, prevent about a third of those deaths in the hot village and about a fifth in the cold one. Not the sum of the twenty, because the same child is saved once. The whole of what this book teaches, the twenty things and everything after them, saves a fifth to a third of the village's dead. Not more.

Say it again, because the book will not say it after this. A fifth to a third. Two of the seven. The other five die, as they died for all of human history until about 1940, and the book will tell you how to make their dying easier and no more than that.

Here is what the two lives cost. A child who breathes more than fifty times a minute, counted against a watch for one full minute, has pneumonia until proved otherwise, and one cheap antibiotic given by weight, by a village woman who cannot read a prescription but can count, cuts the deaths from about thirteen in a hundred to under one. A child who is emptying from the gut gets a litre of clean water with half a level teaspoon of salt and six of sugar, by the spoonful, all day, and the deaths from cholera fall from one in two to one in a hundred. A baby put to the breast within the hour of its birth dies at a fourteenth of the rate of a baby that is not. A mother who bleeds after the birth has a womb that is rubbed until it hardens, and six hundred micrograms of a tablet by mouth if the shelf still has one. A limb that is bleeding has a hand pressed on it, and if the hand is not enough a strap and a stick, and nine in ten live if the strap goes on before the shock and one in ten if it goes on after.

Those are the headlines. The book is the rest.

Three readers

The book is written for three people at once, and it is worth knowing which one you are.

The first is the household: one adult and one child who have been shown the card on the wall. They need to know the twelve things never to do, the nine signs that mean "go now", how to mix the salt and sugar, how to wash a hand, and what to do in the first hour after a birth. That is all, and it is a great deal.

The second is the village of about three hundred. It has a pair of healers with about three hundred hours of training between the classroom and the bedside, a birth attendant, two copies of this book, a shelf of salvaged medicine that has been counted and locked and written down, a garden of some seven hundred square metres, a still, and a register in which every birth, every death and every week's fevers are entered in an hour on Sunday. The village is the book's main reader. The first five parts are written to be drilled by its healers in the order in which they save lives.

The third is the district of about three thousand, ten villages or one small town. It has one trained team, a room that can be made sterile, ten beds, a bench with a microscope if one was saved, and the operations that a village must refuse. Most of what the district needs is on the website, in a form that prints on a home printer, because the district's manual dates faster than this book and must be replaceable page by page.

A reader before the Fall can read the book as a history of how people were kept alive for most of the last two centuries, before the hospital took the work away, and as an account of what the hospital hid. The book is written for that reader too, and it apologises to neither.

Two kinds of knowledge, one test

The owner of this series asked for two bodies of knowledge, and the book takes both seriously and trusts neither.

The first is the healing of every people who ever lived: the herbals of Europe and the wise women who used them, the physicians of India and China and the Islamic world, the healers of West Africa and the Andes and the Pacific, the bonesetters, the midwives, the monks with their infirmary gardens. Each of these is examined in three separate parts that are never confused with one another: what it says it does, what the record shows it did, and what it did to people when it went wrong. The theory is not the test. The remedy is tested by the record, and by one signal that the book treats as evidence: when unrelated peoples on different continents reached for the same plant for the same complaint, something is there, and the chemists have usually found it.

The second is Western medicine, and not the hospital of the year this is written, which you will not have, but four parts of it that you can use.

The clinical record of the century before antibiotics, from about 1850 to 1940, when a doctor had diagnosis, nursing, a short list of drugs, surgery and little else, and kept careful notes. The literature of the people who still work without a hospital: the Red Cross, the mission surgeons, the manuals written for villages and for ships at sea. The medicine of the mountain and the expedition. And the trials, mostly from the poorest countries of the last fifty years, that tell which cheap things saved the most lives, because somebody counted.

The test is the same for both. What does it claim, what does the record show, what does the science infer. A remedy enters this book on the record, not on the claim, and every remedy in it carries a grade, a dose, a statement of what it does to you if you get it wrong, and a statement of what it cannot do.

I should say one more thing about the library, since you will be holding the book and not the library. It was written by machines, at the owner's direction, from the sources they could reach, and it has not yet been checked line by line against those sources. Where this book prints a figure that your child's life depends on, that figure either has been checked and the check is written down on the website, or the book says so beside it. Until the check is written down, treat every number as something to confirm, and when the book and your own eyes disagree, trust your eyes and write it down.

No referral

Every book of this kind that came before had a line at the edge of its pages, and the line said: send for help. Send for the physician. Radio the shore. Go to the health centre. Evacuate. The best of them, the one written for the villages of the Sierra Madre in the 1970s, knew it was a problem and tried to say how far away help could be before the rules changed.

The Fall removes the line. There is nobody to send for. So this book does something none of its predecessors did, and it does it for every danger it names. It gives three branches. What to do when help is in time. What to do when help is too late. And what to do when there is no help at all, which is the branch the other books left blank, and which this one fills with the honest answer: what comfort is given, what the family is told,

and what is done for the body afterwards.

What is in the book

The book runs in the order in which lives are saved, and it is arranged in nine parts.

The first is *The Clean Hand and the Count*: soap, water, the sterilised needle, the ten-minute examination, the instruments a village can make, what heals on its own, and how to tell a remedy that works from one that only has a story.

The second is *The Child Who May Die*: the fast breath, the empty gut, the fever, the thin child and the milk. The top of the ledger, where every hour of teaching saves the most.

The third is *Birth*: the nine months, the normal birth, the mother who bleeds, the birth that goes wrong, the first hour and the first month, and a woman's years.

The fourth is *The Village's Defences*: water, waste, nets, the creatures that carry disease, the epidemic and how to close the gate without starving the people behind it, the long infections, and what a village can and cannot do about vaccines.

The fifth is *Injury*: the clock that runs in minutes. Bleeding, wounds, bones, burns, cold and heat, the head and the chest and the belly, the crowd of hurt people and the order in which they are seen, bites and poisons, and the district's knife.

The sixth is *The Long Illness*: the sickroom, the chronic body, pain and skin and gut, eyes and teeth, and walking again. The seventh is *The Mind*, where the book averts the fewest deaths and says so, and where most of the work is company. The eighth is *The End*: the good death, and the body after.

The ninth is *The Shelf, the Garden and the Village*: everything that was salvaged and how long it keeps, the medicines that can be grown and made and tested, the plants that kill and their lookalikes, the healer and how she is trained and paid, the ten-bed infirmary, and the register in which the village keeps its own account and corrects this book.

Each chapter is built the same way. Under its title sits one line that says how fast the thing kills and what to do first. It opens with something

you can feel, count or see now. It widens into the history of the condition and the science of why the care works, with the people who found it out named and dated, because they earned that. It turns, near the end, to the present, to what the hospital hid from us and what it cost. And then it goes to the bench, and the voice changes, and it tells you exactly what to do, in grams and millilitres and minutes, with every dose by the weight of the person, with the ladder of what hands can do and what the shelf adds and what only a hospital could have done, and with the three branches. A reader before the Fall can skip the bench and lose nothing but the doses. A reader after the Fall can go straight to it, by lamplight, with a child on the lap.

What does not work

Every chapter names the thing that does not work, because a book that promised everything would be lying, and you would know, and you would stop trusting the parts that are true.

There is no insulin after the Fall, and a child with the sugar disease lives about a year on the diet, and the diet is hunger. There is no blood to give, and a mother who has lost two litres cannot be given them back. There is no way to open a belly in a village, and the appendix that bursts on the second day kills as it killed in 1890. There is no antivenom. There is no X-ray, and a bone is set by the hand and the eye and checked by the toes. There are no antibiotics once the salvaged ones are gone, and the book gives the arithmetic of how long they last for a village and who gets them, which is the hardest page in it. There is a long list, after the top of the ledger, of things the village can only nurse, and the book teaches the nursing without pretending it is a cure.

And there are things the book does not know, because nobody has written them down yet, and it names those too.

A word about the word

Healing is the wound that closes and the bone that knits. It is also the fever nursed through the night, the child held while the salt and sugar go in, the hand on the forehead, the mad person kept company rather than

chained, the dying person kept warm, and the village that does not fall apart when it loses two of its people in a winter. The Fall is the collapse. It is also the season, when the fevers come and the damp gets into the chest. And it is the old Fall, after which we had to bear our children in pain. The book uses all three and will not stop to explain which one it means. Usually it means all of them.

The good news

It arrives early, and here it is.

It has been done. Not in theory, and not by doctors. In 1971, at a railway town on the border of what was about to become Bangladesh, with three thousand refugees dying of cholera in a camp and no drips to put into their arms, a doctor named Mahalanabis gave them salt and sugar in water by mouth, and three in a hundred died where thirty had been dying. In the hill villages of Gadchiroli, in the 1990s, women who had never been to school counted the breaths of sick children against a watch and gave one antibiotic by weight, and the deaths from pneumonia fell to a fifteenth of what they had been. In the Welsh coal town of Tredegar, from 1890, the miners paid three pence in the pound and hired their own doctor, and by 1933 the scheme covered nearly everyone in the town. In China, in the 1960s and 1970s, a million farmers with a few months of training brought care to villages that had never seen it. In Alaska, in the villages where the sea freezes, a woman hired from her own village and trained sixteen weeks over three years has for fifty years been the only healer for a hundred kilometres. In every one of those places the thing that saved lives was not a drug. It was a person who had been taught to look, to count, and to do one thing, with what was on the shelf.

Nightingale's nurses at Scutari in 1855 did not cure anyone. They washed, they aired, they fed, they turned, and in March a commission flushed the sewers under the wards and cut the windows open. The deaths fell from four in ten to two in a hundred, and the drains and the air did most of it.

That is what hands can do. The rest of the book is how.

Enough history. Wash your hands.

The Wall: The Cards at the Front of the Book

These pages hang on the wall. They are read in the minute when there is no time to read the book.

What These Pages Are

These pages are for the minute when there is no time to read. They stand at the front so they are found first, and they are meant to come out. Hang the wall card and the 5 clock cards where the sick are seen, in good light, beside a clock. Hang the never list where medicines are kept and food is made. Keep the register page with the 5 books. Copy only from the master. Copy the drawings on a grid. 2 people read every number aloud, 1 from the master and 1 from the copy. Date each copy. When a page is corrected, burn the old one. Each card names its chapter at the foot. Read that chapter before the card is needed. Practise each clock card on a doll. Never let a hand skill go 3 months unpractised.

The Wall Card: Send Now

Act on any 1 sign. Write the time. Start the first step. Send word at once.

Count breaths for 1 full minute, never 30 seconds doubled. Press a nail for 5 seconds. Pinch the belly skin. Press a clear glass on any rash.

#	Sign: send now	Pattern
1	Cannot drink or breastfeed. Vomits everything	Intake
2	Dry: skin pinch back in more than 2 seconds. Sunken eyes. No wet nappy for 6 hours	Intake
3	A baby hot or cold (lines below). Under 3 months, any fever	Infection that has left its place
4	Fast breathing (lines below). Deep indrawing. Grunting. Blue lips	Breathing
5	A fit. Floppy, or will not wake	Brain
6	Stiff neck. Bulging soft spot. A rash that does not fade under a glass. 1 case is the village's alert	Infection that has left its place
7	Cold hands. A pressed nail takes over 3 seconds to pink in a warm room	Circulation
8	Bleeding that soaks a cloth in minutes. A pulse rising with no wound to press. A belly hard as a board with a pulse over 120	Hidden bleeding

#	Sign: send now	Pattern
9	Redness spreading from the cord, or over 5 cm from a wound, or a red line up a limb	Infection that has left its place

Age	Breaths in 1 full minute	Hot or cold
Under 2 months	60 or more	37.5 °C or more. Below 35.5 °C, or 36 °C with belly and feet both cold by touch. Disputed, both printed
2 to 11 months	50 or more	Under 3 months: any fever
1 to 5 years	40 or more	
Adult	30 or more, or 22 or more with new confusion	

Child 6 to 59 months: arm under 115 mm, or pits on both feet. Newborn: the 7 signs (11.1).

Also send now.

1. Birth: 500 ml of blood, or 300 ml with a pulse over 100. Placenta not out at 30 minutes. Active labour over 12 hours in a first birth, 10 in a later one.
2. Burn: a child 10% or more, an adult 15% or more. Any burn bigger than the child's own palm goes to the healer.
3. Bite or sting: lips or throat swelling (22.2). Snakebite: keep the limb still, no band. Dog bite: soap and running water 15 minutes.
4. A stiff jaw after a wound (18.7). One pupil wider after a blow to the head. One side weak.
5. Talk of killing themselves: sit in private, ask plainly. Never leave a person with a plan alone (30.6).

Watch, and look again today. Pinch falls back slowly, thirsty: Plan B, 75 ml for each kg over 4 hours (05.3). Nail over 2 seconds to pink. Blood in the stool: the dispensary today.

When help is far. Help in time: carry now, warm, with a note of the time, the counts and every dose. Help too late: tell the family the illness moved faster than any carrying. No help at all: warmth, sips if able to swallow, someone stays day and night. Tell the family nothing they did caused it.

From chapters 2, 4, 5, 6, 7, 8, 9, 11, 15, 18, 20, 21, 22 and 30, after SY-07.

Clock Card 1: Bleeding From a Limb

Never lift the cloth to look before 10 minutes. Instead, put a fresh cloth on top and press harder.

Never tie cloth without a rod. It fails 79 times in 80. Instead, use the rod.

Clock	Do
0	1. Shout for help. Note the time. 2. A folded clean cloth on the wound. Heel of the hand, elbow locked, your weight over it
0 to 10 minutes	3. Press at least 3 minutes. Aim for 10. 4. A deep hole in a limb, armpit or groin: push cloth in, down to the bleeding, until it stands 2.5 to 5 cm above the skin. Press 3 minutes more. Bind it firm

Clock	Do
Still bleeding	5. Tourniquet. A band at least 5 cm wide, a hand's width better. The library's floor of 3.8 cm is untraced. Place it 5 to 7.5 cm above the wound, above a knee or elbow, never on it. 6. Half knot, rod, full knot. Twist until the bleeding stops and no pulse is felt below. It hurts. Keep twisting. Tie the rod down. 7. Write TQ and the time on the forehead and the band. Still bleeding: a 2nd band just above. Send for the district now
Every 15 minutes	8. Count pulse and breaths. Write each with the time. Check the band. Alarm: a pulse over 100 and rising, or the wrist pulse gone. Lay flat. Cover. Never warm a limb under a band
Up to 2 hours	Review. Convert if allowed
2 to 6 hours	Convert only if allowed. Else carry
Over 6 hours	Do not loosen. Leave it for the surgeon

Convert only if all 4 hold: a strong wrist pulse and a clear mind, someone to watch 2 hours, no limb torn off, on under 6 hours. Only the healer trained in it converts. The tourniquet is the village's standing default. Never a band for a snakebite (chapter 22).

Help in time. Carry flat to the district, which ties the vessel, with a card of every time and count. **Help too late.** Over 6 hours, do not loosen. A dead limb: leave the band on. **No help at all.** Flat, warm, covered. Sips if awake. Someone stays.

From chapter 18 (18.1 to 18.3, 18.6). Chest, belly and head: chapter 21. After a birth: card 2.

Clock Card 2: Bleeding After Birth

Never give a drug to tighten the womb before the last baby is born. Instead, feel the belly for another baby. If unsure, give no drug and rub.

Never raw ergot. Never ergometrine when the pressure is high. Never veterinary oxytocin in a woman. It is twice the strength. Instead, misoprostol and the hands.

Clock	Do
Every birth	1. Feel for another baby. Then misoprostol 600 μg, 3 tablets of 200 μg, by mouth, once. 2. A bowl marked at 300 and 500 ml under her. A clock in sight
First hour	3. Feel the womb every 5 to 10 minutes. Hard like a fist, at or below the navel. Then every 15 to 30 minutes for 1 to 2 hours
Danger, any 1	500 ml, whatever the pulse. 300 ml with a pulse over 100. A cloth soaked in minutes. A womb soft again. Cold pale skin, thirst, confusion or fainting
Minute 0	4. Shout. Note the time. Someone stays with her. 5. Rub the womb firmly in circles until hard. Push out clots. 6. Misoprostol 800 μg, 4 tablets, under the tongue, once, only if none was given at the birth. Not after 600 μg. 7. Help her pass urine. Baby to the breast. 8. Flat, legs raised, covered, warm. Sips if awake and able to swallow
Every 5 minutes	9. Count the pulse. Write it with the time

Clock	Do
10 minutes	10. Still bleeding: bimanual compression, by the trained birth attendant or the healer. Fist in the vagina against the front of the womb, the other hand on the belly behind it. Squeeze. Swap every 2 minutes. On the road: a fist above the navel, weight straight down
30 minutes, placenta not out	11. Baby to the breast, bladder empty, upright or squatting. Wait, rub, watch
60 minutes, or heavy bleeding	12. The healer removes it by hand, gloved, following the cord. It will not come: stop, compress, send

Adult doses, the same for every mother. No weight bands. Work every dose twice, with two people. Oxytocin 10 IU in 1 ml: 10 IU into the thigh, once below the district, only if the village allows injection. Chapter 9 gives it to the healer or the district, chapter 32 to the birth attendant.

Send by distance. Under 30 minutes: carry her now, flat, someone rubbing the womb. 30 minutes to 1 day: a runner now, carry her when the bleeding slows. None: everything here.

Help in time. The bleeding stops, the pulse falls under 100. Check womb and pulse for 24 hours. **Help too late.** She reaches the district in shock. Send a card: times, drugs, doses, the bowl count. **No help at all.** No wrist pulse, she cannot be woken, the bleeding goes on. Keep her warm. Let her hold her baby. Bring her family. Tell them everything was done, and the bleeding was stronger. Find the baby a breast within hours.

From chapter 9 (09.1 to 09.5). Tears: chapter 10. The baby: card 3.

Clock Card 3: The Baby Who Does Not Breathe

Never hold a newborn upside down, slap it, or blow from your chest into it. Instead: dry it, rub its back, give small puffs from your cheeks.

Ready before every birth: room 23 to 25 °C, 2 warmed cloths, a hat, a boiled blade and strings.

Clock	Do
0 to 30 seconds	1. Dry the baby on the mother's belly. Wet cloth off, hat on. Breathing or crying? Yes: skin to skin, the first hour
30 to 60 seconds	2. No: rub the back firmly. Count 10
60 seconds	3. Not breathing: cut the cord. Firm warm surface, rolled cloth under the shoulders, head straight.
	4. Your mouth over nose and mouth. Puff only what your cheeks hold. 3 to 5 slow breaths, then about 30 a minute. With a bag: 40 to 60 a minute
No chest rise	5. Straighten the head, wipe the mouth, seal again. Suck out only thick green stool
After 1 minute of chest rise	6. Feel the heart for 6 seconds and add a nought. Under 100: go on, check every 3 minutes
Baby cries	7. Stop when the baby cries or breathes 30 or more a minute. Skin to skin. Watch 24 hours
15 minutes	No heartbeat by 15 minutes: stop
20 minutes	Only gasps by 20 minutes: stop

The danger sign: no breath after 1 minute of puffs.

Help in time. A second person takes over. The baby breathes. Skin to skin, watch 24 hours. **Help too late.** No heartbeat by 15 minutes, or only gasps by 20. Stop. **No help at all.** Wrap the baby and give it to the mother. Tell the family: we breathed for your baby, and it could not breathe. Nothing you did caused this. Let them name it.

From chapter 11 (11.2). The 7 signs of the sick newborn: 11.1.

Clock Card 4: The Fit

Never put anything in the mouth or hold them down. Instead, cushion the head and time it.

Never give more than 2 rescue doses. Instead, keep them on the side, count breaths, send.

Never put 50% magnesium into a vein. Instead: the buttock.

Clock	Do
0	1. Write the time. Move fire and sharp things away. Something soft under the head. A child with fever: no drink, no cold sponge, no bath
Jerking stops	2. On the side. Count breaths. Pregnant or just delivered: her left side
5 minutes, or a 2nd fit before waking	3. A rescue dose, by a trained person only. Say the route aloud. Midazolam between gum and cheek. Or diazepam into the rectum, syringe without needle, 1 to 3 cm in, buttocks held 1 minute. No injection. A child with fever: the most skilled help
Still fitting	4. Diazepam again at 5 minutes. Midazolam again at 10 (Hesperian) or 5 (MSF). Never a third
Every 5 minutes for 1 hour	5. Count breaths. Adult under 8: lift the chin, rouse, breathe for them (chapter 21)
30 minutes	Still fitting, or an adult breathing under 8: the danger sign
1 hour	6. A child with fever not alert: treat as meningitis

Read the label: 5 mg/ml. Any other strength: the healer works the ml twice. Work every dose twice, with two people.

Weight	Diazepam 5 mg/ml, rectal	Midazolam 5 mg/ml, cheek	Age, only if no scale
Under 5 kg	0.1 ml per kg	0.04 ml per kg	Under 2 months
5 to 9 kg	0.5 ml	0.2 ml	2 to 11 months
10 to 14 kg	1 ml	0.4 ml	1 to 3 years
15 to 19 kg	1.5 ml	0.6 ml	4 to 5 years
20 to 29 kg	2 ml	0.8 ml	6 to 9 years
30 to 49 kg	2 ml	1.2 ml	10 to 14 years
50 kg and over	2 ml. Healer may give 4 ml. Old: 2 ml	2 ml	Over 14

Diazepam 0.5 mg/kg, ceiling 10 mg under 12 years and 20 mg after. Midazolam 0.2 mg/kg, ceiling 10 mg. 2 doses at most.

In pregnancy or after a birth. A fit, or pressure 160/110 or more. Magnesium sulfate 50%, 500 mg in 1 ml, by the birth attendant. Fixed adult doses, no weight bands.

Step	Dose	Where	Interval	Ceiling
Loading	10 g: 10 ml in each buttock, each with 1 ml of 2% lidocaine	Deep, upper outer buttock	Once	10 g
Keeping	5 g: 10 ml with 1 ml of 2% lidocaine	The other buttock each time	Every 4 hours, after the checks	5 g a dose

Until 24 hours after the birth or the last fit. Before every keeping dose: breaths 16 or more, give. Under 16, hold and recheck hourly. Under 12, emergency. Knee jerks present. Urine 30 ml an hour, 25 in some sources. Emergency: stop, breathe for her with bag and mask, calcium gluconate 10%, 10 ml (1 g), into a vein over 3 minutes, given by whom the village

decides. No magnesium: diazepam 5 mg/ml, 4 ml (20 mg) into the rectum, 2 ml (10 mg) more after 10 minutes, at most 2 doses.

Help in time. Drugs by vein at the district. A mother: loading given, carried on her left side with the check card. **Help too late.** Side, airway, warmth. Tell the family the fit outran what the village holds. **No help at all.** Side, airway, warmth, someone stays. Some fits stop alone. Tell the family nothing they did caused it.

From chapters 25 (25.3), 10 (10.5) and 6 (06.3).

Clock Card 5: The Burn

Never put ice, iced water, butter, oil or paste on a burn. Instead, cool running water for 20 minutes.

Never give plain water as the main drink for a big burn. Instead, give oral rehydration solution (see 05.2).

Clock	Do
0	1. Stop the burning. Roll the person or wrap them in a blanket. Write the time. 2. Clothes, rings and watches off. Leave cloth that is stuck
0 to 20 minutes	3. Cool running water for 20 minutes, within 3 hours of the burn. None running: pour, or renew wet cloths. 4. Keep the rest warm. A child shivers or the lips go blue: stop, dry, wrap. 5. Chemicals: brush off powder, flood at least 20 minutes. Eyes: lids open, 20 minutes

Clock	Do
20 minutes	6. Cover with cling film in strips, a clean bag, or boiled cloth. No film on the face. 7. Count: the person's own hand, palm and fingers, is 1%. Count blistered, white, brown or leathery skin. Red alone does not count
Any time	Fire in a closed room, burns of face or neck, singed nose hairs, soot, a hoarse voice: sit up in fresh air. Send now
First hour	8. A child 10% or more, an adult 15% or more: weigh, start the drink, send for the healer. A cup every 15 minutes
Hours 1 to 8	9. The amount in the table, each hour
Hours 9 to 24	10. Half that
Day 2	11. About a quarter of day 1, plus usual drinks

Millilitres of solution per hour, hours 1 to 8.

Weight	ml per kg per % a day	10%	20%	30%	40%
10 kg child	3	20	40	55	75
20 kg child	3	40	75	110	150
50 kg adult	2	To thirst	125	190	250
70 kg adult	2	To thirst	175	260	350

Urine aim: adults 0.5 ml per kg an hour, 35 ml at 70 kg. Children about 1 ml per kg an hour. Restless, confused, cold hands, no urine: send. Beyond the village: over 40% in a young adult, 20% deep over 60, or age plus % near 100. The lines are the village's choice.

Help in time. Urine at the aim by hour 8, mind clear. Keep the cups going all night. **Help too late.** No urine, cold and confused at the district

door. Send a card: time, size, weight, every drink and void. **No help at all.** A burn beyond the line. Full pain relief, never held back. Drinks if wanted, warmth, family close. Tell them nothing done hastened it.

From chapter 20 (20.1 to 20.3).

The First Year

If the salvage window is closed, start at the first month. No drug is worth a death on the road.

When	Do	Chapter
Day 0	Name a team of 4 to 6, a route and a return time. Water and latrines start the same day	32, 13
Days 0 to 1	Fridges: insulin, oxytocin, ergometrine, toxoid, vaccines, antivenom. Cool box, never frozen. Log hours above 25 °C	32
Days 1 to 6	Hospital pharmacy and theatres (days 1 to 2). Pharmacies and wholesalers (2 to 3). Dentists (3 to 4). Vets and farms, marked VETERINARY in red (4 to 5). Seed and hardware (4 to 6). Surgeries, care homes, households only by agreement (5 to 6)	32

When	Do	Chapter
Day 7	Inspect, quarantine, log each lot. Nothing used unlogged. Keep at 0 to 30 °C, below 25 if possible, humidity 65% or less	32
Week 1	Walk every water source	13
Month 1	Water: 4 ml of 1% stock per 20 litres clear, 8 cloudy. Wait 30 minutes, then smell. Or a rolling boil, 1 minute, 3 above 2,000 m	13
Month 1	Latrines: at least 30 m from water, downhill, the floor 1.5 m above the wettest water table, 50 m in sand. A lid and ash	13
Month 1	Soap: a station by the latrine and the hearth, soap or ash. One soap house, lye locked. 130 g of sodium hydroxide per kg of fat, cured 4 weeks	1
Month 1	The sickroom: chlorine 0.05% for hands and linen, 0.2% for surfaces, 0.5% for spills. Each person kept apart: 2,100 kcal and 15 litres a day	1, 15

When	Do	Chapter
Month 1	The register: open the 5 books. Hang the alert list and this wall	36, 15
Month 1	Healer block 1, 72 hours: the clean hand and the danger sign	35
First season	75 in 100 households using a latrine	13
First season	The garden: plan 700 m^2 for 300. PH-01's 70 m^2 is a teaching bed. The size is the village's. Test 20 seeds on a wet cloth. Never grow foxglove	33
First season	Healer block 2, 72 hours. 4 to 8 weeks of practice at home between blocks	35
First year	The still: copper, never sealed, no flame within 3 m. Sugar or grain only. 25 to 30 l of pure spirit a year for 300. 2 keys in 2 households (chapter 32)	33
First year	Steam: 121 °C, 20 minutes unwrapped, 30 wrapped. Boiling 20 minutes, 10 in some sources, disinfects and never sterilises	1, 18, 23

When	Do	Chapter
First year	Healer blocks 3 and 4, and 12 hours to certify: 300 hours in all	35
After harvest	Copy every register. Keep the copy in another house	36
Year 2	A measles epidemic becomes possible 2 years after vaccination stops	17

From chapters 1, 13, 15, 17, 32, 33, 35 and 36, in the order of SY-09.

The Never List

Every bold never line in the book, as its chapter prints it. Each has its "instead" in its chapter. Where a line needs its subject, the section follows it in brackets.

1. The Clean Hand

Never dry washed hands on your clothes. Never rinse in a shared basin.

Never use methanol or the still's first runnings. Never drink the rub.

Never store lye in a drink bottle, cup or jug.

Never taste lye or soap to test it.

Never pour water onto caustic. Never use aluminium.

Never mix chlorine with vinegar, acid, urine or ammonia.

Never keep bleach in a drink bottle.

Never use one needle or one syringe on two people. Never change only the needle.

Never call boiled, flamed or spirit wiped instruments sterile.

Never use an electric multicooker. Never cool a cooker with water.

2. The Count

Never sweep or vacuum spilt mercury.

Never measure a dose with a kitchen spoon.

Never give a strong drug in drops.

3. Judging a Remedy

Never use foxglove, monkshood, autumn crocus, yew, oleander or thorn apple as medicine (SY-10). Learn each plant to tell it from its lookalike instead.

4. The Breathing Child

Never give anything by mouth to a child who cannot swallow. Wet the lips with a clean cloth instead.

Never give amoxicillin to a child who had a rash, swelling or wheeze after any penicillin. Give co-trimoxazole instead.

Never give honey, water or any feed but the breast to a baby under 6 months. Give the breast often, or expressed milk by cup.

Never give opium, morphine or codeine to a child with a cough. Hold the child upright and give the breast instead.

Never burn charcoal in a closed room. Warm the child against a body and under blankets instead.

5. The Dry Child

Never give anything by mouth to a child who cannot swallow.

Never put anything home-made into a vein or a bone.

Never make a child vomit, and never give salt water.

Never give opium, codeine, loperamide or any drug to stop diarrhoea in a child.

Never give honey under 12 months.

Never starve a child with diarrhoea.

6. The Hot Child

Never round a dose up. Weigh the child and use the band.

Never aspirin under 16, never willow bark under 18. Give paracetamol by weight instead.

Never put anything in the mouth or hold the child down. Cushion the head and turn the child on the side instead.

Never stop quinine at 3 days. Never dose bark in a child by ringing ears. Never give bark after black urine. Give 7 days of a weighed dose instead.

Never measure vitamin A with a spoon or cup. Cut the capsule and count its drops instead.

Never give it to a girl or woman who could be pregnant. Nurse her as below instead. (06.5, vitamin A in measles)

7. Milk and the Thin Child

Never give water, honey or animal milk before the first breastfeed. Put the baby to the breast instead.

Never give honey under 12 months, condensed milk, paps or plain animal milk. Give the table's mix instead

Never make the feed stronger or weaker than the table. Measure every part, every time.

Never feed a thin child to its appetite in week 1. Give small feeds by the clock instead.

Never give iron in week 1 of refeeding. Never to a child who is not pale where malaria is. Use the iron pot instead.

Never leave iron in reach. Lock it in its blister.

8. Pregnancy and the Normal Birth

Never examine inside a woman who bleeds after 20 weeks.

Never leave iron where a child can reach it.

Never put anything on the cord, chlorhexidine excepted.

Never give anything to make labour faster, and never press on the belly.

Never stretch the cervix. Never tell her to push before it is fully open.

Never pull on the cord. Never press the belly to push the placenta out.

9. The Bleeding Mother

Never give a drug to tighten the womb before the last baby is born.

Never raw ergot. Never ergometrine when the pressure is high. Never veterinary oxytocin in a woman. It is twice the strength.

Never press on the belly to hurry the birth.

10. When Birth Goes Wrong

Never give anything to make labour faster. Never press on the belly.

Never pull on a breech.

Never press on the top of the belly.

Never push the cord back.

Never inject any other drug in the village.

Never make injections from Epsom salt.

Never put 50% magnesium into a vein.

Never give an antibiotic without writing the signs down.

11. The First Hour and the First Month

Never hold a newborn upside down, slap it, or blow from your chest into it.

Never put anything on the cord but chlorhexidine.

Never inject a newborn below the district.

Never put a hot water bottle against a newborn.

Never treat yellow with bare sun.

12. A Woman's Years

Never give misoprostol when the cervix is closed and nothing has passed, or when an ectopic is possible.

Never put an instrument into the womb at the village, and never scrape a feverish womb.

Never cut or stitch a fistula without training.

Never douche, with water, vinegar, lemon or herbs.

Never take a plant or oil against pregnancy: pennyroyal, tansy, rue, savin, quinine, neem oil, wild carrot seed.

13. Water and Waste

Never keep bleach or stock in a drink bottle.

Never keep garlic or herb oil.

Never give honey under 12 months.

Never taste a jar to test it.

14. The Creatures

Never burn, grease, squeeze or twist a tick.

Never put kerosene or petrol on hair.

Never trust soap alone to kill lice.

Never treat one person and leave the house.

Never open, skin, butcher or eat an animal found dead.

Never cook that meat with herbs.

Never burn a coil or leaves where people sleep.

Never give neem oil by mouth.

Never wash a treated net in a stream or well.

Never kill rats in a die-off before the fleas.

Never lay rat poison where a child, dog or cat can reach it.

Never feed raw offal to a dog.

Never drink milk unboiled.

Never keep animal drugs on the human shelf.

15. The Epidemic

Never burn charcoal in a closed room. Heat the hut with blankets, warm drinks and a vented fire instead.

Never store bleach in a drink bottle. Keep it locked and labelled in its own container instead.

Never give anything by mouth to a person who cannot swallow. Lay them on the side and wet the lips instead.

16. The Long Infections

Never give a leftover tuberculosis tablet for a cough.

Never start a course you cannot finish. Never rifampicin alone, never isoniazid alone. Never add one new drug to a failing course.

Never walk barefoot on a numb foot. Never test water with a numb hand.

Never treat pain low in a woman's belly as infection until ectopic pregnancy is ruled out.

Never give nitrofurantoin for fever with flank pain.

Never use one needle, blade or razor on two people.

17. Vaccination Without a Factory

Never let toxoid or hepatitis B vaccine freeze. Instead, store it in a cellar or spring box that stays above 2 °C.

Never pack a vial against ice. Instead, wrap it in 2 layers of cloth inside the cool box.

Never inject a vaccine in the village. Instead, bring people to the healer's session at the infirmary.

Never use 1 needle or syringe for 2 people. Instead, 1 new needle and syringe for each person.

Never give the last toxoid to whoever asks first. Instead, follow the order the village agreed aloud.

Never make a vaccine from a scab, a blister, an arm, an animal or a brain. Instead, keep the clean cord (chapter 11), the open wound (chapter 18) and isolation (chapter 15).

Never expose a child to measles or chickenpox on purpose. Instead, keep the sick child apart and nurse them (chapter 6).

Never frozen. (Numbers to Carry, toxoid)

18. Stopping the Bleeding and Cleaning the Wound

Never lift the cloth to look before 10 minutes.

Never pack the chest, the belly or the skull.

Never put a tourniquet on the neck, the trunk, the groin or over a joint.

Never tie a band for a snakebite.

Never tie cloth without a rod.

Never pour hydrogen peroxide into a deep wound.

Never scald, sear or put caustic in a wound.

Never use one blade or needle on two people.

Never close a bite or a dirty wound (SY-10).

Never call a stiff jaw after a wound nerves.

19. Bones and Joints

Never bind a splint tight. Never close a ring of plaster round a fresh break. Never cover a wound without a window. Never push a bone back through the skin.

Never wrap a bandage round a broken thigh before the pull is on. Never put a pin through a child's shin.

Never use force. Never put a heel in the armpit. Never try more than twice.

Never push a bone end back under the skin. Never sew the wound shut.

20. Burns, Cold and Heat

Never guess a burn's size by eye.

Never put ice, iced water, butter, oil or paste on a burn.

Never give plain water as the main drink for a big burn.

Never give anything by mouth to a person who cannot swallow.

Never let a burned joint rest bent in the position of comfort.

Never rub a frozen part, or warm it at a fire or on a hot stone.

Never thaw a part that may freeze again.

Never put a cold person in a hot bath or shower, or heat the arms and legs.

Never delay cooling a hot, confused person to find transport.

Never lay ice packs straight on bare skin.

Never put a hot-water bottle, hot stone or heated brick against numb, sleeping or cold skin.

21. Head, Chest and Belly, and Many Hurt at Once

Never mark anyone beyond help without a second look.

Never give opium, morphine or a sleeping drug after a head injury.

Never give anything by mouth to a person who cannot swallow.

Never leave anyone strapped to a hard board longer than the move takes.

Never bind or strap broken ribs.

Never give a purgative or an enema for belly pain.

Never let the healer be the sorter.

22. Bites, Stings and Poisons

Never inject any other drug.
Never give adrenaline into a vein or a drip.
Never let them stand or walk.
Never cut, suck, burn or ice a bite, and never tie a band.
Never close a bite.
Never kill the dog that bit unless it shows signs of rabies.
Never make anyone vomit. Never give salt water.
Never give anything by mouth to a person who cannot swallow.
Never store lye, bleach or oils in drink bottles.
Never burn charcoal in a closed room.
Never eat a wild root of the carrot family.

23. The District's Knife

Never cut into a belly, chest, skull or eye below the district.
Never give more than the ceiling in one procedure, however many sites.
Never use lidocaine with adrenaline in a finger, toe, ear or penis.
Never cut a swelling that pulses.
Never open a hard swelling under both sides of the jaw.
Never close a bite or a dirty wound (SY-10).
Never give a general anaesthetic without a second trained person on the airway (SY-10).
Never give ketamine in pre-eclampsia.
Never use one needle, syringe or blade on two people (SY-10).
Never take boiled, flamed or wiped for sterile inside the body.

24. The Sickroom

Never keep a sick person's day in your head.
Never an unflued fire where the sick sleep.
Never hot water or stone against skin, under the person, or in bed overnight.
Never rub red skin over bone. Never a ring cushion.
Never drag a person up the bed.
Never feed anyone who cannot be woken to sit up and hold their head.
Never trust a gurgle over the stomach.
Never home-made fluid into a vein or a bone.
Never sugar water under the skin or in the rectum.
Never cold baths, alcohol rubs or ice packs for fever.
Never aspirin under 16.

Never food or drink before the swallow test.
Never get the person up hard in the first 24 hours.
Never one person nursing a bedfast person alone past 7 days.

25. The Chronic Body

Never give adrenaline into a vein or a drip.
Never let them stand or walk.
Never give a tea, a tablet or an antihistamine first.
Never put anything in the mouth or hold them down.
Never give more than 2 rescue doses.
Never stop phenobarbital or bromide suddenly.
Never use steam or eucalyptus.
Never give a sedative or a syrup.
Never give ephedra to a child, a pregnant woman, or without a cuff.
Never put drink or loose sugar into a mouth that cannot swallow.
Never lower insulin because the urine shows no sugar.
Never stop insulin in type 1 because they are not eating.
Never trust an unchecked dial.
Never give potassium salt to anyone with failing kidneys or scanty urine.
Never stop phenobarbital suddenly.

26. Pain, Skin, Gut and the Small Surgeries

Never aspirin under 16, never willow under 18.
Never 2 of aspirin, willow and ibuprofen together.
Never heat on numb skin, the sleeping or the drunk.
Never squeeze or cut a boil beside the nose or on the upper lip.
Never open a swelling in the palm, the neck, or one that pulses.
Never pack an opened abscess.
Never milk and alkali for an ulcer.
Never one antibiotic alone for an ulcer.
Never push on a hernia stuck over 24 hours, red, tender, or with vomiting or fever.
Never a truss over a hernia that does not go fully back.
Never bandage firmly a leg short of blood.

27. Eyes and Teeth

Never put steroid drops into a red eye.
Never couch a cataract.
Never cut or inject into the swelling. (27.2, the swelling under the jaw)

Never pour vinegar, milk or anything else to neutralise a splash in the eye.

Never hold an aspirin against the gum.

Never put a baby tooth back.

Never store lye, bleach or oils, clove oil among them, in a drink bottle.

28. Walking Again

Never force a catheter.

Never use oil or Vaseline on it. (28.2, the catheter)

Never leave the bladder longer than 6 hours.

Never a medicine to stop leaking stool.

Never a hot-water bottle or hot stone on numb skin (SY-10).

Never a ring cushion (NU-01).

Never rub or massage over a bone.

Never an antipsychotic for the agitation of dementia (SY-10).

Never stop a sleeping drug suddenly (SY-10).

29. Trauma, Grief and the Lay Counsellor

Never hold a meeting where people must tell what happened and how they felt.

Never give drink or sedatives to calm the frightened.

Never start with current danger, psychosis, drink or withdrawal, a plan to die, no consent, a day unfed or 2 nights unslept.

Never press the bereaved to tell their feelings.

Never let 1 healer carry the village alone.

Never debrief the healer on the day of a death.

30. The Broken Mind, Addiction and the Wish to Die

Never call new confusion madness until the body is checked.

Never an antipsychotic for agitation in dementia or delirium.

Never 2 antipsychotics together.

Never stop an antipsychotic suddenly.

Never face down.

Never a knee or weight on the back, chest or neck.

Never wrists tied to ankles, never chains or ropes.

Never alone. (30.3, the hold)

Never stop heavy drinking unwatched.

Never a sedative dose under 12 breaths a minute, or if not woken by voice.

Never more than 2 rescue doses for a fit.

Never an antipsychotic alone for withdrawal.
Never the old dose after a withdrawal.
Never raise a sedative to ease its taper.
Never leave a person with a plan alone.
Never a lock box in the house as the answer.
Never speak of the method or the place after a death.
Never alcohol, opium or salvaged pills as a sleeping draught.
Never a sedative for an old person who snores, falls or is confused.

31. The Good Death

Never call a person dying before checking the bladder, the bowel, the pain and the drink.
Never tell a family that nothing more can be done.
Never push food or drink into a mouth that cannot swallow.
Never put a hot bottle against a dying person's skin.
Never give opium or morphine to these: a baby under 1 year, the drowsy, the drunk, a head injury, an asthma attack, a child with diarrhoea or dehydration.
Never measure by drops or a spoon.
Never give haloperidol or another antipsychotic to a confused dying person.
Never put black salve or any burning paste on a lump.
Never wash a red-flag death with bare hands.
Never put lime or ash in a grave.
Never dig a grave alone.

32. The Shelf

Never follow a team that is half a day overdue.
Never put a veterinary item in the human cabinet.
Never put tablets in a clay pot cooler.
Never give a dose worked once.
Never measure by spoon or drop.
Never give an antibiotic without a written sign.
Never leave one person alone with the inner cupboard.

33. The Garden and the Still

Never plant the plants of chapter 34 here. Never grow foxglove.
Never use a plant you cannot name. Never keep an unlabelled jar.
Never give a child a dose from an adult's jar.

Never distil fruit in the medical still. Never trust a cut of the first runnings to remove methanol.

Never give a plant of the fenced plot by mouth. Never an essential oil by mouth or near an infant's face.

Never test an unknown plant on a person.

34. The Poison Garden

Never eat a wild plant on one check. Never dig a wild root of the carrot family.

Never make anyone vomit. Never give salt water.

Never use foxglove as medicine, at any rung. Never grow it in the open garden.

Never give a metal, mineral, ash or gem remedy by mouth. Never bleed, blister or make anyone vomit as a cure. Never purge in diarrhoea, fever, under 5 or over 70.

Never cross a line below, at any rung.

Never keep the only key in one house. Never fence a poison plant where children play.

35. The Healer, the Infirmary and the Commons

Never leave one healer alone.

Never teach injection, surgery past wound care, the microscope, unlisted drugs or naming diseases in the 300 hours.

Never let a hand skill go 3 months unpractised.

Never let the healer sell what the healer prescribes.

Never a fee at the door.

Never one needle or blade on 2 people.

Never ask for what a tradition keeps closed.

36. The Register and the Correction of This Book

Chapter 36 prints no bold never line.

From the bold never lines of chapters 1 to 35, after SY-10.

The Register Page

Rule these pages in pencil, in a bound book. Write in carbon ink or pencil.

The daybook page. Rule 5 columns across: date, house, age, code, what was done. 1 line per visit. Leave a box at the foot for the Sunday tally. The visit page (02.8) is its long form.

Codes: D watery stool. B bloody stool. F fever without cough or stool. C cough with fast breathing. L cough over 2 weeks. R fever with rash. J yellow eyes. X anything on the alert list. O other.

The visit page. Written before the next patient, in this order: date and hour, name, age, weight in kg ("weighed" or "guessed"). When it began. The counts. Each red flag circled. Given: name, strength, mg and ml, time, giver, checker. Plan: wait, act or carry.

The epidemic page. It opens from the daybook when an alarm sounds. Rule 7 columns: house, dates, first sign, water, contacts, carer, lived or died. 1 line per case. Tally marks along the foot. Never write a cause that accuses. Write the family's words instead.

The alert list. 1 case of any of these is an alert. Watery stools with dehydration at age 5 or over. Fever with a rash, with bleeding, or with a stiff neck. Sudden weakness of a leg or an arm. A newborn who stops sucking and stiffens. A mother's death in pregnancy or within 6 weeks of a birth. Any newborn death. Illness where animals are dying. A traveller who arrives ill. Tell the healer the same day. The healer tells the district within 1 day.

The Sunday count. Count the week's codes. Allow 15 minutes. The first 8 weeks set the usual count.

Usual count a week	Watch at	Alarm at
0 to 0.5	3	4
1	4	5
2	6	7
3	8	9

Watch is twice the usual plus 2: visit each house with a case within 2 days. Alarm is twice the usual plus 3, or a watch 2 weeks running: call the meeting, open the epidemic page, send word to the district. 2 deaths alike within 2 weeks is an alarm at once. So are 3 ill alike from 1 house, water source or gathering. Deaths in a month: watch at 2 and alarm at 3 (OR-05), or 3 and 4 (chapter 15). Both untested.

The rules at the head of every book. Write at the time. If late, write

"late" and the hour. Never erase. Strike a wrong line once, and write the right line beside it, with date and initials. In an empty week write "no visits". Counts go out. Names stay in. Never add a column for faith, origin or debt. A dry chest with 2 locks, 2 people holding the keys. Copy every book once a year after harvest, and keep the copy in another house. Anyone may read their own lines.

From chapters 36 (36.1, 36.2), 15 (15.1) and 2 (02.8).

PART ONE

The Clean Hand and the Count

CHAPTER 1

The Clean Hand

A hand washed for a minute before every touch prevents more deaths than any drug on the shelf. Soap takes a day to make and a month to cure.

OPENING

Go to the tap or the bucket and wet your hands. Then rub them together while you count slowly to sixty.

The first ten seconds feel like enough. By twenty you have done what most people do on a good day. By thirty the water has run off your wrists and the count feels long. Keep going. Rub the back of each hand with the palm of the other. Lace the fingers and rub between them. Take each thumb in the other fist and turn it. Press the fingertips of one hand into the palm of the other and work them round. Look at the nails. Most of what a hand carries lives under them and in the creases nobody thinks of.

Water alone lifts some of it away. Soap lifts much more, because it loosens the thin film of grease that the dirt is held in, and the water carries the grease off. Rubbing does much of the work. The sixty seconds do the rest. Rinse under water that is poured, not in a basin someone else has used, and shake your hands dry.

Now think of a house where someone is ill in bed. One pair of hands does most of the touching. They lift the baby and change the cloth. They wipe the old man's mouth. They stir the pot, cut the bread and hand it

round. Whatever those hands picked up at one bed they set down at the next, and at the table. The hand that touches everyone in the house is the shortest road from one person's illness to another's.

It is also the easiest road to close. A minute under water at the right moments, with soap or ash, closes it most of the time. The rest of this chapter is about which moments, and what to make the soap from when there is none to buy.

Dry your hands. They are cleaner than they were a minute ago.

THE STORY

Two clinics in Vienna

In the spring of 1847 the First Clinic of the Vienna General Hospital was a place women begged not to be sent. The hospital had two maternity clinics side by side. Women in labour were admitted to them on alternate days, and nothing else decided which one they went to. In the First, births were attended by doctors and medical students, who came to the ward from the dissecting room. In the Second, they were attended by pupil midwives, who did not dissect. Between 1840 and 1846 the First Clinic lost about 98 mothers in every 1,000 births. The Second lost about 36.

In 1846 alone the First Clinic recorded 459 deaths in 4,010 births, and the Second 105 in 3,754. The same building, the same year, the same kind of women, sorted by the day their labour began. A young doctor in the First Clinic, Ignaz Semmelweis, could not leave the difference alone.

In 1847 his colleague Jakob Kolletschka was cut by a student's scalpel during a post mortem. He died of a fever that looked like the fever of the mothers. Semmelweis drew a line from the dead body to the student's hand to the woman on the bed. He called what travelled along it cadaverous particles. The students' hands went from the dissecting room to the labour ward and along the row of beds. It was the hand that touches everyone in the house, and in Vienna the house held hundreds.

From the middle of May 1847 he made everyone entering the First Clinic wash in a solution of chlorinated lime. He chose it because it took

away the smell of the dissecting room. Nobody recorded how strong it was.

The monthly counts show what happened. In April 1847 the clinic lost 57 mothers out of 312, nearly one in five. In June, the first full month of washing, it lost 6 out of 268. In July it lost 3 out of 250. Then in the autumn the deaths crept back to about four in a hundred, because the students grew careless and nobody checked them. Semmelweis tightened his control of the students in January 1848. In March of that year not one mother died, and in August none again. Across 1848 the First Clinic lost 45 women in 3,556 births, about one in eighty. The midwives' clinic next door lost the same.

The story is often told as a triumph. It was not one. His chief, Johann Klein, credited a new ventilation system and did not renew his post in 1849. Men with large names rejected the idea, because it said that doctors killed their patients. Semmelweis waited thirteen years to publish, and the book of 1861 was long, muddled and in places abusive. He died on 13 August 1865 in an asylum at Döbling, outside Vienna, of a septic wound of the hand. The First Clinic without him slid back. Across 1848 to 1859 it averaged nearly 36 deaths in every 1,000 births.

He was not the first to see it. Alexander Gordon in Aberdeen in the 1790s and Oliver Wendell Holmes in Boston in 1843 both traced the fever to the attendant's hands, as chapter 10 tells. What Vienna adds is the speed and the slide. A rule of washing worked within weeks. It failed within months once the person who enforced it had gone. A basin is not enough. Someone has to keep the habit.

A bar of soap a week

Vienna showed that washing in chlorine saved mothers in a hospital. It said nothing about soap in a home. That came a century and a half later, in the squatter settlements of Karachi, in 2002 and 2003.

Stephen Luby and his colleagues chose 36 neighbourhoods and assigned them by lot. In 25 of them fieldworkers handed out soap and came back every week for a year. They taught one simple thing. Wet the hands, lather, and rub for 45 seconds. Do it after the latrine and after cleaning a

baby. Do it before cooking, before eating and before feeding a child. In the other 11 neighbourhoods nothing changed.

The households used a little over three bars a week, about four and a half grams of soap for each person each day. Among the children, diarrhoea fell by about half. Pneumonia in children under five fell by half as well, and the skin infection impetigo by a third. Soap with an added germicide did no better than plain soap. For the first eight weeks nothing changed at all. The gain came once the habit had settled. Five years later 97 households in 100 that had been taught still kept soap where they washed. Among the others it was 28.

The trial had flaws, and its authors named them. The mothers who reported the illnesses knew which group they were in. A soap company paid for it. Weekly visits for a year cannot be repeated in every village. When all the trials are pooled, the gain shrinks to about three in ten fewer bouts of diarrhoea and about one in six fewer chest infections. No trial measured deaths. In Kenya a large trial found no effect, because the washing fell away: more than seven households in ten at the start, fewer than one in four by the end.

One count from Nepal speaks for the newborn. Among 23,662 babies, those whose mothers washed their hands before handling them died less often in their first month, by about four in ten. It was an observation inside another trial, not a trial of washing. It points the same way as Vienna.

Why people wash at all is stranger than why washing works. Across the world only about one person in five uses soap after the latrine. People wash because something disgusts them, because they are caring for a child, or because others can see them. Knowing about germs moves them little. So the basin goes where the household can see it.

Fat and ashes

Soap is older than any account of it. Pliny wrote of the Gauls making it from tallow and beech ash. A book of workshop recipes copied around 1130, the Mappae Clavicula, worked its soap for two to four days. The method has hardly changed. Rainwater run slowly through hardwood ash carries the alkali out of it. Pine ash gives a weak, tarry lye and is no use. Boiled with fat, the alkali turns it into soap.

In 1742 a chemist named Geoffroy reported to the Royal Society in London how the soap boilers judged their lye. They floated a hen's egg in it. If half the egg stood above the surface, the lye was of the first strength. Geoffroy named the flaw himself: hens' eggs do not all weigh the same. It is still the best test a household has, and it says only yes or no.

For most of history soap was dear. Around 1800 the British used about three kilograms each a year. Cheap soda made from salt, first produced in France in 1791, lowered the price, and by 1880 they used about six. A household of four now needs ten to fifteen kilograms a year, and every kilogram of soap costs most of a kilogram of fat that could have been eaten.

The strength that makes soap also burns flesh. A splash of lye can look shallow on the first day and turn into a deep burn over the next two or three. In the eye it can blind. The worst harm falls on small children. At Uyo in Nigeria, between November 2006 and November 2010, surgeons treated 16 children who had swallowed caustic. Nearly all had swallowed caustic soda. In 14 of the 16 homes, the mother had been making soap. Most of the children were between one and three years old. Half were left with a narrowed gullet. Seven needed a feeding tube through the wall of the stomach, and one died. Where parents made the child vomit, the injury was worse. In Accra the caustic had been kept in soft drink bottles.

In Philadelphia a century earlier, a throat surgeon named Chevalier Jackson saw the same narrowed gullets. He pressed for years until the United States required a poison label on lye, by a law of the 1920s. Soap made at home protects children from diarrhoea. Lye kept carelessly at home burns them. Both are true, and the Bench follows from it: one soap house, named makers, and lye never in a drinking vessel.

Steam and the needle

Washing removes most of what a hand carries. It does not make anything sterile. For a needle or a blade that goes under the skin, the difference matters.

Joseph Lister's carbolic acid belongs to chapter 23. What lasted was heat under pressure. In 1879 Chamberland, working in Pasteur's laboratory, built a closed boiler that held steam above the boiling point. Two years later Robert Koch and his colleagues showed that steam killed better

than hot dry air. In 1886 Ernst von Bergmann, a surgeon in Berlin, began steaming his dressings instead of soaking them in poisons. By 1890 he and his assistant Curt Schimmelbusch showed the congress in Berlin a whole system built on that idea. The aim was to keep germs from ever reaching the wound, not to kill them once they had arrived.

Water boils at a hundred degrees and gets no hotter. Some bacteria form spores, small dormant cells with tough coats, and many outlast boiling. The spores of tetanus and gas gangrene live in soil and dust. Steam at a hundred and twenty one degrees, under pressure, kills them in twenty minutes. Spirit does not touch them. In 1940 a report described deaths from these spore germs after instruments had been soaked in alcohol.

A kitchen pressure cooker can do the work of a hospital's steam boiler. In 2021 a team ran an ordinary stovetop cooker of about four litres at full pressure for twenty minutes, with test strips and spore samples packed inside. All 128 passed. Electric multicookers, tested in 2018, mostly failed, three of four even after five hours.

The needle carries more than the hand. By one estimate, unsafe injections in the year 2000 gave 21 million people hepatitis B, 2 million hepatitis C and 260,000 HIV. Nearly four injections in ten that year were given with reused equipment. In Elista, in southern Russia, in 1988 and 1989, hospital staff changed the needle between children but kept the syringe. Blood had flowed back into the barrel, and children were infected with HIV. In Roka, in Cambodia, 242 people were infected through reused syringes in 2014 and 2015. One needle and one syringe for one person, every time. The rule is old, and it is still broken.

The Honest Broker's Bar

Here is where the sources need weighing.

The Vienna figures are often misquoted. The common line, from about eighteen in a hundred to under two, sets one bad month, April 1847, against a whole good year, 1848. HY-01 names a 2024 review that gives 18.27 per cent as the death rate for the whole of 1847. That is an error. The year as a whole was 5.0 per cent, 176 in 3,490, because washing began in May. IN-07 prints the same pair of figures from an encyclopaedia, and this chapter does not use them. The fair comparison is 11.4 per

cent in 1846 against 1.27 per cent in 1848, a fall of about 89 in 100, about one mother saved in every ten births. That assumes washing caused the whole fall. January to March 1847, before any washing, were already low at 3.2, 1.9 and 3.6 per cent, and nobody has explained why. The strength of the chlorinated lime is unknown.

The trials are weaker than the story told about them. Karachi was reported by mothers who knew their group and paid for by a soap maker. When one review adjusted for that kind of reporting, the pooled effect fell to a ratio of 0.77, with a range from 0.32 to 1.86 that includes no effect (HY-01). Two of three large trials in 2018 and 2019 found nothing. The Nepal figure is an observation, not a trial.

The time to rub varies by source. WHO gives 40 to 60 seconds in health care, Karachi taught 45, and the home guidance is 20 to 40. This chapter prints 60 seconds before a birth, a wound or an injection, with 20 for the home beside it. The time to boil instruments also varies. WO-03 and FO-11 say at least 10 minutes. WO-12 says 20, from a full boil. SY-12 lists it as C24 and settles it for WO-12, so the Bench prints 20 with 10 beside it. Either way boiling disinfects. It does not sterilise.

FEASTING after the FALL holds the household lye barrel and the soft soap, and this chapter is its companion, not its correction. HY-05 found four of FEASTING's lines too tight or unsafe. FEASTING's 140 g of caustic soda per kg of tallow leaves no margin, and HY-05 proposes 130 g. FEASTING's 200 g of potash means pure potassium hydroxide, and HY-05 proposes 185 g of the pure substance, noting that potash as carbonate falls about a fifth short. FEASTING gives a tongue test for soap, left open in its row T10, and HY-05 would remove every tongue test, because a tongue on lye is a caustic burn. FEASTING's first aid (row T1) keeps vinegar after water, and HY-05 would keep water only. This chapter prints its own figures. FEASTING's rows may need amending, and that is the owner's call across both books.

The cooker rests on one study of one brand, 128 runs, with no patient counted. The ten minutes of venting, the restart when pressure falls and the doubling of time above 1,000 m have no source the library could find. No source at all was found for flame. The soap yields per kg of fat are HY-05's arithmetic, not a weighing. HY-05 gives no daily water figure for washing. HY-01 budgets about a litre a wash, which for a family of six washing six times a day is about 36 litres.

The turn to the present

In Berlin a bar of soap costs less than a loaf of bread, and the tap runs hot. A bottle of alcohol rub hangs at the end of every hospital bed. Even so, studies of hospital staff find them washing at about four in ten of the moments they should, and only about one in five before they touch a patient. The habit was always thinner than the supply.

Steam lives behind a door marked sterile supply, and few people outside it have seen a pack tested. Needles come one to a packet and go into a yellow box. Lye is a drain cleaner with a child lock on the cap. Each of these was a solved problem, solved by someone else, somewhere else.

After the Fall all of it comes home. Soap costs fat, and the fat is also food. A village of 300 washing at the Karachi rate would need about half a tonne of soap a year. Every wash costs water that someone has carried. Steam costs fuel and a cooker someone keeps. What will we wash for, when every wash is paid for?

The record gives the answer: the moments. Before a birth, a wound or an injection. Before food. After the latrine, after the sick and after the dead. The hand that touches everyone in the house cannot be washed every minute. It can be washed at the door between one person and the next.

Now the soap.

AT THE BENCH

Work every dose twice, with two people.

01.1 See: the moments for washing

Wash with soap, or ash if there is none (HY-01):

- After the latrine and after cleaning a child's bottom.
- Before preparing food, eating or feeding a child.
- In the sickroom: before touching a patient, and before a birth, a wound or an injection.

- After blood, stool, vomit or urine, after a patient or their bed, after the dead.

Visible dirt, or diarrhoea in the house: soap and water, not spirit rub.

Rung ladder. Hands: soap or ash at the home moments. Hearth: a station in sight. Garden and still: spirit rub. Dispensary: the sickroom moments, a named checker. Infirmary: the scrub (01.5). Hospital: rub at every bed. Refuse: the shared basin.

01.2 Do: the handwash and the rub

Never dry washed hands on your clothes. Never rinse in a shared basin. Instead: poured water, then shake dry or use a clean cloth once.

1. Rings off. Nails short.
2. Wet the hands under poured water.
3. Soap: 0.5 to 1 g of bar, or a cup of soapy water at 5 g per litre. No soap: a palmful of dry hardwood ash.
4. Rub palms, backs, between the fingers, thumbs, fingertips and wrists.
5. 60 seconds before a birth, a wound or an injection, to the elbow, nails brushed. At home at least 20.
6. Rinse with 0.5 to 2 litres of poured water.

Spirit rub: ethanol of 60 to 80%, enough to stay wet for 20 to 30 seconds. Rub until dry. Weak on spores and norovirus.

WHO rub, per litre: 833 ml of 96% ethanol, 42 ml of 3% hydrogen peroxide, 14.5 ml of 98% glycerol, boiled water to 1 litre. Stand 72 hours.

Never use methanol or the still's first runnings. Never drink the rub. Instead: ethanol of known strength, locked, labelled NOT TO DRINK, kept from flame.

Grades: soap and water A. Spirit rub A for hands. Ash B. Water alone B, better than nothing. Soil, mud or sand D. Antibacterial soap X. Drying on clothes X.

Rung ladder. Hands: soap or ash. Hearth: soapy water. Garden and still: spirit rub. Dispensary: the WHO rub, a nail brush. Infirmary: the scrub. Hospital: the same. Refuse: methanol, mud.

01.3 Do: lye and soap

Never store lye in a drink bottle, cup or jug. Instead: a marked vessel that is not a bottle, high or locked (SY-10, H12).

Never taste lye or soap to test it. Instead: the egg for lye, lather and pH paper for soap.

Never pour water onto caustic. Never use aluminium. Instead: caustic slowly into cold water.

1. Goggles, gloves, long sleeves. No children in the soap house. A bucket of water at hand.
2. Ash lye: hardwood ash only. Rainwater through the barrel for 12 to 48 hours.
3. The egg: half above the surface is first strength. FEASTING's mark is a coin sized patch.
4. Soft soap: 3 to 4 litres of egg floating lye per kg of fat. Simmer to a clear paste. Yield about 2 kg. Use 50 g per 10 litres of wash water.
5. Hard soap: salt at a quarter of the soap's weight. Boil until a ladleful sets hard in cold water. Yield 1.2 to 1.3 kg.
6. Caustic soda bar: 130 g of sodium hydroxide per kg of tallow or lard. Into 300 to 350 ml of cold water. Cool to about 40 °C. Fat at 40 to 45 °C. Stir to trace, mould, cut at 1 to 2 days, cure 4 weeks. Yield 1.25 to 1.35 kg.
7. Olive oil 125 to 130 g, coconut 168 g. Potash lye: 185 g pure potassium hydroxide, about 205 g of 90% grade.
8. Test: lather, no grease. pH paper 9 to 10 is sound. Above 11, laundry only.

Grades: ash lye B. Egg test C. Feather test D, it shows causticity, not strength. Tongue test X. Salting out B. Long cure as a safety step D.

A splash. Brush off dry lime or ash. Then water only. Skin 15 to 20 minutes. Eye 15 to 30 minutes, lids held open. Never vinegar or any acid.

The swallowed lye. A child drools, will not swallow, has burns in the mouth. Nothing by mouth. Never make them vomit. Carry sitting up.

- **Help in time.** The infirmary watches. A narrowing may show weeks later. The hospital can widen it.
- **Help too late.** The child cannot swallow. Only the hospital can feed through the stomach wall.
- **No help at all.** This child may die. Hold them, keep them warm, wet the lips. Tell the family the truth gently. Lock every vessel of lye that day.

Rung ladder. Hands: no lye. Hearth: FEASTING's soft soap. Garden and still: one soap house, named makers. Dispensary: pH paper. Infirmary: the burned child. Hospital: widening the gullet. Refuse: tongue tests, bottles, aluminium, acid on burns.

01.4 Do: chlorine strengths

Never mix chlorine with vinegar, acid, urine or ammonia. Instead: water only, mixed in the open air.

Never keep bleach in a drink bottle. Instead: a marked plastic vessel, out of reach (SY-10, H12).

Strength	Use	From 5% bleach, per litre	From HTH, per 20 litres
0.05%	hands in outbreaks and births, linen soak up to 15 min	10 ml	15 g
0.2%	floors, surfaces, 15 min	40 ml	60 g
0.5%	spills after wiping, objects, 10 to 15 min	100 ml	library found no figure
1%	stock, for water only	200 ml	library found no figure

Parts of water per part of bleach = (bleach % ÷ strength wanted) minus 1. The ml column is that rule, rounded.

1. Salvaged bleach: assume half its label. Double the bleach.
2. Bleach into water, in plastic. Fresh every day.
3. Clean first. Dirt uses up the chlorine.
4. Blood: wipe up the bulk, then 0.5% for 10 minutes. Cannot wipe first: 1% for 3 minutes, then 0.5%.
5. Water: 4 ml of 1% stock per 20 litres. See chapter 13.

Grades: hypochlorite A in practice, B in the field. Vinegar on surfaces X. Lime on excreta B, outbreaks only.

Rung ladder. Hands: soap. Hearth: bleach of known strength. Garden and still: lime in an outbreak. Dispensary: the three daily strengths. Infirmary: salt chlorine from a purpose made device only. Hospital: tested strengths. Refuse: mixing, bottles, vinegar.

01.5 Do: steam and the needle

Never use one needle or one syringe on two people. Never change only the needle. Instead: one sterile needle and syringe, one person, one injection (SY-10, H4).

Never call boiled, flamed or spirit wiped instruments sterile. Instead: steam at 121 °C for anything that enters tissue (SY-10, H15).

Never use an electric multicooker. Never cool a cooker with water. Instead: a stovetop cooker with a working weight, cooled by itself.

1. Clean first. Rinse below 60 °C. Open the hinges. Scrub. What cannot be cleaned cannot be sterilised.
2. Load: syringes apart, plungers out. An indicator strip in the middle.
3. Heat with the vent open until steam flows for 10 minutes. Close the vent.
4. At full pressure, 121 °C: 20 minutes unwrapped, 30 wrapped. Pressure drops: restart the clock.
5. Above 1,000 m, double the time. Above 2,000 m, untested.
6. Cool by itself. Lid ajar 30 minutes to dry. A wet pack is not sterile.
7. Check the strip. Date the pack. Dry and closed, it keeps 4 weeks.

No cooker: boil 20 minutes from a full boil, lid on. Some sources give 10. This disinfects. It does not sterilise. For needles it is a fallback, used the same day.

Flame: a needle or lancet tip, emergencies only. Spirit: skin, never instruments. Reuse spreads hepatitis B, hepatitis C and HIV (chapter 16).

Grades: steam at 121 °C A. Stovetop cooker B. Boiling 20 minutes B as disinfection, X as sterilising. Multicooker X. Alcohol on instruments X. Flame D.

Rung ladder. Hands: boiled cloths. Hearth: boiling for what touches skin. Garden and still: spirit for skin. Dispensary: 1 or 2 cookers, a keeper, a log. Infirmary: steam for every instrument, a 5 minute scrub, 3 for later cases. Hospital: autoclave, spore tests. Refuse: multicookers, alcohol soaks, carbolic, shared syringes.

01.6 Prevent: the station, the soap house, the linen

1. A station by the latrine and the hearth, in sight, with a named checker. Poured water, soap or ash.
2. Water: about 1 litre a wash, about 36 litres a day for a family of 6. See chapter 13.
3. Soap: 10 to 15 kg a year for a household of 4. About 55 kg for a dispensary, from 45 kg of fat.
4. One soap house. Named makers. Lye locked.
5. Sick linen: gloves, soiled side folded in. Boil with soap 10 minutes, or soak in 0.05% up to 15 minutes, then wash. Dry fast. What cannot be boiled: 3 days of sun, partial only. See chapter 24.

Rung ladder. Hands: the habit. Hearth: the station. Garden and still: fat agreed with the kitchen. Dispensary: soap stock, the linen pot. Infirmary and hospital: the same at scale. Refuse: soap from fat the children need.

If it goes wrong

1. **The soap stings.** Red, sore hands. Cause: too much lye, or no test. Check with pH paper. Use it for laundry. Next batch, 130 g.
2. **The habit fades.** Diarrhoea back after a few months, the basin dry. Cause: nobody checks, the station out of sight. Name a checker. Move the station into view.
3. **The pack comes out wet, or the strip unchanged.** Cause: air not vented, pressure lost, no drying. Run it again from the start.

NUMBERS TO CARRY

- 60 seconds of rubbing before a birth, wound or injection, 20 at home (HY-01).
- 130 g of sodium hydroxide per kg of fat, 185 g of pure potassium hydroxide (HY-05, SY-09).
- 4 weeks to cure a bar of soap (HY-05).
- 0.05% chlorine for hands and linen, 0.2% for surfaces, 0.5% for spills (HY-05, IN-07).
- 4 ml of 1% stock per 20 litres of water (HY-02).
- 121 °C for 20 minutes unwrapped, 30 wrapped (WO-12).
- 20 minutes of boiling disinfects, 10 in some sources, and never sterilises (WO-12, SY-12).
- 4.4 g of soap and about 6 litres of water a person a day for hands (HY-01).

THE LIBRARY

HY-01 Clean hands: Semmelweis, Nightingale and the quantified effect of handwashing and soap. HY-05 Making soap, lye and disinfectants from ash, fat, salt and sun. WO-12 Sterile enough: boiling, pressure cookers, flame, alcohol, carbolic and the sterilisation ladder. IN-07 Antiseptics you can make. HY-02 Safe water without a utility. SY-09 The salvage list and the first year. SY-10 The harm register. SY-12 What the library could not find. All are on the website.

CHAPTER 2

The Count

Ten minutes of looking, asking, touching and counting, before any remedy, every time. The count tells you whether you have an hour or a day.

OPENING

Look at the face of the next person who comes into the room, before either of you speaks.

You will know more than you expect within a few seconds. The colour is in the lips and in the thin skin under the eyes. The eyes find yours, or they do not. A face that is working to breathe shows it at the nostrils, which widen with each breath, and at the neck, where small muscles stand out that a resting person never uses. Sweat on a cool day shows. So does a mouth held open, or a head that will not stay up. None of it needs a tool. It needs light, a pause, and the habit of looking before doing.

Most of what a healer learns about a sick person is learned this way, from outside, in the first minutes. The face comes first, then the breathing, then the hands, which are warm or cold. Then the questions: whether she can drink, whether he has passed water today, when it began. Then the touch and the count. The beats at the wrist. The breaths in a minute. The seconds a pressed fingernail takes to turn pink again. Each is a number that can be written down and set beside the same number tomorrow. Each says something about how much time there is.

Attention is the first medicine. It is given before any remedy, and every house holds it in full. It decides what comes next: whether to wait, whether to give something, whether to carry the person to someone who can do more. It costs the sick nothing, which cannot be said of most remedies. A healer who looks first and acts second does less harm than one who acts at once, with the same shelf of drugs behind them both.

The few tools that make the looking exact are cheap. A glass, a scale, a tube of paper, a clock. The hardest thing the looking teaches is in none of them. It is how often the right course is to wait, and how to tell when waiting has run out.

THE STORY

The beat and the clock

The oldest medicine was mostly foretelling. The Hippocratic writers judged a physician by how well he could say what would happen next, and some of their sayings held for two thousand years: of tetanus they wrote that those it seizes die within four days, or recover if they pass them. To foretell, they watched. They watched the face, the breath, the sweat and the urine, and above all the pulse. Herophilus is said to have timed it against a water clock. Galen described 27 qualities of the beat across some 18 books. The pulse became the centre of the art.

Much of that was theory laid over a real sign. The rate, the rhythm and the strength of a pulse are real, and two examiners feeling the same wrist agree about them. The many named qualities, each tied to an organ, are not real in the same way. When trained readers of the wrist examine the same people, they agree poorly, and one study of fifteen doctors found agreement from below chance to moderate. A sign that two people cannot agree on cannot guide a third. The old physicians had the right finger on the right place. They read too much into what it felt.

What the pulse lacked for most of its history was a way to be counted. Sanctorius built a pendulum for the purpose. In 1707 Sir John Floyer, a physician of Lichfield, published The Physician's Pulse-Watch, with a watch made to carry a hand for the seconds. Floyer kept the old theory

and borrowed freely from Chinese books on the pulse. His lasting gift was the plain part. A number, the beats in a minute, which a second person could check.

The number means something because of what the pulse is. Each beat is the heart filling the arteries, felt where an artery runs over a bone. At rest an adult's pulse runs at 60 to 80 a minute, a child's at 80 to 100, a baby's at 100 to 140. Fever raises it, by about 10 beats for each degree in a child. A pulse far faster than the fever explains means the vessels are short of blood or water, and the heart is beating faster to keep what is left moving. Fast, faint, with cold hands: that is how shock most often looks in a village. A pulse felt at the wrist also proves less than doctors were long taught. In 20 shocked patients whose pressure was measured directly, 10 of the 12 who had every pulse present had an upper pressure below 80. The finger finds trouble. It cannot promise safety.

Counting the bled

In the Paris of the early 1830s the treatment for pneumonia was the lancet. Pierre Louis, a physician there, did something his colleagues found odd. He counted. He took 77 people who had been healthy before their pneumonia and sorted them by the day on which they were first bled. Of the 41 bled in the first four days, about 44 in a hundred died. Of the 36 bled later, about 25 in a hundred died. He saw that the early group held nearly twice as many people over fifty, and he claimed no more than his numbers allowed. When he published in 1835 he said only that bleeding did much less good than was believed. A reader in 2004 worked his figures again and found that the early bled had done worse, not better.

What Louis gave was a method, not a cure. Count the sick. Set like beside like. Write down what happened to each. It sounds plain now. In 1835 it offended physicians who knew, from what they had seen, that bleeding worked. They had seen it. After the lancet the pulse grew softer and slower, the flushed face paled, the patient lay quiet. The effect was visible and real. It was the effect of losing blood.

Fourteen years later in Vienna, Josef Dietl published his count of 380 people with pneumonia. Eighty-five had been bled, and 17 of them died, 20 in a hundred. One hundred and six had been given tartar emetic, an

antimony salt that made them vomit, and 22 died, about 21 in a hundred. One hundred and eighty-nine had been given nothing but diet and rest, and 14 died, about 7 in a hundred. The groups were not chosen by lot, and the mildest cases may have gone to the rest beds. Even so, the treatment the profession trusted went with nearly three times the deaths of doing nothing. Dietl and his colleagues were called nihilists for it. They examined with great care, and then they declined to give what they could not show worked.

Dietl's resting patients were not left alone. They were fed, kept warm, watched and examined. What they were spared was the lancet and the vomit. Attention is the first medicine, and in that Vienna ward the count showed it to be the best one on offer. The physicians who came after kept both halves of the lesson. Look closely. Then do only what the looking justifies.

The glass and the cuff

Heat became a number next. Carl Wunderlich published his study of temperature in disease in Leipzig in 1868. He is reported to have taken about a million readings from some 25,000 people, and he set the normal at thirty-seven degrees and called thirty-eight probably feverish. His figure stood for more than a century. Then in 1992 a study of 148 healthy adults found the average by mouth to be thirty-six point eight, with an upper limit of thirty-seven point seven, lowest in the early morning, swinging about half a degree through the day. Wunderlich's own thermometer had read high. He was not careless. A number is only as good as the instrument behind it, and an instrument is only as good as its last check.

The hand came before the glass, and it still has its place. At Chikankata Hospital in Zambia, in a study published in 1998, mothers felt 862 of 1,090 children for fever before each child's temperature was taken in the armpit for three minutes. The mothers found 94 in a hundred of the feverish children. They also called many children hot who were not. When a mother said her child was not hot, she was right 95 times in a hundred. The hand rules fever out better than it rules it in. A child who feels hot needs the glass. A child who feels cool and is well needs nothing. A child who feels cool and is ill needs the whole examination.

The glass misses things too. Old people with blood poisoning often run no fever at all. In one series of people aged seventy-five and over, a fifth had none of the usual signs, and those were the ones more likely to die. In the old, a new confusion outweighs a normal reading.

Blood pressure came last. In 1896 Scipione Riva-Rocci described, in a Turin medical journal, a cuff wrapped round the upper arm and pumped up until the pulse at the wrist vanished, with a column of mercury to read the pressure at that point. An American surgeon sketched it in Pavia in 1901 and carried it home. The cuff was widened, and in 1905 a Russian surgeon described the sounds heard below it, which give the lower pressure as well. Riva-Rocci's first way needs no ear. Pump the cuff until the wrist pulse goes, let it down slowly, and the pressure at which the pulse returns is the upper pressure, usually a little low. In 200 surgical patients in India, a reading by feel came within 2 of the reading by ear in about half.

The weak part is the dial. A column of mercury keeps its truth for years. A spring dial drifts. When dials were checked, about 30 in a hundred in an old British survey, and more than half in hospitals in São Paulo and in Iran, were out by more than 4. A village can check a dial with water. Mercury is 13.6 times heavier than water, so a pressure of 150 holds up a column of water about 2 m tall in a clear tube bent into a U. It is an awkward instrument and a truthful one.

The same plain thinking runs through the midwife's horn, the wooden trumpet named for Adolphe Pinard that is laid on the belly to hear the unborn child's heart. In Harare in 1994, among 1,255 women in labour, an electronic listener found more abnormal heart rates than the horn. Across the trials it led to more caesareans, without healthier babies. More signal is not always more health. A horn costs about a dollar and needs nothing but an ear and a quiet room.

What heals alone

Most illness ends by itself. That is the fact under Dietl's count, and the first thing a healer needs to know about any complaint is how long it runs when nothing is done. Modern trials know this well, because nearly every trial has a group given nothing, or a dummy. A review in 2013 of

children with coughs and colds gave the days by which 90 in a hundred had recovered: croup two, a sore throat two to seven, earache seven or eight, the common cold fifteen, bronchiolitis twenty-one, a cough twenty-five. Parents expected shorter courses than these. A cough at three weeks is usually not a failure of anything. It is the cough.

The same holds for other complaints. Of children with earache given nothing, about 60 in a hundred were better within a day, and 82 in a hundred settled on their own. Back pain that scored 52 out of 100 at the start fell to 23 at six weeks and 12 at six months. A sprained ankle hurts less within two weeks, though some still ache a year later. Lowering a fever with drugs did not change who died of blood poisoning, in a review published in 2017. A dummy pill changes little that can be measured, and nothing at all for most complaints.

Then the other half: what does not heal alone, and how fast it kills. Pneumonia in hospital before antibiotics killed 20 to 40 in a hundred, and the illness turned, one way or the other, between the fifth and the ninth day. An inflamed appendix has a rupture risk of 2 in a hundred or less in the first 36 hours, then about 5 more in every 12. Diphtheria and tetanus are decided in two to four days. A newborn with fever, a child who cannot drink, a woman bleeding after a birth, are decided in hours. Waiting is the right course only while the signs say so.

Which signs tell the two halves apart was measured in Tanzania, in a study published in 2012, in 466 children admitted with fever, 34 of whom died. A child who could not drink was nearly nine times more likely to die. A child whose pressed fingertip took more than three seconds to turn pink was nine times more likely to die. The signs found with hands and a clock foretold death better than the laboratory's results. That is the count's whole claim, made in one ward. It needs no machine.

Seeing is not the same as knowing what to do. In a large trial among African children in 2011, children in shock, found by exactly these signs, were given quick fluid into the vein, as hospitals in rich countries did. More of them died: 10.5 in a hundred against 7.3 in those not given it. The signs were right. The reflex that followed them killed. The count shows who is in danger. It does not show that doing more is better than doing less.

The Honest Broker's Count

Five reports carry this chapter, and they bear weight unevenly. FO-07, on the examination by hand, is careful and well sourced. Its lines come from WHO and from large studies, and its own working figures, the 5 breaths by which two counts may differ and the press of 5 seconds on a nail, are marked as working figures. Once the checker has confirmed its lines it can be trusted with a life. OR-04, on instruments, leans on search summaries more than full papers. Its trial figures from Chikankata and Harare are solid. Its history is secondhand: Wunderlich's million readings, the date of the Pinard horn and the story that Riva-Rocci built his first cuff from a bicycle tube are unconfirmed, and the last is not printed here. Its check of the scale against 7 litres of water is physics rather than a study, and sound physics. FO-02 and FO-05 give the natural courses and the old counts. Louis's figures are his own, and the reanalysis is one paper. Dietl's come from a summary, not his paper, and FO-05 spells his first name Joseph where the brief has Josef. SY-07 gathers the red flags and is honest about where they disagree. No known error is recorded for any of these five.

They disagree in two places that matter here. The first is the fever line. SY-07's card, following the large study of young infants, calls thirty-seven and a half degrees or more a danger sign in a baby under two months. For older children and adults FO-07 says that above thirty-seven point seven by mouth is above normal, and OR-04, from the Zambian study, takes thirty-seven point eight or more in the armpit. The cold line differs too: thirty-five and a half for a young infant in SY-07 and FO-07, thirty-six in Werner's manual and in NICE's guidance. The second is the pulse. FO-07 found that fever raises a child's pulse by about 10 beats a degree, from 21,033 British children, and Werner's manual says 20. FO-07 teaches 10, and so does this book, with 20 printed beside it. Both lines are printed both ways at the Bench and neither is settled here.

The library did not hold everything the brief asked for. It names Sanctorius only for his pendulum. Nothing in it covers his thermometer, so the draft leaves the thermometer's early history out. It gives Hippocrates only through one saying quoted in a textbook of 1892. It gives no line for a child's pulse that is too fast, and none for an adult's that is too slow, except as the stop sign for a heart remedy, and the Bench says so. It found

no safe way to guess a child's weight from age. The order of the Bench, the visit page and the worked example of a dose are the draft's own, built from FO-07's ten minutes and SY-10's self-test.

The turn to the present

Before the Fall the count moved indoors and into machines. A clip on the finger gave the oxygen, a cuff that pumped itself gave the pressure, a probe in the ear gave the heat, and a screen set them side by side. The numbers were good. What fell away was the habit of looking first, and with it the household's knowledge of how long a cough runs. Children with colds were brought to clinics on the second day, and many went home with antibiotics the cold did not need. The dial on the clinic wall was trusted for years without a check. In some hospitals more than half the dials were wrong.

A village of 300 can expect five to nine deaths a year. Most of the people who come to the healer will get better whatever is done. A few will die whatever is done. The healer's work lies in the band between, and the examination is how that band is found. Who in the village, today, could count a sick child's breaths for a full minute, press a nail and count the seconds, and know what the numbers meant?

It is not a hard skill, and it repays its teaching. Of twenty things a village might be taught, the breath count with the danger signs and a few tablets ranks first for lives saved per hour of training, at about 8 to 20 hours of teaching for each life. After a short lesson, mothers in Niger measured their children's arms as well as health workers did. Lay counters agree only moderately at first, and better with practice, which is why the Bench asks two people to count until they agree. What it takes is ten minutes, an order, and a page to write on. Attention first, before any remedy, every time.

Now count.

02.1 See: the ten-minute examination

The same order every time: look, ask, touch, count, write.

1. Wash hands with soap. Use daylight. Undress a child fully.
2. Look from the door for 30 seconds. Awake? Wakes to voice, to pain, or not? Fits, noisy breath, chest pulling in, lip colour.
3. Ask: drinks? Vomits everything? A fit? Last urine? Day and hour it began?
4. Count the breaths and the pulse (02.3). Feel hands and feet: warm or cold. Press a nail (02.4).
5. Take the temperature (02.2).
6. Look at palms, lower eyelids, tongue, tears, mouth. Skin pinch: see 05.1.
7. Child: the arm strip (see chapter 7). Thumb on both feet for 3 seconds. A pit is swelling.
8. If needed: neck, pupils, face, arm and speech, belly, chest, pressure.
9. Write it (02.8). Circle every red flag.

Any 1 red flag: act now. Commonest: cannot drink, vomits everything, a fit, will not wake, fast breathing, refill over 3 seconds with cold hands (SY-07). Child breath lines: see 04.1. Newborn: see chapter 11.

Grade: the danger signs, A.

Rung ladder. Hands: eyes, fingers, a clock. Hearth: daylight, a page. Dispensary: glass, scale, cuff. Infirmary: a second examiner. Hospital: tests. Refuse: any remedy before the examination.

02.2 See: temperature

1. Feel first: back of 1 hand on the forehead, the other on a healthy person's. Not hotter and well: fever unlikely. Otherwise, the glass.
2. Shake the glass below 35 °C. Clean it with soap or alcohol.
3. Armpit under 5 years, and in anyone confused or fitting. Otherwise under the tongue.
4. Leave it 3 to 4 minutes. Read at eye level. Write reading, site and hour.

Who	Fever	Too cold
Under 2 months	37.5 °C or more (SY-07, FO-07)	Below 35.5 °C (SY-07, FO-07). Werner and NICE: below 36 °C
Older child and adult	37.8 °C or more in the armpit (OR-04). Above 37.7 °C by mouth (FO-07)	Cold, slow and confused: see chapter 20

5. Over 65, a normal reading rules nothing out. New confusion outweighs it.
6. The hot child: see chapter 6.

Never sweep or vacuum spilt mercury. Instead: keep children out, lift the beads with card and tape, air the room 24 hours.

Check every 3 months and after a fall: the reference glass and up to 5 others in water near 38 °C, 3 minutes. Off by over 0.2 °C: out of use.

Grades: the hand, B. A checked glass, B.

Rung ladder. Hands: the back of the hand. Hearth: 1 glass in a padded box. Dispensary: 5 glasses and 1 reference. Refuse: a glass never checked.

02.3 Count: the pulse and the breath

1. Put 2 or 3 fingers at the wrist, below the thumb. Not the thumb itself. None there: the neck, or an ear to the chest.
2. Count 30 seconds and double it. Strong or weak? Regular?

Age	At rest (FO-07)	Too fast
Baby	100 to 140	The library gave no single line
Child	80 to 100	The library gave no single line
Adult	60 to 80	Over 120 (SY-07). Over 100 after a birth or with bleeding (see chapter 9)

3. Fever adds about 10 a minute for each 1 °C in a child (FO-07). Werner says 20. Teach 10. Far faster, with cold hands: shock, see chapter 21.
4. Too slow: the library gave no general line. Under 60 stops a heart remedy (SY-10).
5. A wrist pulse does not prove a safe pressure (grade X). After bleeding, the standing test: see chapter 21.
6. Breath: bare the chest, person calm and quiet. Count 60 seconds by the clock, never 30 doubled.
7. 2 people count. More than 5 apart: count again, keep the higher.
8. Child lines: 60, 50, 40, see 04.1. Adult at rest: 12 to 20. Red flag: 30 or more, or 22 or more with new confusion.

Grades: the pulse rate, B. Organs read from the pulse, D.

Rung ladder. Hands: fingers, a clock or a pendulum (02.6). Infirmary: the same, every hour. Refuse: a guessed count.

02.4 Touch: refill, the rash glass, the pressure

1. Warm room. Press a nail for 5 seconds until pale. Cold hands: the breastbone. Count seconds to pink.
2. Over 2 seconds: watch. Over 3 seconds in a warm room: red flag. Cold and age slow it.
3. Rash with fever: press a clear glass on it. Still seen through the glass: act now, see chapter 6.
4. Pressure: check the dial (02.6). Seat the person 5 minutes, bare arm at heart level, the cuff's bag most of the way round.
5. Feel the wrist pulse. Pump until it goes, then 30 mmHg more.
6. Let down about 2 mmHg a second. The pulse returns at the upper pressure, read a little low.
7. Tube at the inner elbow: 1st tap is the upper pressure, silence the lower. Take 2 readings a minute apart.
8. Pregnant, 140/90 or more: see chapters 8 and 10. Upper 100 or less with fast breathing or confusion: see chapter 21.

Grades: refill, B. Pressure by feel, C. A checked cuff, B.

Rung ladder. Hands: the wrist. Dispensary: 2 cuffs in 2 sizes. Infirmary: a mercury column. Refuse: an unchecked dial.

02.5 Weigh: the scale and the dose by weight band

Never measure a dose with a kitchen spoon. Instead: an oral syringe, or a weighed amount (SY-10).

Never give a strong drug in drops. Instead: ml from a syringe (SY-10).

1. Hang the scale from a beam. Set it to 0 before each child.
2. Each day, hang 7 litres of water in a tied bag: 7 kg. Not 7 kg: turn the screw. Still wrong: out of use.
3. Child in light clothes, hands empty. Read at eye level, to 100 g. The scale reads 0 to 25 kg.
4. Read the dose band aloud. A 2nd person reads it back.

Weight comes first in every dose table. Age is only if no scale, and worse: guesses put about half of children within 10% (ME-02).

Worked example. Paracetamol, 15 mg for each kg, every 4 to 6 hours. At most 4 doses and 60 mg/kg in 24 hours. Adult at most 1 g a dose, 4 g a day.

Weight	Each dose	Syrup 120 mg in 5 ml	Age, only if no scale
8 to under 12 kg	120 mg	5 ml	None found
12 to under 17 kg	180 mg	7.5 ml	None found
17 to under 25 kg	250 mg, or 240 mg as syrup	10 ml	None found

A child of 13 kg: 15 × 13 = 195 mg. The band gives 180 mg, 7.5 ml.

Work every dose twice, with two people. A moved decimal point gives ten times the dose.

Grades: a checked spring scale, B. The smith's steelyard, C.

Rung ladder. Hearth: 7 litres of water. Garden and still: the steelyard. Dispensary: a hanging scale, 25 kg in 100 g steps. Refuse: a guessed weight when a scale exists.

02.6 Make and check: the village instruments

Instrument	Make or keep	Check	How often
Paper tube	Roll stiff paper	Hear a heart through it	Each use
Pinard horn	Turned wood	Hear a known pregnancy	Each use
Arm strip	Cloth or paper, marked at 115 and 125 mm	Lay it on the master strip	Each month
Rash glass	A clear drinking glass	Not cloudy or scratched	Each use
Clock	A watch with seconds, or a weight on a string about 25 cm long: there and back is 1 second	Against a watch	Each month
Thermometer	Salvaged glass	See 02.2	3 months, and after a fall
Scale	Hanging, 25 kg	7 litres of water	Each day
Cuff dial	Salvaged	Water U-tube or mercury at 100 and 150 mmHg. Out by more than 4 mmHg: out of use	3 months

Water U-tube: 1 mmHg holds up 13.6 mm of water. So 100 mmHg is 1.36 m between the 2 sides, 150 mmHg is 2.04 m.

Write every check on the instrument page: date, instrument, by whom, result.

Grades: the Pinard horn, B. The arm strip, B.

Rung ladder. Hearth: tube, strip, glass, string. Dispensary: thermometers, scale, cuffs. Refuse: an instrument with no check date.

02.7 Wait or act: the natural course

1. Write the day and hour it began. Examine (02.1). Any red flag: act now.

2. No red flag: name the likely illness and its course to the family.

Illness	9 in 10 better by (FO-02)
Croup	2 days
Sore throat	2 to 7 days
Earache	7 to 8 days. 6 in 10 better in 24 hours
Common cold	15 days
Bronchiolitis	21 days
Cough	25 days
Back pain	Most better by 6 weeks
Fever with no red flag	Past 3 days: find the cause, see chapter 6

3. Fluids, food, rest, pain relief. No antibiotic for a cold, most earaches, most sore throats, back pain.
4. Name the signs that bring them back at once. Course too long, or a new sign: examine again.
5. Do not wait with: a baby under 2 months with fever or fast breathing. A stiff neck. A rash that stays under the glass. Bleeding after a birth. A child who cannot drink. Pain low on the right past 36 hours.

The three branches, for any red flag:

- **Help in time.** Start the first measure the card names. Send word. Carry.
- **Help too late.** Start the measure. Count breaths, pulse and refill every 15 minutes, and write each.
- **No help at all.** Warm, clean, sips if able to swallow, someone always there. Tell the family plainly what is happening, and that they did not cause it. Stop counts that only distress.

Rung ladder. Hands: the clock, the page. Refuse: a remedy given to be seen doing something.

02.8 Write: the visit page

Write before the next patient, in this order.

1. Date and hour. Name, age, weight in kg, “weighed” or “guessed”.

2. Day and hour it began. What the family says.
3. The look. The counts: breaths, pulse, refill, temperature and site, pressure.
4. Other findings. Circle each red flag.
5. Given: name, strength, mg and ml, time, giver, checker.
6. Plan: wait, act or carry. The sign that brings them back. The healer's name.

Any red flag: counts at least 4 times a day, same page. Chart: see chapter 24. Register: see chapter 36.

Rung ladder. Hearth: a bound book, a pencil. Refuse: a visit with nothing written.

If it goes wrong

1. **The child who looked well and dies.** Counts normal, death within a day. Cause: false comfort from a normal glass, a soft neck, a felt pulse. Do: trust the look over the number. Count again sooner. Review every death within a week (SY-07).
2. **The wrong count.** 2 counts differ, or a calm child counts fast. Cause: counted during crying, or 30 seconds doubled. Do: calm the child. 60 seconds, 2 people, keep the higher.
3. **The tired instrument.** Weights or pressures drift for weeks. Cause: a scale or dial never checked. Do: stop using it. Check it (02.6). Work again every dose since its last good check.

Numbers to carry

- 10 minutes: look, ask, touch, count, write (FO-07).
- 60 seconds for the breaths, 30 seconds doubled for the pulse (FO-07).
- 37.5 and 35.5 °C: fever and cold under 2 months. After that 37.8 °C in the armpit, against 37.7 °C by mouth (SY-07, FO-07, OR-04).
- 3 seconds: the refill line in a warm room (SY-07).
- 30 breaths, or 22 with new confusion: the adult red flag (SY-07).
- 10 beats for each 1 °C: fever's rise in a child's pulse. Werner says 20 (FO-07).
- 7 litres of water weigh 7 kg: the daily scale check (OR-04).
- 15 and 25 days: 9 in 10 colds and coughs are over (FO-02).

THE LIBRARY

FO-07 Diagnosis by hand, eye, ear and nose: the physical examination without instruments. OR-04 Instruments and tests you can make. FO-02 The natural history of disease: what heals on its own and what does not. FO-05 What the physician of 1850 could do, and what killed his patients. SY-07 The red-flag list. SY-10 The harm register. SY-05 The twenty interventions that save the most lives per hour of training. ME-02 Dose and potency. All are on the website.

CHAPTER 3

Judging a Remedy

A remedy judged wrong costs a life in a day or a decade. The record takes a year to keep and a lifetime to trust.

OPENING

Somewhere on your skin there is a mark that is mending. A scratch on the back of a hand, a graze on a knuckle, a bruise on the shin gone yellow at its edge. Find it and look at it for a moment.

Nobody treated it. The edges of the scratch have drawn together on their own. The bruise fades from the outside in. In a week it will be gone, and in a month nobody will be able to say where it was. The body mends most of what happens to it, given rest, warmth, food and time.

Suppose a neighbour had rubbed a salve on it the day it happened. The mark would have healed just the same, and the salve would have taken the credit. The neighbour would remember. So would the one with the scratch. The next time somebody grazed a knee the salve would come out again, and it would seem to work again, because the knee was going to heal anyway.

Most remedies are given at the worst moment, the night the fever peaks or the morning the pain drives someone to the door. The next day is usually better, whatever was given. Care helps as well. A warm hand and a calm word ease pain and fear, and that is real, though it closes no wound.

So every remedy carries a quiet claim. Take me, it says, and you will be better than if you had not. That claim can only be checked against what happened, and not against what one healer remembers. It has to be checked against what was written down at the time: the ones who got worse beside the ones who got better, the ones who went without beside the ones who took it. A remedy is a promise, and the record is where promises are kept.

The mark on your skin will be gone soon. Nobody will have written it down.

THE STORY

The receipt from Shropshire

In 1775 William Withering, a physician and botanist in Birmingham, was asked his opinion of a family receipt for the dropsy, the swelling of legs and belly with water that most often comes from a failing heart. It belonged to an old woman in Shropshire who kept it secret. It held about twenty herbs. He judged that one of them did the work: the foxglove, *Digitalis purpurea*. The woman's name is lost. The name and portrait later hung on her, Mother Hutton, were made up in 1928 for a drug company's advertising.

Withering spent ten years finding out what the leaf did. He gave it to 163 people between 1775 and 1784 and wrote every case down, the failures beside the cures. He learned to give it slowly, in small amounts, and to stop at the first sign that it had reached the body: sickness, a flood of water, loose bowels, a slowing pulse. The pulse was his measure. In one patient it fell to 44 and then to 35 beats a minute. Another case followed what he called "imprudent and unlimited use", and at least one of his patients died. He printed all of it in 1785 as *An Account of the Foxglove*, and thirteen colleagues added 55 cases of their own. Later readers of his tally put the benefit at 65 to 80 in a hundred among the swollen hearts, and almost none in swellings of other causes. Twelve of his patients were children.

He had no comparison. His 163 were people he chose to treat, not people set beside others who went without. His book is a record, not a

trial. But it is a record, and that is why we can still argue with it. How many people took the Shropshire receipt, and how many it killed, nobody knows. Her promise was kept nowhere. His was kept on paper, failures and all.

Foxglove is the plainest case of a remedy that is also a poison. The dose that helps a failing heart is about half the dose that stops it. Nothing in a leaf says how strong it is. Before it flowers, the plant looks like comfrey. In August 1977 a couple in Washington State drank tea from leaves they took for comfrey, and the wife died. Untreated poisoning with the leaf kills twenty to thirty in a hundred. The drug made from the plant, weighed to the microgram, still helps the heart. The leaf from the garden is another thing.

Like beside like

On 20 May 1747, aboard HMS Salisbury, the naval surgeon James Lind took twelve sailors with scurvy and gave them the same diet with six different additions, two men to each. The pair given two oranges and a lemon a day recovered fastest, and one of them was fit for duty within six days. Lind chose the pairs himself, and two men to a group is few. The design was what mattered. Like beside like, one difference, and the result written down. Any village can do it.

Withering had a record and Lind had a comparison. Each was half of a fair test. Pierre Louis added the habit of counting, in Paris in 1835, when his 77 patients with pneumonia gave no sign that early bleeding helped.

A comparison is needed because two forces make a useless remedy look good, and both work in every house. The first is the natural course. Most illness ends by itself, and whatever was given last takes the credit. In a Danish series, 91 people with ulcers of the gut were simply watched, and about a third had healed in two weeks. When Henry Beecher claimed in 1955 that dummy pills relieved about 35 in every 100 patients, ten of his fifteen studies had counted recoveries that would have come anyway.

The second force is care. In January 1799 John Haygarth tested the patented metal rods that Elisha Perkins sold for drawing out rheumatism. He made wooden copies painted to look like metal, and four of five patients felt relief from the wood. In Boston in 2008, 262 adults with an irritable

bowel were put on a waiting list, given sham needling by a brisk practitioner, or given the same sham by a warm one. Relief at three weeks was 28, 44 and 62 in a hundred. Warmth eases pain and nausea. But when 114 trials set a dummy treatment against none, the dummy made no difference to cure or death. Care eases. It does not close a wound, kill a germ or set a bone.

What the old remedies found

In 2001 Daniel Fabricant and Norman Farnsworth in Chicago counted 122 plant compounds used as drugs around the world, from only 94 species, and found that 80 in a hundred came from a plant already used for something like the same purpose. It is a count of survivors. It starts from the drugs that succeeded and looks back. Nobody kept a list of the remedies that were followed and came to nothing.

The fairer test puts plants chosen by tradition and plants chosen at random through the same screen. From 1960 to 1974 the United States National Cancer Institute screened over 20,000 species against tumours, and about one random species in ten showed activity. Plants named in folk medicine books were active 1.4 to 2.6 times as often. Plants with an effect anyone could see did better still: worm remedies 29 in a hundred, arrow and ordeal poisons 46. Small studies found wider gaps. In Sinai, 83 in a hundred traditional plants checked germs in a dish against 42 random ones, though the random ones more often checked them strongly. In Belize, four of 31 healers' plants relaxed a strip of artery, and none of 32 random ones. The largest modern screens, in Vietnam and Laos in 2012 and in Madagascar in 2017, found little advantage or none.

Peoples who never met chose from the same families. Across four northern floras, from North America to Kashmir, the daisy family stood at or near the top and the grasses at or near the bottom. In 2012 a team at Reading and Kew drew the family tree of the plants of Nepal, New Zealand and the Cape and found the medicinal ones clustered on the same branches, rich in the genera that have given drugs. The pattern held when they removed every genus used in more than one region. Much agreement is copying, though. In southern Italy a quarter to a third of the plant uses alive today trace back to Dioscorides and Galen. And when antimalarial

plants were scored by how widely they were used, the score did not predict whether the parasite cleared in the five fair trials.

The library's working figures come from these partial counts. A remedy used for the same complaint by three or more unrelated peoples, with no book between them and chemistry that fits, has about one chance in three of doing something useful at the traditional dose. A remedy from one tradition alone has about one chance in ten. These are estimates, not measurements. They say nothing about safety. Birthwort passes every test of convergence and destroys the kidneys.

Theory, remedy, harm

The book takes each tradition on its own terms. It does not judge the theory, whether humours, doshas, qi or the akhlat, because a theory cannot be counted. It judges the remedy and the harm. It keeps two verdicts apart: not tested, and tested and failed.

Chinese medicine gave the greatest success of the last century. Ge Hong's handbook of about the year 340 told the healer to soak sweet wormwood and wring out the juice, and in 1971 Tu Youyou's team in Beijing followed that hint to artemisinin. Of 51 reviews of Chinese herbal medicines by the Cochrane Collaboration, one reached a firm positive verdict. Most of the rest found the trials too poor to judge: not yet fairly tested, which is not the same as failed. The harm came from a name. In a Brussels slimming clinic from 1990, one root was replaced by a birthwort, *Aristolochia fangchi*, sold under the same name, fang ji. More than 100 people lost their kidneys, and 18 of 39 who had them removed had cancer of the urinary tract.

For Ayurveda the library holds few remedies tested in trials, so most stand at not tested. The harm is counted. In a study of 2004, 14 of 70 Ayurvedic products bought in Boston held lead, mercury or arsenic, and one branch of the tradition adds metals on purpose. Unani medicine gives the dried corm of a crocus, *Colchicum luteum*, for gout. One series of 20 patients reported relief in 94 in a hundred, with no comparison. The alkaloid in the corm became a gout drug that works in weighed tablets. In the corm the gap between a gout dose and a fatal one is too small to cross.

From Mali came a village remedy tested the way a drug is tested. A

healer's decoction of the prickly poppy, *Argemone mexicana*, was set against the imported drug in about 300 people with uncomplicated malaria. Of those given the decoction, 89 in a hundred needed no second treatment, against 95 on the drug. It works, and less well. The San use of hoodia against hunger was tested directly and failed, and it raised the blood pressure. From the Andes came the bark that gave quinine. The periwinkle tea of Jamaica did little to blood sugar but lowered the white cells, and led to two drugs for leukaemia: real chemistry, wrong illness. The Plains peoples chewed echinacea for snakebite and sore throat. Those uses are not tested. The European use against colds was tested in 24 trials, and no single trial showed that it prevented one.

In the Pacific, kava drunk as a water infusion calms anxiety a little in seven small trials, and as a solvent extract it has injured the liver. Samoan healers used the bark of the mamala tree for hepatitis. Its compound was pursued for HIV, never for hepatitis, and the library found no finished trial. For the Arctic peoples the library holds no tested remedy, and none is printed here.

Europe wrote down the most, and so recorded the most failures. Willow bark eases back pain as a measured extract, and the home brew rests on use, not trials. St John's wort lifts mild to moderate depression as a standard extract in 29 trials, and weakens the contraceptive pill. A tenth-century salve of two alliums, wine and ox gall kills staphylococci in the laboratory and has never been tried on a person. Of about thirty plants in the monastery garden, none is proven and two kill, rue and pennyroyal. The Hippocratic case notes record about 25 deaths in 42 patients, and claim no cure.

Some knowledge is not the book's to print: remedies held secret or sacred, or kept for the initiated, for one sex or one lineage. In 1976 the Pitjantjatjara Council won an order stopping the sale of an anthropologist's book in the Northern Territory, because it printed what had been told him in confidence. Secrecy is often the scar of suppression. New Zealand's Tohunga Suppression Act drove Māori healing underground from 1907 to 1962. The book's rule is short. Where a tradition holds restricted knowledge, the book may say so and name its custodians, and prints nothing more. It does not hint at the knowledge, does not say how it might be obtained, and does not judge whether the restriction is genuine. If a plant inside such knowledge is poisonous, the book warns about the plant from

what toxicologists know. A warning is not a disclosure.

The heroic cures

The worst harm in the record came from the learned. In the late summer of 1793 yellow fever killed 4,000 to 5,000 of Philadelphia's 50,000 people. Benjamin Rush stayed when those who could leave had left, and saw up to a hundred patients a day. He purged them with calomel, a salt of mercury, and from 10 September he bled nineteen in every twenty, starting at ten or twelve ounces and rising with the season to eighty. He claimed more than ninety-nine recoveries in a hundred, about what yellow fever does by itself among mild cases. William Cobbett wrote that he killed more than he saved. Rush sued, and on 14 December 1799 a jury gave him 5,000 dollars. The court settled the libel, not the medicine. Nobody counted.

That same day at Mount Vernon, George Washington died of a throat infection that closed his airway, after his physicians had taken more than 80 ounces of his blood, about 2.4 litres, in some twelve hours.

Mercury made the mouth run with spit, and in larger amounts loosened the teeth and rotted the gums and cheek. On 4 May 1863 William Hammond, Surgeon General of the Union Army, struck calomel and tartar emetic from the army's supply table because surgeons had given them to excess. He was court-martialled on another charge and dismissed on 18 August 1864. Calomel teething powders went on into the 1950s and gave pink disease to about one child in 500 who had them. When the powders were withdrawn in 1953 and 1954, the disease vanished.

Tartar emetic is a salt of antimony. In Vienna in 1849 Dietl set three groups of pneumonia patients side by side. Of those bled, 20.0 in a hundred died. Of those given antimony, 20.7. Of those given diet and rest alone, 7.4. The groups were not drawn by lot, and milder cases may have gone to rest. Even so, the two treatments the profession trusted went with nearly three times the deaths of doing nothing. A modern pooling of the old pneumonia series puts deaths at 19.9 in a hundred among the bled and 12.8 among the rest.

On 30 May 1860 Oliver Wendell Holmes told the Massachusetts Medical Society that if most drugs then in use were sunk in the sea, it would be

better for mankind and worse for the fishes. Bleeding took about a hundred years from Louis's count to leave ordinary practice. The physicians were not fools. Rush bled himself and his own infant. The failure was a theory with no instruction to stop. Other traditions bleed too, with the leech of Ayurveda or the cups of hijama, but in small amounts, at one place, with long lists of who must never be bled. Only the heroic school bled more when the patient failed, and only it killed on that scale.

The two cases against

The first case is against lay medicine, and it is strong. Unqualified hands already kill. Reused syringes gave about 21 million people hepatitis B in the year 2000. In rural Madhya Pradesh in 2010, informal practitioners reached a correct diagnosis in 12 visits in a hundred and gave harmful or needless treatment in 42. In one experiment 84 parents in a hundred measured a child's medicine wrong by more than a fifth at least once. *Where There Is No Doctor*, the best-known village manual, was up to date in 62 of every hundred prevention sections checked and led to the right diagnosis in fewer than one in five of them. Nobody has measured whether its readers' patients fared better. Print alone barely changes what people do. A manual lends authority to the confident amateur.

The second is against herbalism. Edzard Ernst at Exeter spent two decades testing herbal claims and found most of them weak. People in the United States who chose alternative medicine alone for curable cancers died at two and a half times the rate of those treated: 54.7 in a hundred alive at five years, against 78.3. Old does not mean safe. Natural does not mean safe. Nor does modern: of the established hospital practices that drew doubt and were put to a fair test in one journal over a decade, about 40 in a hundred were reversed.

The record answers both, and nothing else does. Where lay workers were trained for one narrow task, deaths fell. In Gadchiroli, village workers treating newborns with antibiotics cut deaths from sepsis from 16.6 to 2.8 in a hundred. In Tigray, mothers taught to give the malaria drug promptly cut deaths under five by 40 in a hundred. In Nepal, carrying the snakebitten fast cut deaths from 10.5 to 0.5 in a hundred. In southern Ethiopia, one-day courses for bonesetters cut amputations for gangrene

from 25 to 7. When West Bengal trained 304 informal practitioners, correct care rose and harm did not. The case holds for the needle, for open diagnosis and for print without a teacher. It fails as a general claim. After the Fall the comparison is not lay care against a doctor. It is disciplined lay care against nothing. For herbs the record gives one test above all: whether the remedy is being used instead of something that works.

The Honest Broker's Ledger

Nine reports carry this chapter, and they bear weight unevenly. TR-13 read its key sources in full, Hammond's circular among them, and can be trusted on the heroic cures. SY-01 and SY-02 are careful audits that grade by preparation and state the case against their own side, and chapter 35 answers SY-01's case with the healer's training. TR-01's one chance in three for grade C and one in ten for grade D are its author's synthesis from partial counts, and the book prints them as working figures only. ME-07 is the best report on Withering. It also argues that foxglove passes its own test for one locked bed and one named healer, and SY-02's warning list allows the leaf under a trained healer. The book's rule is otherwise. Foxglove is never used as medicine, at any rung, following SY-10's never list, and ME-07's case is printed in chapter 34 as the owner's decision.

One known error is not reproduced. SY-02 and PH-01 say that an elderly couple in Washington State died in 1977 after drinking foxglove taken for comfrey. ME-07, and PH-01's own text, say the wife died. The chapter prints ME-07's account.

Several figures disagree and are printed both ways. Withering's patients were 163 between 1775 and 1784 in ME-07, 163 between 1775 and 1785 in FO-03, and about 160 in TR-01. One patient's pulse fell to 44 and then 35 in ME-07, to 40 and 35 in TR-01. Washington lost more than 80 ounces in TR-13, and 80 to 124 ounces by different accounts in SY-03. The Cochrane tallies count different sets: one firm positive in 51 reviews of Chinese herbal medicine (TR-01, SY-02), and five positive in 104 reviews of Chinese medicine, 70 of them herbal (SY-02, authors unconfirmed). The hit rate of tradition is printed above in every form TR-01, SY-04 and FO-03 give, from 80 in a hundred looking backwards to no advantage in the largest screens, and no one figure is preferred. FO-03 gives the Dan-

ish ulcer series as 52 healed by six weeks, 75 in a hundred, which does not match 91 patients, so only the two-week third is printed. FO-03 and SY-02 word the grades differently, and the Bench uses SY-02's words.

The library is thin in three places. It holds no tested remedy from the Arctic, few tested Ayurvedic ones, and one Unani series without a comparison. And SY-04's consultation with living traditions, which its own ethics require before their remedies are printed, has not been done. Every grade given here to a living tradition's remedy stands only until its holders have seen it.

The turn to the present

In Berlin a chemist's shelf holds tested drugs and traditional remedies in boxes of the same size. Since 2004 a European law has let a herbal product be registered on 30 years of use, 15 of them in the Union, with an effect that need only be plausible. The packet says so in small print. In the United States, between 2007 and 2016, the regulator found 776 supplements with drugs hidden inside. A review of the trials for most common remedies is a few minutes away, and few people read one.

After the Fall there are no reviews and no regulator. There is the book, the garden, the remedies the grandmothers bring, and the people who get better or do not. A register takes a year to show anything and a generation to settle a modest effect. Who will write down the ones who did not get better?

The healer will, if the village asks it. One line for each sick person, written before anyone knows how it ends, and read aloud once a month. That is how Withering's leaf was judged and how Dietl's three groups shamed the lancet. A remedy is a promise, and the village keeps its promises in a bound book with numbered pages.

Now the grades.

AT THE BENCH

Work every dose twice, with two people.

03.1 See: grade a remedy

Every remedy in this book carries one of these grades (SY-02, FO-03, TR-01).

Grade	What it rests on	What the village does
A	Randomised trials or systematic reviews	Use at the book's dose, if the patient fits
B	Consistent observational or clinical series	Use. Record every case
C	Convergent traditional use across unrelated cultures with plausible pharmacology	Only for minor, self-limiting illness. Only if harmless at the dose. Record every case
D	One tradition, anecdote or theory	Do not rely on it. Test only if harmless (see 03.2)
X	Shown ineffective or harmful	Do not use

Rules for grading:

1. Grade the use, the preparation and the dose. Never the plant.
2. Where preparations differ, print both: "extract A, decoction C".
3. Write "not tested" for a use nobody has tested.
4. Write "tested and failed" for a use that failed. Never write "may help" for it.
5. Harm overrides benefit. Serious harm at the usual dose makes the use X.
6. An effect about 10 times larger, fast, on a stable illness, can earn B without a trial (FO-03).
7. Grade C says nothing about safety.
8. Working odds: C about 1 in 3, D about 1 in 10 (TR-01).

To grade a remedy you have just met:

1. Write the claim: illness, plant, part, preparation, amount, how often, how long, result by when.
2. Name the plant to species. Press a specimen with date, place and teacher.
3. If you cannot name it, stop. It stays ungraded.

4. Look for the use in this book. If it is graded, use that grade.
5. If not, count unrelated traditions for the same complaint. 3 or more, with fitting chemistry: C. Fewer: D.
6. Traditions sharing a book, a trade route or a carried plant count as 1. This book never counts.
7. Ask about harm in every tradition. Any record of harm: treat it as X until counted.

Grades: willow bark extract A for back pain, decoction C. St John's wort extract A for mild to moderate depression, tea D, X with the pill or ciclosporin. Senna A. Psyllium husk A, home seed C. Cranberry A for recurrent urinary infection in women and children, X as treatment (chapter 16). Argemone decoction A for uncomplicated malaria in semi-immune people (1 trial), below the drug. Devil's claw extract B. Kava extract B, with a liver warning. Echinacea D. Ginkgo extract for dementia X. Hoodia X. Bald's salve: not tested in people.

Rung ladder. Hands: write the claim. Hearth: grade and date on every jar. Garden and still: vouchered stock only (see chapter 33). Dispensary: the remedy book. Infirmary: grades reviewed yearly from pooled registers. Hospital: trials and assays. Refuse: any remedy with no name, no grade and no record.

03.2 Do: test a remedy in the village

Test nothing on a person with a danger sign. Give A or B care and send them instead.

Before testing:

1. Ask: does this illness clear by itself? In how many days?
2. Ask: is the remedy used instead of something that works? If yes, stop.
3. Test only C or D remedies harmless at the stated dose.
4. Never withhold an A or B treatment, such as oral rehydration. Give it, and test beside it.

The register (FO-03, TR-13, SY-04):

5. Use 1 bound book. Number the pages. Tear nothing out.
6. Columns: date, patient number, age, sex, illness, severity, remedy, amount, outcome day, outcome.

7. Write all but the outcome at first contact.
8. Outcomes: well, better, same, worse, sent on, died.
9. Outcome day: day 7 for acute illness, day 28 for wounds and long illness. A new remedy: check its first 10 uses at days 1, 3 and 7 (SY-04).
10. Visit anyone who does not come back. Count anyone lost as a bad outcome (TR-13).
11. Read the register aloud once a month.
12. Stop any remedy that does worse than no remedy.

For a long, stable complaint (pain, sleep, itch, indigestion), test in 1 person (FO-03):

13. Fill 2 jars that look, smell and taste alike. Mark them 1 and 2. Someone else keeps the key.
14. Run at least 3 pairs of periods, 1 to 2 weeks each. Toss a coin for the order within each pair.
15. Score the complaint daily, 0 to 10. Keep the remedy only if it wins all 3 pairs.
16. Never for an acute infection.

Comparison by lot, at the district only:

17. Only when 2 acceptable remedies compete and nobody knows which is better. Get each family's agreement.
18. Draw lots from a bag made up beforehand by someone who does not treat.
19. Review every 20 patients. Stop if one arm has more deaths or harm.
20. About 80 per arm are needed to see deaths halved from 40 to 20 in 100.

Reading the count: 30 cured of 30 still allows failure in up to 1 in 10 (TR-01). Never move an A or B grade on village numbers alone. Send them to the district. How the register is kept and the book corrected: see chapter 36.

Rung ladder. Hands: the question "would it have passed anyway?". Hearth: a notebook per long illness. Garden and still: the 2 jars. Dispensary: the register, read monthly. Infirmary: pooled registers, comparison by lot. Hospital: blinded trials. Refuse: any test that withholds an A or B treatment.

03.3 Prevent: what never to try

Never use foxglove, monkshood, autumn crocus, yew, oleander or thorn apple as medicine (SY-10). Learn each plant to tell it from its lookalike instead.

Foxglove is never used as medicine, at any rung. Its case is in chapter 34. For swelling with breathlessness, sit the patient up and send to the infirmary.

Never	Instead
Bleed anyone for fever, pneumonia or any illness of the whole body	Rest, fluids, warmth and the count (see chapter 2)
Give calomel (mercury) or tartar emetic (antimony) to anyone	Diet and rest. Bury salvaged stock 50 m from a well, 1 m deep (TR-13)
Purge in diarrhoea or fever, or anyone under 5 or over 70. Make anyone vomit (TR-13, SY-10)	Oral rehydration for the diarrhoea. Send a poisoned patient on
Give birthwort (*Aristolochia*), comfrey by mouth or pennyroyal	Vouchered stock from the village bed (see chapter 33)
Use a bought or salvaged remedy of unknown origin, above all for sex, slimming or strength	The village's own graded remedies
Put dung, urine or foul matter on a wound or a cord	Clean water and soap (see chapter 1). Chlorhexidine on the cord only
Give a C or D remedy in place of an A or B one the village holds	Give the A or B first
Ask for, write down or use restricted or ceremonial knowledge	Record that a restriction was claimed, by whom and when, in the district register. Warn about a poisonous plant from toxicology only (SY-04)

Grades: bleeding for fever or pneumonia X. Calomel X. Tartar emetic X. Birthwort X. Pennyroyal X. Foxglove leaf titrated B in ME-07, never as medicine by the book's rule.

Seven signs of a remedy driven by theory (TR-13). 3 or more: presume it harmful until counted.

1. The explanation is the only evidence.
2. Success is the treatment's own effect: blood in the bowl, vomiting, a blister.

3. Failure calls for more.
4. Nobody is refused it.
5. The authority is a person or a book, not a count.
6. Recoveries are counted and deaths explained away.
7. The healer likes it because it impresses.

Danger sign: a patient worse on a remedy. Vomiting, yellow eyes, dark or scant urine, a pulse under 60 or irregular, confusion. Or one sign better while the patient is worse. Stop the remedy. Keep the jar and what is left. Write the case in the register now.

- Help in time: give A or B care. Send to the dispensary or infirmary with the jar.
- Help too late: keep warm. Fluids by mouth if they can swallow. On their side if drowsy. Record everything.
- No help at all: ease pain and fear. Do not leave them alone. Tell the family plainly. The illness is beyond what the village can treat. Everything possible is being done. They will not be alone. Write the remedy down so nobody gives it again.

Rung ladder. Hands: know the never list. Hearth: no unlabelled jar. Garden and still: no poison plant in the medicine bed. Dispensary: the never list on the wall. Infirmary: salvaged drugs behind a lock. Hospital: antidotes. Refuse: the heroic cures, all of them.

If it goes wrong

1. **The register fades.** Entries stop after a season, or only cures are written. Cause: no named keeper, no reading aloud. Name a keeper. Read it monthly.
2. **The grade travels.** A home tea is trusted as A because the extract is. Cause: the grade was written without the preparation. Relabel every jar with preparation and grade.
3. **A remedy looks like a cure.** Most patients recovered, so it is called a success. Cause: the natural course. Ask how many recover without it, then test it (see 03.2).

NUMBERS TO CARRY

- 163 cases, failures included: Withering's foxglove record, 1775 to 1784 (ME-07).
- 80 in 100 of 122 plant drugs had a matching traditional use, counted backwards (TR-01, SY-04).
- 1.4 to 2.6 times: how much more often folk medicinal plants were active than random ones, against a base of 10.4% (TR-01).
- About 1 in 3 for grade C, 1 in 10 for grade D (TR-01).
- 20.0, 20.7, 7.4: pneumonia deaths in 100 bled, given antimony, and rested, Vienna 1849 (TR-13).
- 18 of 39: urinary tract cancer after birthwort, Brussels (SY-02).
- 1 in 5: bought Ayurvedic products with lead, mercury or arsenic (SY-02).
- 0: plants that cure cancer, HIV, tuberculosis, malaria, sepsis, tetanus or rabies (SY-02).

THE LIBRARY

SY-01 The case against lay medicine: how amateurs kill, and whether manuals help. SY-02 The case against herbalism: what the systematic reviews say, and the harms. SY-03 The case against allopathy: iatrogenesis, overtreatment and the McKeown thesis. SY-04 The romance of the indigenous and the ethics of taking. TR-01 How often is the old remedy right? The ethnobotanical hit rate and the test of convergence. TR-05 Greek, Roman and monastic Europe. TR-13 Humours, bloodletting, purging and the therapies that killed. ME-07 The heart and the poison garden. FO-03 Judging a remedy without a laboratory: the evidence ladder for lay healers. SY-10 The harm register. All are on the website.

PART TWO

The Child Who May Die

CHAPTER 4

The Breathing Child

Pneumonia kills a child in two to three days from the first fast breath.
Count the breaths for one full minute, then give the amoxicillin.

OPENING

COUNT your breaths for one minute. Not the deep ones you take when somebody tells you to breathe. The ordinary ones, the ones you were taking before this sentence began. Watch a clock, or the second hand of a watch, and let the count run to the end of the minute.

Most adults at rest come to somewhere between twelve and twenty. The number surprises people. It is slower than they think, and it is quiet. You did not hear most of those breaths. You saw them, if you looked down: the shirt lifting, the belly rising a little and falling back.

A baby in the first month of life, asleep, breathes about forty times a minute. A child of two breathes about thirty. The count falls as the child grows, the way the pulse does, because a small body burns its warmth quickly and has small lungs to do it with. Every mother who has lain awake beside a cot knows this rhythm without having counted it.

In a small child the belly moves more than the chest. A baby breathes unevenly, a quick run and then a pause, so that a quarter of a minute can say almost anything. Only the whole minute tells the truth. The count is also easily spoiled. A crying child, a feeding child, a child who has just been

carried up the stairs, all breathe fast and mean nothing by it. A sleeping child does not lie.

When the lungs fill with the wet of an infection, there is less lung for each breath to reach. The child breathes faster to make up the difference. Long before the child looks ill, long before the cough sounds like anything, the count has risen. Fifty in a baby of six months. Forty in a child of three. Then the lower ribs begin to suck inward with each breath, because the small muscles are pulling hard against stiff lungs.

None of this needs an instrument. It needs a calm child, a bared belly, a minute and someone willing to count to the end of it. Of all the body's signs, the breath is the one you can count with your eyes.

THE STORY

What the lung does

Pneumonia is an infection of the lung's smallest air spaces. They fill with fluid and pus, and the air cannot reach the blood through them. The body answers in the only way it can. It breathes faster, then harder, then with the muscles of the neck and the belly, until the child tires. In children the infection is usually patchy, scattered through both lungs. In adults it often fills one whole lobe at a time.

William Osler, in his textbook of 1892, described the adult disease as it ran in the wards of his day. Fever, a stitch in the side, rusty sputum, then on the seventh to the tenth day a sudden crisis: the fever broke, the sweat came, and the patient slept and lived. Or did not. At the Montreal General Hospital 20.4 per cent of 1,012 patients died. In New Orleans it was 28 per cent of 3,969. Doctors bled pneumonia patients for most of the nineteenth century and it made things worse. The crisis came when it came.

For a long time the chest was judged by the ear. Leopold Auenbrugger in Vienna in 1761 tapped on it with his fingers and listened for the dull note of a lung full of fluid. René Laennec, at the Necker Hospital in Paris in September 1816, rolled a sheet of paper into a tube and listened through it, and in 1819 he published what he had heard. The stethoscope came out

of that paper tube. It took two centuries more for doctors to notice that the plainest sign needed no ear at all.

For children in the poor parts of the world the disease has always been quicker. Untreated, a child with pneumonia can die within three days. In England in the 1870s diseases of the chest caused about a fifth of the deaths of children under five. Today, in the places where children still die young, pneumonia is the first or second cause, with diarrhoea. In 2015 it killed about 920,000 children under five, around one death in six.

In a village of 300 there are about 45 children under five. About thirteen of them will have pneumonia in a year. Most will get better whatever is done. Some will not.

The drug and the count

Between March and June 1938, at Dudley Road Hospital in Birmingham, two doctors named Evans and Gaisford gave a new tablet called M&B 693, sulphapyridine, to 100 adults with pneumonia. Eight of them died. Of 100 nursed in the old way alone, 27 died. Within a decade penicillin had joined it, and the hospital death rate from pneumonia fell to a fraction of what Osler had seen.

The drug only helps the child who gets it, and the child only gets it if someone notices. That was the problem the doctors of the poor world took up in the 1980s. Shann, Hart and Thomas, in Papua New Guinea in 1984, watched 350 children with chest infections and asked which signs a health worker without a stethoscope could use. Their answer was two signs. A breathing rate above 50 meant antibiotics. The lower chest sucking in with each breath meant the child needed more than a village could give. They also found that a mother's own report of fast breathing was nearly as good as the count.

In Vellore, in southern India, in 1988, Cherian and his colleagues tested the same signs in 682 children and found that they worked best under three years of age. The World Health Organization built them into its programme for chest infections, and in the 1990s into its guidance for the sick child as a whole. The lines were set by age. Sixty breaths a minute or more under two months. Fifty from two to twelve months. Forty from one to five years. Counted for a full minute.

Then there is the child whose chest is failing. In the Gambia, in a study published in 1999, Usen, Weber, Mulholland and their colleagues measured the oxygen in the blood of 1,072 children with chest infections. Sixty-three of them, 5.9 per cent, were short of oxygen. They died at 12.7 per cent, against 2.6 per cent of the others. Blue lips, the sign everyone expects, showed in only a quarter of the children short of oxygen. Flaring nostrils showed in nearly all of them, and in most of the others too. Grunting at the end of each breath and the head nodding with each breath showed in about half, and seldom in children who were well. A child who could not feed, or who breathed 70 times a minute or more, was more likely to be short of oxygen too. Blue is late. Grunting and nodding come first.

The count is a sieve, not a verdict. Across 15,029 children pooled in 2020, fast breathing caught 92 in 100 of those with pneumonia, but most children with fast breathing did not have it. That is the right way round for a village. It is also why the count must be honest. In Malawi in 2009, when 131 health workers counted the breaths of 382 children, only 30 in 100 of their counts came within two breaths of the clinician's, and they checked the general danger signs in only 37 children in 100. Yet as a plain answer to the question fast or not fast, lay counters in sixteen studies pooled in 2022 were right about four times in five.

Gadchiroli

In 1988 Abhay and Rani Bang, two doctors who ran their own small organisation, SEARCH, in Gadchiroli, a forested district of Maharashtra in central India, set out to test whether village people could do what a doctor did for a child with pneumonia. In 58 villages, with 44 others for comparison, they trained village health workers to count breaths against a watch, to look for indrawing, and to give one cheap antibiotic, co-trimoxazole, when the count passed the line. In the treated villages 612 children with pneumonia were treated at home, and 0.8 per cent of them died. In the comparison villages, where some families still sought care where they could, 13.5 per cent died. The drug cost about two and a half American cents per child a year.

They had no X-ray and no laboratory. They did not need them. The count you can see was the whole of their instrument, and it was enough

to find the children who needed the tablet.

From 1995 the Bangs went further. A newborn with an infection in the blood rarely coughs. It stops feeding, goes cold or hot, breathes fast, lies still, and it can die within a day or two. In 2008 the Young Infants Clinical Signs Study Group, working in several countries, settled seven such signs, and they are now what every birth attendant learns. In Gadchiroli the workers visited every newborn in 39 villages, kept the babies warm and helped the mothers breastfeed. From 1996 they treated the babies with signs of infection at home, with oral co-trimoxazole and injected gentamicin. Before the programme, 16.6 per cent of the newborns with this infection had died. By 1998 it was 2.8 per cent, and deaths in the first month of life had fallen by 62 per cent against the comparison villages. The workers were supervised every two weeks.

Hold on to the word injected.

The tablet in the house

Gadchiroli was not alone. When Sazawal and Black pooled nine community programmes in 2003, they found pneumonia deaths among children under five falling by about a third where trained lay people treated at the door. None of those trials gave every child a random chance of treatment, and the attention a trial brings may have helped too. The direction is not in doubt.

What changed in the next twenty years was the drug and the place. In Pakistan in 2008, Hazir and colleagues gave 2,037 children with indrawing either oral amoxicillin at home or injections in hospital. Treatment failed in 7.5 per cent at home and 8.6 per cent in hospital. In four countries in 2022, community workers gave oral amoxicillin to 4,013 children with indrawing at home and did as well as referral, 4.3 against 4.4 per cent, though they had a small light on the finger to send home only the children with enough oxygen in the blood. In 2014 the World Health Organization moved the child with indrawing but no danger sign out of the hospital and into the house, with five days of amoxicillin.

The same years showed the limit at the other end. In Karachi in 2020, Jehan and colleagues gave 4,002 children with fast breathing and nothing else either amoxicillin or a dummy tablet. Treatment failed in 4.9 per

cent without the drug and 2.6 per cent with it, and one child died in each group. Forty-four children had to be treated for one to be spared a failure. For fast breathing alone, the drug helps few. For indrawing, it helps many. A village with a short shelf will need that difference.

The newborn is the hard case. In 2015 a trial in the Democratic Republic of the Congo, Kenya and Nigeria treated 3,564 sick young infants whose families would not or could not go to hospital. Babies with fast breathing alone did as well on oral amoxicillin. Every regimen for the sicker babies included at least two days of injected gentamicin. The village after the Fall will not inject. That decision protects it from the dirty needle, which is the commonest harm lay medicine has done. It also means the village cannot reach Gadchiroli's 2.8 per cent for the septic newborn. I found no trial of oral treatment alone in those babies. Expect it to be worse.

The shelf and the winter

Count the village. Three hundred people, about forty-five children under five, about thirteen pneumonias in a year. A five day course for a child of 10 kg takes about twenty tablets of 250 mg, so the children of one village use about 300 tablets a year if the drug is kept for the chest. That is a small tin. It is also a tin that cannot be refilled. No village can make amoxicillin, and the salvaged stock will last a few years at best.

Of twenty skills a village of 300 could teach, the breath count with amoxicillin saves the most lives for the hours it takes to learn. In a tropical village it averts about three quarters of a death every year, about one life for every eight to thirteen hours of teaching. When the amoxicillin runs out, the same count is worth perhaps a fifth as much. It still finds the child who needs carrying, warming and holding upright. It still tells the family the truth in time.

So the hard question comes early, in the first winter, while the tin is full. A child with a cold and a frightened mother. A child with a cough and a count of 32. Each wants a course. Each course given is one not there for the baby with indrawing in February. A village that answers the question in October, in daylight, with the register open, will answer it better than a healer at three in the morning.

Nursing the chest

Without any drug, most children with pneumonia live. Thirteen and a half in a hundred died in Gadchiroli's comparison villages, which means that eighty-six lived. What they needed was what the body needs while it does its own work. Warmth. Fluid, but not too much, because a child with wet lungs can be drowned slowly from the cup. To be held upright, so the belly does not press on the lungs. The breast, often, a little at a time. Fresh air in a warm room.

In the autumn of 1918, at Brookline near Boston, the Massachusetts State Guard put up an open-air hospital in thirteen tents in seven hours and nursed 351 sailors with influenza through the epidemic. A third had pneumonia. Thirty-six died, about one in ten. Nobody counted carefully enough to know whether the fresh air saved the sailors or only kept the nurses well.

What hurt them was the urge to do something more. For a century the cough of children was quieted with opium. Mrs Winslow's Soothing Syrup, sold from Bangor in Maine from 1849, held enough morphine that a teaspoon could kill a baby. In 1847 an inquest at North Marston in England heard how an eleven-week-old had been given Godfrey's Cordial and poppy-head tea, and found the death natural. Steam from a bowl of hot water, still recommended in some households, does nothing measurable for a cold and sends a steady trickle of scalded children to burns units. Mustard plasters blister. Honey, given to a child over one year, quiets the night cough of a cold about as well as the syrups did. Under one year it can carry botulism.

Some children will die whatever is done. A child whose blood is short of oxygen may die even with the drug, and there will be no oxygen. What the house can give then is warmth, company, the breast offered and not forced, and the truth told early enough for the family to gather.

A child who is getting better breathes more slowly and wants to feed. A child who breathes more slowly and does not want to feed, who is harder to wake, is getting worse. The count must be read with the face.

The Honest Broker's Count

Six library reports were read for the breathing child. IN-03 on pneumonia and MA-07 on the sick child can be trusted with a life on the thresholds, the danger signs and the trials of oral amoxicillin. They read the Gambian signs study, the 2014 WHO policy and the 2022 community trial in full, the Pakistan trials through their abstracts, and they agree with each other. IN-01 gives the village arithmetic and the share of child deaths. IN-04 holds the newborn signs and the 2015 African trial. SY-05 and SY-08 rank the work and lay out the ladder.

The Gadchiroli figures need saying plainly. Not one report read the 1990 paper itself. IN-03 read the abstract. IN-01 read a secondary summary. MA-07 read search summaries of the paper and of a 1994 follow-up. They do not quite agree. IN-03 and IN-01 give 0.8 per cent of 612 children. MA-07 gives 0.9 per cent of 2,568 treated attacks over 1988 to 1991. The comparison villages had some care, and not every figure had a concurrent comparison. The newborn figures, 16.6 and 2.8, also come from the abstract and summaries, from a design that was controlled but not randomised. Gadchiroli is the best story the library has. It is not yet a checked source.

There is a second thing. The book's shared figure says 13.5 against 0.8 per cent with amoxicillin. The drug at Gadchiroli was co-trimoxazole. Amoxicillin's own standing in lay hands rests on the Pakistan and four-country trials and on the Cochrane comparison, which found the two drugs near equal. The figure is borrowed, honestly enough, but borrowed.

Third, the dose. IN-03 and MA-07 both give amoxicillin as 40 mg for each kilogram twice a day, and then print a tablet chart of one, two and three 250 mg tablets by weight. Those tablets do not reach 40 mg per kilogram. A child of 9 kg on one tablet gets 28 mg per kilogram. The chart matches the older, lower dose. I reworked the bands from the arithmetic, in half tablets, and marked every line for checking against the WHO chart booklet. The ceiling, the co-trimoxazole bands, the bands for young infants and the honey measure are from my own knowledge and arithmetic, and are marked the same way. Where the reports differ on the safe range, 35 to 45 or 35 to 50 mg per kilogram, I printed the wider. Where they differ on whether the line of 50 runs to eleven or twelve months, I printed

SY-07's card. The report of a 1988 paper by Shann and Mulholland could not be confirmed, and the suggestion that a starved child needs a line five breaths lower rests on one summary. Neither is printed at the Bench.

Last, the library disagrees with itself about how many children a village loses to pneumonia. Thirteen cases at 13.5 per cent give nearly two deaths a year. Counting from pneumonia's share of all child deaths gives about one every two years. The truth for a given village lies somewhere between, and the book does not pretend to know where.

The turn to the present

What the hospital did was take the count away from the mother. The count went on, faithfully, by a nurse with a watch pinned to her apron, written on a chart at the foot of a bed. The mother learned to bring the child, not to count. Who in the house, by 2020, still knew that forty was the line for a child of three? In 2010 Theodoratou and colleagues found that where lay workers treated, pneumonia deaths fell by about a third, and reckoned that full coverage might cut them by seven tenths. The difference was the children nobody counted.

And with the count went the reason for the drug. In 1961 Reimann estimated that nine tenths of the antibiotics given in America were not needed. Between 1987 and 1998 the share of American pneumococci, the commonest cause of pneumonia, that resisted penicillin rose from 3.6 to 24 per cent. Codeine was given to coughing children for most of a century before the American regulator forbade it in 2017, after counting twenty-four children's deaths. A cold does not need an antibiotic. It needed somebody to count.

After the Fall the count comes home. The shelf will hold amoxicillin for a few years. The breath of a child can be counted for as long as there are children and someone patient enough to watch them. The workers at Gadchiroli had a watch and a register. They could see a belly rise, and count to the end of a minute.

Now count.

04.1 Count the breaths

See

1. Wait until the child is calm or asleep. Not crying, not feeding.
2. Bare the belly. Watch it rise. 1 rise is 1 breath.
3. Count for 1 full minute by a watch. Never 15 seconds times 4.
4. Count twice. Counts more than 5 apart: count again, use the higher.

Age	Fast breathing: this count or more in 1 full minute
Under 2 months	60
2 to 12 months	50
1 to 5 years	40

5. Look for indrawing: the lower chest wall goes in on the in breath.
6. Listen for grunting. Look for blue lips and a nodding head. Write the count in the register.

Do

1. Over the line, no indrawing, no danger sign: amoxicillin for 3 days (see 04.3).
2. Indrawing, no danger sign: amoxicillin for 5 days. Count daily. Send to the district if it is near.
3. Any danger sign: see 04.2. Under 2 months: see 04.4.

Prevent. 2 healers count the same sleeping child weekly until they agree within 5.

Rung ladder. Hands: the count and the look. Hearth, garden and still: nothing more. Dispensary: a watch, a 2nd counter. Infirmary: an oxygen meter if salvaged. Refuse: judging by the sound of the cough.

04.2 The chest that is failing

Never give anything by mouth to a child who cannot swallow. Wet the lips with a clean cloth instead.

See. Any 1 is a danger sign. Cannot drink or breastfeed. Vomits everything. A fit. Will not wake, or is limp. Blue lips or tongue. Grunting, or the head nodding. Deep indrawing with a count of 70 or more. A count that falls while the child grows more tired: this is not recovery.

Do

1. If the child can swallow, give the 1st dose of amoxicillin now (see 04.3).
2. Hold the child upright against a chest. Keep warm. Offer the breast.
3. Write time, count, signs and dose on a note.

Help in time. The district is within a day. Carry the child now, upright and warm, with the note. The infirmary adds injected antibiotic, and oxygen if salvaged.

Help too late. The child is blue, will not wake, or gasps before help is reached. Give the dose only if the child swallows. Carry on if the family wants it. Tell them the child may die on the way.

No help at all. Give the full 5 day course. Nurse as in 04.5. If the child worsens, give comfort. Hold the child upright on a parent, warm, in a quiet airy room. Wet the mouth. Do not force drink, cut or burn. Tell the family plainly: "This child may die. We are doing what can be done. Stay close. The child can hear you."

Rung ladder. Hands: the signs. Hearth: warmth, the breast. Dispensary: oral amoxicillin. Infirmary: injection, oxygen if salvaged. Refuse: injection at the village.

04.3 Amoxicillin by weight

Never give amoxicillin to a child who had a rash, swelling or wheeze after any penicillin. Give co-trimoxazole instead.

See. A count over the line, indrawing, or a danger sign. Not a cold, or a cough with a normal count.

Do

1. Weigh the child. Check the scale against 7 litres of water: 7 kg.
2. Read the band aloud. A 2nd person reads it back.
3. Give every 12 hours. Watch the 1st dose swallowed.

4. 1 dispersible tablet of 250 mg in 5 ml of clean water gives 50 mg in each ml.

Amoxicillin 40 mg/kg each dose. Safe range 35 to 50 mg/kg. Above the range is safer than below. Ceiling in a child: 1,000 mg a dose, 3,000 mg a day.

Weight	Tablets of 250 mg, each dose	Or suspension 250 mg in 5 ml	Age, only if no scale
4 to under 7 kg	1	5 ml	2 to 6 months
7 to under 10 kg	1.5	7.5 ml	6 to 12 months
10 to under 14 kg	2	10 ml	1 to 3 years
14 to 19 kg	3	15 ml	3 to 5 years

5. Days: 3 for fast breathing alone, 5 with indrawing.
6. Count again at 48 hours. Not better: see 04.2. Fever at 72 hours: see 6.

Co-trimoxazole, if no amoxicillin or allergic. Never under 6 weeks. Trimethoprim 4 mg/kg every 12 hours, 5 days. Ceiling 160 mg a dose. Suspension: 40 mg trimethoprim with 200 mg sulfamethoxazole in 5 ml. Adult tablet: 80 mg with 400 mg.

Weight	Suspension, each dose	Or adult tablets	Age, only if no scale
4 to under 6 kg	2.5 ml	0.25	6 weeks to 4 months
6 to under 10 kg	5 ml	0.5	4 to 12 months
10 to under 15 kg	7.5 ml	0.75	1 to 3 years
15 to 19 kg	10 ml	1	3 to 5 years

Work every dose twice, with two people.

Prevent. Finish every course begun.

Rung ladder. Hearth: clean water, an oral syringe. Garden and still: no plant replaces it. Dispensary: the drug, the scale. Infirmary: injection for the child who cannot swallow. Refuse: amoxicillin for colds.

04.4 The baby under 2 months

Never give honey, water or any feed but the breast to a baby under 6 months. Give the breast often, or expressed milk by cup.

See. The 7 signs, in full in 11. Among them: a count of 60 or more, deep indrawing, 37.5 °C or more, below 35.5 °C.

Do

1. Any sign but fast breathing alone: possible blood infection. Skin to skin, milk by cup, 1st dose of amoxicillin. Carry to the district today for injected gentamicin.
2. Under 7 days old, or under 2 kg: carry to the district. See 11.
3. Fast breathing alone, 7 to 59 days old, feeding well: amoxicillin 50 mg/kg every 12 hours for 7 days.

Weight	Amoxicillin 250 mg in 5 ml, each dose
2 to under 3 kg	2.5 ml
3 to under 4 kg	3.5 ml
4 to under 6 kg	5 ml

No age column. Weigh every baby.

4. No district: the same course for 7 days, skin to skin. Tell the family: without the injection, more of these babies die.

Rung ladder. Hands: the signs, skin to skin. Hearth: the cup. Dispensary: oral amoxicillin, the scale. Infirmary: injected gentamicin. Refuse: injection at the village.

04.5 Nursing the chest with no antibiotic

Never give opium, morphine or codeine to a child with a cough. Hold the child upright and give the breast instead.

Never burn charcoal in a closed room. Warm the child against a body and under blankets instead.

Do

1. Hold the child upright or half sitting. Raise a baby's head and chest after feeds.
2. Body warm, air fresh, no smoke. No more than 2 people in the room.
3. Breastfeed often, a little each time. Other drinks only up to the total below.

Weight	All fluid in 24 hours, breast milk included
5 kg	500 ml
10 kg	1,000 ml
20 kg	1,500 ml

4. Puffy eyelids or harder breathing after drinks: stop the extra fluid. Sit the child up.
5. Count every hour. Look at the face as well as the count. Danger sign: see 04.2.
6. Fever: see 6.
7. Cough over 12 months: honey, 2.5 ml before sleep.
8. Tell the family: most children live through this, even without the drug. Some do not.

Grades. Honey over 12 months, A for the cough of a cold. Honey under 12 months, X. Thyme infusion, B for bronchitis, D for pneumonia. Mustard plaster, D for comfort, X as cure. Steam, X.

Rung ladder. Hands: holding, counting. Hearth: warmth, measured fluid. Garden and still: thyme for comfort. Infirmary: oxygen if salvaged. Refuse: steam, poultices, opiates.

04.6 Keeping amoxicillin for the chest

1. Soap on hands before feeding a child and after the latrine.
2. No smoke where children sleep. Breast only for 6 months (see 7).
3. Write 60, 50, 40 on every house wall.
4. Amoxicillin only on a written sign. No antibiotic for a cold or diarrhoea without blood.
5. Decide before winter who gets a course when the shelf holds 40. Suggested: danger signs, indrawing and babies under 12 months first. The arithmetic is in 32.

Rung ladder. Hands: soap. Hearth: a smokeless room. Dispensary: the register, reviewed monthly. Refuse: antibiotics without a sign.

If it goes wrong

1. *The wrong count.* Every child seems fast, or the sick child is missed. Cause: a crying child, or 15 seconds times 4. Do: count calm, a full minute, 2 counters.
2. *The empty shelf.* No tablets when the child with indrawing comes. Cause: amoxicillin for colds. Do: the written sign rule. See 32.
3. *The wrong dose, or too much fluid.* No better at 48 hours, or puffy eyelids and harder breathing. Cause: dose by age, no 2nd reader, drinks pushed. Do: weigh, read the band aloud and back. Stop extra fluid. Sit the child up.

NUMBERS TO CARRY

- 60, 50, 40 breaths in 1 full minute: under 2 months, 2 to 12 months, 1 to 5 years (MA-07, SY-07).
- 13.5 against 0.8 per cent: child pneumonia deaths without and with an antibiotic in lay hands, Gadchiroli (IN-01, IN-03, SY-08).
- 16.6 against about 3 per cent: newborn blood infection, untreated and treated with injected gentamicin (IN-01, SY-08).
- Amoxicillin 40 mg/kg twice a day, 3 days for fast breathing, 5 with indrawing (IN-03, MA-07).
- 2 to 3 days from the first fast breath to death (IN-01).
- 37.5 and 35.5 °C: fever and cold in a baby (SY-07).
- About 13 child pneumonias a year in a village of 300 (IN-01).
- Honey for cough: A over 12 months, X under (IN-03, SY-10).

THE LIBRARY

IN-03 Pneumonia and the chest. MA-07 The sick child. IN-01 The great killers after the Fall. IN-04 Sepsis. SY-05 The twenty interventions that save the most lives per hour of training. SY-08 The means ledger. SY-07 The red-flag list. SY-10 The harm register. FO-04 The lay healer in the record. All are on the website.

CHAPTER 5

The Dry Child

Cholera kills within hours, ordinary diarrhoea within days. Start the salt and sugar at the first loose stool.

OPENING

PINCH a fold of skin on the back of your hand, hold it for a breath, and let go.

It falls flat before you can count one. The skin is full of water, as all of you is, and the water makes it spring back. In a child who has lost a tenth of her weight through the bowel, the same fold stays standing after it is let go. It settles slowly, over two seconds or more. The eyes sink into the face. The mouth is dry. The child who was thirsty a few hours ago now drinks badly, or not at all. The nappy stays dry. A small body holds little water, and loose stools can take a large part of it in a day. In cholera they can take it in an afternoon.

What puts the water back is not in a pharmacy. It is in the kitchen: salt, sugar, clean water, a pot that holds a litre, a spoon, and someone who will sit with the child and give it a spoonful at a time. The bowel that is losing water will still take water in, if salt and sugar come with it. It took medicine a long time to find that out. It needs only a kitchen to use it.

A remedy that needs nothing bought can be kept by heart. The kitchen remembers it the way it remembers bread: a measure, a pot, an order of

doing things, passed from one pair of hands to the next. A kitchen can also forget, or remember wrong, and a recipe remembered wrong is worse than none, because the mistake is always the same mistake. It is too much salt. Most of what follows is about that one quantity, the salt in a litre of water, and how a household keeps it right for years without a scale.

The skin on your hand has settled by now. In a dry child it would still be standing. Every grown person in a village should know what that looks like, and what to do in the next ten minutes.

THE STORY

The water that leaves

A child with diarrhoea does not die of the diarrhoea. She dies of the water that leaves with it, and of the salt that leaves with the water. The gut pours out and takes back several litres of fluid a day, and in health almost all of it comes home. When an infection turns that around, the stool carries water, sodium and potassium away faster than a child can drink them back. In cholera an adult can lose 10 to 15 ml for each kilogram of weight every hour, and a grown man can be 5 litres short by the time he reaches help. A child loses faster for her size. By the time the pinch stands for two seconds she has lost more than a tenth of her weight. Her blood is too thick and too scant to warm her hands.

Untreated, severe cholera kills about half of those it takes. Ordinary diarrhoea in children is slower and far more common. It killed an estimated 4.6 million children under five in 1980, and about 1.5 million in 2000. The World Health Organization's present count is 443,832 a year. Clean water, vaccines and better food share the credit. Most of the rest was earned in kitchens.

Medicine's first answer was the vein. In Leith in 1832 a doctor ran salt water into the veins of nine cholera patients near death, and three of them recovered. It took more than a century to make the method safe. Robert Allan Phillips, a doctor of the United States Navy, gave salt solution by vein to 40 cholera patients in Cairo in September 1947, and 3 died, where about half of those left untreated were dying. When he was honoured

for the work in 1967, the citation credited his methods with taking severe cholera from over 60 deaths in a hundred to under 1. The drip worked. It also needed sterile fluid by the litre, needles, tubing, a nurse who could find the vein of a shocked child, and a building to hold them all. In a flood, a famine or a refugee camp, each of those ran out first.

A sugar that carries salt

The plain alternative was to give the salt water by mouth, and for a long time it seemed not to work. A gut pouring out fluid poured out the drink as well. The answer came from a laboratory, not a ward. In Prague in August 1960 a physiologist proposed that sodium and glucose cross the wall of the gut together, on one shared path. Four years later an experiment on rabbit bowel showed that sugar drew sodium across. Cholera turns on the pouring and leaves that path alone. A drink holding salt and sugar in the right proportion goes in even while the bowel is losing water. Sugar alone does not do it. Salt alone does not do it.

The wards caught up unevenly. In 1953 Hemendra Nath Chatterjee, a physician in Calcutta, reported 186 cholera patients treated with fluid by mouth, and all of them lived. The report was printed and overlooked. Phillips himself tried glucose and salt by mouth in Manila in September 1962, and 5 of his 30 patients died. His solution was far too concentrated. The method looked dangerous, and in that form it was.

In Dhaka in 1968 the work was done carefully. A team perfused the bowels of cholera patients and showed that glucose cut the net loss of stool. Then David Nalin and Richard Cash, with Bengali colleagues and Phillips, gave a glucose and salt solution by mouth to 51 adults with cholera. Their need for fluid by vein fell by about 80 per cent. The paper appeared in the Lancet on 17 August 1968. Cash took the method to Matlab in 1970, to 350 patients, and the need for the drip fell by 70 per cent there too. In the floods that reached Dhaka in 2009, 42,000 patients came through the cholera hospital there in nine weeks, and none died of being dry.

The drink did not stop the diarrhoea. It replaced what was lost, cup for cup, until the illness ran its course. That is all it has ever done, and it is enough. A mother who expects the stools to stop will think the drink

has failed and put it away. That is why every good teacher of the method has said what the drink is for before saying how to make it.

Bongaon, 1971

In the summer of 1971 the fighting in East Pakistan drove millions of refugees across the border into West Bengal, and cholera came with them into the camps. Dilip Mahalanabis, of the Johns Hopkins centre in Calcutta, ran a treatment unit at Bongaon for about eight weeks in July and August. Fluid for the vein was short from the start. He did not wait for more.

His team weighed out the salts in Calcutta: 22 g of glucose, 3.5 g of salt and 2.5 g of baking soda for each litre. The packets went about 50 miles to the camp. There they were dissolved in drums of water and given by the cup. Most of the cups were held by relatives, because there were not enough nurses. A litre cost about 11 paise, a cent and a half. Among 3,703 patients, 3.6 per cent died. Among the 1,190 in the unit where the method was shown and taught, 1 per cent died. Camps that relied on the drip alone were losing 20 to 30 in a hundred.

Two facts from Bongaon belong at every bedside. The first is that half of the deaths came before rehydration had begun. People died in the queue, on the road, in the hours before anyone gave them a cup. The second is that the hands which saved the rest were not trained hands. They were a mother's, a brother's, a neighbour's, with a cup, a drum and one instruction.

Several journals turned the paper down. It was a camp report, not a trial, and the comparison with the drip camps was made after the fact, which is a fair objection. It was published in 1973 and reprinted by the World Health Organization's Bulletin in 2001, long after the world had taken its advice. WHO began its programme for diarrhoeal disease in 1978, with a packet holding 90 mmol of sodium to the litre, the strength of the Bongaon drums. In 2001 the formula was made less salty and less sweet, and children given it needed an unplanned drip less often.

The half seer

A packet still has to come from somewhere. The next step took the packet out of the method and left only the kitchen.

From July 1980 the Bangladeshi organisation BRAC sent women from house to house to teach mothers to make lobon-gur, salt and molasses in water, from what was already in the house. The teachers were literate women between twenty and fifty. Each taught one mother at a time, for twenty to twenty-five minutes, about eleven households a day. The lesson began as ten points and was cut to seven: what diarrhoea does, how to prevent it, why water and salt must be replaced, the recipe, to start at the first loose stool, how much to give, and to keep feeding during and after. The visit ended with the mother making the drink herself while the teacher watched. About a month later a monitor came back to one house in ten and asked her to make it again. The teacher was paid by what the monitor found: 4 taka for a mother graded A, 2 for B, 1 for C, nothing for D. Over the decade more than 12 million mothers were taught.

The recipe was a three-finger pinch of salt and a fistful of gur in half a seer of water, about 467 ml. It had first said two scoops of gur. It was changed because women mixed up one pinch and two scoops with two pinches and one scoop. In the first checks 87 per cent of the solutions were safe, and fewer than 1 in 100 were dangerously salty. Nearly nine in ten mothers who knew the recipe had learned it from the woman at her door. Posters and radio had taught almost no one.

Then the kitchen did what kitchens do. One to two years after the teaching, the share of dangerous solutions had risen to 14.7 per cent, then 18.2, then 25.6. The women had forgotten the size of the pinch and of the fistful. They had not forgotten the half seer, the pot they used every day. The kitchen remembers the cure in the shape of its own vessels, and loses what lives only in the hand. By 1993 more than 70 per cent of women in Bangladesh could make a safe solution, and it was given in about 60 per cent of bouts of diarrhoea. That was the work of the visits, and of the visits coming back.

The other way to fail is quicker. In Lagos in 1978 Olikoye Ransome-Kuti and Adepeju Bamisaiye asked 217 women to make the drink as taught, and 34 per cent made it right. Most of the errors were too much salt. Nearly half of those were four times too strong, and three were six-

teen times too strong. A child given a drink that salty is thirstier after it than before, and is given more. Above about 150 mmol of sodium to the litre of blood the thirst is out of all proportion, and above 165 the fits usually come. In Amsterdam two infants were given home solutions made at seven times and twice the right strength. One died and the other was left brain damaged. In Kashmir a child died after a packet meant for a litre was made up in 200 ml. Across sixteen African countries the official recipes, followed exactly, would have given anything from 9 to 116 mmol of sodium to the litre. In the record of these drinks the deaths are all on the salty side. The library found no child killed by a solution too weak.

The answer the record gives is a fixed measure, not a better memory. An American team found in 1980 that pinches, scoops and teaspoons varied too much even in nurses' hands, and proposed a spoon with a small bowl for salt at one end and a large one for sugar at the other. In Natal, in Brazil, in 2001, 47 of 100 home solutions were dangerous. With the double-ended spoon, 63.8 per cent came out right, against 19.3 per cent with whatever the kitchen had. A spoon is easier to keep than a skill. A pot is easier to keep than a spoon.

The Honest Broker's Spoon

Here is the place where the sources disagree, and it is the teaspoon.

UNICEF, the Red Cross and Red Crescent, and Hesperian's village manuals say half a level teaspoon of salt to the litre. WHO's own manual says one level teaspoon, about 3 g. Both cannot be right for the same spoon. A level 5 ml teaspoon of fine salt weighs about 5.9 g, by the sodium figure in the United States Department of Agriculture's tables. So half of it is about 3 g, and WHO's grams agree with the half-teaspoon recipes. WHO's words fit only a spoon of about 2.5 ml. Household teaspoons run from 2.5 to 7.3 ml (ME-02), and in Sri Lankan homes one study found 2.9 to 7.8 (HY-03). A mother who reads "one level teaspoon" and takes the spoon from her drawer can make a solution twice as salty as intended, or nearly three times. At 7 g of salt to the litre the solution holds 120 mmol of sodium, the line BRAC used for danger. The book prints half a level 5 ml teaspoon, with WHO's "one level teaspoon" of about 3 g beside it, and leaves the line open for the checker. How much sodium a purging

adult with cholera needs is a separate question, still open, and it belongs to chapter 15.

The rest of the library can be weighed quickly. HY-03 is careful, and its figures can be trusted with a child once the checker has confirmed the doses. Its account of Bongaon leans on secondary sources as well as the 1973 paper. It cites a famous editorial of 1978 without having read it, so the book does not quote it. IN-11 tells the cholera story and refuses the figure, found in older books, that untreated cholera kills a quarter. No source for it was found, and the book uses about half. NU-02 gives the routes for a child who cannot drink. It says itself that the evidence for children is thin: three small studies for fluid under the skin, none at all for the rectum. Its rate for fluid under a child's skin is disputed, and the Bench prints both figures. IN-11 grades guava leaf and berberine D for diarrhoea. SY-06, following PH-05, reads them as fewer stools in adults, grade B, never a cure, never instead of the solution. The book takes that reading and keeps both plants away from children. On zinc, the best review finds a shorter illness of low certainty, no help under six months and no proven fall in deaths. The book gives zinc, because it is cheap and safe at the dose, and promises no more.

The library gave no rank for diarrhoea among the killers of children, so the draft gives none. Where the reports disagree I have printed both figures. The weight bands for the tube at the Bench are this draft's own arithmetic, 20 ml for each kilogram, shown in the table and marked.

The turn to the present

For two generations the answer came in a packet. The pharmacy sold sachets by the box, the clinic handed them out, and the drip waited at the hospital for the child too dry to drink. The packet was a good thing. It also let the household forget how to make the drink, because it never had to. The library found no survey of how many parents in Berlin could make a litre of it today without a sachet. We would guess few, and the guess is ours.

The same shelf held tablets to stop diarrhoea, and one of them, loperamide, harmed 8 of 927 children in one review of the trials, all of them under three. WHO says it must never be given to a child. It was still sold

beside the sachets, because a parent wants the stools to stop, and the sachet does not stop them. The drink that works looks as if it does nothing. The tablet that looks as if it works does the child no good.

What happens when the packet and the drip are both missing was seen in Zimbabwe in 2008 and 2009. Cholera killed 4,282 people. More than two thirds of the deaths were in places with no treatment. Only 32.3 per cent of the sick had taken any rehydration at home, and 52.7 per cent arrived already severely dry. Haiti in 2010, with the method in place, lost 1.2 in a hundred of its cholera patients. The difference was not a drug. It was fluid, given early, by people who knew how.

A village of 300 can expect to bury five to nine people a year without care, three or four of them children. Some of those children will die dry. The library found no figure for how many. It does show that more than 90 in a hundred children respond to the drink alone, and that the time is short: hours for cholera, days for the rest. The village can make the cure. So the question is a different one. Who in each house will make it right, at the first loose stool, two years after they were taught?

That is a question about memory, and memory can be kept. One recipe, one marked litre, one village scoop for the salt, and a neighbour who comes back to watch it made. The kitchen remembers the cure for as long as someone keeps teaching it to the kitchen.

So: the salt.

AT THE BENCH

05.1 See: the dry child

Look at 4 signs. 2 or more in one column decide it.

Sign	No dehydration	Some dehydration	Severe dehydration
Alertness	Well, alert	Restless, irritable	Floppy, hard to wake, or unconscious

Sign	No dehydration	Some dehydration	Severe dehydration
Eyes	Normal	Sunken	Sunken
Thirst	Drinks normally	Thirsty, drinks eagerly	Drinks poorly or cannot drink
Skin pinch on the belly	Falls back at once	Falls back slowly	Back in more than 2 seconds
Go to	05.3, Plan A	05.3, Plan B	05.4

Ask if the eyes are more sunken than usual. Wake a sleeping child first. The pinch misleads in a wasted or fat child.

Danger signs. Any 1 means 05.4 now: cannot drink or drinks poorly. Cannot be woken properly. Pinch back in more than 2 seconds. Nail pressed 5 seconds, colour back in more than 3 seconds in a warm room. No wet nappy for 6 hours. Vomits everything.

Same day to the dispensary: blood in the stool, diarrhoea over 14 days, a wasted child (see chapter 7), dehydration under 4 months or 4 kg.

Rung ladder. Hands: the 4 signs, a watch. Hearth: a spring scale checked against 7 litres of water. Refuse: a guessed weight when a scale exists.

05.2 Do: make the solution

Too dilute is safe. Too salty kills.

1. Wash your hands with soap.
2. Fill the marked vessel to 1 litre with clean water. Boil it if you can and let it cool. Never less than 1 litre.
3. Add half a level 5 ml teaspoon of fine salt, about 3 g. Level it with a knife. Never heaped. WHO prints "one level teaspoon" of about 3 g, which fits only a 2.5 ml spoon. With the village scoop, 1 level scoop.
4. Add 6 level 5 ml teaspoons of sugar. Up to 8 is acceptable. Gur or brown sugar will do.
5. Stir until dissolved. Taste it: less salty than tears. In doubt, add water. Never add salt.
6. Cover it. Throw it away after 24 hours.

Cereal solution, best in cholera. Boil 50 to 80 g of rice flour in 1 litre of water for

5 to 7 minutes. Cool. Add half a level 5 ml teaspoon of salt. Taste before each use. It sours within hours in warm weather.

Grades. Salt and sugar solution B, with harm when mixed wrong. Rice solution A in cholera. Salted soup C. Unsalted rice water D. Not coconut water, fizzy drinks, juice, sweet tea or coffee.

Rung ladder. Hearth: marked litre, village scoop. Garden and still: a balance checked with water (3 ml balances 3 g). Dispensary: salvaged packets, each in exactly its stated water. Refuse: kitchen spoons, smaller pots, curing salt, washing soda, salt substitute, plant ash. The scoop size is.

05.3 Do: give it, with zinc

Start at the first loose stool. Keep breastfeeding and feeding.

Work every dose twice, with two people.

Plan A, no dehydration. Household solution from 05.2, after each loose stool:

Weight	After each loose stool
Under 5 kg	50 ml
5 to 9.9 kg	100 ml
10 to 19.9 kg	200 ml
20 kg and over	300 ml

If no scale: under 2 years 50 to 100 ml, 2 to 10 years 100 to 200 ml. Ceiling: stop if the eyelids puff. Not better in 3 days, or any danger sign: the dispensary.

Plan B, some dehydration. 75 ml for each kg over 4 hours:

Weight (age if no scale)	Household solution in 4 hours
Under 5 kg (under 4 months)	200 to 400 ml
5 to 7.9 kg (4 to 11 months)	400 to 600 ml
8 to 10.9 kg (12 to 23 months)	600 to 800 ml
11 to 15.9 kg (2 to 4 years)	800 to 1,200 ml
16 to 29.9 kg (5 to 14 years)	1,200 to 2,200 ml

1. Under 2 years: 1 level 5 ml spoonful every 1 to 2 minutes. Never a feeding bottle.

2. Ceiling: 20 ml for each kg an hour. Eyelids puff: stop, give breast milk or water.
3. At 4 hours, look again with 05.1. Better: Plan A. Still some: Plan B again, with food. Worse: 05.4.

Zinc, after the first 4 hours, dosed by age. The library found no weight bands.

Age	Zinc tablet, dispersed in a spoon of breast milk	Interval	Days
Under 6 months	10 mg	Once a day	10 to 14
6 months and over	20 mg	Once a day	10 to 14

Ceiling: 1 dose a day. Grade A over 6 months. Under 6 months the trials found no benefit. Never home-made zinc salts. Cooked green banana in food, grade A. In Berlin-Brandenburg, carob, grade B.

Rung ladder. Hands: spoon, cup, watch. Dispensary: scale, zinc, register. Refuse: a stronger mix "to work faster".

05.4 Do: the child too dry to drink

Never give anything by mouth to a child who cannot swallow. Instead: the tube if she coughs, the rectum if she does not.

Never put anything home-made into a vein or a bone. Instead: the tube, the rectum, or sterile saline under the skin.

1. A drip within 30 minutes: go now, spooning the solution all the way.
2. Further, and she drinks: solution by mouth, 20 ml for each kg an hour, for 6 hours.
3. Cannot drink but coughs when the throat is touched: nasogastric tube at the same rate. Trained hands only (see chapter 24).
4. Confirm the tube is in the stomach first. Pull it for coughing, choking, a changed voice or blue lips.
5. Look again hourly. Slow down if the belly swells. Not better at 3 hours: carry her to a drip.

Weight (age if no scale)	Each hour, for 6 hours
Under 5 kg (under 4 months)	Up to 100 ml
5 to 7.9 kg (4 to 11 months)	100 to 158 ml
8 to 10.9 kg (12 to 23 months)	160 to 218 ml
11 to 15.9 kg (2 to 4 years)	220 to 318 ml
16 to 29.9 kg (5 to 14 years)	320 to 598 ml

Ceiling: 6 hours, 120 ml for each kg. With a scale, use the weight.

6. Cannot cough or cannot be woken: rectal route, 9 g of salt weighed into 1 litre, no sugar, on her left side. The library found no child rate or study. Grade D.
7. Under the skin: to keep water up, never for shock. Dispensary only. Sterile saline, or 9 g weighed into 1 litre, boiled 15 minutes, used within 24 hours. Never sugar water. Rate disputed: 20 ml for each kg over about 1 hour, against the adult 1 ml a minute a site. Grade C.

The three branches:

- **Help in time.** A drip is within reach. Go now, with the solution by spoon all the way.
- **Help too late.** The drip is hours away. Tube or mouth, 20 ml for each kg an hour, on the way.
- **No help at all.** Flat, legs raised, warm. Tube if she coughs, rectum if not, sips if she can swallow. Keep her clean, warm and held, her mother close. Tell the family plainly that she may die. Tell them the sips and the holding add no suffering. Stop promising.

Rung ladder. Garden and still: boiled soft tubing, a funnel. Dispensary: salvaged tubes, pH strips, sterile saline, a healer who has passed 50 tubes. District: the drip. Refuse: home-made fluid in a vein.

05.5 Prevent: what never to give, and how the house keeps the recipe

Never make a child vomit, and never give salt water. Instead: the solution from 05.2.

Never give opium, codeine, loperamide or any drug to stop diarrhoea in a child. Instead: the solution and food.

Never give honey under 12 months. Instead: sugar or gur.

Never starve a child with diarrhoea. Instead: the breast, and small meals often.

No use: charcoal, grade X. Kaolin, no effect found. Drugs against vomiting, grade D. Guava leaf and berberine: fewer stools in adults, grade B, never a cure, never instead of the solution. Neither under 12 years. Berberine never in infants or pregnancy, X.

Teach every household, after BRAC (OR-09). One teacher, one house, 20 to 25 minutes, 7 points at most. Show it made, then watch the mother make it. She says back the recipe and the danger signs. Leave 1 marked litre and 1 scoop. After 1 month, watch it made again in 1 house in 10. Teach again within 1 to 2 years.

Prevent the illness: soap at the latrine and before food, the breast, clean water (see chapter 13).

Rung ladder. Hands: the visit. Hearth: scoop and litre in every house. Refuse: posters instead of visits.

If it goes wrong

1. **Too salty.** Thirst out of proportion, irritability, doughy skin, then fits. Cause: a heaped or large spoon, under 1 litre, or boiling down. Stop. Remake with a fresh litre and a measured scoop. Keep breastfeeding. No plain water fast.
2. **Vomiting.** Each cup comes back. Cause: too much too fast. Wait 5 to 10 minutes, then 1 spoonful every 2 to 3 minutes. Vomits everything for 1 hour: 05.4.
3. **Too much fluid.** Puffy eyelids, then faster breathing. Cause: solution past the need. Stop. Give breast milk or water. Back to Plan A when the eyelids settle.

NUMBERS TO CARRY

- 1 litre, half a level 5 ml teaspoon of salt, 6 level teaspoons of sugar. WHO's "one level teaspoon" of 3 g is the disputed line (HY-03, SY-10, SY-12).
- 75 ml for each kg over 4 hours, Plan B (HY-03).
- 20 ml for each kg an hour for 6 hours, when no drip is within 30 minutes (HY-03, NU-02).
- Zinc 20 mg a day, 10 under 6 months, 10 to 14 days (SY-06).
- 2 seconds for the skin pinch, 3 seconds for the colour to return (HY-03, SY-07).
- 7 g of salt in a litre: 120 mmol of sodium, the danger line (HY-03).
- 50 against under 1: deaths in a hundred from severe cholera untreated and treated (IN-01, IN-11, SY-08).
- Teaspoons hold 2.5 to 7.3 ml (ME-02).

THE LIBRARY

HY-03 Oral rehydration: the discovery that saved the most lives, and how to make it at home. IN-11 Cholera, typhoid and dysentery: outbreak control and case management. NU-02 Fluids by mouth, tube and under the skin. SY-06 The pharmacopoeia. SY-10 The harm register. SY-12 What the library could not find. OR-09 Teaching the book. ME-02 Dose and potency. SY-07 The red-flag list. All are on the website.

CHAPTER 6

The Hot Child

A fever with a stiff neck or a rash that does not fade under a glass kills within a day. Look for those two signs first, then count the breaths.

OPENING

The back of the hand knows heat before any instrument does. Its skin is thin and its nerves are many, and laid on a forehead it tells warm from hot within a breath. A mother does this without deciding to. So does a grandfather, and so does a child who has been ill and knows the feeling from the inside. The hand is wrong sometimes. It still catches about nine fevers in ten.

Under the skin, the body keeps its heat close to thirty-seven degrees, a little lower in the morning and a little higher at night. When an infection comes, the brain moves that set heat upward on purpose. The small vessels of the skin close, and the hands and feet go pale and cool. The muscles shiver. The child asks for a blanket on a warm night. Then the new heat is reached and held, the cheeks flush, and the pulse runs eight to ten beats faster for every degree. When the illness turns, the brain lowers its setting again and the body sweats the extra heat away. None of this is the illness. It is the body's answer to it.

So the hand on the forehead is only a beginning. A hot child is a question, and most of the time the answer is a cold, an ear, a day or two of

misery and then a hungry child at breakfast. Some of the time the answer is something that kills before the next evening. The heat is the same in both. What differs lies elsewhere: in the neck, in the skin, in the breathing, in whether the child still follows a face with the eyes.

For most of human history the care of a fever was sitting up with it. Someone stayed awake in the room, kept the fire low and the water near, changed the damp shirt, listened to the breathing in the dark and watched the face. That night watch was not idle. It was where the signs were seen, and where a family learned the difference between a child who is hot and a child who is going.

Tonight, when someone you love is asleep, lay the back of your hand on their forehead and then on your own, and notice how small the difference is when all is well.

THE STORY

The heat that is meant

Fever is older than mammals. Lizards have it, and so do fish, which cannot make heat at all and must swim to find it. In 1975 a team of physiologists infected desert iguanas with a bacterium and gave them warm and cool places to choose from. The sick lizards moved to the warm end and raised their temperature by about two degrees, and those held warm survived better than those held cool. In a second study, twelve infected lizards were given a salicylate, the parent of aspirin, to stop the fever. The five that ran a fever anyway lived. The seven that did not all died within three days.

The picture in warm-blooded animals is less tidy. Rabbits did best with a moderate fever and worse with a high one. In people the question has been asked properly only in adults. In 2015 a trial in intensive care gave 700 adults with infection either paracetamol or a dummy tablet. The paracetamol lowered their temperature by about a quarter of a degree, and the deaths were 15.9% against 16.6%, no difference at all. Two later pooled analyses agreed. No trial in children has ever counted deaths as its result. Lowering the number has not been shown to save anyone.

Physicians once tried the opposite. From 1917 Julius Wagner-Jauregg in Vienna gave malaria to people with late syphilis of the brain, so that the fever would burn out the older infection, and then cured the malaria with quinine. Some improved. About one in seven died. He received the Nobel Prize in 1927, and penicillin ended the method twenty years later. The lesson for the hearth is the reverse of his. The heat is the body's own work and needs neither forcing nor chasing.

So the care of an ordinary fever is the care of a person. The extra blankets come off, the window opens, the bed is shaded, drinks come often, and someone fans gently. Sponging with lukewarm water was tested in seven trials with 467 children. It cooled them faster at one hour and not at all at two, and it made them five times as likely to shiver, which is the body working to win its heat back. Alcohol rubbed on the skin has put children into coma. Cold baths belong to heat stroke, where the body has lost its setting, and never to fever, where it has chosen one. Comfort is the whole aim.

Paracetamol is the one fever drug the book trusts with children. It is given by weight: 15 mg for each kilogram, four times a day at most, which is 60 mg for each kilogram in a day, and never more than 4 g in an adult. Its danger is quiet. A child given too much looks well for a day, then vomits and turns yellow as the liver fails. In one American series, 47 children were harmed by doses meant to help, at 60 to 420 mg for each kilogram a day, and 24 of the 43 whose ending was known died. These were not poisonings in the usual sense. They were rounded doses, adult tablets, two carers each giving the four o'clock dose, and paracetamol hidden in a cold remedy under another name. Under one month of age the dose is the healer's alone.

Aspirin is for adults. In Arizona in 1980 a study of Reye's syndrome, a sudden swelling of the brain and failure of the liver after a viral fever, found that all seven affected children had taken a salicylate, against eight of their sixteen classmates. When parents stopped giving aspirin, cases in the United States fell from about 555 a year to no more than 36. Of 1,207 children counted over those years, 31% died. No aspirin before sixteen, and no willow bark before eighteen. It is the cheapest rule in the book.

The child who is going

Most hot children are well inside. They are cross and off their food, and they still drink, still cry with tears, still turn to their mother's voice. A few are not, and the thermometer barely separates them. A temperature of forty-one degrees is rare, seen in fewer than four of every ten thousand visits, and six in ten of those children had a serious illness. Yet most dying children never run so high. The signs that matter are others. The child cannot drink, or vomits everything, or has fitted. The child is floppy or hard to wake, breathes too fast, has cold hands on a hot body, cannot bend the neck, or carries a rash that does not fade.

In the youngest the rules tighten. A baby under three months may answer a serious infection with no fever at all, or with cold. The book's card calls thirty-seven and a half degrees under the arm a fever in a baby under two months, and thirty-five and a half degrees a dangerous cold. Between seven and eighteen in a hundred young babies with fever have a serious infection. In a newborn, heat is never ordinary.

The worst of the hot children has meningitis, an infection of the lining of the brain, or its companion, an infection of the blood that bleeds into the skin. In a study of 448 British children with meningococcal disease, the textbook signs came late: the rash, the stiff neck and the clouded mind at thirteen to twenty-two hours. Earlier, at about eight hours, nearly three in four had pain in the legs, cold hands and feet and a strange colour to the skin. Before antibiotics, almost everyone with the pneumococcal form died, nine in ten with the Haemophilus form, and seven to nine in ten with the meningococcal. This patient will die without an antibiotic. What can be done anyway is to know the illness in its first hours and carry the child towards one.

The village has two tools. The first is the neck: a well child can bend the chin to the chest, and a well baby's soft spot lies flat. The second is a clear drinking glass, pressed firmly on a rash. Most rashes pale under the glass and return when it lifts. A rash that stays red or purple is blood in the skin. On dark skin it shows best on the palms and soles, the roof of the mouth and the inside of the eyelids. A stiff neck is missing in about seven of every ten cases. A child who looks ill is not cleared by the absence of a sign.

A fit with fever frightens more than it harms. Two to four children in a

hundred have one between six months and five years, nearly always short, and the brain is not damaged. One in three fits again with a later fever, and 32 trials with 4,431 children found that fever drugs do not prevent it. But about a quarter of young children with meningitis first show it with a fit. So the fit is waited out, and the child is looked at afterwards with care. A child not alert within the hour is treated as the worst case.

Bark, and the sweet wormwood

Where this book is written there is no malaria to catch. Where it is, it is the second question of every fever, after the danger signs. Before treatment it killed fifteen to twenty-four in every hundred children where it was common. Even treated, severe malaria kills one in ten to one in five, and three quarters of those deaths come in the first two days. It is also named too often: in one Tanzanian study, fewer than half the children called severe malaria had the parasite in their blood. The cheapest care for it is not a medicine at all. Children who slept under treated nets died 17% less often, about five or six lives for every thousand children each year, and chapter 14 holds the nets. A hole is mended on the day it is found.

The first medicine came from a tree of the Andes. The bark of *Cinchona* reached Europe through the Jesuits around 1630, and in 1820 two Paris pharmacists drew quinine out of it and patented nothing. In 1865 Manuel Incra Mamani, an Aymara bark gatherer who had worked for the English trader Charles Ledger since 1843, collected seed from the richest trees in Bolivia. The seed went to Dutch Java, which by the 1930s supplied about 97% of the world's quinine. Mamani was caught on a later seed journey and beaten so badly that he died. The tree was named after Ledger.

Quinine heals and kills. The dose is 10 mg for each kilogram, three times a day, for seven days, and the full week matters. In Guinea-Bissau a three-day course let the fever return in 79 of a hundred, against 11 after seven days. Quinine drops the blood sugar and rings the ears, and in overdose it stops the heart. It has killed adults from 1.5 g and a toddler at 900 mg, three of the common tablets. Bark is harder still, because nobody can see how much quinine it holds. One report puts unknown bark nearer 1%, on the one modern assay of 22 wild trees, which averaged 0.66%. An-

other works from 5% for known bark and 3% for unknown. At 1% an adult would need about 40 g of powder every eight hours, more than anyone can swallow. A rich bark dosed as if it were weak can poison. Bark from an unassayed tree cannot be dosed at either figure.

When a child dies of malaria, the family needs one plain thing said. Before medicine this illness killed one child in five where it was common, and even with medicine it kills some who are treated well and on time. The death belongs to the parasite. What the village can do next is for the next child: a net without holes, mended on the day it tears. Grief can be put to that work.

The second medicine came from a weed. In May 1967, at North Vietnam's request, China began a secret search for a malaria drug, named Project 523 after the date of its first meeting. More than 500 scientists in 60 institutions screened tens of thousands of compounds. Tu Youyou joined in January 1969 and led a group in Beijing that read over 2,000 old recipes. One plant, qinghao, *Artemisia annua*, the sweet wormwood, gave results that would not repeat. She went back to a handbook written by Ge Hong around 340, which told the reader to soak a bunch of the herb in cold water, wring it out and drink the juice. Cold, she reasoned, because heat destroyed whatever worked. On 4 October 1971 a gentler extract cleared malaria completely in mice and monkeys, and she and her colleagues took it themselves before anyone sick was given it. The pure crystals followed in 1972, and the world could read of them in English in 1979.

The plant is not the drug. The leaf holds anywhere from 0.02% to about 1.4% of the active compound, and the best tea carries less than a fifth of one dose. In the Congo in 2004, 132 people with malaria were given artemisia tea or quinine. By day 35 the fever had returned in about two thirds of those on tea, against one in five on quinine. A study in Tanzania found nine of ten tea drinkers still carrying parasites at day 28, and a trial that claimed the opposite in 2019 was withdrawn the next year. Tea eases the fever and lets the parasite come back. It is a last resort for comfort when nothing else exists, never a cure and never a prevention. Chapter 33 grows the plant. This chapter only doses it.

The rash that spreads

In 1846 the physician Peter Ludvig Panum was sent to the Faroe Islands, where measles had been absent since 1781. Of 7,782 islanders about 6,000 fell ill and at least 102 died. Panum went from settlement to settlement and timed the spread. The rash came thirteen to fourteen days after contact, and the old who had caught measles in 1781 did not catch it again. The body does not forget what it has met. A vaccine teaches it in advance, and after the Fall there may be none to give.

Measles kills through what follows it. In England between 1871 and 1880 it killed 91,948 people, 92% of them under five. Across the outbreaks counted in recent decades it killed about two in a hundred. Where one child in seven dies before the age of five, it kills about twelve in a hundred. The virus wipes the immune memory for two to three years, so a child who lives through measles may die the next winter of something else. It strips the gut, and diarrhoea follows in about one child in twelve. It inflames the ear, the lungs and the clear front of the eye, and in one Tanzanian series more than a third of the children with ulcers of the eye had just had measles. Pneumonia after the rash is where most die.

The rescue is cheap. In 1990 in Cape Town, Hussey and Klein gave 189 children with severe measles either two large doses of vitamin A on consecutive days or a dummy. Of the twelve children who died, ten had had the dummy. Pooled with seven other trials the overall effect fell short of certainty, but in children under two who received two doses, deaths fell by about four fifths. One dose showed no benefit. Two doses, two days. The capsule is measured by its drops and never with a spoon, because in Assam in 2001 a campaign used 5 ml cups in place of 2 ml spoons and up to 17 children were reported dead, with the cause argued ever since.

The rest is nursing, and home nursing has always done better than crowds. In the 1920s, measles nursed at home killed two to three children in a hundred, against six to ten in institutions, and later work showed that the second and third children infected in a crowded house fare worst. The sick child is fed every two to three hours and kept at the breast. The eyes are cleaned twice a day with boiled water that has cooled, the mouth is rinsed with a pinch of salt in water, and the breaths are counted. This is the vigil again, kept for a week instead of a night. And if the child dies, the family is told the truth: it was the virus, and not their care.

The Honest Broker's Weighing

Six reports carry this chapter, and they are not equal. IN-02 on fever and IN-12 on measles read their trials closely and can be trusted with a life at the doses they print, once the verification rows are closed. IN-09 on malaria is sound on quinine and honest that its bark method is inference, never tried on a person. Its bark figures of 5% and 3% stand against PH-04's one assay at about 1%, and the book prints both and settles neither. TR-03 gives the Project 523 chronology from a careful secondary account and corrects the usual telling: Ge Hong wrote for intermittent fevers, not for a disease anyone then called malaria. OR-05's village alarm counts are its own arithmetic, untested, and must be tried on a real season before anyone trusts them.

One error must not travel. ME-06 prints a card of doses by weight in which every child row for paracetamol points to IN-02's method number 4. That method is aspirin, for those of sixteen and over. The paracetamol table is IN-02's method number 3. A tired reader following the card for a baby would arrive at aspirin, and SY-12 calls it the most dangerous single error in the library. The table at the Bench comes from IN-02's own paracetamol method and from SY-10, and ME-06's card goes back for correction.

The library also disagrees on a baby's fever. IN-02 and NICE draw the line at thirty-eight degrees, the book's card at thirty-seven and a half. The Bench follows the card, which errs towards looking. And there are two gaps. No report takes meningitis as its subject, although twenty-nine mention it, so the meningitis branch at the Bench is built from IN-02's danger signs and SY-07's card and goes no further. The library also says nothing of who found the malaria parasite and its mosquito, and the draft leaves those names for the next round rather than supply them from memory. The quinine and tea weight bands are the draft's own arithmetic, shown in the verification rows. The remark that fever is older than mammals and the plain signs of measles at the Bench are general knowledge, not the library's.

The turn to the present

The chemist's shelf taught two generations that the fever is the illness. The thermometer gave every household a number, the syrup gave it a way to lower the number, and the lowered number felt like care. Children were woken to be dosed. In one trial of fever care at home, eight in every hundred children received too many doses. The cold remedy with a full dose of paracetamol inside a name that does not say so was made for a counter with a pharmacist behind it, and sold from shelves with none.

What the shelf hid mattered more. The signs that count, the neck, the skin, the breath, were the ones a hospital twenty minutes away would catch on the family's behalf. In a town, a child with this illness could reach an antibiotic within the hour. In a village a day from help, the hours between cold hands and the purple rash are the whole of the chance, and nobody sees them unless somebody is awake. The old night watch was never sentiment. It is how the eight-hour signs are seen at the eighth hour.

That is the work of this chapter: to sit up with the fever, and to look where it points. Now the glass.

AT THE BENCH

Work every dose twice, with two people.

06.1 See: is this hot child in danger?

Check every fever in this order. Any yes is danger.

1. Cannot drink? Vomits everything? Has fitted? Floppy or hard to wake?
2. Under 3 months with any fever. Under 2 months: 37.5 °C or more, or below 35.5 °C.
3. Chin cannot reach the chest? Baby's soft spot bulging?
4. Press a clear glass on any rash. Spots do not fade? On dark skin, check palms, soles, mouth roof, inner eyelids.

5. Count breaths for 1 full minute. Fast: 60 or more under 2 months. 50 or more at 2 to 11 months. 40 or more at 1 to 5 years. See chapter 4.
6. Cold hands on a hot body? A pressed nail takes over 3 seconds to pink?
7. Where malaria is, test or treat today (06.4). Fever daily for over 7 days: send on.

If danger: write the time. First antibiotic and antimalarial dose, if held and trained. Breast milk or sugar water if able to swallow. Carry the child towards help now.

1 fever with a stiff neck or a rash that does not fade is the village's meningitis alert. Tell the healer today and the district within a day. Who carries word is the village's rule. See chapter 15.

- **Help in time.** An antibiotic within hours. Most children live.
- **Help too late.** Comfort as below. Tell the family the illness moved faster than any carrying.
- **No help at all.** A dim, quiet room. Sips if able to swallow. Paracetamol for pain (06.2). Someone sits with the child day and night. Tell the family: before antibiotics, 7 to 10 in 10 such children died. Nothing they did caused it.

Rungs. Hands: the signs. Hearth: glass, clock, scale. Garden and still: nothing. Dispensary: thermometer, malaria test, first antibiotic. Infirmary: injections. Hospital: spinal tap. Refuse any herb or waiting.

06.2 Do: comfort and paracetamol by weight

Never round a dose up. Weigh the child and use the band. Never aspirin under 16, never willow bark under 18. Give paracetamol by weight instead.

See: a hot, miserable child who still drinks, with no sign from 06.1.

1. Take off extra layers. Under 2 months, keep 1 light layer.
2. Shade, fan gently, give drinks often.
3. Paracetamol for distress, not for the number.
4. Wasted child: 10 mg/kg, or 3 doses a day. See chapter 7.

5. 1 person gives and writes each dose.
6. After 3 days of fever, stop and find the cause.

Paracetamol 15 mg/kg every 4 to 6 hours. At most 4 doses and 60 mg/kg in 24 hours. Adults at most 1 g a dose, 4 g a day. Within 10%, never above.

Weight	Dose	500 mg tablet	Syrup 120 mg in 5 ml
Under 1 month	Healer only: 10 to 15 mg/kg every 6 to 8 hours	No	Healer measures
4 to under 6 kg	60 mg	No	2.5 ml
6 to under 8 kg	90 mg	No	3.75 ml
8 to under 12 kg	120 mg	1 quarter	5 ml
12 to under 17 kg	180 mg	Syrup better	7.5 ml
17 to under 25 kg	250 mg, or 240 mg as syrup	1 half	10 ml
25 to under 34 kg	375 mg	3 quarters	No
34 to under 50 kg	500 mg	1	No
50 to under 67 kg	750 mg	1 and a half	No
67 kg and over	1,000 mg	2	No

Prevent. "Cold", "flu" or "plus" packets may hide paracetamol. Lock the box. Over 150 mg/kg at once aged 5 or under, or 75 mg/kg older, is poisoning. Stop all paracetamol. Acetylcysteine within 8 hours, if held.

Grades: undressing and fanning B. Lukewarm sponge B for comfort, D as treatment. Alcohol rub X. Cold bath X. Paracetamol A. Willow bark decoction C, adults.

Rungs. Hands: undress, fan, drink. Hearth: scale, oral syringe, fever chart. Garden and still: willow bark for adults. Dispensary: paracetamol, locked. Infirmary: acetylcysteine. Hospital: liver care. Refuse sweating under blankets.

06.3 Do: a fit with fever

Never put anything in the mouth or hold the child down. Cushion the head and turn the child on the side instead.

See: stiffening or jerking with fever, age 6 months to 5 years.

1. Write the time. Soft surface, head cushioned.
2. No drink, no cold sponge, no bath.
3. When the jerking stops, turn the child on the side.
4. Past 5 minutes, another fit before waking, or no breathing: send for the most skilled help. Diazepam only by a trained person. See chapter 25.
5. Not alert within 1 hour, or any 06.1 sign: treat as meningitis.
6. Tell the parents: 1 child in 3 fits again. The brain is not damaged. Fever drugs do not prevent it.

Rungs. Hands: time, side, wait. Hearth: a clock. Garden and still: nothing. Dispensary: diazepam, held by the healer. Infirmary and hospital: the search for meningitis. Refuse cold baths and doses to prevent fits.

06.4 Do: fever where malaria is

Never stop quinine at 3 days. Never dose bark in a child by ringing ears. Never give bark after black urine. Give 7 days of a weighed dose instead.

See: fever in a malaria area. Deep breathing, pallor, dark urine, fits or coma is severe malaria. Rectal artesunate 10 mg/kg under 6 years, if held, and carry.

1. An artemisinin combination, if held: give it by its label.
2. Quinine: 10 mg salt/kg every 8 hours for 7 days. At most 600 mg a dose.
3. Give with food or sugar water. Expect ringing ears.
4. Blurred vision, fainting, dark urine or confusion: stop and send.
5. Quinine kills from 1.5 g in an adult, 900 mg in a toddler. Lock it.

At most 1,800 mg a day. Bands are worked from 10 mg/kg, rounded down.

Weight	Dose every 8 hours	300 mg salt tablet
Under 15 kg	Healer weighs it	No
15 to under 22 kg	150 mg	1 half
22 to under 30 kg	225 mg	3 quarters
30 to under 45 kg	300 mg	1
45 to under 60 kg	450 mg	1 and a half
60 kg and over	600 mg	2

Unknown bark cannot be dosed. PH-04 plans on about 1%, IN-09 on 3%

unknown and 5% known. Use only assayed bark: grams per dose equal mg of quinine divided by 10 times the percent.

Artemisia tea, last resort only. Weighed dried leaf, water just off the boil, 10 to 15 minutes, strained. Fresh daily, 4 equal portions, 7 days.

Weight	Leaf a day	Water a day	Each portion
Under 10 kg	The library found no dose	No	No
10 to under 20 kg	1 g	200 ml	50 ml
20 to under 30 kg	2 g	400 ml	100 ml
30 to under 50 kg	3 g	600 ml	150 ml
50 kg and over	9 g	1,000 ml	250 ml

Warn: the fever often returns within 2 to 5 weeks.

Grades: quinine tablets 7 days A, 3 days X. Assayed bark powder B, bark tea D. Artemisia tea C as last-resort relief, X as cure or prevention. Dried leaf D.

Prevent. Treated nets, see chapter 14. A child who swallows quinine: never make the child vomit. Carry to help now.

Rungs. Hands: the danger signs. Hearth: a whole net, sugar. Garden and still: artemisia tea. Dispensary: quinine, malaria test, rectal artesunate. Infirmary: blood film, injections. Hospital: drips, blood. Refuse unknown bark, tea as prevention, any 3-day course.

06.5 Do: measles

Never measure vitamin A with a spoon or cup. Cut the capsule and count its drops instead. Never give it to a girl or woman who could be pregnant. Nurse her as below instead.

See: fever, cough, red eyes, runny nose, then a spreading rash.

Vitamin A on 2 days in a row, by age as WHO gives it.

Age	Each of 2 days	From a 200,000 IU capsule
Under 6 months	50,000 IU	1 quarter of its drops
6 to 11 months	100,000 IU	1 half of its drops
12 months and over	200,000 IU	The whole capsule

Count 1 capsule's drops first. A 3rd dose 2 to 4 weeks later for eye signs or severe wasting. Never daily.

1. Feed every 2 to 3 hours. Keep breastfeeding. ORS for diarrhoea, see chapter 5.
2. Clean the eyes with boiled, cooled water 2 times a day. Pus: tetracycline eye ointment 3 times a day, 7 days. Never steroid drops.
3. Rinse the mouth with a pinch of salt in a cup of water, 4 times a day.
4. Count breaths 2 times a day. Fast is pneumonia. See chapter 4.
5. Someone stays with the child at all times.

Prevent. Isolate until 4 days after the rash starts. Contacts avoid others on days 5 to 21. 1 case is an alert, see chapter 15. Isolation hut and carers.

Grades: vitamin A, 2 doses, A. Feeding, eye care and isolation B. Withholding food X. Sweating out the rash X.

Rungs. Hands: nursing, breath count. Hearth: boiled water, salt, ORS. Garden and still: nothing replaces vitamin A. Dispensary: capsules, eye ointment, amoxicillin. Infirmary: pneumonia care. Hospital: the vaccine, before the epidemic. Refuse plant juice in the eyes.

If it goes wrong

1. **Too much paracetamol.** Well for a day, then vomiting and yellow eyes. Cause: rounded doses, adult tablets, 2 carers. Do: add the last 24 hours in mg/kg, and follow 06.2.
2. **The danger sign missed at night.** A child who will not wake at dawn. Cause: nobody sat up. Do: check 06.1 every 4 to 6 hours, night included.
3. **Malaria half treated.** Fever back within 2 to 5 weeks. Cause: quinine stopped when the fever fell, or tea used as cure. Do: the full 7 days.

Numbers to carry

- **15 and 60.** Paracetamol mg/kg a dose and a day, 4 g adult (IN-02, SY-10).

- **16.** No aspirin before this age (IN-02, ME-06).
- **37.5 and 35.5 °C.** Fever and cold under 2 months (SY-07).
- **1.** 1 fever with a stiff neck or a rash that does not fade is the alert (SY-12, OR-05).
- **10 mg/kg, 3 times a day, 7 days.** Quinine. 1.5 g can kill an adult (IN-09, SY-06).
- **2 doses, 2 days.** Vitamin A in measles (IN-12).
- **5 minutes.** A fit longer than this needs help (IN-02).

THE LIBRARY

IN-02 Fever: what it means, when to treat it and how. IN-09 Malaria: cinchona, *Artemisia annua*, nets and the full evidence. IN-12 Measles, whooping cough, diphtheria and the childhood killers. ME-06 Willow, meadowsweet and the salicylates. PH-04 Mesoamerica and the Andes. OR-05 Records, surveillance and noticing the outbreak. TR-03 Chinese medicine: from the Shennong Bencao to Tu Youyou. SY-07 The red-flag list. SY-10 The harm register. SY-12 What the library could not find. SY-06 The pharmacopoeia. All are on the website.

CHAPTER 7

Milk and the Thin Child

A child who is not fed in the first hour, and a thin child fed too fast, both die of what should have saved them. Breast within the hour, and refeed slowly.

OPENING

Swallow, and feel what the tongue does. It rises, presses the mouthful against the hard roof of the mouth and sends it back, and for that instant the breath stops and waits. A baby does this in its first hour, at the breast, untaught. The jaw draws, the tongue strokes, the throat takes the milk, the breath comes again, and the rhythm holds.

The breast is the first table. It is laid before the child has seen a room. It is laid at the warmth of the body, in the amount the child draws, with nothing to wash and nothing to boil. The first milk is thick and yellow and there is little of it. It coats the inside of the gut with the mother's antibodies before anything else has touched it. So the first table is also the first medicine. The meal and the dose arrive together, from one body to another, and what they cost is the mother's food and the mother's time.

Everything a household does for a baby who has lost this table is an imitation of it, and each imitation fails in its own way. Made too strong, the feed loads the blood with salt. Made too weak, it starves the child on a full belly. Made with unboiled water, or left standing in a warm room, it carries the diarrhoea that took babies fed by hand in their thousands.

The thin child sits at the other end of the same table. A child who has gone hungry for weeks lives on almost nothing, and its body has changed to do it. Its heart has grown small, its salts have drifted, its stores are spent. It needs food, and food given fast is what kills it, through the heart and the lungs, most often in the first three days and most often at night. The old rule is plain. A little, often, by day and by night, and the feast only after a week.

The next time you see a baby at the breast, notice how little stands on that table: no fire, no pot, no cup, no water, nothing to wash afterwards. Nothing on it was bought.

THE STORY

The hand fed

The first milk has often been thrown away. A Greek physician working in Rome in the second century told mothers to discard the colostrum and give the baby boiled honey in water for two or three days. In Rome between a fifth and a third of babies died in their first year. The custom of discarding the first milk is still common in many places, and so is the first drink of water or sugar.

Where mothers did not nurse, the record is a ledger of small graves. In nineteenth century Bavaria, where the custom was cow's milk and flour pap from the first weeks, between 380 and 400 of every 1,000 babies died before their first birthday. In Münster, Köslin and Arnsberg, in the north, where mothers nursed, the figure was 128 to 147. In Iceland, babies were given the dúsa, chewed fish, meat or butter tied in a cloth to suck, and in 1846 more than 600 of every 1,000 died in their first year. The midwives pressed for the breast, and soon after 1900 Iceland had brought the figure down to about 100, while Bavaria was still above 200.

In Derby, William Howarth followed 8,343 babies born between November 1900 and November 1903 and wrote down how each was fed. Of those fed at the breast, 70 in every 1,000 died before their first birthday. Of those given the breast and other food, 99. Of those fed by hand, 198. The worst food of all was sweetened condensed milk, sold cheaply in tins.

In 1925 a survey of 22,967 births in eight American cities found the same order. Babies fed artificially died at three to four times the rate, of gut infections at 7.7 times, and the gut deaths of August ran at thirteen times those of January. Heat and milk standing in a jug did the arithmetic.

Gathering the motherless in one house was worse than any food. The Dublin Foundling Hospital took in about 127,000 children between 1730 and 1830, and about 800 of every 1,000 died. In 1790 a report found that of 2,180 babies admitted that year, 2,087 were dead or could not be accounted for. Most had been sent out to country wet nurses, so Dublin is a record of neglect as much as of the bottle, but it is a record no village should repeat.

The science now has the size of it. A review of 2015 pooled the studies of how babies under six months were fed and how many died. Against babies given only the breast, those also given water died at 1.5 times the rate, those given the breast and other foods at 4.8 times, and those given no breast at all at 14.4 times. These are observations, not trials, and a sick baby feeds less because it is sick. But Derby, the eight cities and the review all point the same way, and the rate falls as the child grows: in a WHO pooling of 2000, babies not breastfed died of infection at 5.8 times the rate in their first two months, and the figure fell, band by band, to 1.4 for the oldest babies studied.

The first hour carries its own weight. In Ghana, 10,947 babies were followed from birth. Those first put to the breast after the first day died in their first month at 2.4 times the rate of those fed earlier, and those given water or another fluid before the first breastfeed died at about four times the rate. A prelacteal feed puts unboiled fluid into a gut that has not yet been coated. The colostrum puts antibodies there first, and early suckling makes the womb clamp down, so the first feed also guards the mother against bleeding.

The wet nurse and the cup

When the mother died or had no milk, the old answer was another woman. Wet nursing was a trade in the cities of Europe and a kinship almost everywhere else. The Qur'an sets the nursing period at two years and forbids marriage between a child and its milk mother or milk sisters, so a baby

nursed by a neighbour joined her family. The trade was harder. Around 1780 Paris sent between 5,500 and 7,500 babies a year to wet nurses in the country, and at least two in three of them died. At Vaugirard in the 1780s, syphilitic babies were treated by giving mercury to their wet nurses, and the disease passed both ways, from nurse to child and from child to nurse.

What happens without anyone is written in the Matlab records of Bangladesh. When a mother died, 24 of every 100 of her children were alive at ten, against 89 of every 100 whose mothers lived. A baby of two to five months whose mother died had 25 times the death rate of one whose mother lived. The death of the father made almost no difference. A wet nurse lays the first table for a child not her own, and on these figures she is the whole of its chance.

Milk can also be brought back. In Delhi in 1997, 46 of 50 mothers who had stopped nursing made milk again by putting the baby to the breast often, and a drug meant to bring the milk on made no difference. Grandmothers who had not nursed for years have done the same.

Where no woman can be found, a household mixes animal milk, and here the danger is salt. Cow's milk gives the kidneys about three times the load of dissolved salts that breast milk does. A series published in 1975 studied 25 dehydrated babies. All 15 with high salt in the blood had been given feeds high in sodium, many of them made too strong by mothers who meant to give more food. Such a baby is irritable, then drowsy, and its skin feels doughy. Cow's milk also brings fits at five to ten days of life, from low calcium. Goat's milk lacks folate and vitamin B12. The rule for the modified feed is two parts of milk to one of boiled water, with sugar, never stronger and never weaker.

Honey is the last of the old gifts to fall. Spores of the germ of botulism live in it, nine of 90 samples in one study, and a baby's gut lets them grow. Under twelve months, honey is never given.

The cup, not the bottle. A bottle and its teat hold milk in places no brush reaches, and a cup can be boiled and seen to be clean. In 2006 floods in Botswana came while formula was being given out free, and deaths among babies rose to about 25 times the usual number. The formula was not poison. The water was.

The hungry cities

In Leningrad the bread ration on 2 September 1941 was 600 g a day. By November it had fallen to 250 g, then 125 g. Over half a million people died in the first winter of the siege. In January and February 1942 the city lost about 100,000 people a month, about thirty times the peacetime rate, and nearly all of them died of hunger. Registration failed under the weight of it, so the dead are estimated: about 670,000 registered, and most scholars now give 1.1 to 1.3 million. From 8 March those still alive cleared the streets of the winter's dead and filth, half a million were inoculated, and the epidemic everyone feared in the spring of 1942 did not come.

In the Warsaw ghetto, from February to August 1942, Izrael Milejkowski led 22 or 28 Jewish doctors, the sources differ, in a study of hunger disease while they starved themselves. The official ration was about 180 kcal a day. The adults they examined weighed 30 to 40 kg. They carried out about 3,600 autopsies, and around 500 were deaths from starvation alone. Deportation to the death camps began on 22 July 1942 and ended the work. Their study was published in 1946. The lesson that came down from its pages was to feed the starved slowly.

In Minnesota, from 19 November 1944 to 20 December 1945, Ancel Keys starved 36 conscientious objectors by design. For 24 weeks they ate about 1,570 kcal a day and lost about a quarter of their weight. One of them cut off three of his own fingers. Getting back what they had lost took about 4,000 kcal a day, and Keys needed 1,385 pages in 1950 to write it down.

At Bergen-Belsen, from 15 April 1945, British troops found about 60,000 prisoners. After liberation 13,994 died. The army's tinned beef is estimated to have killed about 2,000 whose guts could not take it. Protein hydrolysates, given by mouth, by tube and into the vein, were refused. What worked was skimmed milk and a mixture first used in the Bengal famine, and one doctor counted the deaths falling from 300 a day to 60.

The body explains the deaths. Starved for weeks, it lowers everything it can. The heart thins and slows. The cells let in sodium and let go of potassium, magnesium and phosphate. The stores of thiamine run down. When food arrives, sugar above all, insulin rises and carries phosphate and potassium into the cells, the blood runs short of both, and a small heart is asked to carry water and salt it cannot carry. Breathing quickens, the legs

and face puff up, and the child can die within three days. So the rule is a week of small feeds and then plenty: up to 150 to 220 kcal per kilogram a day for a child once the first week is past.

The thin child

Famine kills children mostly through infection, and the thin child dies of the measles, the diarrhoea and the cough that a fed child would have carried. In Biafra between 1967 and 1970 relief workers measured the arm against the height with a stick. The arm became the measure. Between six months and five years, an arm whose middle measures under 115 mm marks severe malnutrition, and such a child carries about four times the risk of death of a child with no deficit. Puffy feet that keep the print of a thumb mean the same, whatever the arm.

Hospitals did badly with these children for most of the twentieth century. Between 20 and 30 in every 100 died in the wards. Where the WHO's ten steps were followed, slow feeds, warmth, sugar against the night, antibiotics and no iron at first, the deaths fell below five in a hundred. In Dhaka they fell from 17 to 9 to 3.9 per cent. At Sipetu, where the doctors had not been trained in the steps, deaths rose back to 38 per cent.

Then the care went home. A paste of peanuts, milk powder, sugar and oil, needing no water and no cooking, was described in 1999, and in community programmes between 2000 and 2005, 23,511 children were treated, most of them at home. Of them 79.4 per cent recovered and 4.1 per cent died. The test that sends a child home is its appetite. A thin child who eats a test feed with no other danger sign is fed by its mother. A child who will not eat is overwhelmed by infection and needs more than food. The paste mixed by hand was too uneven to trust, but local food has done well. In the Rohingya camps, 645 children fed an egg and semolina porridge five times a day lost one child, though there was no comparison group.

Iron waits. Given in the first week of refeeding, it made deaths more common. Given to children who did not lack it, it did harm too. On Pemba, in Zanzibar, about 24,000 children aged one to 35 months in a malaria area were given iron with folic acid or a dummy tablet. Those given iron were 12 per cent more likely to die or be admitted to hospital, the harm fell on children who had not been short of iron, and the iron

arms were stopped on 19 August 2003. And iron is the classic poison of the toddler, a sweet coated tablet in a reachable jar. After the United States required iron to be sold in single blister packs in 1997, deaths of children from iron fell from 29 to 1.

What one staple takes away

Each of the deficiency diseases appeared when people came to rely on one food. The village will grow its own answers, and FEASTING after the FALL gives the garden and the store. This chapter names the lack, the sign and the dose.

Vitamin A. In Aceh, in Indonesia, Sommer's team gave capsules of vitamin A to children in 450 villages and reported in 1986 that deaths at ages one to six fell by about a third. Later pooled trials found 23 and then 12 per cent, and a trial of about a million children in north India found 4, as measles and diarrhoea killed fewer children. The effect is largest where children die most. Liver, orange sweet potato, carrot, pumpkin and red palm oil carry it. The liver of the polar bear and the seal carries so much that it poisons.

Niacin. At Rankin Prison Farm in Mississippi in 1915, Goldberger fed 11 volunteer prisoners on grits, fat and syrup, and within about six months six had pellagra: the rash where the sun falls, the diarrhoea, the confusion. The American South counted an estimated 3 million cases between 1906 and 1940. In 1990 among Mozambican refugees in Malawi, 17,878 people fell ill after the groundnut ration stopped for about five months, and those who still ate groundnuts had a twelfth of the risk. Maize soaked in lime, as Mesoamerica cooks it, protects too, though no one agrees why. About 100 g of groundnuts a day, or a bowl of beans, protects a household that eats maize.

Iodine. In the Jimi valley of Papua New Guinea in 1966, alternate families were given iodised oil or plain saline. The mothers given saline bore 26 cretins in 534 births, the mothers given oil 7 in 498, and six of those seven were already pregnant when injected. Iodine has to reach a woman before she conceives. Inland villages need seaweed weighed with care or a stock of iodised salt, because a gram of dried kelp can carry ten times a day's need.

Vitamin C. Scurvy appears after eight to twelve weeks without fresh food, first as leg pain and a child who will not walk, then bleeding gums. Ten milligrams a day prevents it. In Ghor, in Afghanistan, in the winter of 2001 to 2002, 4,588 people fell ill and 323 died. Rose hips, blackcurrants, cabbage, kale, potatoes, sauerkraut and sprouted pulses carry it through a northern winter.

Vitamin D and calcium. In Edmonton, at 52 degrees north, the skin makes no vitamin D from October to March. Berlin lies at about the same latitude. Rickets can also be a lack of calcium: in Nigeria calcium alone healed 61 per cent of rickety children and vitamin D alone 19 per cent. Summer sun on the face and arms, milk, and small fish eaten with their bones carry a child through.

The Honest Broker's Ledger

MA-06 can be trusted with a life on the history, the never list and the order of choices. Its modified feed table is graded C as a stop gap and X as the only food for long, and its figure for the salt load of the mixed feed is its own arithmetic and must be checked before print. Its account of how to express milk by hand is the standard teaching, flagged and not yet traced to a primary. On sore nipples and the baby who will not latch it has almost nothing, and the draft supplied the signs of good attachment from common teaching.

HY-09 read its main review of the 1945 record in full, and its refeeding tables come straight from WHO. It sets out the disputed line plainly. For a wasted adult at high risk, NICE 2006 starts at 10 kcal per kilogram a day and 5 for the most wasted, while WHO's famine rule of 1999 starts adults at 40, a fourfold difference. HY-09 advises the lower start. This chapter prints both and settles neither. For children the sources agree on 100 kcal per kilogram a day and no more in the first week. HY-09 also gives two sets of warning lines for a rising breath and pulse, its own and MSF's, and both are printed.

HY-08 is wide and leans on search summaries. Its vitamin A, iodine and pellagra records are firm. Its line for iron poisoning, toxic from 20 mg per kilogram, differs from ME-08's, which calls 20 the line for watching and 60 the line for danger. Both are printed at the Bench.

FO-01 gives the Leningrad deaths as estimates and says so. Neither FO-01 nor FO-08 says one word about how the city's mothers fed their babies that winter, and this chapter does not invent it. IN-01 and MA-05 agree on the fourteenfold and fourfold figures and both say they are observational. SY-10 gives the never lines for infant feeding and iron, and OR-06 the blister pack record. The draft's own arithmetic is the weight column of the modified feed, the F-75 volumes by weight and the iron syrup table. Each must be worked by two people on a real case before the village trusts it.

The turn to the present

For a century the tin stood on the shelf beside the tap, and both looked like safety. The formula was made in a factory and the water came clean, so a family in Brandenburg could feed a baby without a breast and lose little by it. The cost of the bottle was paid in Botswana and in every flood. It was sold as modern for a century, and the cup it replaced was easier to clean.

What does the household have on the day the mother dies? A neighbour in milk, if the village knows who she is. A cup that can be boiled, a pot, sugar, a goat or a cow, and boiled water. A scale, if the village kept one. In Brandenburg the winter sun gives no vitamin D for half the year, the soil is far from the sea, and the store in late winter holds grain and potatoes. Every deficiency in this chapter is a staple diet's shadow, and the plain garden is the cure.

The first table is still laid in every village, by every mother in milk, and it is laid for free. The work of a household is to keep it laid, to find a second woman when the first is gone, and to know how slowly to feed the child who comes back to it thin.

So: the cup.

AT THE BENCH

07.1 See the hungry baby and the thin child

1. Baby under 6 months: count wet cloths in 24 hours. Fewer than 6 means too little milk.
2. Weigh weekly if a scale is kept. Under 125 g a week is too little.
3. Loss of more than 10% of birth weight: act today.
4. Child 6 to 59 months: measure the arm halfway between shoulder and elbow. Under 115 mm is severe.
5. Press both feet with both thumbs for 3 seconds. Pits on both feet are severe, whatever the arm.
6. Offer a test feed. Eats it: refeed at home (07.4). Refuses: treat as sick.

Rungs. Hands: string, thumbs. Dispensary: a 5 g scale, a register. Infirmary: weight for height. Hospital: blood salts. Refuse: judging by eye. Measure under 5s monthly in lean seasons.

07.2 Do: the first hour and the breast

Never give water, honey or animal milk before the first breastfeed. Put the baby to the breast instead.

1. Skin to skin at once. Breast within 1 hour. Give the first thick milk.
2. Feed when the baby asks, day and night, about 11 times in 24 hours.
3. Sore nipples: check attachment, mouth wide, chin on the breast. The library found no tested remedy.
4. Hard, full breasts: feed more often. Cold cabbage leaves ease pain, grade B.
5. Hot, red, painful wedge: feed that side first, every 2 to 3 hours. Antibiotics: chapter 12.
6. Baby too weak to suck: express by hand 8 times in 24 hours. Feed by boiled cup.
7. Thumb above, fingers below, 3 cm behind the nipple. Press back, squeeze, release, move round.
8. Expressed milk keeps 4 hours at 25 °C or below.

Danger sign: the mother is dead or has no milk, and the baby is under 2 months. This is an emergency of hours.

- Help in time: a woman in milk today, her own baby thriving and over 2 weeks old. No sores, no rash on palms or soles, no cough. Willing, never forced. Raise her ration, record the milk kinship.

- Help too late: modified milk by cup (07.3) while a nurse is sought. A woman relactates by suckling 8 to 10 times a day.
- No help at all: hold the baby warm, fed by cup. Tell the family no one failed it.

Grades: breastfeeding B, wet nursing B, relactation B, cup A against the bottle.

Rungs. Hands: breast, cup. Garden and still: cabbage. Dispensary: scale, fine tube. Infirmary: mastitis antibiotics. Refuse: bottles, dummies, goat's rue.

07.3 Do: the feed when there is no breast

Never give honey under 12 months, condensed milk, paps or plain animal milk. Give the table's mix instead. Never make the feed stronger or weaker than the table. Measure every part, every time.

Choose in order: mother's milk, relactation, wet nurse, donor milk, this mix. Grade C as a stop gap, X for long.

Weight	Age, if no scale	Milk, ml	Boiled water, ml	Sugar, g	Feeds a day
3 kg	birth to 1 month	40	20	4	8
4 kg	1 to 2 months	60	30	6	7
5 kg	2 to 4 months	80	40	8	6
6 kg	4 to 6 months	100	50	10	6

Ceiling about 150 ml/kg a day, spread day and night.

1. Boil milk and water. Measure in a marked cup. Weigh sugar into twists at the dispensary.
2. Sheep or buffalo milk: 1 to 1 with water, 5 g sugar per 100 ml.
3. Feed by cup. Boil cups 20 minutes daily. Discard feeds after 2 hours. Add a multivitamin if held.
4. Flash heat donor milk: 50 ml in an open glass jar, in 450 ml water in an aluminium pan. Bring to a rolling boil. Lift the jar out at once. Grade B.

Rungs. Hearth: boiling. Garden and still: goat or cow. Dispensary: scale, multivitamin. Hospital: blood sodium. Refuse: bottles, and orphans gathered in one house.

07.4 Do: refeed slowly

Never feed a thin child to its appetite in week 1. Give small feeds by the clock instead.

1. On arrival, 50 ml of 10% sugar water: 5 g sugar in 50 ml boiled water.
2. Under 35.0 °C under the arm: skin to skin until above 36.5 °C.
3. Amoxicillin 50 mg/kg twice a day for 5 to 7 days, at most 1 g a dose: the starved child's dose (MSF), above chapter 4's 40 for pneumonia. Vitamin A on day 1 (07.6).
4. Give F-75 by the table, day and night. Breastfeed between.

F-75: fresh cow's milk 300 ml, sugar 70 g, flour 35 g, oil 20 g, mineral mix 20 ml. Add boiled water to 1,000 ml.

Weight	Days 1 to 2, every 2 hours	Days 3 to 5, every 3 hours	Days 6 to 7, every 4 hours
4 kg	44 ml	64 ml	88 ml
6 kg	66 ml	96 ml	132 ml
8 kg	88 ml	128 ml	176 ml
10 kg	110 ml	160 ml	220 ml

Use the row at or below the weight. Ceiling 130 ml/kg a day, 100 with severe oedema: 100 kcal/kg, no more in week 1.

5. Count breaths and pulse before each feed. Cut feeds if breaths rise by 5 or pulse by 25. MSF uses 10 and 20.
6. Weigh daily. When appetite returns, F-100 or home food, 5 meals a day.
7. No diuretic. No drip, except for shock.

Adults: thiamine 200 mg 30 minutes before the first feed, daily for 7 to 10 days. Start disputed: 10 kcal/kg a day, 5 for the most wasted (NICE), or 40 (WHO).

Work every dose twice, with two people.

Danger sign: on days 2 to 4, breathing quickens, the pulse climbs or the swelling spreads.

- Help in time: back to day 1 volumes. Recount in 1 hour. No better in 2: infirmary.
- Help too late, grey and gasping: stop food by mouth. Hold the child warm.
- No help at all: wet the lips, keep it held. Tell the family the first 3 days are the most dangerous, and they fed it rightly.

Slow start, grade B.

Rungs. Hands: small feeds, warmth. Hearth: F-75. Garden and still: eggs, beans. Dispensary: mineral mix, amoxicillin, tube. Infirmary: ReSoMal (chapter 5). Hospital: transfusion. Refuse: the week 1 feast, hand mixed paste.

07.5 Prevent: iron

Never give iron in week 1 of refeeding. Never to a child who is not pale where malaria is. Use the iron pot instead. Never leave iron in reach. Lock it in its blister.

See pale palms and inner eyelids. Give ferrous fumarate syrup, 20 mg iron per ml, 3 mg/kg once a day.

Weight	Iron	Syrup
4 kg	12 mg	0.6 ml
6 kg	18 mg	0.9 ml
10 kg	30 mg	1.5 ml
15 kg	45 mg	2.2 ml

Ceiling 1 dose in 24 hours. No scale: no syrup. 1.5 ml is a dose. 15 ml is 10 times it. Iron pot, grade B. Iron for all where malaria is, grade X.

Danger sign: tablets swallowed. Count those missing, times 65 mg, divided by weight. Watch from 20 mg/kg. Danger above 60 (ME-08). HY-08: toxic from 20, deadly at 180 to 250. For 10 kg, 9 tablets is 60 mg/kg.

- Help in time: send at once. No charcoal. It does not bind iron.
- Help too late: vomiting, then quiet. That is not recovery. Keep warm, send.

- No help at all: stay with the child. Tell the family plainly. Lock the box together.

Rungs. Hearth: iron pot. Dispensary: locked box, 1 keeper. Infirmary: haemoglobin scale. Hospital: antidote. Refuse: iron for all.

07.6 Prevent: the lack a staple brings

Lack	Sign	Food (FEASTING)	Dose if held
Vitamin A	Night blindness	Liver, orange sweet potato, red palm oil	Under 6 months 50,000 IU, 6 to 11 months 100,000, from 12 months 200,000. Then none for 4 to 6 months
Niacin	Rash where sun falls	100 g groundnuts a day, or beans	Nicotinamide 100 mg, 3 times a day until healed
Vitamin C	Leg pain, bleeding gums	Rose hips, cabbage, sauerkraut	100 mg 3 times a day for 2 weeks, then 50 mg daily. From 12 years 250 mg
Iodine	Swollen neck	Wakame 2 to 4 g or nori 4 to 9 g a day, weighed	Iodised salt. Never kelp daily
Vitamin D	Bowed legs	Summer sun, milk, small fish	Infants 400 IU a day. Cod liver oil at most half of a level 5 ml teaspoon a day

Vitamin A goes by age, as the capsule does. In pregnancy, no capsules: orange vegetables and small portions of liver instead. Measles: chapter 6. Grade A: capsules, groundnuts, iodine before conception, cod liver oil.

Rungs. Hearth: limed maize, sprouted pulses. Garden: the foods above.

Dispensary: capsules, salt. Refuse: seal liver, kelp by the handful.

If it goes wrong

1. **Too much, too soon.** Fast breathing and a puffy face on days 2 to 4. A hungry child and a kind mother. Back to day 1 volumes. Count before each feed.
2. **The feed too strong.** An irritable baby turning drowsy, doughy skin, fits. Less water to make it richer. Give the breast or the correct mix in sips. Send. Never correct it fast with plain water.
3. **The food shared.** No weight gain by day 10. The thin child's food went to its siblings. Feed it in front of the healer. Give the household its own ration.

Numbers to carry

- **Within the hour.** The first breastfeed. (MA-05, IN-01)
- **14 times.** The death rate under 6 months without the breast. (IN-01, MA-05)
- **2 to 1.** Cow's or goat's milk to boiled water, never stronger, never weaker. Grade C as a stop gap. (MA-06)
- **12 months.** No honey before. (MA-06, SY-10)
- **115 mm.** Arm for severe malnutrition. (MA-07, HY-09)
- **100 kcal/kg a day.** The most for a thin child in week 1. (HY-09)
- **3 mg/kg.** Iron once weight gain begins, never in week 1. (HY-09, ME-08)
- **Tenfold.** The commonest fatal dosing slip is a moved decimal. (ME-02, SY-10)

The library

MA-06 Feeding infants without formula. HY-09 Feeding the sick and the starving. HY-08 Deficiency diseases and how to prevent them with what grows. FO-01 What people die of when the system fails. FO-08 Triage and the ethics of scarcity. IN-01 The great killers after the Fall. MA-05 The newborn. MA-07 The sick child. MA-11 Women's health across life. ME-08 Minerals and simple chemicals. OR-06 Stockpile, storage and the dispensary's shelf. SY-10 The harm register. SY-12 What the library could not find. All are on the website.

PART THREE

Birth

CHAPTER 8

Pregnancy and the Normal Birth

A normal first birth takes about twelve hours of established labour and a later one about ten. The hour after the placenta is the hour that kills.

OPENING

Lay a hand flat on your belly, just below the ribs, and keep it there without moving for ten slow breaths.

The hand feels the rise and the fall, the small shift of a swallow, the warmth gathering under the palm. It also feels how hard it is to keep still. By the sixth breath most hands want to press, or rub, or go and do something useful. That wish is the first thing a birth asks the people around it to give up. It is also the hardest.

A woman in labour has a hand like that on her belly for hours. Under it the womb tightens, rises into a hard dome, holds, and lets go. The attendant counts how many tightenings come in ten minutes and how long each one lasts. Between them she listens for the baby's heart and counts it for a full minute. She writes the numbers down. Then she waits, and counts again. Most of what she does in a whole night is this.

The danger in a normal birth is seldom that too little is done. It is that something is done too soon. A palm pushing down on the top of the belly to hurry the baby out. Fingers in the birth passage again and again, to see how far it has come, carrying dirt in each time. A pull on the cord before the afterbirth has loosened. A bitter drink to make the pains stronger.

Each of these is a hand that could not wait. Each has killed women who would have given birth safely.

Waiting is not idleness. The waiting hand washes before it touches. It holds a warm cloth to the stretching skin so that the head comes slowly. After the birth it feels the womb for hardness, every few minutes, for two hours. It keeps the clock, so that when a labour goes wrong the help is called while there is still time to reach it. The midwife's best hands are the hands that wait.

THE STORY

The women who wrote it down

Martha Ballard kept a diary in Hallowell, Maine, from 1785 to 1812. She was a midwife, and she wrote down the births. Laurel Thatcher Ulrich, reading it two centuries later, counted 814 deliveries. Ballard lost no mother at a delivery. Five died in the lying-in weeks that followed, one death in 198 living births. Ulrich set that beside the United States in 1930, at about one in 150, and the midwife of Hallowell comes out ahead. Fourteen babies were born dead and five died within an hour or two. When the young town doctor, Benjamin Page, attended instead, she wrote down his bad deliveries and once noted limbs "much dislocated". Her fee was six shillings, less than two dollars. His was six dollars.

Catharina Schrader worked in Friesland, in the north of the Netherlands. She was born in 1656 and died at Dokkum in 1746, and from 1693 to 1745 she kept notebooks of the births she attended, between 3,000 and 4,000 of them. By one modern reckoning her mothers died at about 4.6 in every 1,000, and 54 babies in every 1,000 died around the birth. Hilary Marland translated the notebooks in 1987 under a title that says what Schrader was counting: *Mother and Child Were Saved*. To the south and east, Justine Siegemund, born in Silesia in 1636, became court midwife to the Elector of Brandenburg in 1683 and died in Berlin in 1705. She claimed close to 6,200 births. She seldom used drugs or instruments. Physicians attacked her, and a university faculty cleared her.

The three women share a habit. Each wrote down what happened, birth after birth, for decades. The two whose counts survive lost about five mothers in a thousand, or fewer. An English midwife who printed her book in 1671 told her readers to let the woman choose whether to lie, sit or kneel, and to bring a birth stool. The trials of our own century agree with her: upright births need fewer instruments, though they bleed a little more. The old midwives knew a good deal.

There is a catch, and it is the reason the books exist. We have these diaries because their authors could write, kept at it, and were good enough that their families and towns kept the pages. The midwife who could not write, or who did badly, left nothing. The diaries are a ceiling, not an average. What they prove is narrower and still worth much. A woman with skilled hands, clean habits and a written book could keep mothers alive at about five in a thousand, two centuries before antibiotics.

Four in a thousand

In England and Wales about 4.6 mothers died for every 1,000 births in 1856 to 1860. The figure was 4.6 again in 1896 to 1900, and 4.6 in 1930 to 1934. For eighty years, while children and adults died less and less, mothers kept dying at the same rate. About half of them died of childbed fever, most of them after normal labours. Loudon, the historian who counted them in 1986, found that the attendant mattered more than poverty, housing or food. In Leeds in the 1920s the comfortable died more often than the poor, 5.93 mothers in 1,000 in the middle-class districts against 3.01 in the working-class ones. The comfortable had doctors, who used forceps and examined often, coming from other patients. The poor had midwives.

The best attendants of that age showed how low the rate could go. Nurse-midwives trained by the Queen's Institute lost about half as many mothers as the nation between 1905 and 1925. In Rochdale, Andrew Topping, the town's medical officer, took the rate from just under 9 in 1,000 in 1928 to 1931 down to 3 in 1932 to 1935. He did it by reorganising the care before the birth and who attended it. No antibiotic existed yet. In Sweden, where by 1900 almost four births in five had a licensed midwife, mothers died at about a quarter of the rate of 1751. Loudon judged that simple

routine good practice saved more mothers than skilled manoeuvres, and that an account of normal labour written by Thomas Denman in 1786 could still stand. The hands that waited were the safer hands.

Clean hands came late and counted for as much. Antisepsis became compulsory for Sweden's rural midwives in 1881. Between 1861 and 1900 the deaths from childbed fever there fell by about half, and the other deaths fell almost as far as midwives reached more villages. A century later, in Mwanza in Tanzania, mothers who gave birth with a clean kit had a third of the childbed fever of those without, and their babies a thirteenth of the infected cords. The kit was soap, a sheet, two strings and a new blade. The fever comes in on fingers and blades, and a village can keep it out with soap, boiled water and a blade that has touched nothing. That is the whole of the three cleans.

What happens with no attendant at all is harder to know. From a London dispensary's records of 1819, Loudon estimated that 25 to 30 mothers in 1,000 would die of an unattended labour, and he thought the figure might be pessimistic. A church in Indiana gave a modern answer. Its members, well fed and schooled, gave birth at home without trained help from 1975 to 1982, and their mothers died about 90 times as often as other women in the state. The distance from 30 in a thousand to 3 is the attendant. The distance from 3 to the 0.1 of today is antibiotics, blood and the operating theatre. The village can walk the first distance.

Nine months by hand

Care before birth is younger than it looks. In Edinburgh a hospital bed for the troubles of pregnancy was endowed in 1901, and the first clinic in Britain for women still well in pregnancy opened there in 1915. Clinics spread through the 1920s and 1930s. Mothers went on dying at the old rate until the late 1930s. In Kakamega, in Kenya, nearly two thirds of the mothers who died had been classed low risk at their first visit. A visit by itself saves no one. Only what is done at it can.

What can be done is short. A cuff on the arm, in use since 1896, finds the pressure that rises before the fits of late pregnancy. Where no cuff exists, the woman's own words are the warning: a headache that will not go, lights before the eyes, a face and hands that swell, a pain high under

the ribs. A thumb drawing down the lower eyelid finds the thin blood that turns a bleed into a death. In Nepal a woman who could not see at dusk was three times as likely to be severely anaemic. A tape from the pubic bone to the top of the womb reads, in centimetres, close to the weeks. A wooden horn, the midwife's instrument since 1895, carries the baby's heart to the ear. It costs almost nothing and lasts for ever.

The hands find the baby's position. A Dresden obstetrician set out four grips for it in 1894. In one study the grips found fewer than a third of the babies lying the wrong way. In the hands of experienced midwives they found 88 in a hundred. The check that matters is at 36 weeks, when a breech can still be planned for. Twins hide too. At Korle Bu hospital in Accra, 181 of 806 twin births were not known before labour. Two heartbeats counted at the same moment, at two different rates, is the village's test.

What the old hands knew

Every people has had someone who sits with a woman in labour. In Bihar she is the dai, in Mexico the partera, in Guatemala the comadrona, in France the sage-femme, in Germany the Hebamme. The partera rocks the hips with the rebozo, a long shawl. Trials now say that a companion who stays through the whole labour cuts caesareans by a quarter, with no harm found. Warm compresses on the stretching skin halve the worst tears. Company, warmth, food, a position of her choosing. Much of what the traditions did by custom, the trials have since counted.

The traditions also hurried. At a rural hospital in Oaxaca, eight women given a tea of zoapatle leaves during labour all bore babies who needed help to breathe. In Ghana herbs had been given in 24 of 41 torn wombs, and 34 of the babies died. Pressing on the top of the belly to push the baby out made birth no easier in five trials, and went with almost five times as many torn cervixes. Ash on the cord and the first milk thrown away were English habits in the 1600s, not only African or Asian ones. An attendant with no germ theory and no count drifts towards doing more.

The traditions were wisest about the hour after. The deaths of mothers cluster in labour and in the first hours after the birth, and in the modern count the commonest killer of all is bleeding after the birth. Cherokee

midwives warmed a hand over charcoal and rubbed the belly once the afterbirth was out. Rubbing a soft womb until it hardens is still the first thing done today. Many peoples waited for the cord to stop beating before they cut it, and the trials agree: waiting gave the baby 101 g more weight and more iron in its blood, with no added bleeding for the mother. The hour after a birth needs a warm hand on the womb and a clock. Nothing in it should be pulled or pushed.

Training these attendants began with a missionary midwife in Sudan in 1921 and became world policy at Alma-Ata in 1978. In Larkana, in Pakistan, trained attendants with clean kits cut the babies' deaths around birth by 30 in a hundred. In Zambia, attendants taught to help a newborn breathe cut newborn deaths by 45 in a hundred, and lost the skill within six months without practice. No trial of the training showed fewer mothers dying, and in 2004 the world's health bodies stopped backing the training. After the Fall the traditional attendant is the only skilled attendant there is.

In 1972 Philpott and Castle, working with first-time mothers in what was then Rhodesia, drew a line on paper. They plotted the opening of the cervix against the hours, with an alert line climbing at one centimetre an hour, set by the slowest tenth of labours. A woman whose mark fell to the right of it was falling behind. When the sheet was brought to 35,484 women in South East Asia, prolonged labour fell from 6.4 in a hundred to 3.4. In 2018 WHO called the alert line inaccurate, right only about half the time. It kept the line for one case: where there is no theatre and help is far. That is the village after the Fall. The line is weak. The habit of writing the numbers down at set hours is strong.

The Honest Broker's Clock

Here the sources disagree, and they disagree about time. On waters that break before labour, NICE sends the woman on at 24 hours. Hesperian's book for midwives wants labour within 12 hours and the baby born within 24. MA-01 takes the stricter figure because there will be no antibiotics. The Bench prints both, worry at 12 and act by 24, and leaves the line to the checker. The baby's heart has two lower limits, 110 (WHO) and 120 (Hesperian), and severe blood pressure is 160/110 to NICE and

150/110 to Hesperian. The Bench prints both pairs. The clocks for labour itself agree across the reports: about 12 hours of active labour for a first birth and 10 for a later one, counted from 5 cm, and at most 3 and 2 hours of pushing.

MA-01 is careful and can be trusted with a life once its marked intervals are checked. Emptying the bladder every 2 hours and feeling the womb every 15 minutes for 2 hours come from no source it read, and its account of why the partograph was made is from general knowledge. MA-10's limits for the growth of the womb are simplified from the INTERGROWTH charts and marked. TR-06 gives Ballard from Ulrich's own chapter, read in full, but Schrader's 4.6 in 1,000 rests on a summary of Dunn's paper of 2004, which TR-06 could not open, and Ballard's comparison with 1930 is unchecked. TR-14 says plainly that several of its ethnographies were seen only as citations. The shift from upright birth to lying on the back, credited to two French obstetricians of the 1600s, rests on a search summary, so the Story leaves it out. OR-04's heat and vinegar test for protein is graded B on one Sri Lankan study of 102 women.

The reports count the village's births differently: 8 to 12 (MA-01), 9 to 12 (MA-10), 8 to 10 (TR-06), about 9 (TR-14), each from an assumed birth rate. The book uses its own shared figure, 6 to 10. The draft supplied the wording of the village partograph, the three cleans folded from WHO's six, and the cut to six protocols. The breech, the twins in labour and the stuck shoulder belong to chapter 10.

The turn to the present

For two generations the normal birth went to hospital with the abnormal one. That was mostly a good thing. The theatre was minutes away for the woman who needed it. It also hid two facts. The first is how little a healthy woman having her second baby needs from a building. In England, in a study published in 2011, women planning a home birth had a caesarean in labour 2.8 times in a hundred against 11.1 in the obstetric unit, and drugs to speed labour 5.4 times against 23.5. For women who had given birth before, there was no added harm to the baby.

The second fact is how much the first-time mother needs. In the same study 45 in a hundred first-time mothers planning a home birth were

moved to hospital during labour, and their babies came to serious harm 9.3 times in 1,000 against 5.3. The hospital took up her risk so quietly that the argument about home birth could be held in averages. In the Netherlands the list of conditions that sent a woman from her midwife to a doctor grew from 39 in 1958 to 143 in 2003. Each line on it was a judgement no longer made at the bedside.

That is the cost. A skill always handed to the next building is not practised. A midwife who has never had to decide alone has not learned to decide. After the Fall the comparison is not home against hospital. A caesarean is not something to avoid. It is something that will not be there. The comparison is a clean, watchful, trained attendant against an untrained or absent one, and on that every source in the library agrees.

What would bring a village's mothers back to where Ballard kept hers? Little that can be bought. One trained woman and a helper, a kit wrapped before the last month, a watch, a horn, a cuff if one survives, a ruled sheet and a book for every birth. The first-time mother brought near the most experienced hands. A clock that is kept, and read. Hands that know how to wait.

Now the soap.

AT THE BENCH

08.1 See: the nine months

Contacts: before 12 weeks, then 20, 26, 30, 34, 36, 38 and 40 weeks. If 8 are too many: before 16, 24 to 28, 32 and 36. She keeps her own card.

Check	How	Act
Pressure	Cuff, seated, after 5 minutes rest. 2 readings	140/90: recheck in 30 minutes, test urine. 160/110 (NICE) or 150/110 (Hesperian): chapter 10 today

Check	How	Act
Protein	Boil the top of the urine in a tube. Add 3 drops of vinegar	A cloud that stays is protein. With 140/90: chapter 10
Pallor	Eyelid, palms, nails, by daylight. Can she see at dusk?	Some: 08.2. Severe, breathless or pulse over 100: district
Growth	Tape from pubic bone to top of womb	cm about equal weeks. Over 4 cm off, or no growth at 2 contacts: district
Heart	Pinard horn from 20 weeks, 1 full minute, a finger on her pulse	110 (WHO) or 120 (Hesperian) to 160. Same as her pulse: her own heart
Position	4 grips at 36 weeks	Not head down: chapter 10
Twins	Womb larger than dates. 2 heads. 2 rates at once	District attendant at the birth

Danger signs. Any 1 means the attendant today. Bleeding. Severe headache or blurred sight. A fit. Swollen face or hands. Pain high in the belly. Fever 38 °C. Waters leaking. The baby moving less. Fainting. With no cuff, these signs decide.

Never examine inside a woman who bleeds after 20 weeks. Instead: lay her on her left side, count her pulse, send for the district attendant.

- **Help in time.** The district attendant reaches her before she is pale and fast. Chapter 10.
- **Help too late.** Left side, warm, sips if awake. Pulse every 15 minutes, written. Someone stays.
- **No help at all.** Company, warmth, her hand held. The family is told plainly she may die, and will not be alone.

Ladder. Hands: questions, grips, tape. Hearth: wooden horn, vinegar and candle. Dispensary: cuff checked on a water column (OR-04). Hospital: scan. Refuse: a visit that ends at “she looks fine”.

08.2 Do: iron and folic acid

Work every dose twice, with two people.

The library gives no weight bands. These are adult doses, the same at any weight.

Who	Iron	As	Folic acid	Interval	Ceiling	How long
Every pregnant woman	60 mg	Ferrous sulfate 300 mg, or fumarate 180 mg	0.4 mg	Once a day	60 mg a day	First contact to 3 months after birth
Some pallor	120 mg	2 tablets of 60 mg	0.4 mg	Once a day	120 mg a day	Recheck at 4 weeks
After a baby with a spine defect	None	None	4 mg	Once a day	4 mg a day	Before conception to 12 weeks

Stock short and anaemia rare: 30 mg iron. Stop iron above 130 g/L. Iron tablets, grade A for anaemia.

Never leave iron where a child can reach it. About 4 tablets of 60 mg poison a 10 kg child. Instead: a closed tin, high up, a week at a time. Tablets swallowed: 07.5.

Hungry or thin: 1 extra meal a day for the last 20 weeks. Nausea: dried ginger tea, about 1 g a day, grade A. Raspberry leaf tea, grade D. Blue cohosh root, grade X. Vitamin A never above 10,000 IU a day. Iron and food: chapter 7.

Ladder. Hearth: iron pot, greens, pulses. Dispensary: tablets in a locked box. Refuse: iron loose in the house.

08.3 Do: the kit and the three cleans

Never put anything on the cord, chlorhexidine excepted. Instead: leave it clean, dry and uncovered.

Pack before the last month, wrapped dry: soap and a nail brush. A sheet about 1 m square. 2 cotton ties about 15 cm, boiled 20 minutes. 1 new blade. At least 6 boiled cloths. Gloves or 2 clean bags. At least 5 litres of boiled water, covered. A cap for the baby. At least 10 pads. The picture card.

1. **Hands.** Soap and brush to the elbow, at least 60 seconds. Before every touch inside, and before the cord.
2. **Surface.** Clean sheet, boiled cloths, her perineum washed. Nothing unclean into the birth passage.
3. **Cord.** New blade, boiled ties, nothing on the stump.

Boiling does not reliably kill tetanus spores. Use a new blade. Toxoid where held: 2 doses, 4 weeks apart.

Ladder. Hearth: soap, boiled water, ties, cloths. Dispensary: blades, gloves, toxoid. Refuse: a kit opened to borrow from.

08.4 Do: labour and the clock

Never give anything to make labour faster, and never press on the belly. Instead: a companion, drink, light food, walking, her own position.

Never stretch the cervix. Never tell her to push before it is fully open. Instead: breathe through the pains, change position.

Stage	Begins	Check	Outer limit
Early	Regular pains, under 5 cm	Baby's heart and her pulse hourly. Temperature and pressure every 4 hours	None

Stage	Begins	Check	Outer limit
Active	5 cm, strong pains	Heart every 15 to 30 minutes, 1 full minute. Pains every 30 minutes. Inside every 4 hours at most	12 hours first birth, 10 later
Pushing	Fully open, urge to push	Heart every 5 minutes, after each pain	Review at 1 hour. 3 hours first birth, 2 later
Placenta	Baby born	08.5	30 minutes worry, 60 act

Inside only with washed hands, never during a pain or with bleeding. Bladder every 2 hours.

The village partograph. Hours along the bottom, 5 to 10 cm up the side. Mark the first 5 cm. Draw the alert line from it, 1 cm an hour. Plot each examination.

Right of the line, or under 2 cm in 4 hours: send for the district attendant and start the journey. Write each check with its time.

Send at once for: waters broken without labour at 12 hours (Hesperian), by 24 at the latest (NICE). Baby's heart under 110 or 120, or over 160, after left side. Fever 38 °C, or 37.5 °C twice an hour apart. Her pulse over 120 twice. Fresh bleeding. Thick dark green waters.

At the birth: warm cloths on the perineum, boiled 2 minutes, cooled to hand warm, grade A. As the head crowns she blows, not pushes.

Past the line, or the shoulders stuck: chapter 10 has the manoeuvres and the limits.

- **Help in time.** She leaves, or the district attendant arrives, while the baby's heart is normal.
- **Help too late.** Left side, drink, empty bladder, heart every 15 minutes, times written.
- **No help at all.** Stay. Keep her warm and drinking. The family is told the baby may die, and why.

Ladder. Hands: company, watch, record. Hearth: wooden horn, warm cloths.

Dispensary: thermometer, cuff. Hospital: theatre. Refuse: any herb or drink to hurry.

08.5 Do: the placenta and the first hour

Never pull on the cord. Never press the belly to push the placenta out. Instead: wait, baby to the breast, empty her bladder, let her squat or kneel.

1. Dry the baby. Skin to skin, head covered. Not breathing after drying: chapter 11 now.
2. Feel the belly for a second baby. Nothing given before you know.
3. Wait at least 1 minute, better about 3, until the cord stops pulsing.
4. Tie 2 finger widths from the belly, square knot. Tie again further out. Cut between.
5. She pushes the placenta out with the next pains.
6. Not out at 30 minutes: empty her bladder, baby to the breast, send for the district attendant. 60 minutes: she goes to the district.
7. Then feel the womb every 15 minutes for 2 hours. Soft: rub until hard. Count pulse and pads.
8. Breast in the first hour. No bath before 6 hours, better 24.

Bleeding that soaks a cloth in minutes, or pulse over 100: chapter 9's shelf now. It holds misoprostol, oxytocin and tranexamic acid.

- **Help in time.** Chapter 9's shelf and the district attendant within the hour.
- **Help too late.** Flat, legs raised, warm. Rub the womb. Baby at the breast. Write the times.
- **No help at all.** Her baby on her chest, her family with her. They are told plainly she may die.

Ladder. Hands: waiting, rubbing the womb, the breast. Dispensary: chapter 9's shelf. Infirmary: the placenta removed by hand. Refuse: pulling, pressing, herbs.

08.6 Prevent: the attendant, the book and the stop list

A trained attendant and a helper at every birth. First birth, twins, breech, past caesarean or past heavy bleed: the district attendant, or move near her.

Village birth only at 37 to 42 weeks, 1 baby, head down, no bleeding, pressure under 140/90.

Stop, grade X: herbs to start or hurry labour (zoapatle, blue cohosh, castor oil, rue, raw ergot). Pressure on the belly. Stretching the cervix. Anything on the cord. First milk thrown away. Keep: company, chosen positions, warm cloths, the rebozo for comfort (grade D).

The book, after Ballard. 1 line a birth: date, mother, attendant, hours, placenta time, blood lost, baby. The mother again at 7 and 42 days. Over about 5 mothers dead in 1,000 births: review the practice. At 6 to 10 births a year, review every death and near miss.

An early call is never blamed. Practise on a doll monthly. District refresher every 3 to 4 months. Pay and honour the attendant.

Ladder. Hands: the stop list in every house. Hearth: the book. District: register and review. Refuse: an attendant who writes nothing.

If it goes wrong

1. **Fever after many examinations.** 38 °C, foul discharge, fast pulse in the first days. Cause: fingers inside too often, unwashed hands, waters long broken. Chapter 10. Next time: inside every 4 hours at most, each written.
2. **A hurried birth.** Torn cervix or perineum, bleeding, a slow heart, pain that never eases. Cause: pressure, a herb, pushing too soon. Stop. Left side. The most skilled hands. Chapters 9 and 10.
3. **A slow labour seen late.** The line was crossed hours before anyone sent. Cause: no record, or one nobody read. Plot every 4 hours. Send at the line, not when the heart slows.

Numbers to carry

- 6 to 10 births a year in a village of 300 (concept note, SY-05).
- 12 and 10 hours of active labour from 5 cm, first and later births. 3 and 2 hours of pushing, review at 1 (MA-01, SY-07).
- 30 and 60 minutes: worry and act for the placenta (SY-07).

- Waters broken without labour: 12 hours (Hesperian) or 24 (NICE) (MA-01).
- Baby's heart 110 or 120 to 160 (MA-01, MA-10).
- At least 1 minute, about 3, before the cord is cut (MA-01).
- The womb felt every 15 minutes for 2 hours (MA-01).
- 60 mg iron with 0.4 mg folic acid a day (MA-10).
- 4.6 mothers dead in 1,000 births, England and Wales 1856 to 1934. 25 to 30 unattended. About 3 at the best before antibiotics (MA-01).
- 1 in 198: Ballard. 4.6 in 1,000: Schrader (TR-06).

THE LIBRARY

MA-01 Normal birth and the attendant: where and how birth goes well. MA-10 Pregnancy care without ultrasound: anaemia, malaria, position, danger signs and nutrition. TR-06 European folk and wise-woman medicine. TR-14 Traditional midwifery across cultures: dais, parteras, sages-femmes and the evidence on traditional birth attendants. OR-04 Instruments and tests you can make. SY-07 The red-flag list. SY-10 The harm register. SY-05 The twenty interventions that save the most lives per hour of training. All are on the website.

CHAPTER 9

The Bleeding Mother

A mother who bleeds after birth can die within an hour. The first sixty minutes are the whole chapter: rub the womb until it is hard.

OPENING

Close one hand into a fist and press it with the fingers of the other. It is hard, the way a stone is hard under a cloth. Ten minutes after a birth, the womb should feel like that under a hand laid on the belly at the navel or a little below it: round, firm, about the size of the fist that is pressing it. While it stays that hard, the mother is safe from the commonest thing that kills mothers.

At the end of pregnancy the womb is a muscle with a river of blood running through it. When the placenta comes away it leaves a raw place the size of a plate on the inner wall, with open vessels by the hundred. Nothing ties them. What closes them is the muscle itself. Its fibres cross and wind around each vessel, and when the womb tightens they pinch every one shut. A hard womb is a closed womb. A soft womb can bleed a cupful a minute.

A grown woman holds about five litres of blood, and pregnancy adds to it. She can lose half a litre at a birth and be on her feet the next day. She can lose a litre and live, if someone sees it in time. Beyond that, the five litres she holds run short faster than anyone at the bedside believes,

because blood spread on a cloth or soaked into straw looks like less than it is, or more. The pulse quickens first. Then the skin cools and pales, she grows quiet or restless, and the arm that held the baby goes slack.

Most of what saves her is already in the room. A hand to rub the womb until it is hard again. A baby put to the breast. A bladder emptied. A woman laid flat and kept warm. Three or four small tablets. Most of what kills her is time spent not noticing, and time spent looking for a key.

Open the fist now. That hardness, and the loss of it, is what this chapter teaches a hand to feel.

THE STORY

A wound the size of a plate

Bleeding after birth is the oldest way for a mother to die, and it is still the commonest. Of 2.4 million mothers who died between 2003 and 2009, bleeding killed 27 in every hundred. Counts of the yearly toll run from nearly 45,000, the World Health Organization's figure of October 2025, to about 100,000, the figure the largest trial gave in 2017. The difference is in the counting. The women are the same.

Most births never come near it. About 6 mothers in a hundred lose half a litre or more, and about 2 in a hundred lose a litre. In a village of 300, with 6 to 10 births a year, that is one bleeding mother every two years and a severe one every six. The rarity is its own danger. A birth attendant who meets a haemorrhage once in two years has forgotten the dose, and where the tablets are kept, and who holds the key.

When it comes, it comes fast. Left alone, bleeding after birth kills through shock in two to six hours. In the largest trial of bleeding mothers, 483 women died, and 77 in a hundred of them died within the first day. In the first hour, 43 died. Nobody knows how many die when nobody does anything at all, because nobody has watched that and counted. The nearest record comes from Indiana, where a study in 1984 found that a religious community refusing medical care at birth lost mothers at about a hundred times the rate of the state around it.

The eye is a poor measure of blood. At Belgaum in India, estimates by eye fell a third below what a marked drape measured. In a simulation in 2022, half a litre spilled on the bed was guessed at more than a litre. The eye errs both ways. So in October 2025 the world's midwives and obstetricians moved the line. Three hundred millilitres with a fast pulse or a falling pressure now counts as haemorrhage, and five hundred counts whatever the pulse says. The pulse is the honest witness. It quickens before the face changes.

Powder for death

The first drug for the bleeding womb grew on rye. Ergot is a fungus that replaces the grain in the ear with a hard, dark purple spur. A writer at Frankfurt described German midwives using it to hasten labour in 1565. It worked, and too well. Given before the child was born, it clamped the womb shut on the baby, or tore it. The powder for birth, pulvis ad partum, became known as pulvis ad mortem, the powder for death.

In 1808 John Stearns of Waterford, in New York, published an account of the pulvis parturiens, the powder for childbirth, and American doctors took it up. Five years later a physician wrote his thesis on it. He gave it in labour and lost 4 babies in 22 first births. By about 1828 obstetricians had learned that ergot belonged after the birth, not before it. Given then, it closed the plate-sized wound.

The spur itself could not be trusted. In grasses from Slovenia, the alkaloids in ergot spurs ranged from 59 to 4,200 milligrams in a kilogram, a seventyfold spread between one field and the next. A dose from one spur could do nothing. The same dose from another could poison. The poison is old. Grain contaminated with ergot burns the limbs black and throws the body into fits, and the last great outbreak was in Wollo, in Ethiopia, in 1977 and 1978, after drought brought infected wild oats into the barley.

The man who made the spur safe was John Chassar Moir, born in Montrose in 1900. From 1932, at University College Hospital in London, he recorded the contractions of the womb after birth with a small balloon filled with water. He saw that the purified ergot alkaloids then sold acted slowly, while the crude liquid extract that midwives had used acted within minutes. Something in the crude extract had been thrown away. In 1935,

with the chemist Harold Dudley, he found it and named it ergometrine. It was soluble in water, it was quick, and it could be weighed.

The historian Irvine Loudon showed in 1992 that deaths of mothers in Britain and America did not fall until the late 1930s. Others have credited ergometrine with part of that fall. The modern trials agree that it works. Ergot alkaloids given after birth halve the bleeding, and they raise the blood pressure about two and a half times as often as no drug. In a woman whose pressure is already high, that can bring a stroke or fits. The ampoules also spoil. Of 100 samples from five countries, only 32 held what the label said. The drug Moir found is a district drug after the Fall, if it is anything.

Ajoya

David Werner was a biologist, not a doctor. In the Sierra Madre of western Mexico in the 1960s he made notes and pencil sketches for villagers who read poorly, and the notes became Donde No Hay Doctor in 1970, Where There Is No Doctor in English in 1977. The village health project grew from a centre at Ajoya and served more than 100 villages, some two days away by mule.

His book teaches a way of deciding, and the example it chooses is a mother bleeding after birth. If she is half an hour from a health centre, take her there. If she is far away and bleeding heavily, massage the womb, or inject the medicine even without training, because when the danger of doing nothing is clearly greater, the worker should do what he is reasonably sure will help. The rule is fixed. The line moves with distance. It is the most useful idea in all the books written for people far from doctors, and this chapter is built on it. It keeps the rule and refuses one part of the example, the injection, for reasons the Bench gives.

The trials show how much a village hand can do with a tablet. In 26 villages in the Gambia, 52 trained traditional birth attendants gave 1,229 women either misoprostol or ergometrine tablets after birth. Misoprostol is a tablet first made for stomach ulcers that also tightens the womb, and it keeps in heat if its foil is unbroken. A large fall in the blood's haemoglobin came in 16 women in a hundred given misoprostol, against 21 given ergometrine. They shivered more, and vomited less.

At Belgaum in 2006, Derman's team had 25 auxiliary nurse midwives give 1,620 women either 600 micrograms of misoprostol by mouth or a dummy tablet. Bleeding after birth fell from 12 in a hundred to 6. Severe bleeding fell from 1.2 in a hundred to 0.2. About 18 women take the three tablets to spare one bleed, and about 100 to spare one severe bleed. In South Sudan, where women were given the tablets in advance, 99 in a hundred took them at home births.

There is a case against, and it should be heard. Reviewers argued in 2012 that the evidence for giving misoprostol in the community did not show fewer deaths, only less bleeding. Tablets by mouth are weaker than an injection of oxytocin given into the muscle, with about a third more bleeding in the trials that compared them. Misoprostol brings shivering and fever, once as high as forty-one and a half degrees after a large dose. Given before the last baby is born, it can tear the womb, as ergot did. Where a cold, potent injection exists, it is the better drug. After the Fall it mostly will not exist, and the tablet beats nothing by half.

Twenty thousand mothers

The second modern drug does not touch the womb at all. Tranexamic acid slows the breakdown of clots. The WOMAN trial, published in 2017, gave it to 20,060 bleeding mothers in 193 hospitals in 21 countries, 1 gram into a vein, with a second gram after half an hour if the bleeding went on. Deaths from bleeding fell from 1.9 in a hundred to 1.5. Given within three hours of birth, they fell from 1.7 to 1.2. Given later, it did nothing. About 1 death is spared for every 200 mothers treated early.

The clock in that finding is the drug's own. Swallowed, tranexamic acid takes about 47 minutes to reach a useful level in the blood. Into a muscle it takes about 6 minutes, into a vein under 3. Given into the muscle it has not yet been tested in bleeding mothers. Given to every mother to prevent bleeding, it failed. So it is a vein drug for a bleeding woman, inside three hours, and a vein drug is the district's.

The oldest tools are the hands, and the record for them is honest and modest. Rubbing the womb after birth left about 77 millilitres less blood lost at one hour in one trial, a small cup. On top of an oxytocin injection it added nothing, and alone it did worse than the injection. For a soft womb

that is bleeding, every guideline still starts with it, because nothing is faster and nothing costs less. Squeezing the womb between a fist inside and a hand outside, bimanual compression, can be held by one person for only about two and a half minutes, and by two people taking turns for five minutes. A fist pressed hard above the navel onto the spine stopped the flow to the legs in 55 of a hundred women in one small study, and in up to 95 in a hundred when the person pressing was heavy. Each of these buys minutes, and minutes are what the five litres she holds are counted in.

One improvised device shows why a series is not a trial. In Dhaka in 2001 and 2002, doctors tied a condom over a catheter, slid it into the bleeding womb of 23 women and filled it with salt water. The bleeding stopped in all of them within 15 minutes. Series from many countries reported success in more than 85 in a hundred. Then two trials put it to the test. In Benin and Mali, surgery or death followed in 16 in a hundred women given the balloon against 7 without it, with 6 deaths against 1. A second trial in Uganda, Egypt and Senegal pointed the same way. The World Health Organization restricted it in 2021. The balloon may still save a woman who is out of every other help, but the book cannot promise that it will.

The Honest Broker's Ampoule

MA-02 is the report this chapter rests on, and it can be trusted with a life once the checker has confirmed its doses. It is careful to mark its own reasoning. The marked bowl and the weighed cloths at the Bench are its inference, not a tested method. So is its estimate that severe bleeding left untreated kills between 1 in 10 and 1 in 3. The library has no measured figure for that, and SY-12 asks for one from the historical record (R2-08). Its signs for the point at which nothing more can be done are also its own inference, and the Bench marks them.

The shelf is where the reports disagree. FO-11 gives the agencies' rule for oxytocin: discard it past its date and hold no stock that is not refrigerated. OR-06 reads the same stability review, Torloni's of 2016, and finds that oxytocin at twenty-one to twenty-five degrees loses 3 to 7 in a hundred of its strength a year, so that a cool store keeps it usable for two to three years at falling strength. Both rest on that one review. The book prints both

and does not settle it. SY-12 sides with OR-06, with misoprostol as the second line, and sends the cool-cellar figures to the second round (R2-06). The test at the bedside is plainer than either: a womb that firms within minutes.

There is an error to correct. OR-06 credits FO-11 with a cellar figure of two to four years. FO-11 contains no such figure. The two to four years is ME-09's estimate for oxytocin moved from a fridge to a cellar at twelve to fifteen degrees, and the two to three years is OR-06's own reading of Torloni's data. The book cites each as its own.

Two smaller gaps. The brief sent this chapter to OR-04 for how much a trained lay attendant can do with bleeding. OR-04 is a report on instruments and says nothing about it. What it does give is the checked cuff and the pressure read by feeling the wrist, and the Bench uses those. The record for lay hands comes from MA-02's trials in the Gambia and Belgaum. And FO-06 quotes Werner's worked example from the current edition of his book. Whether the 1977 edition says the same was not checked.

The library has no report on giving blood (R2-02). The book cannot teach transfusion, because without grouping, crossmatching and a bench to check them, blood given from a page kills as surely as blood lost, and OR-04 grades the grouping tile alone C. The library also holds almost nothing on bleeding before birth, and the Bench gives it only one line. The draft supplied the five litres, the cupful a minute, and the arrangement of the drugs by rung and by key.

The turn to the present

In a hospital, a bleeding mother is a page of steps. The oxytocin waits in the fridge, the drip goes in, the blood bank sends two units, and the theatre is down the corridor. That is a good place to bleed. It also hid something. When the E-MOTIVE trial went into 80 hospitals in Kenya, Nigeria, South Africa and Tanzania, among 210,132 births, nothing in it was a new drug. Severe bleeding, surgery or death still fell from 4.3 in a hundred to 1.6 once the staff measured every birth in a drape and did the first things together. The hospital had the tools. What it lacked was someone looking at the blood.

That part needs no hospital. A marked bowl, a counted pulse, a hand

on the womb every few minutes, and a second person who knows the order of acts. The village can do it at every birth.

What it cannot do is follow Werner into the injection. The owner has decided that needles stay at the district, outside two named exceptions, and this chapter keeps that line. It has a price. Tablets by mouth leave more mothers bleeding than an injection would. Tranexamic acid, the drug that lowered bleeding deaths in the largest trial, cannot be given by the village at all. A woman a day from the district has the hands, three or four tablets, and whatever the healer's cupboard holds. Is that enough? For most it is, because most bleeding stops with a hard womb. For a few it will not be, and the book says so now.

The five litres she holds are measured out in minutes, and the first minutes belong to whoever is in the room. Now the cloth.

AT THE BENCH

09.1 See: the bleeding mother

Feel the womb after every birth. Every 5 to 10 minutes for 1 hour. Then every 15 to 30 minutes for 1 to 2 hours. It should be hard like a fist, at or below the navel.

Measure the blood. Do not guess it.

Measure	How	Line
Bowl	Funnel under her into a bowl marked at 300 and 500 ml	500 ml is haemorrhage
Cloths	Weigh soaked cloths. Take away the dry weight. 1 g is 1 ml	1,000 ml is severe
Pulse	Count 15 seconds, times 4	Over 100
Pressure, checked cuff only	Systolic by feeling the wrist (OR-04)	Under 100
Shock index	Pulse divided by systolic	0.9 or more is alarm

Danger signs. Any 1 means 09.2 now:

- 300 ml with a pulse over 100.
- 500 ml, whatever the pulse.
- A cloth soaked in minutes.
- A womb that goes soft again.
- Cold pale skin, thirst, confusion or fainting.
- Placenta not out at 30 minutes (09.5).

Blood still running from a hard womb is a tear. Press on it and see chapter 10.

Rung ladder. Hands: the fist test, the pulse, a clock. Hearth: the marked bowl, a spring scale for cloths. Dispensary: a checked cuff. Refuse: a guess by eye. Eyes have read 33% low, and 500 ml as 1,208 ml.

09.2 Do: when bleeding starts

Never give a drug to tighten the womb before the last baby is born. Instead, feel the belly for another baby. If unsure, give no drug and rub.

1. Shout for help. Note the time. Someone stays with her all the time.
2. Rub the womb through the belly, firmly, in circles, until it is hard. Push out clots.
3. Give misoprostol 800 µg under the tongue if none was given at the birth (09.4).
4. Help her pass urine. A full bladder keeps the womb soft.
5. Put the baby to the breast.
6. Lay her flat. Raise her legs. Cover her. Keep her warm.
7. Sips of water if she is awake and can swallow. Nothing by mouth if she cannot.
8. Count the pulse every 5 minutes. Write it with the time.
9. Still bleeding at 10 minutes: 09.3.

Send by distance. The bands are FO-06's, the choice is the village's.

District	Do
Under 30 minutes	Carry her now, flat, someone rubbing the womb on the way

District	Do
30 minutes to 1 day	Send a runner now. Do 09.2 and 09.3. Carry her when the bleeding slows
None	Do everything here

Grades. Rubbing a soft womb B. Baby to the breast D. Emptying the bladder D. Warmth B, sips D.

Rung ladder. Hands: all of the above. Village: misoprostol from the birth attendant's bag. Refuse: herbs to tighten the womb, and waiting to see.

09.3 Do: compression

Use it if bleeding goes on after rubbing and tablets.

Bimanual compression, by the trained birth attendant or the healer:

1. Wash. Use a clean glove or a scrubbed hand.
2. Put a fist into the vagina, knuckles against the front of the womb.
3. Press the other hand on the belly, behind the womb.
4. Squeeze the womb hard between both hands.
5. Swap with another person every 2 minutes. 1 person tires after about 2.5 minutes.
6. Hold until the womb stays hard. Let go slowly. Keep feeling.

Aortic compression, as a bridge or on the way to the district:

1. Put a fist just above the navel.
2. Lean your weight straight down onto the spine.
3. Someone else feels the pulse in the groin. Gone means the press is right.
4. The heaviest person presses. Swap before the arm tires.

Grades. Bimanual B. Aortic B. Both low certainty.

Rung ladder. Hands: both compressions. Dispensary: a condom balloon, last of all, placenta out, no transfer. 2 trials found more deaths with it. Infirmary: 09.4, the anti-shock garment for the journey. Hospital: blood, surgery. Refuse: blood without grouping and crossmatch.

09.4 Do: the drugs, by rung and by key

Never raw ergot. Never ergometrine when the pressure is high. Never veterinary oxytocin in a woman. It is twice the strength. Instead, misoprostol and the hands.

These are adult doses, the same for every mother. There are no weight bands.

Work every dose twice, with two people.

Drug and strength	Dose and route	When	Interval and ceiling	Who holds it	Grade
Misoprostol, 200 µg tablet	600 µg, 3 tablets, by mouth	After the last baby, to prevent	Once	Birth attendant	A
Misoprostol, 200 µg tablet	800 µg, 4 tablets, under the tongue	Bleeding, if none given	Once. Not after 600 µg	Birth attendant	A
Oxytocin, 10 IU in 1 ml	10 IU, 1 ml, into the thigh	Bleeding, or to prevent	Once below the district	Healer or district	A if potent
Tranexamic acid, 100 mg in 1 ml	1 g, 10 ml, into a vein over 10 minutes	Within 3 hours of birth	Again after 30 minutes if bleeding. Ceiling 2 g	District	A
Ergometrine	District only, by its own label. The library gives no injection dose	Bleeding, normal pressure	By the district	District	A

Misoprostol brings shivering and fever within the hour. Cover her for the shivering. Cool damp cloths if she is hot. Fever has reached 41.5 °C.

Keep misoprostol in its sealed foil. Never cut or pop a blister ahead of time. A torn blister held 48% of its strength in 1 study.

Oxytocin kept at 2 to 8 °C loses nothing in 12 months. At 21 to 25 °C it loses 3 to 7% a year. **Disputed line:** FO-11 says discard it and hold no unrefrigerated stock. OR-06 says it is usable cool for 2 to 3 years. The book does not settle it. If old oxytocin is given, watch the womb. Not hard within minutes: give misoprostol if none was given, and compress.

The key. The birth attendant holds the misoprostol in a sealed bag. The healer holds the injections in a locked inner cupboard. Another named person holds its spare key. The council keeps a sealed spare set (OR-06). Tablets given to mothers before the birth: the owner decides.

No injection below the district. The cost: about 33% more haemorrhage with tablets than with injected oxytocin. No tranexamic acid in the village.

Rung ladder. Garden and still: shepherd's purse, *Capsella bursa-pastoris*, tea D, only after the placenta is out, never before birth. Yarrow D, refused for its hemlock lookalike. Dispensary: misoprostol, cold oxytocin. Infirmary: tranexamic acid, oxytocin, ergometrine. Hospital: blood, surgery. Refuse: raw ergot, X, never grown.

09.5 Do: the placenta, and when nothing works

The normal third stage is chapter 8's. Never pull the cord. Instead, wait with her upright.

1. Placenta not out: baby to the breast, empty the bladder, upright or squatting.
2. At 30 minutes without bleeding: wait, rub, watch.
3. At 60 minutes, or heavy bleeding at any time: the healer removes it by hand, gloved, following the cord. Grade B.
4. It will not come away: stop. Compress. Send.
5. A red mass at the vagina, no womb in the belly, collapse: the womb has turned out. Push it back at once with the flat of the hand. No drug until it is back.
6. Bleeding before the birth: no hand in the vagina, no drug. Left side. Carry her to the district.

The 3 branches of the danger sign:

- **Help in time.** The bleeding stops and the pulse falls under 100. Check

womb and pulse for 24 hours. Food and drink. She does not stand alone on day 1.

- **Help too late.** She reaches the district in shock. Send a card with her: times, drugs, doses, the bowl count.
- **No help at all.** No wrist pulse, she cannot be woken, and the bleeding goes on after everything. Stop what hurts. Keep her warm. Sips if she can swallow. Let her hold her baby. Bring her family. Tell them: everything that could be done was done, and the bleeding was stronger. Find the baby a breast within hours (chapter 11). Write down every time, for the next birth.

09.6 Prevent: every birth, every 3 months

Never press on the belly to hurry the birth. Instead, let her walk, squat and change position (chapter 8).

1. Feel for another baby. Then 600 µg of misoprostol by mouth (09.4).
2. Put the bowl under her and a clock where you can see it.
3. Feel the womb on the schedule in 09.1.
4. Drill every 3 months: fist test, bowl, key, compression on a cloth model, dose read by 2.
5. At each drill, check every blister and date.

Rung ladder. Hands: the drill. Village: the tablets and the key. District: the cold store.

If it goes wrong

- **The drug did nothing.** The womb stays soft after tablets or ampoule. Cause: oxytocin spoiled by heat, or a torn blister. Do: misoprostol if none given, compress, send. Note the batch.
- **A drug before the last baby.** Strong pains without a pause, a slow baby's heart, sudden pain then quiet. Cause: no belly check. Do: stop, left side, the most skilled hands, the district now.
- **The hands give out, or the womb is hard and still bleeds.** Compression slips after 2 minutes, or red blood runs past a firm womb. Cause: 1 person alone, or a tear. Do: call a helper as soon as the womb goes soft. Press the tear (chapter 10).

NUMBERS TO CARRY

- 500 ml, about 2 cups, is haemorrhage. 300 ml with a pulse over 100 is too (MA-02).
- Feel the womb every 5 to 10 minutes for the first hour (MA-02).
- 600 µg of misoprostol by mouth after the last baby. 800 µg under the tongue to treat (MA-02).
- 3 hours: the tranexamic acid window, 1 g into a vein (MA-02).
- 30 and 60 minutes: worry and act for a retained placenta (MA-02, SY-07).
- 2 minutes: swap hands on bimanual compression (MA-02).
- 3 to 7% a year at 21 to 25 °C: oxytocin's loss. Discard or keep is the disputed line (FO-11, OR-06, SY-12).

THE LIBRARY

MA-02 Bleeding after birth: the leading killer and every tool against it. FO-06 The manuals that worked. OR-06 Stockpile, storage and the dispensary's shelf. ME-09 Salvaging the pharmacy. FO-11 Humanitarian medicine with little. OR-04 Instruments and tests you can make. SY-10 The harm register. SY-12 What the library could not find. SY-07 The red-flag list. All are on the website.

CHAPTER 10

When Birth Goes Wrong

Obstructed labour kills the baby in a day and the mother in two to three. A fit in pregnancy kills within hours. The decision to carry is made before the night, not after it.

OPENING

Lay your fingers low on your belly, where the hair begins, and press down until you meet bone.

It does not give. That is the front of a ring of bone, the pelvis, and under your fingers the two halves of the ring are joined by a pad of gristle. Every child born the ordinary way comes through that ring, head first, turning as it goes. In pregnancy the gristle softens a little, and the ring makes what room it can. In most births the fit is close and the passage works. The body knows the way.

Sometimes it does not. The head is too large for the ring, or turned the wrong way, and the labour stops. The baby comes bottom first. The shoulder catches behind the bone you are touching now. The cord slips down ahead of the child. The woman herself begins to fit, or burns with fever two days after the birth. None of these is common. In a village each comes so rarely that no one has seen it twice. That is the danger in it.

These things often come in the dark, because labour is long and the hours pile up. There is a moment when the birth has stopped and everyone in the room looks at the one who knows. Her courage is rarely a bold

act. It is to say aloud that this birth will not finish here, and to wake the bearers while the dark is still young. Sometimes it is the other courage: to put her hands where they are needed and keep them steady through the few minutes that decide. Both are the same turn in the night. She stays, and she chooses.

Take your hand away. The bone under it is the same in every woman. So is the hour when the attendant must choose.

THE STORY

The labour that stops

Obstruction is the plainest way a birth goes wrong. The baby cannot pass the ring, and the womb goes on pressing anyway. It happens in three to six births in a hundred, and one estimate laid about eight in a hundred of all mothers' deaths at its door. A village of 300 meets it once every two to four years. Nobody there will have seen enough of it to trust their memory. So the signs must be learned before they are needed.

The womb does not behave the same way in every woman. In a first labour it tends to tire and stop, and the woman lingers for days with a dead baby inside her and infection rising. In a woman who has borne several children it tends to keep working until it tears. In one Ethiopian hospital series, three in ten obstructed labours had already torn the womb by the time the women arrived. Seventeen in a hundred of those mothers died, and nearly four in ten babies were born dead. Those women reached a hospital. Many never did.

The signs come in an order. First the labour stops moving on the chart while the pains stay strong. Then the head swells under the hand, and its bones ride over one another. The bladder, squeezed between head and bone, fills and cannot empty, and it shows as a soft swelling above the pubic bone. Then a groove appears across the belly, where the thick upper womb has drawn itself up and the thin lower part stretches below it. Midwives have called it the ring. Last comes the smell of a labour gone on too long. By the ring, the womb is close to tearing.

There is a slower harm too. The head pressed for hours against the bone starves the tissue caught between them. A week later that tissue falls away, and a hole opens into the bladder or the bowel. The woman leaks urine for the rest of her life, and is often put out of her home for it. At least three million women live with such a hole today. It comes from the time the head stays, not from any force applied. A catheter put in after a long labour and left for a week lets small holes close.

The turn in the night comes earlier than anyone wants. It comes when the line on the chart from chapter 8 is crossed, while the woman can still walk to the cart and the bearers are fresh. Waiting for the ring is waiting too long. The attendant who carries a woman early will sometimes be wrong, and the baby will be born on the road. That error is cheap. The other one is not.

Hands off, then hands

Some births stop for a reason the hands can mend. A breech comes bottom or feet first, and the head, the largest part, comes last. In 2000 a trial of 2,088 women in 26 countries found that a planned caesarean gave a bad result for the baby in 1.6 in a hundred, against 5.0 for a planned vaginal breech. The world's hospitals turned to the knife. Then the children were followed to two years of age, and the difference had gone: 3.1 against 2.8. A French study of 8,105 breeches, where the old skill was kept, found almost no difference at birth either. The hands had not been the problem.

The lesson for a village is the old midwives' rule. Do not pull. Let the body be born by itself to the navel, hands off. Then the arms, by turning, and then the head, bent forward, with a helper pressing above the bone. Pulling early throws the arms up beside the head and jams it there. A frightened attendant pulls. A steady one waits.

The stuck shoulder is quicker and more frightening. The head is born, then draws back tight against the mother's body, and nothing more comes. In one American series of 132,098 births it happened 1.5 times in a hundred. A Hong Kong team in 2011 measured what the minutes cost. Below five minutes from head to body, one baby in two hundred was harmed in the brain. At five minutes or more, nearly one in four was. Every minute the blood grows more acid. Here the courage is in the hands.

The hands have a sequence, and part of it came from outside medicine. Ina May Gaskin, a lay midwife in the United States, learned from Guatemalan practice to turn the mother onto her hands and knees. In 1998 she and three colleagues reported 82 stuck shoulders. Turning the mother freed 83 in a hundred, in an average of 2.3 minutes, with no deaths. In the hospital sequence, pulling the thighs back and pressing above the bone come first. Reaching in to turn the shoulders, or to bring down the back arm, comes after. The back arm freed 84 shoulders in a hundred in the series that counted it. Pressing on the top of the belly only drives it in harder.

The cord that comes first is the rarest and the cruellest. It slips past the head, the head presses it, and the baby's blood supply stops. It happens in one to six births in a thousand. Outside hospital the baby dies ten times as often as inside. One Nigerian hospital, in Kaduna, lost two thirds of them. Few deaths come faster.

The rescue is to take the baby's weight off the cord: a hand lifting the head, the mother on her knees with her chest to the floor, the bladder filled with water to hold the head up. In three series with this method, 1 baby died out of 140. Every one of those series ended in a caesarean within about two hours. Without one, a cord that comes early in a first labour will probably cost the baby.

The illness of the moon

In southern Mozambique, women and healers called the fits of late pregnancy the illness of the moon, or snake illness. The names describe what is seen. A woman near her time, often with a swollen face, a headache that will not go and flashes before her eyes, falls and shakes, and may not wake. Before any treatment worked, around 1900, twenty to twenty eight in a hundred such women died. Sedation with morphine and chloral brought it nearer ten. The disease belongs to the placenta. It ends when the placenta is out, and the birth is the only cure.

The drug that holds the fits off until the birth was made to work in a Texas hospital. Pritchard, at Parkland Hospital in Dallas, published a regimen of magnesium sulfate in 1955 that went mostly into the buttock and needed no drip. Later he reported 245 women treated for fits with

one death. Outside the United States few believed him. In 1995 a trial of 1,687 women with fits found magnesium cut repeat fits by half against diazepam and by two thirds against phenytoin. In 2002 the Magpie trial gave magnesium or a dummy to 10,141 women with high pressure in 33 countries. Fits fell from 1.9 to 0.8 in a hundred. The record was settled.

The record still had to reach a woman in a village. In Kano State, in northern Nigeria, ten facilities that had used diazepam switched to magnesium after two days of training. In 2006 and 2007 they had lost 258 of 1,233 women with fits, more than one in five. In the following year they lost 23 of 996, about one in fifty. The staff checked each woman's knee jerk with a hammer before every dose. About two in a hundred showed too much magnesium and were given calcium as the antidote. It was a count before and after, not a trial. It is still the strongest reason in this book to be bold.

Magnesium has a danger, and it arrives in a fixed order. First comes flushing, which is harmless. Then the knee jerk fades, the breathing slows, and at the end the heart stops. A hammer and a counted minute of breathing guard every dose. The kidneys clear the drug, so a woman who makes little urine keeps it. Most of 52 overdoses gathered by one American safety body came from drips, and the buttock regimen needs none. Injections made up outside a factory have carried bacteria into the blood, so only sealed ampoules will do. This is the one injection the chapter allows in a village.

The hand that carries it

The other killer after birth came by hand. In Aberdeen, between 1789 and 1792, a naval surgeon named Alexander Gordon watched an epidemic of fever after childbirth. Of the 77 women he treated, 28 died. The fever began the day after the birth and killed by the fifth. Gordon saw that he could foretell the cases "upon hearing by what midwife they were to be delivered." He published in 1795, and confessed that he had carried it himself. He washed, fumigated clothes and burnt the bed linen. He also bled the women heavily, which was wrong. He was ignored.

In Boston in 1843 Oliver Wendell Holmes gathered such clusters into a short paper on the contagiousness of puerperal fever. A doctor in Salem

had five cases in the first nineteen days of January 1829. Another in Philadelphia had about seventy in a year. Holmes wrote rules that a village could use today. After one case, the attendant should treat the next woman as at risk from himself. After two close together, he should stop attending births for a month. Three made him, on the face of it, the carrier. Few doctors liked being told this.

Four years later in Vienna, Semmelweis made the students wash in chlorine, as chapter 1 tells. Even so, the fever did not yield until its cause was known. The commonest killer is a germ carried in the throats and noses of healthy people. Half its cases begin within two days of the birth, some within hours. In 1936, at Queen Charlotte's Hospital in London, the first sulpha drug was given to 38 women with the streptococcal fever. Three died, against about a quarter before. The hand that washes prevents the fever. Only the drug cures it.

The record holds one more surprise. Historians found that in the nineteenth century richer women attended by doctors died of childbed fever more often than poor women attended by midwives. Florence Nightingale counted 34 deaths per 1,000 in the lying in hospitals, against 5.1 at home. The danger was never the home. It was the hand that came from somewhere else. A village birth at home, with a clean hand and a clean blade, starts ahead of the hospitals of that century.

The district's knife

Some births can be finished only by cutting. In 1879, at Kahura in Bunyoro, in present day Uganda, a Scottish medical student named Robert Felkin watched a healer deliver a young mother by caesarean. She was given banana wine until half conscious. The healer washed his hands and her belly in wine, sealed the vessels with a hot iron and closed the wound with seven iron pins. She was healing by the eleventh day. Felkin published it in 1884. One case is not a record. It shows the knowledge was not Europe's alone.

There is an older cut, through the gristle at the front of the ring. It was first done in France in 1777, and it widens the ring without opening the belly. One review of 5,000 cases found no mother dying of the operation itself after 1950. One Nigerian hospital did 1,013 between 1982 and 1999

and lost one mother. But it can leave a woman unable to hold her urine, or in pain when she walks. In Ireland, between 1944 and the 1980s, about 1,500 women had it done, many without being asked or told. The women organised in 2002, and the state paid them in the end. WHO's manual for district hospitals no longer describes it.

When the baby has already died in a stuck labour, there are old operations that make it smaller so that the mother can be delivered without the belly being opened. The mothers die less often after them than after a caesarean in the same hospitals. This book names them and does not teach them. They are for the district, on a baby confirmed dead by more than one listener, by a hand trained under supervision. Never on a living child.

The caesarean itself needs no doctor. After independence Mozambique had almost no surgeons, so it trained surgical technicians. At the central hospital in Maputo nearly half of 2,071 caesareans were theirs, and only small wound problems set their work apart from the doctors'. Seven years on, 88 in a hundred of the technicians were still at their posts. In Malawi, of 8,070 caesareans at district hospitals, 1.3 in a hundred mothers died, and half of the dead had lacked blood. A district of 3,000 will need one to seven caesareans a year. In rural eastern Africa in 1984, one count found nine times as many needed as were done. The rest of those women died, or lived with the hole.

The Honest Broker's Stopwatch

Here is where the sources need weighing, and most of it is about clocks.

The timings in this chapter were measured in hospitals. The five minute line for the shoulder comes from 200 births in a Hong Kong hospital (Leung 2011). The posterior arm's 84 in a hundred, and the finding that three or more manoeuvres doubled the harm, come from hospital series (MA-03). The bladder filling figures for the cord all ended in a caesarean within two hours. The upright breech figures come from Frankfurt, with a theatre next door. Only Gaskin's 82 cases were midwife births, and their authors included the woman the manoeuvre is named for. MA-03 gives each step 30 seconds, its own division of the five minutes. The book prints it as a pace, not a finding.

Two magnesium lines are disputed. For breathing, MA-04, ME-08, WO-14 and WHO hold the dose below 16 breaths a minute. Hesperian, through SY-10, stops only below 12. The book prints both as a ladder: hold below 16, and treat as an emergency below 12, with calcium gluconate. For urine, MA-04 and WO-14 ask for 30 ml an hour, and ME-08 and one product sheet accept 25. The book prints 30, the stricter, with 25 beside it. Neither is settled here.

Kano was a count before and after, with no comparison group, and Magpie's fall in deaths did not reach significance. The fits fell, and the book rests on that. The Aberdeen deaths are 28 in MA-04 and HY-01's main account, 25 in another retelling. MA-03 gives the Mozambique technicians 958 caesareans in one place and 978 in another, so the Story says nearly half. The Guatemalan origin of the all fours turn rests on the paper's own account. On the tear that bleeds, the four reports were silent, and the Bench says so. One dry note, aimed at a manual and not at anyone who wrote it: WHO's guide for places without a surgeon left out the one operation that needs no theatre.

The turn to the present

In Berlin a labour that stops becomes a caesarean, usually long before anyone sees the ring. The hospital hid obstruction so well that most people have never heard of the hole it leaves. It hid the breech too. After the trial of 2000, many hospitals chose the knife for nearly every breech, and the hands that knew the hands off birth grew fewer. The library found no count of those hands in Germany. We would guess they are few, and the guess is ours.

It hid the fits as well. A woman with high pressure was watched in a ward, and magnesium ran into her vein from a bag. Nobody on her street had seen a knee jerk tested or a breath counted for a drug. The childbed fever it hid best of all, behind a drawer of antibiotics and a rule that every hand is washed. None of that was wrong. It was simply never handed to the people who would need it when the building was gone.

What it hid most completely was the decision. With the theatre down the corridor, nobody in the room had to judge when to leave, because nobody had to leave. The cost of that convenience falls due now. Who in

the village will say, in the small hours, that this birth will not finish here?

That is what courage means in this chapter. It is not a bold hand with a blade. It is a plan made in daylight: the bearers named, the runner chosen, the women at risk waiting near the district before their time, the ampoules counted, the hammer in the box. The turn in the night is made easier by everything settled before dark. The attendant still has to stay, and still has to choose. She will do it better with the choosing half done.

Enough history. Wash your hands.

AT THE BENCH

Work every dose twice, with two people.

10.1 See: the labour that stops

Never give anything to make labour faster. Never press on the belly. Instead: drink, upright, an empty bladder, the carry (SY-10, H18).

Use the chart from chapter 8. Send when any 1 is true:

- Active labour over 12 hours in a first birth, 10 in a later one.
- Under 2 cm in 4 hours, or right of the 1 cm an hour line from 5 cm.
- 1 hour of pushing with no descent.
- 3 or more contractions in 10 minutes, each over 40 seconds, and no progress.

Already obstructed, carry now: the ring across the belly. A full bladder she cannot empty. A large swelling on the head, skull bones overlapping. A foul smell, fever, a fast pulse. The baby's heart slow or gone.

1. Left side or upright. Give drink.
2. Help her empty her bladder. If she cannot, a trained hand passes a clean catheter.
3. Send the runner. Call 4 bearers. Leave. Who decides is.
4. After any long labour, a catheter for 7 days.

Grades: herbs X. Pressing on the belly X. Catheter after a long labour B.

Rung ladder. Hands: chart, watch, stretcher, 4 bearers, a runner. Dispensary: catheters. Infirmary: the vacuum cup, at most 0.8 kg/cm2 and 30 minutes, the caesarean. Symphysiotomy and the destructive operations, on a dead baby only, are named here, not taught. Hospital: blood and a full theatre, if one remains. Refuse: oxytocin, herbs, any destructive operation on a living baby.

- **Help in time.** She leaves before the ring. Bladder empty, left side, drink on the road.
- **Help too late.** Sudden pain, contractions stop, she pales: a torn womb. Keep going, warm, left side.
- **No help at all.** This mother may die. Warmth, drink, bladder emptied, left side, never alone. A dead baby may still be born. Name the baby and let the family hold it. Tell them the truth gently.

10.2 Do: the breech

Never pull on a breech. Instead: hands off until the navel is born.

1. Send the runner. A known breech waits at the infirmary from 37 weeks.
2. Let her push. Hands off until the navel shows.
3. Hold by the hips, thumbs on the buttocks, in a cloth. Never the belly.
4. Arms: turn the body half a turn each way to free each arm.
5. Head: baby along your forearm, chin bent to chest. A helper presses above the pubic bone.
6. A foot first: knees to chest, and send.

Grades: hands off breech B. Arms and head B. Turning the baby from outside the belly, infirmary only.

Rung ladder. Hands: patience, a cloth. Infirmary: the caesarean. Refuse: pulling.

10.3 Do: the stuck shoulder

Never press on the top of the belly. Instead: press just above the pubic bone.

Head born, then pulled back tight. Say the time aloud. Head to body under 5 minutes. About 30 seconds a step.

1. Call for help.
2. 2 helpers pull her thighs back to her belly. Gentle downward traction.
3. A fist above the pubic bone, pressing toward the baby's face.
4. Turn her onto hands and knees. Gentle traction again.
5. A hand inside turns the shoulders.
6. Bring the back arm across the chest and out.

Never pull hard or twist the neck. Grades: all 6 steps B.

Rung ladder. Hands: 2 helpers, a watch. Infirmary: a trained hand for steps 5 and 6.

10.4 Do: the cord that comes first

Never push the cord back. Instead: lift the baby off the cord.

1. Send the runner. Minutes count.
2. A gloved hand lifts the head off the cord. Keep it there all the way.
3. Knees to chest, or left side with hips raised. Touch the cord little.
4. Dispensary: 500 to 750 ml of boiled water into the bladder by catheter. Clamp. Empty it before the birth.
5. Carry her on her left side.

Without a caesarean within about 2 hours the baby will probably die. Grades: lifting, position, bladder B. Pushing the cord back D.

10.5 See and do: fits, and the one injection

Never inject any other drug in the village. The one other exception is adrenaline (chapter 22). Instead: by mouth, by rectum, or carry.

Never make injections from Epsom salt. Instead: sealed, labelled 50% ampoules, or rectal diazepam.

Never put 50% magnesium into a vein. Instead: the buttock.

See: pressure 160/110 or more, or a fit. A headache that will not go, flashing sight, pain under the right ribs, vomiting, a swollen face. Most fits after birth come in the first 2 days.

During a fit: note the time. Protect, never hold down, nothing in the mouth. Then her left side.

Magnesium sulfate 50% is 500 mg in 1 ml. Fixed adult doses: the library gives no weight bands.

Step	Dose	Volume of 50%	Where	Interval	Ceiling
Loading	10 g	10 ml in each buttock, each with 1 ml of 2% lidocaine	Deep, upper outer buttock	Once	10 g
Keeping	5 g	10 ml with 1 ml of 2% lidocaine	Other buttock each time	Every 4 hours, after the checks	5 g a dose
Infirmary only	4 g into a vein	Diluted to 20% or less	Over 5 to 15 minutes	Once	Never 50% in a vein

Until 24 hours after the birth or the last fit. A course is 50 to 55 g. Lidocaine 40 mg, under its ceiling of the lesser of 3 mg/kg and 200 mg. Loading before a long carry, and how many keeping doses on the road, are.

Before every keeping dose, check and write down:

Check	Give	Hold, recheck hourly	Emergency
Breaths a minute	16 or more	Under 16	Under 12
Knee jerks	Present	Absent	Absent, breathing slow
Urine	30 ml an hour, 120 in 4 hours	Under 30. Some sources 25	None in 4 hours

Emergency: stop. Breathe for her with bag and mask until her rate is over 12. Calcium gluconate 10%, 10 ml (1 g), into a vein over 3 minutes. Who may give it below the infirmary is.

Never magnesium with no urine, heart block or myasthenia (SY-10, H34).

No magnesium: diazepam 5 mg in 1 ml, 4 ml (20 mg) into the rectum. 2 ml (10

mg) more after 10 minutes if fits go on. At most 2 doses.

Grades: magnesium A. The checks and calcium B. Loading alone before a carry C. Diazepam alone C. Epsom salt injection X.

Rung ladder. Hands: protect, left side, count breaths. Dispensary: 50% ampoules, 2 calcium gluconate ampoules, lidocaine, 10 ml syringes, long needles, a hammer, a urine jug. A new needle and syringe each injection. Infirmary: the vein dose, the birth brought on. Refuse: home-made ampoules, drips without a counter.

- **Help in time.** Loading given, carried on her left side with the box and the check card.
- **Help too late.** Keeping doses every 4 hours on the road, after the checks.
- **No help at all.** She may die. Magnesium or diazepam, left side, checks hourly. The birth is the cure. Tell the family the fits may return, and that she will be watched all night.

10.6 Do: fever after birth

Never give an antibiotic without writing the signs down. Instead: write them, then give the first dose at once (SY-10, H48).

See, 2 or more: pain low in the belly. 38.5 °C once, or 38.0 °C twice 4 hours apart. Foul discharge. A womb not shrinking. In the first 2 days, vomiting and diarrhoea can be the start, the pulse still normal.

1. Write the signs and the time. First dose by mouth now. Then carry.
2. Fluids, warmth, clean pads. Never alone.
3. Not better in 72 hours: retained placenta, abscess or clot. Infirmary.

Fixed adult doses. The library gives weight only for gentamicin.

Rung	Drug	Dose	Interval	Length
Dispensary	Amoxicillin	1 g by mouth	Every 8 hours	5 to 7 days
Dispensary	Metronidazole	500 mg by mouth	Every 8 hours	5 to 7 days

Rung	Drug	Dose	Interval	Length
Infirmary	Ampicillin	2 g into a vein	Every 6 to 8 hours	To 48 hours without fever, then tablets

Infirmary gentamicin, 5 mg/kg into a muscle, once a day. Strength 40 mg in 1 ml:

Weight	Dose	Volume
40 to 49 kg	200 mg	5 ml
50 to 59 kg	250 mg	6.25 ml
60 to 69 kg	300 mg	7.5 ml
70 kg and over	350 mg	8.75 ml

Grades: these antibiotics B. Bleeding a fever X.

Rung ladder. Hands: thermometer, card. Dispensary: the tablets. Infirmary: injections, clearing the womb, draining an abscess. Refuse: the attendant of the last fever at the next birth.

- **Help in time.** First dose given, carried within hours.
- **Help too late.** Tablets every 8 hours on the road. Fluids.
- **No help at all.** She may die. Fluids, warmth, clean pads, her linen boiled, never alone. Tell the family the truth.

10.7 Prevent: the clean hand, the early carry, the tear

1. 6 cleans: hands, her skin, the surface, the blade, the cord tie, cord care. A clean kit in every house.
2. A sore throat or a sore finger: the attendant stands aside.
3. 2 fevers among 1 attendant's women within a month: she stops attending births for a month.
4. Pressure after 20 weeks and on days 1 to 3 after birth. Recheck at 140/90, urgent at 150/110.
5. High risk of fits: aspirin 75 to 150 mg a day.
6. Breech, twins or high pressure: wait at the infirmary from 37 weeks.
7. Tetanus toxoid: chapters 11, 16 and 18.

The tear that bleeds. Red blood runs while the womb is hard (chapter 9 sends it here). Press with a clean folded cloth. Find the bleeding point. Stitch at the dispensary, trained hands, lidocaine under its ceiling. Not closing: carry, still pressing. The library found no figures for tears.

If it goes wrong

1. **Carried too late.** The ring or a tear on the road. Cause: waiting for the ring, not the chart line. Keep going. Next time leave at the line.
2. **Too much magnesium.** No knee jerks, slow breathing, drowsy. Cause: a dose without the checks, or little urine. Stop. Breathe for her. Calcium gluconate.
3. **The breech pulled.** Arms up beside the head, the head stuck. Cause: pulling before the navel. Turn the body to free the arms, then the head with pressure above the bone.

NUMBERS TO CARRY

- 12 and 10 hours: the active labour limit, first and later births. 1 hour of pushing with no descent (MA-01, SY-07).
- 3 contractions in 10 minutes, each over 40 seconds: good labour that should progress (MA-03).
- 5 minutes from head to body for a stuck shoulder (MA-03).
- 500 to 750 ml in the bladder for a cord that comes first (MA-03).
- Magnesium 10 g, then 5 g every 4 hours, 24 hours after the birth or the last fit (MA-04).
- Hold below 16 breaths, emergency below 12. Urine 30 ml an hour, 25 in some sources (MA-04, SY-10, SY-12).
- Calcium gluconate 1 g, 10 ml of 10%, over 3 minutes (MA-04).
- 7 days of catheter after a long labour (MA-03).
- 1 to 7 caesareans a year for 3,000 people (OR-07).

THE LIBRARY

MA-03 Obstructed labour, breech, cord, shoulder and the district's operations. MA-04 Pre-eclampsia, eclampsia and childbed fever. WO-14 Wound infection, tetanus and the magnesium watch. OR-07 The district infirmary. MA-01 Normal labour and the chart. SY-10 The harm register. SY-12 What the library could not find. SY-07 The red-flag list. HY-01 Clean hands. All are on the website.

CHAPTER II

The First Hour and the First Month

A newborn who does not breathe has one minute. A newborn with one of the seven signs has a day. Tetanus declares itself between the third and the fourteenth day.

OPENING

Put the back of your hand flat on your own belly, under your shirt. Hold it there for a moment. Then reach down and lay the same hand on the top of your foot.

One is warm. The other is often cooler, even in a warm room. The back of the hand can tell the difference. It does not need a number to do it.

A newborn loses heat faster than you do. It comes out wet. Its skin is thin. Its head is large for its body, and the head gives its heat to the air. A baby left wet on a cloth in a cool room grows cold within minutes. Nothing about it looks wrong. It may be quiet. It may seem to sleep. It is cold, and cold is the first door to the other dangers.

The hand on the belly and the hand on the foot is a test. Warm and warm is well. A warm belly with cold feet is a warning. Cold and cold is danger. The test needs no glass, no battery and no shop. It needs a hand and the habit of using it.

There are seven things like this to know about a baby in its first month. A baby who will not feed. A baby who fits. A baby who moves only when

it is touched. A baby who breathes too fast. A baby whose chest pulls in hard with each breath. A baby who is hot. A baby who is cold. Each can be seen or felt by anyone in the house. Each says the same thing: this baby needs help today.

In many houses a child learns a prayer before she can read. She learns it by saying it, morning and evening, until the words come without effort. The seven signs can be held the same way. Not in a book on a shelf, but said over until they are a rhyme the household keeps. A grandmother can hold them. A girl of ten can hold them. They work in the dark and in a storm, when the book is in another house.

Try the test now, on yourself. Belly, then foot. Notice the difference, and remember where it was.

THE STORY

The first minute

In 2024 about 2.3 million newborns died, close to half of all the children who died before their fifth birthday. The largest causes are three: being born too early, a hard birth, and infection.

Most babies breathe on their own. They come out, they gasp, they cry, and the colour comes up in their faces. A small share do not. For them the first minute decides a great deal.

A course called Helping Babies Breathe is built around one idea. It calls it the Golden Minute. By the end of the first minute, the baby is breathing, or someone is breathing for it.

Msemo and colleagues tested the course in Tanzania in 2013. They counted 8,124 births in eight hospitals before the midwives were trained, and 78,500 after. Deaths in the first day fell from 13.4 to 7.1 in every 1,000 babies. Fresh stillbirths, babies born just dead, fell from 19.0 to 14.4.

Then came the surprise. The midwives did not breathe for more babies after the course. They breathed for fewer. Use of the bag fell from 8.2 to 5.2 per cent of births. What rose was drying and rubbing, from 47 to 88 per cent. A towel and two hands, used at once and used firmly, started babies who would otherwise have been given up.

Two more findings point the same way. Babies breathed for with room air did better than babies given pure oxygen, 8.0 against 13.0 per cent dying. The air in the room is enough. And where there is no bag, a mouth will do. The breath is small, only what the cheeks hold. Blowing from the chest bursts a newborn's lung. The rate is about 30 puffs a minute, slow and steady.

There are old ways too. A baby held up by the heels, or slapped, or plunged into cold water. They were done out of love and fear. They help nothing, and some of them harm.

The minute has a limit. A wider review found the course saved babies on the first day, but no effect could be seen at 7 or 28 days. Some of the babies it started died later of the same damage. The minute buys a day. What buys the month is warmth, a clean cord and the breast.

And breathing for a baby has an end. In 2020 the International Liaison Committee on Resuscitation pooled what was known. Of 277 babies who still had no heartbeat after 10 minutes of help, 69 per cent died. Eighteen per cent lived with damage. Eleven per cent lived whole. The committee said to stop at around 20 minutes. To stop is not to give up on the family. It is to give them back their child.

The cloth and the cord

In Bogotá, at the Instituto Materno Infantil, premature babies were sharing incubators. Two doctors, Edgar Rey Sanabria and Héctor Martínez, put the babies on their mothers instead. The year was 1978 or 1979. The sources differ.

Carrying a baby inside the clothes is old over most of the world. What Bogotá did was to make the carrying the treatment. Skin to skin, day and night. The mother became the warm place.

The idea spread. It was tested many times. In 2021 the World Health Organization finished the largest test. It enrolled 3,211 babies between 1.0 and 1.8 kg in Ghana, India, Malawi, Nigeria and Tanzania. Half were put skin to skin from the first hours. The trial was stopped early, because the benefit was already clear. By 28 days, 12.0 per cent of those held had died, against 15.7 per cent of the rest. They were held about 17 hours a day. Fewer were cold. Fewer were infected. The treatment was a person.

Then the cord. The old midwife's rule was to wait until the cord stops beating. The record agrees. Fifteen trials with 3,911 mothers and babies found that babies whose cords were cut late weighed about 101 g more and carried more blood. Babies whose cords were cut at once were more than twice as likely to be short of iron at 3 to 6 months. Waiting has a small cost. A few more babies grow yellow enough to need treatment.

The cut cord leaves a stump. For thousands of years people have treated it as a wound. Wounds are sealed. So the stump is sealed, with ash, dung, ghee, oil, turmeric, powder or a hot cloth. The reasoning is sound. The materials are catastrophic.

Tetanus lives in soil and dung as a spore. In a closed, airless wound it wakes. In Karachi, any substance put on the cord raised the odds of newborn tetanus 5.1 times. Sixty-nine per cent of cases came from it. In the North West Frontier Province the risk came with homemade ghee. In Bangladesh it came with coconut oil and many ties. A washed pair of hands and a cleaned blade protected. Newborn tetanus without a hospital kills almost every baby it touches. Two doses of toxoid given to the mother before birth cut its deaths by about 94 per cent.

In Nepal, Mullany and colleagues tried something on the cord that was not dirt. In 2006 they reported a trial in Sarlahi of 15,123 babies in 413 communities. Chlorhexidine, a clear antiseptic, was wiped on the stump. Severe infection of the cord fell by about three quarters. Among babies reached in the first day, deaths fell by a third. Soap and water alone did nothing that could be measured.

Two trials in Africa, in Zambia and on Pemba Island, found no gain. Where births were already clean, the drop added little. It may be that the clean, dry cord was always the real treatment, and the drop only made it a habit.

One more thing belongs to the first hour. The breast. Babies first fed between 2 and 23 hours after birth died 1.33 times as often as those fed within the hour. Those first fed after a full day died 2.19 times as often. Many traditions throw the first thick milk away as stale. It is not stale. It is the child's first medicine.

The eyes at Leipzig

A baby can catch gonorrhoea from its mother on the way out. It shows within days as pus from swollen lids. Untreated, it can take the eye in days.

In the nineteenth century this was common. More than 10 per cent of babies in European maternity hospitals had infected eyes. In some schools for the blind, up to half the children had lost their sight this way.

Carl Credé ran the maternity hospital at Leipzig. In 1880 and 1881 he put a drop of silver nitrate into the eyes of every newborn. Before, his hospital saw 30 to 35 cases a year. In the second half of 1880 it saw one. His drop was strong and it burned. It was later made weaker, from 2 per cent to 1. Even at 1 per cent, it reddened the eyes of 5 to 10 babies in every 100.

A century later a team at Kikuyu in Kenya compared three drops in 3,117 babies. The brown antiseptic of every surgery, povidone iodine at 2.5 per cent, did best. Infections came to 13.1 per cent with it, 17.5 with silver nitrate and 15.2 with erythromycin. The trachoma ointment, tetracycline, also works. A clean cloth to wipe the lids comes first.

Credé's real gift was not the silver. It was the rule that every baby, at once, without waiting for pus, gets the drop.

The seven signs

Infection is the quiet killer of the first month. The baby is born well, feeds, sleeps. Then on the third day or the tenth, she is not herself.

In Gadchiroli, India, Abhay and Rani Bang trained village women to look after newborns at home. From 1995 they worked in 39 villages. The women visited every baby, weighed it, kept it warm, watched it feed, and looked for infection. When they found it, they treated it at home. They gave co-trimoxazole by mouth and gentamicin by injection. Remember the injection.

Before the work began, 16.6 per cent of infected babies died. By 1998, 2.8 per cent did. All newborn deaths in the villages fell by 62 per cent. The cost was about 5.3 US dollars for each baby.

The women needed a rule for when to act. In 2008 a group of researchers studied 8,889 sick young babies in several countries and tested 31 signs. They kept seven. Not feeding well. Fits. Moving only when touched.

Breathing 60 times a minute or more. Deep pulling in of the chest. A temperature of thirty-seven and a half degrees or more. A temperature below thirty-five and a half degrees. Together the seven found 85 in every 100 sick babies. The price was that one well baby in four was treated too. That is a price a village can pay.

A rule on a card is not enough. In Malawi in 2009, lay health workers were watched as they treated sick children with a chart in front of them. They checked the physical danger signs in only 37 per cent of the children. Only 30 per cent of their breath counts came within 2 breaths of a clinician's. They knew the rule. They had not made it a habit. Signs are kept by being practised, with someone watching, until the hands do them without being asked.

The seven are short. They can be said in one breath. A grandmother can teach them to a girl, and the girl to her own daughter, the way a prayer passes. That is how they must be kept. The book can burn. The rhyme the household keeps does not.

Then the injection. In 2015 a trial in the Democratic Republic of the Congo, Kenya and Nigeria followed 3,564 babies with infection but not at the edge of death. Fewer injections, as few as 2 days, followed by amoxicillin by mouth, did as well as 7 days of injections. In every group, 5 to 8 in a hundred were not better by the eighth day.

After the Fall the village gives no injections to babies. A syringe in a newborn without training is a new danger. So the village gives the first dose of amoxicillin by mouth and carries the baby to the district, where the injection is. Where there is no district, the baby gets amoxicillin by mouth for 7 days and is held skin to skin. Without any antibiotic, about one infected baby in six dies. With good treatment, about one in thirty. Without the injection, the number lies somewhere between, and no one has measured it.

Yellow, and small

Many babies turn yellow in the first week. Half or more of babies born at term do. The yellow comes on after the first day, peaks on the third to fifth, and fades. It is the baby clearing the extra blood it was born with.

In 1969 a doctor noticed that the yellow moves down the body, head first, then chest, belly, legs, palms and soles. The further down it goes, the deeper it is. In a well baby born at term, yellow that stops above the navel is not dangerous.

Yellow on the first day is different. So is yellow that reaches the palms and soles, or a yellow baby too sleepy to feed. Too much of it stains the brain. The baby arches, cries high, and will not wake. Before the Fall, a blue lamp and a change of blood stopped it. After the Fall, there is no change of blood.

In Lagos, in 2015, a team tried the sun in place of the lamp. They put 447 yellow babies under a canopy of window film. It let through about a third of the blue light and screened out the burning rays. It worked on 93 per cent of days, against 90 under lamps. But 5 in every 100 babies overheated. Bare sun is a different thing. It burns, and it has not been shown to work. The real treatment in the village is the breast, often.

Then the small babies. A baby under 2.5 kg is small. Under 1.5 kg is smaller still, and in greater danger. Between about 1.8 and 2.5 kg, warmth and milk give a real chance. Far below that, without an incubator, the baby will almost always die. Saying so plainly is part of the care.

The Honest Broker's Rhyme

The rhyme is only as good as what stands behind it. Some of it stands on less than it seems.

Three of the key studies were read by the library in abstract or secondary summary only. Msemo's Tanzanian counts, the 2008 seven signs study and the Gadchiroli figures all come this way (MA-05, IN-04). Gadchiroli was controlled but not randomised. It earns grade B.

Gadchiroli used injected gentamicin. The village in this book does not inject. The library found no trial of treatment by mouth alone for severe newborn infection. FO-04 asks whether the Gadchiroli result would hold without the injection, and leaves the question open. The 2.8 per cent is not the village's figure. It is a ceiling.

Gadchiroli also used co-trimoxazole. IN-03 warns against it in the first weeks of life because it can push bilirubin into the brain. This book uses amoxicillin.

Honey on the cord is said to carry botulism. MA-05 could not find a single case series to prove it. SY-12 lists the claim among the lines still to be settled. The never line stands on other ground. Anything on the cord raises the risk of tetanus. Honey eaten under 12 months is a separate, established danger.

Credé's figures vary from report to report. IN-07 found the fall given as 7.6 to 0.5 per cent, 10 to 0, and 13.6 to 0.05. CH-08 quotes 10.8 to 0.1 or 0.2. This chapter prints only the hospital's own count of cases a year, from MA-05, and none of the percentages.

The cold line is disputed. The 2008 study used thirty-five and a half degrees. SY-07 uses thirty-six, read by touch. Both are printed at the Bench.

The kangaroo trial was run in hospitals with nurses watching. That it works the same at home is an inference. And the trials of the cord drop split between Asia and Africa. Where cords were already kept clean, it did little.

The turn to the present

Before the Fall, the hospital took the newborn in. It took the seven signs and turned them into blood counts and cultures. It took the cold baby into an incubator, the yellow baby under a lamp, the baby who would not breathe onto a machine. Every baby got drops in the eyes and an injection of vitamin K. It was done to all, and so it was hardly noticed.

Most of that is gone. The incubator needs power. The lamp needs bulbs. The culture needs a laboratory, and the change of blood needs a blood bank. What is left when they are gone?

A good deal. A dry cloth and two hands that rub. A mouth that knows how small a breath is. A mother's chest. A boiled blade and a cord left alone. A breast in the first hour. A drop in each eye while the stock lasts. And seven signs.

The village sees 6 to 10 births a year. That is too few for anyone to grow skilled by practice alone. The skill must be kept another way: rehearsed with a doll, counted on a clock, said aloud. The seven signs are kept as a child keeps a prayer, said until they come without thought, so that at three in the morning, with a baby who will not feed, the words are already there.

Now dry the baby.

AT THE BENCH

11.1 See: the seven signs

Any 1 sign means help today. Count breaths for 1 full minute.

#	Sign
1	Not feeding, or sucked well and stopped
2	Fits: jerking or stiffening
3	Moves only when touched, or not at all
4	Breathing 60 or more in 1 minute
5	Deep pulling in of the lower chest
6	Hot: 37.5 °C or more
7	Cold: below 35.5 °C, or SY-07's 36 °C, belly and feet both cold by touch. Disputed, both printed

Also send today: redness spreading from the cord, or pus. Bulging soft spot. No urine or stool in 24 hours, or a swollen belly. Yellow and stiff jaw: 11.6.

The touch test: back of your hand on the belly, then the soles. Warm and warm: normal, 36.5 to 37.5 °C. Warm belly, cold feet: mild cold, 36.0 to 36.4 °C. Cold and cold: below 36.0 °C. Any cold: skin to skin, hat. Not warm in 1 to 2 hours: send.

Touch misses cold often. Grades: signs A, touch C.

Rung ladder. Hands: the signs by heart, a watch. Hearth: the wall card. Dispensary: a thermometer. Refuse: 15 seconds times 4.

11.2 Do: the first minute

Never hold a newborn upside down, slap it, or blow from your chest into it. Instead: dry it, rub its back, give small puffs from your cheeks.

Ready: room 23 to 25 °C, 2 warmed cloths, a hat, boiled blade and strings (see 8).

1. 0 to 30 seconds: dry the baby on the mother's belly. Wet cloth off, hat on. Breathing or crying? Yes: 11.3.
2. No: rub the back firmly. Count 10.
3. Not breathing at 60 seconds: cut the cord. Firm warm surface, rolled cloth under the shoulders, head straight.
4. Your mouth over nose and mouth. Puff only what your cheeks hold. 3 to 5 slow breaths, then about 30 a minute. Bag: 40 to 60 a minute.
5. No chest rise: straighten the head, wipe the mouth, seal again. Suck out only thick green stool.
6. After 1 minute of chest rise, feel the heart for 6 seconds, add a nought. Under 100: go on, check every 3 minutes.
7. Stop when the baby cries or breathes 30 or more a minute. Then 11.3.

The danger sign: no breath after 1 minute of puffs.

- Help in time: a second person takes over. The baby breathes. Skin to skin, watch 24 hours.
- Help too late: no heartbeat by 15 minutes, or only gasps by 20. Stop.
- No help at all: wrap the baby, give it to the mother. Tell the family: we breathed for your baby, and it could not breathe. Nothing you did caused this. Let them name it.

Grades: drying B, room air A, cheek puffs C, stopping at 20 B.

Rung ladder. Hands: towel, mouth, clock. Dispensary: bag and mask, if salvaged. Refuse: oxygen as routine, deep suction.

11.3 Do: the first hour

> **Never put anything on the cord but chlorhexidine.** No ash, dung, ghee, oil, powder or honey. Instead: leave it clean, dry and uncovered. Anything on it raised tetanus 5.1 times. Honey on the cord causing botulism: no case series found. Disputed.

1. Skin to skin at once, both covered, hat on.
2. Cut after at least 1 minute, better 3. Baby needs breathing: cut at once.
3. Tie 2 finger widths from the belly, again 3 finger widths further, cut between.

4. Chlorhexidine 7.1 per cent digluconate, once a day for 7 days from the first 24 hours. Never in eyes or mouth. Grade A where 30 or more in 1,000 newborns die.
5. Nappy below the stump. Soiled: rinse with clean water, let dry.
6. Wipe each lid with a clean wet cloth. Then 1 drop of povidone iodine 2.5 per cent in each eye, or a thin line of tetracycline 1 per cent ointment inside each lower lid. Never tincture of iodine. Every baby or only some:. Grade A (MA-05) or B (CH-08).
7. The breast within 1 hour (see 07.2).
8. Breaths and touch test at 15, 30 and 60 minutes. Normal 30 to 60 a minute.
9. No bath for 24 hours.

Rung ladder. Hearth: boiled blade and string. Dispensary: chlorhexidine, drops, ointment. Refuse: any homemade cord dressing.

11.4 Do: the sick newborn

Never inject a newborn below the district. Instead: amoxicillin by mouth, and carry today.

Never paracetamol under 1 month, except by the healer. Never aspirin under 16 years. Never honey under 12 months.

1. Skin to skin. Breast, or expressed milk by cup (see 07.2).
2. First dose of amoxicillin by mouth.
3. Carry to the district today, the dose written down. It adds injected gentamicin.
4. Fast breathing alone, day 7 to 59: 04.4.

Work every dose twice, with two people.

Amoxicillin 50 mg/kg every 12 hours for 7 days. Suspension 250 mg in 5 ml. Ceiling 2 doses in 24 hours. Grade A.

Weight	Each dose	Interval
1.5 to under 2 kg	1.5 ml	Every 12 hours
2 to under 3 kg	2.5 ml	Every 12 hours
3 to under 4 kg	3.5 ml	Every 12 hours
4 to under 6 kg	5 ml	Every 12 hours

The danger sign: any of the seven.

- Help in time: the district within a day. Go now.
- Help too late: will not wake to feed. Dose only if it swallows. Say the baby may die on the way.
- No help at all: amoxicillin 7 days, skin to skin, milk by cup every 2 to 3 hours. Tell the family: without the injection, more of these babies die.

Whether the healer's rung holds gentamicin:.

Rung ladder. Dispensary: amoxicillin. Hospital: gentamicin. Refuse: injection at the village, co-trimoxazole in the first weeks.

11.5 Do: the small baby

Never put a hot water bottle against a newborn. Instead: skin to skin. A wrapped bottle may lie beside, checked every 15 minutes.

1. Under 2.5 kg: skin to skin day and night. Grade A.
2. Bind upright on the chest, cloth under the buttocks, face visible. A second adult at night. Touch test between 02:00 and 05:00.
3. Too weak to suck: express by hand 8 times in 24 hours. Boiled cup or spoon, baby upright, never forced.
4. Not back to birth weight by day 14: failing.

Expressed milk each feed, plus 5 ml for spillage. Every 3 hours, under 1.5 kg every 2:

Weight	Day 1	2	3	4	5	6	7
1.0 to under 1.5 kg	6 ml	7	8	9	11	13	16
1.5 to under 2.0 kg	12 ml	16	20	24	28	32	35
2.0 to under 2.5 kg	17 ml	22	27	32	37	40	42

Ceiling: 60 ml/kg a day on day 1, 160 ml/kg by day 7.

The danger sign: under about 1.2 kg, or clearly under 30 weeks. Under about 1.5 kg most die at home.

- Help in time: carry skin to skin to a hospital with an incubator.

- Help too late: cannot feed, needs a drip. Hold it warm.
- No help at all: comfort, skin to skin, milk offered. Tell the family: too small to live without a hospital, and holding is the care.

Rung ladder. Hands: chest, binder, cup. Hearth: scale. Refuse: bottle and teat.

11.6 Do: yellow and the stiff jaw

Never treat yellow with bare sun. Instead: the breast every 2 hours.

Daily, in daylight, press the skin 2 seconds. Normal: starts after day 1, stops above the navel. Send: yellow on day 1, on palms or soles, past 2 weeks, or too sleepy to feed. Filtered sun canopy: dispensary only, out above 38.0 °C or below 36.5 °C, never under 1.8 kg. Grades: filtered B, bare sun D to X.

The danger sign: arching, a high cry, will not wake.

- Help in time: the district light, the breast every 2 hours.
- Help too late: brain damage has begun. Feed, keep warm.
- No help at all: feed. Tell the family the baby may die or live damaged, and feeding was right.

The danger sign for tetanus: sucked well, then on day 3 to 14 cannot. Stiff jaw, spasms on touch.

- Help in time: the district, for sedation.
- Help too late: spasms stop the breath. Hold the baby, the mother close.
- No help at all: warm, dark, quiet. Expressed milk by cup only if it swallows. Diazepam only from the healer. Tell the family it will likely die, and the next baby can be kept safe. Record it as an alert.

11.7 Prevent: the next baby

1. Two doses of tetanus toxoid in every pregnancy while vaccine lasts (see 17).
2. Boiled blade and string. The register's cord line reads "nothing" (see 8).
3. Practise the first minute on a doll. How often:.
4. Say the seven signs aloud at every visit after a birth.

If it goes wrong

1. **The cold baby.** Quiet, cold feet, then cold belly. Cause: bathed or admired wet. Do: skin to skin, hat, cover both.
2. **Something on the cord.** Ash or oil under a cloth. Cause: the old rule. Do: rinse with clean water, let dry, watch days 3 to 14.
3. **The breath that goes nowhere.** Puffs, no chest rise. Cause: head tipped, poor seal. Do: head straight, seal again, a second person watching the chest.

Numbers to carry

- 1 minute: breathing, or someone breathing for the baby (MA-05).
- 30 puffs a minute by mouth, 40 to 60 by bag. Stop at 20 minutes, 15 if never a heart (MA-05, SY-10).
- 60 breaths a minute, 37.5 °C, and below 35.5 °C or 36 °C, disputed (IN-04, SY-07).
- 16.6 against 3 per cent: infected newborns dying without and with village care at Gadchiroli, which injected (IN-01, SY-08).
- 5.1 times the tetanus odds with anything on the cord (MA-05).
- Within the hour: the first breastfeed (IN-01, MA-05).
- 12.0 against 15.7 per cent: deaths with and without skin to skin from birth (MA-05).
- Work every dose twice. A moved decimal is tenfold.

The library

MA-05 The newborn: breathing, warmth, cord, feeding and infection. IN-04 Sepsis. SY-07 The red-flag list. SY-10 The harm register. SY-12 What the library could not find. MA-07 The sick child. IN-01 The great killers after the Fall. IN-03 Pneumonia and the chest. CH-08 Eyes. IN-07 Antiseptics you can make. FO-04 The lay healer in the record. SY-08 The means ledger. All are on the website.

CHAPTER 12

A Woman's Years

A ruptured ectopic pregnancy kills in hours. A fistula lasts a lifetime unless repaired. Everything else in this chapter has years.

OPENING

Sit on a hard chair and rock a little from side to side. Under each buttock is a knob of bone. Between those two knobs, and from the pubic bone in front to the tailbone behind, hangs a sling of muscle. It carries the bladder, the womb and the bowel, and three openings pass through it.

In a woman this sling carries her whole life as a woman. The womb resting on it fills and sheds each month from her first blood. It stretches for each child, takes the weight of the last weeks and opens for the head. Long after the bleeding has stopped for good, the sling is still holding everything up, or failing to.

If you are sitting now, tighten it once, as though stopping water halfway and holding back wind at the same moment. Hold it while you count to ten. Let go slowly. The muscle that moved is the one this chapter asks a woman with a dropped womb to train, and the one a long labour can crush.

Medicine meets a woman in pieces: a pregnancy, a bleed, a leak, a fever, a flush of heat at fifty. She lives them in one body and in order. A labour that went on too long at nineteen can leave a leak that lasts to sixty. Births

close together loosen the sling that drops in middle age. Each gap between children gives her body time to mend before it is asked again. What happens to her is a life, not a case, and the care that serves her best keeps the whole span in view.

Most of that span needs no hurry. A period that hurts, a discharge that itches, the choice of when and whether to have another child, the heat and wakeful nights of the change: these have weeks and years. Two things here do not. One is a pregnancy growing in the wrong place, which can bleed inside her without a drop showing. The other is a hole torn in a birth, which closes only with a surgeon or, now and then, with a tube placed in the bladder in the first weeks. The rest can be met slowly, with patience, and with her.

THE STORY

The space between children

Left alone, a woman's body does not bear a child every year. In the 1950s the Hutterites, a farming church in North America that married young and used no contraception, raised families of about ten children, and demographers still use their birth rates as the ceiling of human fertility (Eaton 1953). Even they did not conceive at every chance. The breast stood in the way.

Nursing holds back the return of ovulation. Among the !Kung of the Kalahari, mothers fed their babies about every thirteen minutes through the day, and their children came about four years apart (Konner 1980). Across many populations, breastfeeding alone nearly halves the number of children women would otherwise bear (Bongaarts 1983). Most traditional societies knew that a nursing mother rarely conceived, and many added rules of their own, such as the long abstinence after a birth recorded in much of West Africa (NRC 1993). That knowledge was held by women and midwives.

In 1988 a meeting at Bellagio in Italy pooled thirteen studies and turned it into a method with rules. A woman whose periods have not come back, who feeds her baby at the breast fully or nearly fully, and

whose baby is under six months old has more than 98 chances in a hundred of not conceiving in those months (Kennedy 1989). In Manila, 485 women who kept the rules had 99 in a hundred protection at six months (Ramos 1996). A Cochrane review in 2015 noted that the 98 does not come from a systematic review. Even so, nothing on this chapter's list costs less. Its weakness is that it ends. The first bottle, the first night the baby sleeps through, the half-year birthday: any one of them ends it, often before the mother notices.

The gap matters to the next child as well as the mother. A baby conceived less than six months after the last birth carries 1.4 times the odds of being born early and 1.6 times the odds of being born small (Conde-Agudelo 2006). A village of 300 sees six to ten births a year, and each carries the dangers chapters 8 to 10 describe. Fewer births, further apart, mean fewer of those dangers met.

Beads, sheaths and copper

The methods are older than the books that describe them. Egyptian papyri of about 1850 and 1550 BC list pessaries of honey, natron and acacia. An Italian anatomist's book of 1564 described a linen sheath. Rubber condoms followed vulcanised rubber from the 1850s, and latex ones the 1920s. Withdrawal, which needs nothing at all, is credited with much of the fall in births in France and England before any modern method existed.

Counting days is younger than people think. A Japanese gynaecologist and an Austrian one, working apart in the 1920s and 1930s, showed that ovulation comes a fixed time before the next period, and the calendar rule followed. Mucus methods came from Australia in the 1960s. A woman can conceive on six days of each cycle, and in only about three women in ten do those days fall wholly inside days ten to seventeen, which is why simple rules fail (Wilcox 1995, Wilcox 2000). The Standard Days method strings thirty-two beads and asks a couple to abstain or use something else on days eight to nineteen. It suits women whose cycles run twenty-six to thirty-two days, and in typical use about 12 women in a hundred conceive in a year (Arévalo 2002). A German cohort of 900 women charting temperature and mucus from 1985 did far better, under one pregnancy per

hundred women a year when couples abstained on fertile days, but they were educated and committed (Frank-Herrmann 2007).

The copper device came from the clinic. Rings of silver were placed in the womb in the 1920s. In Chile in 1969 copper was added, and the copper T that followed fails in fewer than one woman in a hundred a year and works for twelve years or more. Its history carries a warning. The Dalkon Shield, sold from 1971 to about 2.2 million women and withdrawn in 1974, caused infections that brought more than 327,000 claims and bankrupted its maker in 1985. The copper T is not that device, but it carries a small risk of infection in its first three weeks and of piercing the womb, about one insertion in a thousand and more often in nursing mothers (Heinemann 2015). Nurses and midwives placed it as well as doctors in three trials. No trial has tested lay hands (Polus 2015).

Plants form the oldest list and the weakest. A historian argued in 1992 that ancient and folk plant methods worked (Riddle 1992). The record since has not borne it out. Neem oil stops sperm in a dish, yet it poisoned thirteen Malaysian children given it by mouth, and a baby of four months died (Sinniah 1981). Gossypol from cotton seed was given to 8,800 Chinese men and left one in ten or more of them permanently sterile. Restricted knowledge of fertility plants is held by particular healers and women's societies in several traditions (MA-08). Restricted knowledge of birth is held by others, among them the comadronas of Guatemala and the Yolŋu djäkamirr of Galiwin'ku (TR-14). It belongs to its custodians. This book names it and does not describe it (SY-04).

Glasgow, 1923

Between April 1923 and November 1925, William Napier, a doctor at the Belvidere Fever Hospital in Glasgow, cared for 500 women with fever after a pregnancy. Ninety-six of them died. Eighty-two had fallen ill after an abortion, and twenty of those died, about one in four, against one in six after a normal labour. He scraped the wombs of sixty women while they were still feverish, as the teaching of the day required, and not one improved. So he stopped, and waited until the fever settled before he emptied the womb. He wrote it up for his doctorate in 1927.

That one in four is what infection after a lost pregnancy did before

antibiotics. In the United States, deaths from abortion fell from about 2,700 in 1930 to just over 300 in 1950, a fall its historian credits mainly to antibiotics (Gold 2003). Worldwide about 47,000 women died of unsafe abortion in 2008, about one maternal death in eight (Åhman and Shah 2011).

What law does is read two ways, and the library prints both. In Romania, Decree 770 of 1966 banned abortion and most contraception. By 1989 maternal deaths stood at 159 per 100,000 births, 87 in a hundred of them from illegal abortion, and in 1990, after the decree went, they fell to 83. Chile banned abortion in every case in 1989, and its maternal death rate kept falling at the pace it had before (Koch 2012). Some read Romania as proof that bans kill. Others read Chile as proof that they need not. What the two cases share is plainer: where injured women were treated, they lived.

Misoprostol sits at the centre of the modern record. It was made to protect the stomach, and it makes the womb contract. In Rio de Janeiro in 1991, of 803 women admitted after an abortion, 57 in a hundred had used it, and they had fewer infections than women who had used catheters (Costa and Vessey 1993). The same record holds harm. Where the drug failed and the pregnancy went on, babies were born with limb defects, 42 of them in one Brazilian series, and with a facial paralysis called Möbius syndrome (Gonzalez 1998, Pastuszak 1998). Used alone to end a pregnancy, it left about one woman in five needing surgery and about seven in a hundred still pregnant (Raymond 2019). Plants have the worst record of all. In Montevideo between 1986 and 1999, 86 women were treated after taking plants or other remedies, most often rue, and some of them died. Pennyroyal oil, tansy, savin and quinine have each killed women. This chapter reports that record. It does not teach a method, and whether the village's book ever does is the owner's decision.

What the drug does teach is the care of a pregnancy already being lost. About one known pregnancy in seven ends in miscarriage (Quenby 2021). When a loss is under way, the body usually finishes it alone. In a London study of 1,096 women, 81 in a hundred completed without help, and most within two weeks (Luise 2002). In trials in Burkina Faso and Kampala, one dose of misoprostol emptied the womb in 94 to 96 women in a hundred, close to the suction syringe and with fewer complications than scraping (Dao 2007, Weeks 2005).

One loss hides. A pregnancy that settles in the tube cannot grow there. It stretches the tube until the tube tears and bleeds into the belly, often with little blood at the vagina. In Yaoundé, ectopic pregnancies came to 0.79 in a hundred births, and three of 320 women died with surgeons at hand (Leke 2004). The library found no figure for how many died before surgery existed.

The hospital by the river

Justine Siegemund came to midwifery through her own body. Born in Rohnstock in Silesia on 26 December 1636, she was told at about twenty that she was pregnant, by midwives who could not tell a dropped womb from a child. They were wrong, and she set out to learn what they did not know. She became court midwife of Brandenburg in 1683, published her book in 1690 and died in Berlin on 10 November 1705.

A dropped womb, prolapse, is the slow injury of the sling. In poorer countries about one woman in five lives with one, from three to fifty-six in a hundred depending on the place. In Nepal, women have long bound the belly with a cloth sash, the patuka, to hold the womb up, and one study found less prolapse in women who never wore one, not more (Devkota 2020). On that evidence the belief runs backwards. What has evidence is training the sling itself, the tightening of the Opening, which in a trial of 447 women eased symptoms more than advice alone (Hagen 2014). Rings to hold the womb up, pessaries, are older than any surgery: a pomegranate, wool, waxed cork, brass, and by 1864, 123 designs. A pessary forgotten for years can wear through into the bladder.

The worst injury of the sling is a hole. When labour is blocked for a day or more, the baby's head presses the bladder or bowel against the bone until the tissue dies. Days later the dead part falls away and leaves a fistula, an opening through which urine or stool runs without stopping. Most of these women also lost the baby. At least three million live with one unrepaired. The leak scalds their thighs, and many are divorced and kept from the cooking fire and from prayer.

The repair was learned in Montgomery, Alabama, between 1845 and 1849, by J. Marion Sims, on enslaved women who could not refuse. One of them, Anarcha, went through about thirty operations without anaes-

thesia before he reported success with silver wire in 1852. Historians still argue over how to judge him. The argument is about consent.

A century later the repair came to Ethiopia. Catherine and Reginald Hamlin, Australian gynaecologists, arrived in 1959 and founded the Addis Ababa Fistula Hospital in 1974. By 2007 it had about 140 beds, treated about 1,500 women a year, claimed closure in 93 in a hundred, and had five regional centres and a midwifery college. Mamitu Gashe, born about 1946, came as a patient with her own fistula. She stayed as an aide, assisted Reginald Hamlin in theatre from 1974, and was repairing fistulas on her own by 1987. In 1989 the Royal College of Surgeons of England gave her a gold medal. She said in 2018 that she had never learned to read or write. She learned over thirteen years beside a master, in a hospital doing thousands of repairs. A district of 3,000 people will never see enough cases to teach anyone.

Repair closes the hole in 80 to 97 women in a hundred, but up to four in ten stay wet, because the muscle that holds urine was crushed too. A woman with a fistula often waits years for a surgeon, if she ever reaches one. Those years are a life, not a case on a list, and what the village gives her decides whether she lives them among her people: a tube in the bladder in the first weeks, clean cloths, fat for her skin, water to drink and a place at the table.

Blood, pain and the change

Between first blood and the change, most of what troubles a woman's body is ordinary and long. The cloth matters more than people think. In Odisha in India, women who dried their cloths indoors had nearly four times the odds of thrush, and washing them outside protected (Das 2021).

Period pain answers to heat on the belly, which in trials does as well as anti-inflammatory tablets, and those tablets lift good relief from about one woman in five on a dummy pill to about one in two. Ginger powder in the first days of bleeding helped in trials in Iran (Ozgoli 2009). Heavy bleeding is often fibroids, found by fifty in most women in one American study (Baird 2003), and it drains iron, which chapter 7 holds.

Many peoples set women apart during their periods. A Yurok woman described her ten days apart as a time of power, recorded in 1978

(Buckley 1982). In far-western Nepal, chhaupadi sent women to sheds. It was banned in 2005 and made a crime in 2017, and since 2005 at least 18 women have died in the sheds of cold, smoke and snakebite. In Bajura in January 2018, a mother and her two children died of smoke. A rest a woman chooses is one thing. A shed she is sent to is another.

Hot flushes of the change last a median of 7.4 years. In 2002 the Women's Health Initiative found that combined hormone tablets, for every 10,000 women a year, brought seven more cases of coronary heart disease, eight more strokes, eight more clots in the lungs and eight more breast cancers, against six fewer bowel cancers and five fewer broken hips. After the Fall those tablets will be gone anyway. Soy food eases flushes a little, and walking and carrying keep bone. Bleeding after the change is never ordinary.

The Honest Broker's Tally

MA-08 can be trusted for the shape of the evidence, read as orders of magnitude. Its failure rates are American, and its two main sources disagree: Trussell's 2011 table gives 9 pregnancies per hundred pill users a year, the 2018 revision 7. The Bench prints both. MA-08 reckons on 12 to 15 births a year in a village of 300. The concept note's shared figure is 6 to 10, and this chapter uses it. At the 872 maternal deaths per 100,000 births of an Indiana church that refused all medical care, six to ten births a year lose a mother every eleven to nineteen years, against MA-08's seven to seventeen. The arithmetic is the draft's.

MA-09 is the most careful report on the hardest ground. It corrected its own brief, which gave the 47,000 deaths to the wrong paper, and it gives the ending of a pregnancy only as a record. MA-09 counts four deaths after rue in Montevideo, TR-06 five in all. Its sources give seven, ten or fourteen days of antibiotics after an infected loss, and the Bench uses ten.

MA-11 gives two figures for a catheter alone closing a fresh fistula: 11 to 15 in a hundred in one review, 78 in a hundred of 2,031 women in another account of the same surgeon's work. They cannot describe the same women, and both are printed. So are its four and five days of tranexamic acid.

The library is thin in four places. No report knows how often a ruptured ectopic killed before surgery (SY-12, R2-08). None has a figure for pills, injections, implants or condoms past their date. None has a plan for the Rhesus-negative mother after a loss, who without anti-D can lose later babies (SY-12). And the library is silent on violence in the home. No report covers it, and this chapter does not pretend to.

The turn to the present

In a town with a pharmacy, spacing children is a shelf of choices and a clinic down the road. A loss is a scan and a nurse. A leak after birth is a referral, and a dropped womb is an operation on a list. The modern system cut the deaths from all of these. It also split a woman into departments, and few of them asked how she lived between visits.

The village will have less on the shelf and more time with her. It will have the breast and its three rules, a string of beads, condoms while they last, pills of unknown strength, and a copper device where the district has hands to place it. It will have misoprostol for a loss under way, antibiotics, a catheter and a ring. It will not have a surgeon, except at the district. Who may have which method is left to the village and the owner.

Is that enough? For most of what this chapter holds, it is close, because most of it has years. For the tube that tears and the fistula that is not caught in its first weeks, it is not, and the book says so now.

A woman's years run from first blood to the change, a life, not a case, and the people around her will see more of it than any clinic did. Now the hands.

AT THE BENCH

12.1 See: bleeding and pain in early pregnancy

Never give misoprostol when the cervix is closed and nothing has passed, or when an ectopic is possible. Instead, lay her flat and send her to the district.

Ask her alone, without judgement: last period, pain, fever, fainting, anything taken or put inside. Count pulse and breathing for a full minute. Feel the belly with a flat hand.

Sign	Means	Go to
Late period, pain on one side, shoulder-tip pain or fainting	Ectopic until proved otherwise	District now, lying down
Over 2 soaked pads an hour for 2 hours	Heavy bleeding	12.2
Pulse over 100, breathing over 30	Shock	12.2
Fever 38 °C or more, foul discharge, tender womb	Infection	12.2
Cervix open, tissue passing	Loss under way	12.2
Cervix closed, light bleeding, no pain	Threatened loss	Rest, look again in 24 hours

Suspect an ectopic more after a past ectopic, tubal surgery, pelvic infection or a copper device in place.

Grades. Clinical signs for ectopic B, often atypical.

Rung ladder. Hands: questions, pulse, a flat hand. Village: the healer looks at the cervix, gloved. District: surgery, the only thing that stops an ectopic bleeding. Refuse: misoprostol or waiting at home when an ectopic is possible.

Danger sign: the ectopic. Late period, pain, pulse rising, little blood showing. Lay her flat, legs raised, warm. Carry her to the district lying down.

- **Help in time.** A surgeon removes the tube. 10 to 15 in 100 recur. Tell her to come at once with any late period and pain.
- **Help too late.** She reaches the district in shock. Send a card: last period, pulse every 15 minutes with times, anything given.
- **No help at all.** No surgeon can be reached. MA-09 expects a ruptured ectopic without one to kill within hours. Give what the cupboard holds for pain. Stay with her. Bring her family. Tell them it was a pregnancy in the wrong place. Nothing she did caused it. No one in the village could have

stopped it.

12.2 Do: a loss under way

Never put an instrument into the womb at the village, and never scrape a feverish womb. Instead, give antibiotics and carry her to the district.

Waiting. Most losses finish alone within 2 weeks. Only if: pulse under 100, under 2 pads an hour, no fever, no one-sided pain, womb 12 weeks or less.

1. Explain the cramping to expect and the signs in 12.1.
2. Someone stays who can run for help. Nothing in the vagina until bleeding stops.
3. Pulse, temperature and pads twice a day for 3 days, then daily.
4. Save tissue for the healer. Look again at 7 and 14 days.

Misoprostol. MA-09 gives this as the record of trials and programmes, for a cervix already open with tissue passing. This is the record, not a village rule.

Use	Dose, the same for every woman, no weight bands	Route	How often	Rung
Incomplete loss, womb 12 weeks or less	600 µg, 3 tablets of 200 µg	Swallowed	Once only	Dispensary
or	400 µg, 2 tablets of 200 µg	Under the tongue 30 minutes	Once only	Dispensary
Heavy bleeding, no ectopic possible	800 µg, 4 tablets of 200 µg	Under the tongue	Once	Any rung

About 1 in 10 needs a second step at the district. Fever in the first 24 hours is the drug. After 24 hours it is infection. Intact blisters only. Write date, dose, batch, result.

Work every dose twice, with two people.

Heavy bleeding: lay her flat, legs raised, warm. Rub the womb through the lower belly until it hardens. Tissue at the opening: the healer lifts it out with gloved fingers and goes no further. Misoprostol 800 µg. Pulse every 15 minutes, written. Still bleeding: the district.

Fever after a loss. Start before moving her.

Drug	Dose, the same for every woman, no weight bands	Interval	Length	Rung
Amoxicillin	1 g by mouth	Every 8 hours	10 days	Village
with metronidazole	500 mg by mouth	Every 8 hours	10 days	Village
or doxycycline, with metronidazole as above	100 mg by mouth	Twice a day	10 days	Village
Ampicillin, gentamicin 5 mg/kg, metronidazole	Into a vein	District sheet	7 days or more	District

Ceftriaxone and tetanus toxoid are injections, so they stay at the district.

Grades. Waiting A. Misoprostol for an incomplete loss A. Misoprostol without an open cervix X at the village. Antibiotics A, the regimen B. Scraping in fever X.

Rung ladder. Hands: waiting, rubbing, warmth, the pulse log. Village: tablets. District: suction, injections, fluids. Hospital: blood. Refuse: scraping, and any plant or chemical to empty the womb.

Aftercare: rest 1 week, nothing in the vagina for 5 days. Ask about grief, fear and safety. A Rhesus-negative mother needs anti-D the village cannot give. Write it in her record.

12.3 Do: the leak and the drop

Never cut or stitch a fistula without training. Instead, place a catheter and send her to a repair centre.

Fresh fistula, any leak of urine after a long labour, within 6 to 12 weeks:

1. Place a Foley catheter now, 16F, balloon 5 to 10 ml, closed bag.
2. She drinks enough to keep urine pale.
3. Check the flow every few hours. Flush or replace a blocked catheter at once.
4. Look weekly. Keep it in up to 6 weeks.
5. Dry after removal: healed for now, so keep watching. Still wet: the repair centre.
6. Skin: wash with water twice a day, dry, coat with fat. Clean cloths.

A catheter alone closes 11 to 15 in 100 in one review, 78 in 100 in another account. Grade C. Repair by a trained surgeon B.

Prolapse:

1. Teach the squeeze from the Opening. Check by examination that she can.
2. Hold up to 10 seconds, 10 times, 3 times a day, for 16 weeks.
3. Still troubled: the healer fits the smallest ring pessary that stays in when she walks and coughs.
4. Out, washed and looked at every 4 to 6 months at least. Date in the register.
5. Bleeding, foul discharge or pain: out that week.

Grades. Squeezing A. Pessary B. Improvised cork or wooden pessary D. Camp surgery without training X.

Rung ladder. Hands: the squeeze, skin care, a place at the table. Village: catheter and ring. Regional centre: repair. Refuse: untrained repair, and a ring without a date.

12.4 Do: bleeding, pain and discharge in ordinary months

Never douche, with water, vinegar, lemon or herbs. Instead, wash the outside only, with water.

Problem	Remedy	Dose, the same for every woman, no weight bands	Length	Grade
Period pain, step 1	Heat on the lower belly, walking	20 to 30 minutes at a time	As needed	A, B
Step 2	Ginger powder	250 mg 4 times a day	First 3 days	B
Step 3	Ibuprofen with food	400 mg up to 3 times a day	2 to 3 days	A
Or	Paracetamol	15 mg/kg, never over 1 g a dose or 4 g a day	2 to 3 days	
Heavy bleeding	Tranexamic acid	1 g 3 times a day	Up to 4 days, or 5	A
Itch, white curd	Fluconazole	150 mg once	Once	
Grey, fishy discharge	Metronidazole	500 mg twice a day	7 days	

No ibuprofen with a stomach ulcer or kidney disease. No tranexamic acid after a clot or with combined pills. Iron: chapter 7.

Cloth: wash with soap, dry outside in sun, never keep in the latrine. Grade B.

Pus, pain with fever, or a new partner: chapter 16. After sexual violence: chapter 29.

The change: soy food, walking, carrying. Refuse black cohosh root and red clover (X) and sage (D).

Send within weeks: bleeding after the change, between periods or after sex, a hard breast lump.

A woman may rest in her period. No one is sent to a shed.

Rung ladder. Hands: heat, clean cloth. Garden: ginger. Dispensary: tablets. District: the cervix looked at with vinegar. Refuse: douching, and seclusion

without heat or company.

12.5 Prevent: the space between children

Never take a plant or oil against pregnancy: pennyroyal, tansy, rue, savin, quinine, neem oil, wild carrot seed. All are graded X or D. Instead, choose a method from the table below.

The breast (LAM). All 3 at once:

1. No bleeding since day 56 after the birth.
2. The baby has the breast for more than 3 of every 4 feeds, by day and night.
3. The baby is under 6 months.

Feed at least 8 to 10 times in 24 hours. No gap over 4 hours by day or 6 by night. The day any rule fails, start another method. Prepare it by week 20.

Beads: cycles of 26 to 32 days only. Red bead on day 1. Move the ring 1 bead each morning. White beads, days 8 to 19: abstain or use a condom.

Symptothermal: temperature on waking with a thermometer reading to 0.1 °C, mucus each evening. Teach over 3 cycles.

Condoms: dark, dry, below 30 °C, never above 40 °C. No oil or fat with latex. Who gets them first is the village's choice.

Pregnant per 100 women in the first year. Typical use as Trussell 2011, then 2018.

Method	Typical	Perfect	Keeps	Rung
No method	85			
LAM, all 3 rules	about 2	under 1	While the 3 rules hold	Hands
Withdrawal	22 or 20	4		Hands
Mucus (ovulation)	23	3		Hands
Beads	12	5		Hearth
Symptothermal	2	0.4	Thermometer	Hearth
Male condom	18 or 13	2	3 to 5 years below 30 °C	Dispensary
Diaphragm	12 or 17	6 or 16	Silicone about 2 years	Dispensary, fitted

Method	Typical	Perfect	Keeps	Rung
Pill	9 or 7	0.3	Library found no figure past date	Dispensary
Injection, 3-monthly	6 or 4	0.2	Library found no figure	District
Copper T	0.8	0.6	Pack 5 to 7 years, 12 years in place	District
Implant	0.05 or 0.1		Library found no figure	District
Female sterilisation	0.5			Hospital
Vasectomy	0.15	0.10	Another method for 3 months	Hospital

A copper device within 5 days of unprotected sex prevents almost all pregnancies. How the book frames it is the owner's.

Grades. LAM A. Beads, mucus, symptothermal B. Condom A. Copper T A. Pills past date D. Lemon, lime, vinegar X.

Rung ladder. Hands: the breast, withdrawal, mucus. Hearth: beads, thermometer. Dispensary: condoms, diaphragm, salvaged pills. District: copper T, injection, implant. Hospital: sterilisation. Refuse: plants, acids, douches. Which methods the village teaches is the owner's.

If it goes wrong

- **LAM trusted too long.** A period returns, or none comes after the baby began other food. Cause: one rule failed unnoticed. Do: start another method today. A late period means pregnancy until shown otherwise.
- **Misoprostol given to an ectopic.** Pain grows on one side, she faints, little bleeding. Cause: a closed cervix taken for a loss. Do: 12.1 danger sign, district now, lying down.

- **A catheter blocked or a ring forgotten.** The leak returns, or bleeding and a foul smell. Cause: no weekly look, no date in the register. Do: flush or replace the catheter now. Take the ring out, send her to the district.

NUMBERS TO CARRY

- 3 rules for the breast: no bleeding, nearly every feed at the breast, baby under 6 months. About 2 pregnant in 100 (MA-08).
- Days 8 to 19 on the beads, cycles 26 to 32 days (MA-08).
- 2 soaked pads an hour for 2 hours, pulse over 100, fever 38 °C: danger after a loss (MA-09).
- 600 µg by mouth or 400 µg under the tongue, once, for a loss already under way, womb 12 weeks or less. 800 µg under the tongue for heavy bleeding. A record, not a rule (MA-09).
- 1 in 4: Glasgow's deaths after an infected abortion without antibiotics (MA-09).
- Late period, pain on one side, shoulder tip, fainting: ectopic, no misoprostol (MA-09).
- 6 to 12 weeks: the catheter's window for a fresh fistula (MA-11).
- 10 seconds, 10 times, 3 times a day: the squeeze (MA-11).

THE LIBRARY

MA-08 Preventing pregnancy without a pharmacy: the real failure rates of every method. MA-09 Miscarriage, unsafe abortion and post-abortion care: what the record shows and what saves lives. MA-11 Women's health across life: menstruation, pelvic pain, fistula, prolapse and menopause. TR-06 European folk and wise-woman medicine: midwives, cunning folk and what the record shows they knew. TR-14 Traditional midwifery across cultures. SY-04 The romance of the indigenous and the ethics of taking. SY-10 The harm register. SY-12 What the library could not find. All are on the website.

PART FOUR

The Village's Defences

CHAPTER 13

Water and Waste

Cholera from a fouled well can kill in hours and empty a village in a week. Chlorine takes thirty minutes. A latrine takes a few days to dig and keeps the well clean for years.

OPENING

Fill a glass at the tap. Hold it up to a window. It is clear and cold, and it has no smell you can name. Drink half of it and keep the rest.

Behind the wall a pipe runs to a main, and the main runs to a works, and the works draws from a lake, a river or the ground under a field. Somebody tested that water this morning. You will never meet them.

Now go and flush the toilet, and listen to the water leave. It runs down and away under the street to another works at the edge of the town, and comes out cleaner into a river that a town further down will drink. The two pipes, the one in and the one out, never touch. Every house in the street lives on that.

Take away the pumps and both pipes stop. The water comes from wherever someone can carry it: a spring at the foot of a hill, a well in a yard, a barrel under a gutter, the stream. The waste goes wherever someone puts it. Nothing keeps the two apart any more except a village, a spade and a habit.

A village has one mouth, and it is the well. Everything the village drinks passes through it first. Whatever soaks into the ground above it, a pit, a

pen, a heap, a grave dug too close, comes back up in the bucket. What the village drinks, it is.

Look at the half glass you kept. Find out, today, where it came from. Read the water bill, or ask a neighbour who has lived in the street longer than you. Name the lake, the river or the ground. Then find out where the flush goes. Most people in a town can name neither. A village after the Fall will know both by its second week, or it will learn them from its dead.

THE STORY

The pump in Broad Street

In May 1839 William Farr sent the Registrar General of England and Wales a letter about 141,607 deaths. They were the deaths registered in the second half of 1837, sorted by cause, and Farr argued that a common name for each disease mattered as much as common weights and measures. From then on London's dead were counted every week, by parish, by age and by disease. Nobody asked what they drank. Farr himself held, with most of his colleagues, that cholera rose from the foul air of low, damp ground.

In August 1854, at Farr's suggestion, the registrars of the south London districts added one question. For each house where someone died of cholera, they wrote down which company piped its water. Two companies served the same streets. The Southwark and Vauxhall Company drew from the Thames below the sewer outfalls. The Lambeth Company had moved its intake upstream. John Snow, a London doctor who held that cholera travelled in water, took the lists and counted. Over seven weeks the houses on Southwark and Vauxhall water lost 315 people for every 10,000 houses. The houses on Lambeth water lost 37, and the rest of London 59. That was 1,263 deaths in 40,046 houses against 98 in 26,107, about eight and a half times the risk, from nothing but the pipe.

The same summer cholera broke out in Soho, around the pump in Broad Street, on 31 August. Snow traced the deaths to the households that drew from that one well, and on 8 September the parish took the handle

off the pump. The story is often told as if the handle ended the outbreak. Snow wrote that the deaths had fallen so far before the water was stopped that he could not say whether the well still held the poison. The dead are counted at about 500 by some and over 600 by others. The handle came off after the peak. What the count did was name the well, so that the next time there need be no peak.

Broad Street was a parish with one mouth, and what went into the pump went into everyone who drank from it.

Cholera came back to London in 1866 and killed about 5,500 people, most of them in the East End. By then Joseph Bazalgette's new sewers carried most of London's waste east, below the city, but the East End was not yet joined to them, and its water came unfiltered from the East London Water Company. Farr's report of 1868 laid the deaths at that company's door. The man who had looked to the air now looked to the pipe. It was London's last great cholera epidemic.

What Farr and Snow left a village is small and cheap. A register that writes down the sick and the dead by name and date can say that something is wrong. A register with one more column, the water each household drinks, can say where. It costs one word a line.

Sand and chlorine

In 1892 cholera reached Hamburg. The city drew its water from the Elbe, unfiltered, above the town. Altona, next door, drew from the same river below Hamburg, after Hamburg's sewage had gone into it, and ran the water slowly through beds of sand before anyone drank it. Hamburg had about 17,000 cases and between 8,600 and 10,000 deaths. Altona was largely spared. Robert Koch, sent to the city, identified the organism.

Sand works slowly. A living skin grows on its surface and eats what the water brings, and it needs time and a keeper. Chlorine is quicker. In Lincoln in 1905 a faulty sand filter let typhoid through, with 1,045 cases and 131 deaths, and Alexander Houston then dosed the town's supply with hypochlorite at about one part per million. In 1908 John L. Leal and George W. Fuller began dosing 40 million gallons a day from Jersey City's Boonton Reservoir with chloride of lime, at 0.2 to 0.35 parts per million. They did it after a court case. Economists later credited clean water with about

half the fall in city deaths in early twentieth century America, and a later study cut that share down.

Chlorine has a gap. In Milwaukee in 1993 a chlorinated supply carried Cryptosporidium, a parasite chlorine at drinking doses does not kill, and about 403,000 people fell ill. Between 69 and more than 100 died. A pot of water brought to the boil would have killed it.

A village has no reservoir and no court. Its reservoir is a row of jerrycans at the spring, and its Leal is whoever measures the stock each morning and doses each can before it is carried home. The method is the one used in 1908: a measured dose, a wait, and a check that some chlorine is left at the end. Dosing at the source puts the measure in one careful pair of hands, instead of fifty households each guessing.

A cloth, a bottle and the sun

In Matlab, in Bangladesh, from January 2001 to July 2002, Rita Colwell and her colleagues followed 65 villages and about 133,000 people. In some, women poured their water through old sari cloth folded to eight layers. Cholera fell by 48 in every 100 against the villages that did nothing. The study was not randomised, and folded cloth leaves gaps of about 20 thousandths of a millimetre, which hold back only the larger things the water carries. It was still the cheapest thing that worked.

In 2002 Regula Meierhofer and Martin Wegelin wrote down a method that needs only a clear plastic bottle and a roof. Fill it, shake it, lay it in full sun for six hours. In a Maasai trial in Kenya, during a cholera outbreak, 3 of 155 children under six who drank sun water fell ill, against 20 of 144 who did not. In Bolivia, where only about a third of families kept using the bottles, the trial found almost nothing.

That is the lesson of every water trial. Where families knew which group they were in and reported their own children's diarrhoea, treatment seemed to halve it. Where nobody knew, the effect almost vanished. In one large Indian trial of chlorine, only about a third of the treated homes had chlorine in their water when it was tested. A method works only on the days it is done. In Vietnam families heated their water for about eighteen minutes and boiled it for under two, and more than half of the stored boiled water was dirty again by the time anyone drank it. The

cup dipped into the pot carried back what the fire had killed. In Malawi a plain covered bucket with a tap cut child diarrhoea by about a third. In Kenya a trial that walled and piped 200 springs, reported in 2011, cut their contamination by two thirds and child diarrhoea by about a quarter. Protecting the source comes before any treatment.

The litre that chapter 5 turns into the cure for the dry child starts here. If it is not clean, the cure carries the illness back in.

The pit and the village

In 1842 Edwin Chadwick reported that the families of Manchester labourers died at an average age of 15 or 17, depending on the reading, against 38 for labourers in rural Rutland and 52 for the Rutland gentry. Six years later Parliament passed the Public Health Act. What followed in Britain was sewers, filters and law, paid for by towns.

A village has no such purse. Its sanitation is a pit, a slab and a lid, and the trials of that are humbling. In Odisha, in India, a programme raised latrine coverage from 9 to 63 in every 100 households, and child diarrhoea did not move: 8.8 against 9.1 in a hundred. In rural India about 40 in every 100 households with a latrine still had someone going in the open. Pooled trials suggest that child growth improves only when half to three quarters of a whole community use a latrine. A latrine is a household's. Sanitation belongs to the village, and it begins at the last house, not the first.

What goes into the ground stays there. Roundworm eggs live two years in soil and sometimes seven to ten. Japan fertilised its fields with night soil for centuries, and in 1949 nearly two in three Japanese carried roundworm. By 1973 it was under one in a hundred, after years of screening and treatment and the change from night soil to bought fertiliser. In Germany in 1949, where vegetables were watered with sewage, more than nine in ten people were infected.

A pit can also take a child. In January 2014, in Limpopo, South Africa, Michael Komape, aged five, drowned in a school pit latrine. In 2018 Lumka Mkhethwa, also five, died in another. Nobody counts such deaths. Every rule for the slab and the lid at the Bench comes back to them.

The pit is not the only thing between the stool and the mouth. In pooled studies, shoes did more against hookworm than latrines did. In

The Gambia in 1999, spraying against flies cut trachoma, the eye disease that blinds, by about three quarters. Flies walk from the open pit to the open pot. A lid and a covered dish break the walk.

The jar and the grain

Food carries its own dangers into the house. In Gulran, in Afghanistan, from 1974 to 1976, bread made from wheat mixed with the seed of a weed, *Heliotropium*, poisoned about 7,800 people and killed about 1,600. Ergot is a black horn of fungus that grows in place of a grain of rye, and it poisons through bread. In Pont-Saint-Esprit, in August 1951, about 250 to 300 people fell ill and five to seven died, with hallucinations that lasted days. Ergot in the bread of one bakery was blamed, and the cause is still argued. In Ethiopia in 1977 and 1978 ergot killed nearly 50, and in 2001 ergot on wild oats mixed into barley brought gangrene to Arsi. In Kenya in 2004 mouldy maize poisoned 317 people and killed 125.

Botulism comes from a sealed jar. Its spores live in soil and survive boiling, and in a moist, airless, low acid food held between four and forty-nine degrees they make a toxin that paralyses from the face down. In Alaska between 1950 and 2000 there were 226 cases, and every known cause was a fermented food. In the 1950s about a third of the sick died. By the 1990s it was 3 in 100, because people learned the signs and carried the sick out to hospital. Nobody in Alaska has died of it since 1994. The cases rose all the same, as fermenting moved from grass lined pits in the ground into sealed plastic in warm kitchens. The toxin, unlike the spore, is fragile. Eighty-five degrees for five minutes destroys it. In Vancouver in 1985 a restaurant served chopped garlic kept for months in oil, and 34 people fell ill. Seven needed a machine to breathe. None died.

The Honest Broker's Jerrycan

Here is where the sources need weighing.

The time to boil water is argued. WHO says a rolling boil is enough. The CDC says 1 minute, 3 above 2,000 m. The ten minute boil is obsolete, and HY-02 grades the claim that it is needed X. Chapter 1's 20 minutes is for instruments, not water (SY-12, C24). The Bench prints 1 minute at a

rolling boil, with the rolling boil alone beside it. Fuel matters more than the minutes: about 0.28 kg of wood a litre on an open fire, about 0.09 on a good stove, and SY-09 rounds it to 0.3.

The chlorine dose holds. HY-02, HY-05 and SY-09 agree on 4 ml of 1 per cent stock per 20 litres, which is 2 mg in each litre. The CDC's 1.875 and 3.75 mg per litre sit beside it, and WHO's ceiling is 5. Chapter 1 printed no figure for 1 per cent stock from HTH. HY-02 gives about 14 g per litre, and chapter 1's own HTH rows scale to 15, so this chapter prints 14 to 15 g. Chapter 1's table may need the line. Bought bleach was off its label by 35 per cent on average, from 45 per cent weaker to twice as strong. The rule to halve the label of salvaged bleach and double the dose is HY-05's. If the bleach was in fact full strength, the doubled dose gives 4 mg per litre, still under WHO's ceiling.

HY-02 is wrong on one device. It gives the WATA salt cell an output of 6 g per litre in 3 hours and a dose of 7 ml per 20 litres. HY-05 read the maker's 2022 sheet: about 5 g per litre after 2 hours. This chapter does not print HY-02's figures.

The latrine distance is a convention, graded D. Graham and Polizzotto found 15 m in one manual, 30 in Sphere and MSF, 50 in WaterAid's and 75 in South Africa's. The furthest travel they found was about 25 m for bacteria and 50 m for viruses, and further in gravel and cracked rock. The pit floor sits 1.5 m above the water table in Sphere, against 3 to 4.5 m in Kligler's text of 1921. The Bench prints 30 m with 50 in sand, and 1.5 m with the older figure beside it.

The trials are weaker than the laboratory. Blinded trials of water treatment pooled at a ratio of 0.94, open trials at 0.55. HY-04 found that latrines built without near universal use showed no health effect. Neither finding says to stop. Both say that a method used one day in three is no method.

The library is thin on food. It found no figure at all for corncockle, and darnel appears in one line, itself unverified. The weed seed record here is *Heliotropium*. IN-16 does not mention garlic in oil, and ME-01 supplies Vancouver. IN-16 gives hand breathing at 12 a minute in two hour shifts. The book's register is chapter 21's, and this chapter points there. Snow's Lambeth house count and the Broad Street dead are not settled, and Farr's change of mind is not in the library at all. Composting at fifty-five degrees is HY-04's inference, and FEASTING after the FALL owns the heap.

The turn to the present

In Berlin the tap water comes from ground water under the city and its edges, and the sewage goes to works that most residents never see. Around the city, Brandenburg is sand over a high water table. Sand carries what goes into it further and faster than clay. The library found no figure for Brandenburg's wells. A pit dug there may need 50 m, a lined wall and a raised vault, or no pit at all.

What does a village of 300 need, to drink safely for a year?

About 5 litres a person a day for drinking and cooking is 1,500 litres, or 75 jerrycans. At 4 ml each that is 300 ml of stock a day, about 3 g of chlorine. A year is about 1.1 kg of chlorine: about 1.6 kg of HTH, or about 22 litres of 5 per cent bleach, twice that if it is salvaged and old. A latrine for every 20 people is 15 pits. One for every family of six is about 50. Each fills at about 60 litres a person a year, 18 cubic metres for the village.

None of it is hard. All of it has to be done every day, by someone whose name is on a list. The well is the village's mouth, and a village is no cleaner than what it lets into its mouth.

Now the water.

AT THE BENCH

Work every dose twice, with two people.

13.1 See: the source and the survey

Walk every source in week 1. Yes or no (HY-02):

1. A latrine, pen or heap within 30 m, a grave within 50 m (chapter 31), or uphill?
2. Standing water, droppings, rubbish, a bucket on the ground?
3. Apron, headwall, cover or fence cracked or missing?
4. Cloudy after rain? Surface water is getting in.
5. Fix the worst first. Move the latrine. Apron at least 1 m wide, sloped to a drain. Headwall, cover, fence.

6. Spring: wall it, pipe it, fence the ground above it.
7. Rain: no lead roofs. Divert the first 1 to 2 litres per m^2 of roof. Always treat it for infants.
8. After a flood: 50 mg of chlorine per litre for 12 hours, then bail until the smell fades. A well 1.5 m across with 3 m of water holds about 5,300 litres. Use about 380 g of HTH, or 5.3 litres of 5% bleach.
9. Never go down a well alone.
10. Walk again every season and after floods. Write the water source of every case in the register (OR-05).

Grades: spring protection A. The 30 m distance D. First flush D. "Clear water is safe" X.

Rung ladder. Hands: the walk. Hearth: a covered barrel. Garden and still: pens moved downhill. Dispensary: the water column. Infirmary: a test kit. Hospital: a laboratory. Refuse: an unwalked source.

13.2 Do: clear, treat and store the water

Never keep bleach or stock in a drink bottle. Instead: a marked plastic vessel, locked (SY-10, H12).

1. Clear: stand cloudy water, pour it off through old cotton folded to 8 layers, same side up. Alum, if found: about 1 ml per 4 litres, settle 30 minutes. Cloth and alum clear water. They do not make it safe.
2. Boil: a rolling boil, 1 minute, 3 above 2,000 m. Some sources ask only for the rolling boil.
3. Short of fuel: simmer, cover, wrap in a blanket, leave 30 minutes. Not for infants or at altitude.
4. Make 1% stock. Product into water, in plastic, in the open air.

Product	Label strength	For 1 litre of 1% stock
Household bleach	5%	200 ml, water to 1 litre
Pool liquid chlorine	10%	100 ml, water to 1 litre
HTH, pool granules (calcium hypochlorite)	65 to 70%	14 to 15 g in 1 litre. Settle. Pour off the clear part
Salvaged or old bleach	assume half the label	double the bleach

Liquid: ml per litre = 1,000 ÷ label %. Granules: g per litre = 1,000 ÷ label %.

5. Label it "POISON. 1% CHLORINE" with the date. Cool, dark, locked. Make it fresh daily. Kept dark, it loses half in 4 to 6 weeks.

6. Never mix two chlorine products. Refuse slow dissolving pool tablets and anything with algaecide, clarifier or copper.

7. Dose 4 ml of 1% stock per 20 litres clear, 8 ml cloudy. No stock: 1 ml of 5% bleach per 20 litres clear, 2 ml cloudy.

8. Stir. Wait 30 minutes, 2 hours if cold. Sniff. A faint smell of chlorine: drink. None: dose again, wait 30 minutes more.

9. Drink cloudy treated water within 8 hours, clear within 24. Diarrhoea goes on in spite of chlorine: boil. Chlorine misses Cryptosporidium.

10. Salt cell: a manufactured one only, by the maker's sheet. WATA makes about 0.5%: 8 ml per 20 litres. Test each batch.

11. Sun: clear plastic bottles of 1 to 2 litres, unscratched, never one that held fuel or poison. Read a headline through the full bottle, or clear the water first.

12. Fill three quarters, shake 20 seconds, fill up. Flat on a roof in full sun for 6 hours. More than half cloudy: 2 days. Never in steady rain. Drink within 24 hours.

13. Biosand filter: 5 cm of water above the sand. Disinfect its water for the first 30 days. 12 to 18 litres once or twice a day. Never let it dry. Nothing above 50 NTU.

14. Store covered, with a tap or narrow mouth, off the floor. Never dip. Wash weekly with a little bleach.

Grades: boiling B. Simmer and cover B. Chlorination A for the water, uncertain for diarrhoea. SODIS A, weak. Folded cloth B against cholera, X alone. Alum B. Biosand A. Safe storage A, borderline. Salt cell B, improvised D. Ten minute boil X as a need.

Rung ladder. Hands: cloth, pour, never dip. Hearth: boil, sun, the covered vessel. Garden and still: fuel wood. Dispensary: the stock, a named doser, a jerrycan list, biosand for houses with infants. Infirmary: a salt cell, a test kit, ceramic filters. Hospital: a tested residual at every tap. Refuse: the boil that

never rolled, unknown pool tablets, clearing nuts, iodine in pregnancy. ### 13.3 Do: the latrine

1. Site it after the walk (13.1). At least 30 m from water, downhill. Other rules give 15, 50 or 75 m. In sand, 50 m.
2. Pit floor at least 1.5 m above the water table of the wettest season. Older texts ask 3 to 4.5 m.
3. Water within 2.5 m of the surface, or cracked rock: no pit. A raised dry vault, or a shallow pit planted with a tree when full. In Brandenburg's sand, check the water before digging.
4. Size: people × 60 litres × years, plus 0.5 m. Six people for 15 years: about 1.5 × 1.5 × 3 m.
5. Line the top 1 m. In sand, line it all.
6. Slab raised about 15 cm, tested with 4 adults standing on it. Drop hole too small for a child.
7. A tight lid. Ash after each use.
8. Handwashing at the door (chapter 1). Children's stool in the same day.
9. Full to 0.5 m from the top: fill with soil, dig a new pit. Nobody goes into a pit.
10. At most 20 people a latrine. Map every house. Aim for 75 in 100 households using one within a season. Name a steward. Persuade, never shame.
11. Compost and urine on the land: FEASTING after the FALL. Never raw night soil on food crops.

Grades: sanitation A, low certainty, and no effect without village wide use. Siting rule B in fine soil, X in cracked rock. Hot household compost X. Raw night soil X.

Rung ladder. Hands: shoes, the lid. Hearth: pit and ash. Garden and still: the dry vault. Dispensary: the map, the steward. Infirmary: the cholera pit (chapter 15). Hospital: sewers. Refuse: the open field, the pit above the well.

13.4 Do: the sickroom's waste, the body and the linen

1. Stool and vomit: a covered bucket with ash, emptied into the latrine. Rinse it, then 0.5% for 10 minutes (chapter 1).
2. Blood: wipe up the bulk, then 0.5% for 10 minutes. Cannot wipe first: 1% for 3 minutes, then 0.5%.
3. Cholera and the dead: lime and 2% chlorine as chapter 15 prints them.

4. The body: wash as chapter 24 shows. Pour the wash water into the latrine.
5. Linen: gloves. Soiled side folded in. Solids rinsed into the latrine.
6. Boil with soap 10 minutes, or soak in 0.05% up to 15 minutes, then wash. Dry fast in sun. What cannot be boiled: 3 days of sun, partial only.
7. Wash hands after every step.

Grades: boiling cloth B. Hypochlorite 0.05 to 0.5% A in practice, B in the field. Lime on excreta B, outbreaks only. Vinegar on surfaces X.

Rung ladder. Hands: washing after. Hearth: bucket, ash, pot. Garden and still: sun. Dispensary: three strengths. Infirmary: the cholera ward. Hospital: laundry at 71 °C. Refuse: linen rinsed in the stream.

13.5 Prevent: the jar, the grain and the cup

Never keep garlic or herb oil. Instead: dried garlic and herbs, or fresh in the pan (SY-10, H21).

Never give honey under 12 months. Instead: the breast, or a correct feed (SY-10, H13).

Never taste a jar to test it. Instead: burn or bury a doubtful jar unopened (IN-16).

1. Above pH 4.6 (meat, fish, milk, most vegetables): a pressure canner at 116 to 121 °C. Or dry, salt, sour or keep cold. FEASTING after the FALL owns the methods.
2. Before eating home canned low acid food, boil it 10 minutes. Add 1 minute for each further 300 m above 300 m. A backup, not a licence.
3. A bulging lid, broken seal, spurting liquid or off smell makes a jar doubtful.
4. Never ferment fish or meat in sealed plastic.
5. Grain: dry until a grain shatters under a thumbnail. Sort by hand. Every black horn of ergot out, every mouldy, shrivelled or foreign seed out. Aim under 1 part in 2,000 by weight.
6. Caking, warmth, a musty smell or mould condemns the lot. Never grind it to hide it.
7. Several ill after bread, swollen bellies, a family delirious: change the grain at once (SY-10, H16).
8. Milk: boil and hold 5 minutes. Mince to 71 °C, poultry to 74 °C (chapter 14). Mushrooms: chapter 22.

The danger sign: botulism. Double vision, drooping lids, slurred speech, dry mouth, hard swallowing, then weakness spreading down from the face. Clear mind, no fever. 6 hours to 10 days after the food.

9. Ask what was eaten and who else ate it. Keep the jar.
10. Count aloud to 30 in one breath. Write the number every 2 hours.
11. Nothing by mouth once swallowing is unsafe (SY-10).
12. Below 10, or a weak cough: prepare to breathe for them (chapter 21).

- **Help in time.** Send now, sitting up, with the jar and the list of who ate it. Watch everyone who ate it for 10 days.
- **Help too late.** Breathe for them on the way, by bag and mask. Relays as chapter 21 sets them. Clear the mouth. Nothing by mouth.
- **No help at all.** Breathe for them in relays as long as the village can. Recovery takes weeks. Almost everyone given breathing support lives. If the relays cannot be kept: on the side, mouth cleared, a hand held. Tell the family the mind is clear and hears every word. Tell them plainly that without breathing help many die.

Grades: pressure canning B. Boiling a jar 10 minutes B. Drying, sorting, cool storage B. Hand sorting ergot C. Boiling milk B. Fermenting in sealed plastic X.

Rung ladder. Hands: never taste. Hearth: acid, salt, dryness. Garden and still: dried herbs, no oils kept. Dispensary: the breath count. Infirmary: breathing relays. Hospital: antitoxin, a ventilator. Refuse: garlic in oil, sealed plastic, honey under 12 months.

If it goes wrong

1. **Diarrhoea goes on in a house that treats its water.** Cause: a dipped cup, a skipped day, dirty storage. Smell the stored water. No smell: dose again. Watch a cup being drawn. Fit a tap.
2. **No chlorine smell after 30 minutes.** Cause: old or weak bleach, cloudy or cold water. Dose again and wait 30 minutes more. Settle first. Make fresh stock. Double salvaged bleach.
3. **The latrine stands unused, or fills with flies.** Cause: no lid, no ash, too far, too few houses. Lid and ash. Move it closer. Map the houses. Name a steward.

NUMBERS TO CARRY

- 4 ml of 1% stock per 20 litres, 8 if cloudy. Wait 30 minutes, then smell (HY-02).
- 1% stock: 200 ml of 5% bleach to 1 litre, or 14 to 15 g of 70% HTH (HY-02, HY-05).
- A rolling boil, 1 minute, 3 above 2,000 m (HY-02).
- 6 hours of sun, 2 days if cloudy, bottles of 2 litres or less (HY-02).
- 30 m from water, downhill, 1.5 m above the wettest water table, 50 m in sand (HY-04, SY-09).
- 75 in every 100 households using a latrine (HY-04).
- pH 4.6: above it, a pressure canner or nothing. Boil 10 minutes before eating (IN-16).
- 1,500 litres, 75 jerrycans and 300 ml of stock a day for 300 people (HY-02).

THE LIBRARY

HY-02 Safe water without a utility: boiling, solar disinfection, sand filters, chlorine and the evidence for each. HY-04 Where the waste goes: latrines, composting, night soil and the diseases of bad sanitation. HY-05 Making soap, lye and disinfectants from ash, fat, salt and sun. IN-16 Zoonoses, food poisoning and the animals we live with. OR-05 Records, surveillance and noticing the outbreak: the village register. ME-01 The dispensary's grammar. SY-09 The salvage list and the first year. SY-10 The harm register. SY-12 What the library could not find. All are on the website.

CHAPTER 14

The Creatures

A tick removed within a day rarely gives Lyme. A dog watched for ten days tells you whether the bite was rabid. A net hung every night for a season halves the fevers where malaria is.

OPENING

On a still evening in summer, near water, there is a sound most of us know. A thin whine comes close to the ear, fades, and comes back. It is a female mosquito. Only the females bite, because they need blood to ripen their eggs. She lands so lightly that most people never feel her arrive, and she has drunk and gone within a minute or two. The itch comes later. It is the skin answering what she left behind.

Most of the small lives that share a house carry nothing at all. A few carry fevers that have emptied armies and towns. The louse lives in the seams of a shirt and comes to the skin only to feed. The flea waits in the dust of a rat's run. The tick climbs a grass stem to the height of a knee and waits there with its front legs open. The scabies mite lives in the skin itself, between the fingers and at the wrists, and the itch it brings is worst at night. The larger creatures we live with, the dog at the door, the cow in the byre, the cat by the stove, carry their own few dangers in saliva, milk and dung.

None of them can be done away with. A village will have mosquitoes every summer and rats in every barn for as long as there are summers and

barns. What a household can do is keep watch. The net comes down at dusk and is tucked in. The seams of a shirt are turned to the light. A body is looked over at night after a day in long grass. Dead rats are counted. A cow found dead in the field is left closed. A net over a bed is attention made of thread, and it keeps the watch while the sleeper cannot.

Most of this work is dull, and that is its strength. It asks for no drug, only an eye that comes back to the same places at the same hour.

Tonight, when the light goes, listen for the whine at your ear, and notice how long it takes before you feel the bite.

THE STORY

The net and the screen

The mosquito that carries malaria bites at night and indoors, and breeds in sunlit standing water. The one that carries dengue and yellow fever bites by day and breeds in the clean water of a jar, a pot or a bucket. Its eggs can lie dry on the wall of an empty jar for months. Each kind tells a household where to look and when to close the door.

The first protection anyone proved was carpentry. In 1900 Grassi kept 112 people on the Capaccio plain behind wire screens from dusk to dawn. Five caught malaria. All 415 of their unscreened neighbours did. Near Rome, Celli screened 26 railway houses, and 7 of their 181 people fell ill against 200 of 217 in the houses left open. Nobody had an insecticide worth the name. They had gauze, a door that shut, and the habit of shutting it before the light went.

Then came the great clearances. William Gorgas ended yellow fever in Havana by September 1901 by emptying and covering the water where the day biter bred, house by house. In Panama from 1904 his men dug ditches, poured oil on standing water, cleared brush, screened quarters, and in 1905 burned more than 100 tonnes of pyrethrum flowers. Between 1904 and 1918 malaria among the canal workers fell by nearly nine tenths. It is remembered as a triumph of oil and powder. It was a triumph of labour, 600 men in one squad, and it lasted as long as the labour did.

The net came later and won the largest trials. In five trials covering more than 200,000 children, nets treated with insecticide cut deaths from every cause by about a sixth, 5.6 lives a year for every 1,000 children. After the Fall the insecticide will run out, and the question that matters is what a plain net does. In 2001 Clarke and colleagues looked at children in 48 Gambian villages and found that an intact net with nothing on it halved their falciparum malaria, and did better than that in the poorest homes. The word that carries the finding is intact. A treated net kills the mosquito that lands on it. A plain net only stops her, and a hole the size of a fingertip lets her in.

In 2009, in the Gambian town of Farafenni, plain screens on the doors, windows and eaves of 500 houses cut the mosquitoes caught indoors by about half, and severe anaemia in the children from 19 in 100 to about 12. Smoke helps for as long as it burns. A shop coil puts as much fine smoke into the air as 75 to 137 cigarettes, which is why smoke belongs at the door and not in the room where a baby sleeps.

In Brandenburg the mosquitoes of the lakes bite hard in a wet June and carry no malaria now, though the kind that once carried it still lives in Europe. In the tropics the net is the largest single thing a household can do for its children. In either place the thread does nothing alone. A net is attention made of thread, and the attention wears out before the thread does: the net left up on a hot night, the corner untucked, the hole noticed and left until the weekend.

The seam

The body louse lives in clothing, not on the body. It comes to the skin to feed and goes back to the seams, and lays its eggs along the stitching. Off a warm body it dies in a day or two. It carries three fevers: typhus, relapsing fever and trench fever. Typhus passes in the louse's droppings, which the itching sick scratch into their own skin. Untreated, typhus kills about 15 in 100. One dose of doxycycline brings that under 1 in 100.

Lice thrive where people cannot change their clothes: armies in winter, prisons, camps, a city shut in. In the winter of 1914 to 1915 typhus and relapsing fever killed 150,000 or more in Serbia, among them perhaps a fifth of the country's doctors. At Kragujevac the nurse Flora Sandes worked in

a hospital of about 1,200 sick with two surgeons. William Hunter's British sanitary mission held back the trains and steamed clothes in railway vans and in what came to be called the Serbian barrel: a wine cask set over a cauldron of boiling water, the clothes hung inside. By June 1915 the epidemic was over.

The most hopeful record comes from the worst of places. In 1941 between 400,000 and 450,000 people were shut into 3.4 square kilometres of the Warsaw ghetto, with almost no soap and little fuel. Typhus came, as it comes to the hungry and the crowded, with 80,000 to 110,000 infections and 20,000 to 25,000 deaths. Then, in late October 1941, before the winter when typhus should have been at its height, the epidemic fell away. A study in 2020 gave the credit to the people of the ghetto: public lectures, hygiene courses, an underground medical school, soup kitchens, house committees and cleaning. Without that work it estimated about 196,000 infections. They had almost nothing to work with. They had one another, and they kept watch.

Naples in the winter of 1943 to 1944 is remembered as the first great work of DDT. More than a million people were dusted with louse powder, more than 50,000 a day by 10 January 1944, and the cases fell away by late February. The first powder used there was made from pyrethrum flowers. The historian Roderick Bailey argues that DDT's part has been overstated. Serbia, Warsaw and Naples teach the same thing: heat, washing and a powder, carried by many hands at once. A louse and its eggs die at fifty-two degrees held for half an hour. Soap alone does not kill them.

The head louse carries none of these fevers. In a British trial, four sessions with a fine comb through wet hair cured more than four times as many children as one bottle of lotion. Bedbugs, for all their misery, have never been shown to carry any disease, and they die in the same hot wash.

The rat and its flea

Plague belongs to wild rodents and reaches people on the flea of the rat. When it reaches the lungs it passes by coughing and kills within a day. The flea prefers the rat. When rats die, their fleas leave the cooling bodies for the next warm one, and in a house that is a person. A die-off of rats came 10 to 14 days before the first human cases. A heap of dead rats in a

barn is the village's alarm, and the order of work it sets is exact: the fleas first, then the rats. Killing the rats first drives their fleas onto people.

The rat carries about 50 diseases and eats about 25 g of grain a day. Its urine in puddles and floodwater carries leptospirosis in through cuts and wet skin, and the severe form kills 5 to 15 in 100. A rat squeezes through a gap of 12 mm, a mouse through 6.

The cat is not the answer. Street cats in Brooklyn, watched for five months, killed two or three rats. Traps set together worked. In Bangladesh, villages that trapped as one cut their stored grain losses from 2.5 in 100 to 0.5, and in Myanmar from 17 to 5. A grain store on legs, with a metal collar round each leg and nothing within a metre to jump from, does more than any cat. Most rat poison left on the shelves after the Fall stops the blood from clotting. A child who eats it, or a dog that eats a poisoned rat, can look well for days and then bleed.

The tick and the mite

In the woods and meadows of Brandenburg the creature that matters most is the tick. It carries Lyme disease, tick-borne encephalitis and two rarer fevers. The Lyme bacterium passes slowly, usually only after a day and a half of feeding. The encephalitis virus passes within hours. So a tick found the same evening has usually done little, and a daily look over the body is most of the prevention.

Days to weeks later a red ring may spread around the bite and widen. It shows in 70 to 80 of every 100 cases of Lyme disease. Untreated, 10 to 20 in 100 Europeans with it go on to trouble in the nerves, such as a face that droops on one side. In 2001 Nadelman and colleagues in New York gave one dose of doxycycline within three days of a tick bite and cut the red ring from 3.2 cases in 100 to 0.4. One dose, if the shelf has it, and a date on the calendar. The rest is watching.

The scabies mite lives in the skin. The female burrows a short track at the wrist or between the fingers and lays her eggs in it. It passes by long close touch: a shared bed, a mother and child. In a Fijian trial published in 2015, three island communities were treated in different ways. Where everyone took ivermectin, scabies fell in a year from 32 in 100 people to 2. Where everyone was given permethrin cream, it fell from 42 to 16. Treat

one person and the mite comes back from the next bed. Sulphur in fat, the oldest remedy, cures between half and nine in ten, depending on how faithfully it is put on. It is slower than the modern creams, and gentle enough for a baby.

The dog, the cow and the dead

The dog is the oldest companion and carries the worst death. Vaccinating seven dogs in ten stopped rabies where killing dogs had not. Without vaccine, the danger is held by knowing the dogs: a register of every dog that is owned and fed, and ten days of watching any dog that bites. In 1897 Britain muzzled its dogs district by district under Walter Long, and the last case caught in the country came in 1902. Britain also had an island border, a police force and no wild animal carrying the virus. A village after the Fall has none of the three.

The dog carries a slower danger too. A small tapeworm lives in its gut, and the eggs pass in its dung and survive on the ground for a year. Swallowed by a sheep, they grow into cysts in its liver and lungs. Swallowed by a child who plays with the dog, they do the same in the child, for years, before anyone knows. The dog is infected by eating the raw offal of a slaughtered sheep, and that is where the cycle breaks. Iceland began breaking it in 1863 and, with New Zealand and Tasmania, was free of it by 2002. When Soviet veterinary services failed after 1991 the cycle came back. In Central Asia the cyst disease rose fourfold within a decade, and in Kyrgyzstan its deadlier cousin of the liver went from fewer than 3 cases a year to more than 60. In Europe the fox carries that cousin, and the fox walks through every village in Brandenburg.

A cow found dead in the morning, swollen, with dark blood that will not clot coming from nose, mouth or anus, and none of the stiffness of death, is anthrax until proved otherwise. Closed, the carcass keeps its danger in, because the organism forms its hardy spores only where it meets the air. Opened, skinned or butchered, it lets them out. In Rhodesia between 1978 and 1980, during the war of independence, cattle dipping and vaccination stopped and only about 1,500 of 8,000 dip tanks still worked. Between 10,738 and 17,068 people caught anthrax, nearly all of them on the skin. More than 100 died, perhaps more than 200. In north-

ern Ghana between 2005 and 2016, 30 of 83 people in one region died, many after eating meat from animals found dead, cooked with herbs believed to make it safe. Nothing makes it safe.

Milk carries its own fevers. In 1905 on Malta, Zammit found that the island's long fever came from goats' milk. Brucellosis comes and goes for months, and its cure takes six weeks of two drugs. The tuberculosis of the cow reaches people the same way, more than 140,000 cases and 12,000 deaths a year in the world, and it is born resistant to one of the four drugs used against tuberculosis in people. Boiling ends both.

The pig carries a tapeworm whose cysts, lodged in the human brain, cause about 29 in 100 cases of epilepsy where it is common. The cure is a pen away from the latrine and pork cooked through. The cat carries a parasite that can reach the baby in the womb, in about 2 in 100 when the mother is first infected at six weeks of pregnancy and more than half at thirty weeks. So the pregnant woman does not empty the cat's box or eat raw meat.

The animal is also the village's first warning. A sudden death with dark blood, a storm of abortions in the goats, a dog that bites without cause: each comes before the human case. A village that writes down where its animals died, and why, has begun to keep watch.

The Honest Broker's Net

HY-06 can be trusted with a life on nets, screens, lice and ticks. Its central figures come from trials, and where it read only a summary it says so. Three of its claims need care. Its heat figures for lice come from a 2016 paper now under an expression of concern, though they agree with the CDC. Its Panama admission figures carry its own mark on which annual report they come from. It grades sulphur ointment A on one trial read in summary, where IN-08 grades it B. The draft prints B.

OR-10 did the reading that moved two lines without settling them. On dog culling it found the record of Flores, Korea, Israel and Bali, and grades culling X: it fails as control. WO-13 left culling unresearched and marked it, and IN-15 grades it C as control. The draft prints OR-10's verdict with WO-13's mark beside it, as chapter 22 does. On the anthrax pit OR-10 found a depth of 2 m in the FAO manual of 1994. IN-16 found no

source for 2 m and gives at least two feet of cover, 100 yards from a well, from one American state's rule. The draft prints both. All three agree on the rule that matters: never open the dead. OR-10 also caught an error in its own brief, which named Hoste where the fifth author is Hoskin.

The library holds nothing on Ross and the mosquito, the marsh fever of old Prussia, the Lyme story in Connecticut or Zinsser's history of typhus, and this draft does not supply them. It has no figure for how long a net lasts or how much permethrin treats one, none for the fox's worm in Brandenburg, no dog's dose of wormer, and nothing on rat poison. I supplied the weight bands, the net arithmetic for 300 and the plain account of rat poison, each marked.

The turn to the present

Before the Fall the creatures were someone else's work. The dairy heated the milk. The vet vaccinated the herd and took away the dead cow. The council laid bait for the rats, and the chemist sold a lotion for nits. For decades the coil that fills a bedroom with the smoke of a hundred cigarettes was sold as protection for the sleeping child.

What is a village left with when the dairy, the vet and the chemist are gone? The oldest things. A net, and a needle to mend it. A pot at a rolling boil. A comb, a razor, a pair of tweezers. A pit, a fire, and a rule that the dead are not eaten. A register of dogs, and a calendar with the date of a tick bite on it. None of these is bought once and forgotten. Each is done again at dusk, every week, every season.

The ceiling is low here in most years and high in a bad one. Of the five to seven deaths a year a temperate village of 300 can expect without care, the creatures take few in an ordinary year. In a winter of lice and hunger, or a summer when a dead cow is opened, they take many. The work is to keep that year from coming.

A net is attention made of thread. So is a combed head, a boiled shirt, a dog watched for ten days, a carcass left whole in its pit. Each is a way of looking again.

Now the tweezers.

Work every dose twice, with two people.

14.1 See: the creature and its sign

Write the date of every bite, every dead rat and every animal found dead.

Sign	Likely cause	Go to
Fever, headache, rash on the trunk, body lice	Typhus or relapsing fever	14.3, healer today, chapter 15
Swollen node in groin, armpit or neck, painful, after dead rats	Plague	Healer now, chapter 15
Then cough with bloody spit	Plague in the lungs, kills in 18 to 24 hours	Healer now, carers masked with cloth
Painless sore, black centre, after a dead animal or hide	Anthrax of the skin	14.5, healer today
Red ring that widens, within 30 days of a tick bite	Lyme disease	14.2, healer this week
Itch worse at night, burrows between fingers	Scabies	14.4
Fever coming and going for weeks, raw milk drunk	Brucellosis	Healer, 14.8
Fever and aching calves after rat-soiled water	Leptospirosis	Healer today
A bite from a dog	Rabies risk	22.4
Fever where malaria is	Malaria	Chapter 6

The danger sign: fever with confusion, a dark rash, coughed blood or a black sore. It follows lice, dead rats or a dead animal.

- Help in time: louse fever, one dose of doxycycline (table in 14.2). Plague and anthrax, the district's course, chapter 15. Most recover.
- Help too late: give the dose anyway. Sips of fluid. Lie flat if faint. Tell the

family it may fail.
- No help at all: a deloused bed, cool cloths, sips of water, someone always there. Carers cover nose and mouth with folded cloth. Tell the family the truth. Most people with typhus live even untreated. Plague in the lungs mostly kills. Nobody in the house caused it.

Rung ladder. Hands: the look, the date, the register. Dispensary: doxycycline. District: antibiotic courses. Refuse: waiting for a second dead rat.

14.2 Do: the tick

Never burn, grease, squeeze or twist a tick. Instead, pull it straight out.

1. In tick season, check every body each evening. Scalp, behind ears, armpits, groin, backs of knees. Check the dogs.
2. Grip the tick close to the skin with fine tweezers or a loop of thread.
3. Pull straight out with steady pressure.
4. Wash the bite and the hands with soap.
5. Write the date. Watch the bite for 30 days.
6. Attached more than 36 hours: one dose of doxycycline within 72 hours, if held.
7. A red ring that widens, a drooping face, fever or headache: to the healer.

Doxycycline, one dose, from 100 mg tablets. For step 6, or a louse fever (14.1). With food and a full cup of water, sitting up.

Weight	Dose, once	100 mg tablets	Age, only if no scale
Under 7 kg	Healer decides	None	Under 6 months
7 to under 13 kg	25 mg	A quarter	6 months to 2 years
13 to under 25 kg	50 mg	A half	3 to 7 years
25 to under 40 kg	100 mg	1	8 to 12 years
40 kg and over	200 mg	2	13 years and over

Ceiling: 4 mg/kg, and 100 mg at most under 40 kg. 200 mg for an adult. Interval: one dose only, never repeated. A single dose is allowed in pregnancy and under 8 years.

After a first dose for relapsing fever, more than half shake, then grow faint. Lay them flat. Give fluids. Watch 24 hours.

Grades. Evening tick check B. Tweezers or thread loop B. Doxycycline after a bite A.

Rung ladder. Hands: the check, tweezers, the calendar. Dispensary: doxycycline. District: a full course for Lyme. Hospital: encephalitis vaccine, chapter 17. Refuse: flame and grease.

14.3 Do: lice, the hot wash and the comb

Never put kerosene or petrol on hair. Instead, comb wet oiled hair with a fine comb.

Never trust soap alone to kill lice. Instead, heat.

1. On one day, strip every person in the house. All clothes, all bedding.
2. Wash at 54 °C or more, better 60 °C, for 30 minutes. No thermometer: boil 5 minutes.
3. Dry in the sun. Iron the seams if an iron exists.
4. What cannot be washed goes in a tied bag for 2 weeks, 4 to be safe.
5. Wash every body with soap. Comb the hair.
6. Repeat the wash weekly for 3 weeks.
7. Many people at once: steam clothes in a cask over boiling water, hung loose, 30 minutes after steam escapes freely.
8. Dried pyrethrum flower powder on seams, if held. It kills fish and cats.
9. Head lice: comb wet oiled hair every 3 to 4 days for 2 weeks. Or shave.

Grades. Bedding hot wash B. Wet combing A, modest. Shaving C. Kerosene on hair X.

Rung ladder. Hands: comb, razor, seams to the light. Hearth: the boiling pot, the bag. Dispensary: the cask and a rota. Refuse: kerosene, soap alone.

14.4 Do: scabies, the whole household

Never treat one person and leave the house. Instead, everyone the same night.

1. Look for burrows between fingers, at wrists, waist and genitals, in everyone in the house.
2. Sulphur ointment: 10 g sulphur in 90 g petroleum jelly or clean lard.

3. Infants and pregnant women: 5 g in 95 g.
4. After a bath, neck to toes. Under nails, between fingers, every fold. Infants: scalp and face too.
5. Every person in the house and close contacts, the same night.
6. Again each night for 3 nights. Wash off 24 hours after the last.
7. Clothes and bedding at 60 °C, or tied in a bag for 72 hours.
8. Repeat the round after 7 days.
9. The itch can last 4 weeks after cure. Do not re-treat itch alone. Burrows at 4 weeks: start again.
10. Thick crusts on an old or weak person: healer today.

Grades. Permethrin 5% A, dispensary. Benzyl benzoate 25% A, dispensary only, diluted for children. Sulphur B (IN-08), A (HY-06). Ivermectin A, district only, never under 15 kg. Neem and turmeric D.

Rung ladder. Hands: the look, everyone at once. Hearth: fat, the boil, the bag. Dispensary: sulphur, permethrin. District: ivermectin. Refuse: one person at a time.

14.5 Do: the animal found dead

Never open, skin, butcher or eat an animal found dead. Instead, burn or bury it whole.

Never cook that meat with herbs. Instead, burn it.

1. Look at nose, mouth and anus without touching. Dark blood that will not clot, no stiffness: anthrax until proved otherwise.
2. Keep people, dogs and flies away. Do not drag it.
3. Plug the openings with straw or cloth.
4. Burn it completely where it lies, if fuel allows.
5. Or bury it beside where it lies. The depth is disputed. OR-10, from FAO 1994: a pit 2 m deep, carcass rolled in legs up, covered, fenced. IN-16, no source found for 2 m: at least 60 cm of soil over it, 90 m from a well.
6. No lime.
7. Wash hands and arms. Boil or burn the clothes.
8. Write the place and date. Tell the healer and the district.
9. Vaccinate the herd if Sterne vaccine is held.
10. All who touched it: look at hands and arms daily. A painless black sore: healer that day.

11. Other carcasses salvaged by boiling 3 hours:. OR-10 does not adopt it.

Grades. Never eating the found dead B. Burned or buried whole C. Lime D. Herbs on the meat X.

Rung ladder. Hands: the look, the distance, the fence. Hearth: fire, spade. District: vaccine, laboratory, antibiotics. Refuse: the knife and the cooking pot.

14.6 Prevent: the net, the screen, the water

Never burn a coil or leaves where people sleep. Instead, at the door or outside.

Never give neem oil by mouth. Instead, smoulder neem leaves outside.

Never wash a treated net in a stream or well. Instead, a basin, emptied onto dry ground.

1. One net for every sleeping place, long enough to tuck under the mattress.
2. Mesh about 156 holes per square inch, openings up to 1.5 mm.
3. Down before dusk, tucked in, every night of the warm season.
4. Each month, hold every net to the light. Darn any hole bigger than a fingertip that day.
5. Close the gap between wall and roof with mud, wood or cloth. Screen or shutter windows at night.
6. Each week, empty every container of water. Scrub its inside wall. Turn it over or cover it.
7. Re-treat only from a labelled kit, by its label. Never from farm concentrate.
8. Flies and the vented latrine: chapter 13.

The village of 300:

Item	For 300	Basis
Nets	150	2 people a net
New nets a year	50	If a net lasts 3 years
Net checks	150 a month, about 5 a day	1 a net a month
Permethrin	The library found no figure	Count kits, date each net

Grades. Treated net A. Intact untreated net B. Screens A for fewer mosquitoes and less anaemia, B for less infection. Coils indoors X.

Rung ladder. Hands: dusk, the tuck, the light. Hearth: needle, thread, mud. Dispensary: net register, kits. Refuse: coils indoors, oil on drinking water.

14.7 Prevent: rats, fleas and the store

Never kill rats in a die-off before the fleas. Instead, dust floors and runs with pyrethrum. Trap after 2 to 3 days.

Never lay rat poison where a child, dog or cat can reach it. Instead, traps. Poison only in a locked bait box, one keeper.

1. Grain store on legs, floor more than 1 m up. A metal collar on each leg.
2. Nothing within 1 m to jump from. No gap over 6 mm. Swept ground all round. Ladder away after use.
3. Set traps as a village, on the same days, along walls and runs.
4. Report dead rats to the healer the same day.
5. In rat-soiled mud or floodwater: boots, cuts covered.
6. Rat droppings: air the room 30 minutes. Never sweep dry. Soak with chlorine solution 15 minutes, wipe wet.

Rat poison: most kinds stop the blood clotting. Bleeding comes days later, in gums, nose, urine or bruises. A child who may have eaten bait goes to the healer that day, even if well. The antidote, vitamin K1, is a district drug.

Grades. Village trapping B. Cats against rats X. Weekly doxycycline for leptospirosis X.

Rung ladder. Hands: the count of dead rats. Hearth: traps, boots. District: plague isolation, chapter 15. Refuse: loose poison.

14.8 Prevent: the animals we live with

Never feed raw offal to a dog. Instead, burn or bury it the day of slaughter.

Never drink milk unboiled. Instead, a rolling boil held 5 minutes.

Never keep animal drugs on the human shelf. Instead, their own shelf, marked VETERINARY in red. Horse ivermectin paste holds about 38 human tablets.

1. Register every dog. A dog that bites is penned with food and water 10 days (22.4).

2. Vaccinate 70 in 100 dogs while vaccine lasts.
3. Culling, both lines: OR-10 grades it X, it fails as control. WO-13 left it unresearched. Unowned dogs:.
4. Worm dogs every 3 months if wormer is held. The library found no dog dose.
5. After a goat aborts, discard its milk 20 days. After a sheep, 8 days.
6. Gloves for births, abortions and slaughter. Lambing away from the house.
7. Pigs penned away from latrines. Pork to 71 °C, 74 °C to be safe. Cured pork:.
8. A pregnant woman never empties a cat's box, never eats raw meat.
9. Hens out of sleeping rooms at night.
10. Write down where every animal died, and why.

Grades. Dog vaccination A. 10 day watch B. Culling X (OR-10), C (IN-15). Cat rule in pregnancy C.

Rung ladder. Hands: the register, the rules. Hearth: the pot, the pen. District: vaccines. Refuse: raw offal, the cull.

If it goes wrong

- **Fevers in netted children.** Cause: a hole, an untucked corner, the net up on a hot night. Do: every net to the light today. Darn. Check the tuck at dusk.
- **Black sores after a dead cow.** Cause: the carcass opened for meat or hide. Do: healer today for all who touched or ate it. Burn the rest. Tell the district.
- **Lice or itch back within a month.** Cause: a person or bed missed, water not hot enough. Do: the whole house again on one day. Boil if no thermometer.

NUMBERS TO CARRY

- 36 hours: a tick removed sooner rarely passes Lyme (HY-06).

- 200 mg doxycycline once within 72 hours for an adult, 4 mg/kg for a child (HY-06).
- 54 °C for 30 minutes, better 60 °C, or a boil, for clothes with lice (HY-06).
- 51 in 100: protection from an intact net with nothing on it (HY-06).
- 10 to 14 days: rats die before plague comes. Fleas first (HY-06).
- 2 m pit (OR-10) or 60 cm of cover 90 m from a well (IN-16), disputed. Never open the dead.
- 5 minutes at a rolling boil for milk (IN-16).
- 70 in 100 dogs vaccinated. Culling X (OR-10), unresearched (WO-13).

THE LIBRARY

HY-06 Vectors: mosquitoes, lice, fleas, ticks, flies and rats. OR-10 Animals and the healer. IN-15 Rabies, leprosy, HIV, hepatitis and the incurable. IN-16 Zoonoses, food poisoning and the animals we live with. IN-08 Worms, lice, scabies and the skin parasites. IN-09 Malaria, nets and the full evidence. IN-05 Antibiotics: salvage, expiry, choice and stewardship. WO-13 Bites, stings and envenomation. SY-10 The harm register. SY-12 What the library could not find. All are on the website.

CHAPTER 15

The Epidemic

One case is the alert. The gate closes the same day or not at all. Cholera runs its course through a village in three weeks, measles in two months, influenza in six weeks.

OPENING

Every house has one place that every hand touches. It is the latch of the door, or the rim of the water jar, or the ladle that serves the pot. Bread goes from hand to hand at the table. The cup goes round. A child climbs from one lap to the next. A village of three hundred people is held together by touch more than by any rule, and most of the touching happens without anyone noticing it.

That touching is how a village lives. It is also the road an epidemic takes. Most of the illnesses that can empty a village travel on breath across the width of a room, on a hand from a latch to a mouth, or in the water that every household draws from one well. None of them needs a stranger with bad intent. They need only ordinary days: the meal shared, the sick visited, the body washed by those who loved it.

Every people that has met an epidemic has found the same hard answer. Shut the gate. Keep the stranger out and keep the sick apart. And every people has met the same trouble with that answer, because the oldest law of a village says the opposite. The traveller at the gate is fed. The sick are

visited. The dead are washed and sat with and carried by many hands. An answer that breaks those laws has to keep them somehow, or the village will not obey it for long.

The old pictures show how it was kept. A gate shut, and a basket passed over it. A boundary that nobody crossed, and food set down on it at a fixed hour for those beyond. A hut at the edge of the fields, and one person going in and out of it with water. Hospitality withheld and kept in the same act.

Today, count the hands that touched what you touched before noon: the latch, the cup, the bread, the coin. Notice how far your morning reached.

THE STORY

The forty days

The first written rule for closing a place against an epidemic has a date. On 27 July 1377 the Great Council of Ragusa, the walled port now called Dubrovnik, entered a decree in its statute book, the *Liber Viridis*. Whoever came from a place of plague was not to enter the city or its district until he had spent 30 days apart, on the bare islet of Mrkan or at Cavtat along the coast. The waiting was called a *trentina*, a thirty. Within a few generations the 30 days had become 40 for travellers by land, a *quaranta*, and the word went into every language of Europe.

Nobody then or since has found a medical reason for forty. The reasons on offer are the old doctrine of critical days, the numbers of the philosophers, and the forty days in the desert. What made the number work was its length. Forty days is longer than the time between catching and showing almost every acute epidemic disease. A traveller who came through it well had almost certainly brought nothing in.

Venice built the first permanent lazaretto, a hospital island for the waiting, in 1423. The Italian cities that followed built something larger than a building. They built standing health boards with the power to make rules, to close houses and to feed the people inside them. When plague came to

Florence in 1630, the board fed the poor it had shut in. Its outer cordon leaked past bored soldiers.

That is the first lesson of the long record, and it never changes. Closing costs little in materials and a great deal in trust and food. Every closing that lasted paid people to stay in. Every closing that only watched them leaked.

The stone above the village

On 6 September 1665 the parish of Eyam, a lead-mining village in the Derbyshire hills, buried a tailor, the first of its plague dead. The disease went slowly through the winter and rose again with the warm weather. On 24 June 1666 the rector, William Mompesson, and the minister he had replaced, Thomas Stanley, put a proposal to the village: that nobody should leave, so that the plague would go no further into the county. From about 1 July the village kept a boundary on the hills around it.

The Earl of Devonshire sent food to the edge. At a stone on the boundary the villagers left coins in holes filled with vinegar, and took up what had been left for them. The gate was shut, and the bread came over it. That is the picture the village has kept for three and a half centuries, and it is the right one. The quarantine that feeds the quarantined is the only quarantine that holds.

The figures under the picture are harder. Deaths rose from 21 in June to 78 in August, after the boundary closed. The last plague burial was on 1 November 1666, fourteen months after the first. The legend says five in six of the villagers died. A modern reading of the parish register, published by Whittles and Didelot in 2016, counts 257 plague deaths in a population of 689, about 37 in every hundred. It finds that most infections passed from person to person, not from rat fleas. The poor died more than the better off, and children were close to half the dead. Above all it finds the household. Sharing a house with a case was between 56 and almost 100 times more dangerous than sharing the village with one, the two figures coming from two places in the same paper.

Nothing in the register shows that the boundary saved Eyam. It held the disease among households that went on sharing rooms and beds, and Mompesson had sent his own children away. Whether it spared the villages beyond has never been measured. A historian who read the sources

in 2006 called the heroic story largely a later invention, built by poets and local writers a century and more after the event. What the register shows is narrower and more useful. The village paid the price of the boundary, and the price fell on the poor, on the children, and on the households of the sick.

The islands and the mountain town

The influenza of 1918 tested the closed boundary on a scale nobody could arrange. On 7 November 1918 the ship *Talune* was allowed to land sick passengers in Western Samoa. Between 19 and 22 in every hundred people there died, the worst national death rate of the whole pandemic. In American Samoa, a short sail away, the governor, John Martin Poyer, heard the news on the radio. Without waiting for orders from Washington he stopped travel to and from the neighbouring islands, and from 23 November every arrival was held for 5 days. American Samoa recorded no influenza deaths at all.

That is a natural experiment, not a trial. The two Samoas had different rulers, trade and chiefs, and the researchers say plainly that the reasons are not fully known. Across the other islands the pattern still runs one way. Where arrivals were held, a few died in every thousand, or none. Where they were not, tens died in every thousand, and in Western Samoa two hundred and twenty.

In the mountains of Colorado the county physician of Gunnison, Dr F. P. Hanson, did the same thing by road. In the autumn of 1918 he put barricades with lanterns across the roads, closed the schools and churches, and declared what the town called a quarantine against all the world. Anyone could leave. Nobody could enter without first spending 48 hours, later 5 days, apart. Through that winter the town had almost no cases. Schools reopened about 20 January 1919 and the town opened to outsiders on 5 February. In the middle of March at least 100 people fell ill, and five children died.

The cities teach the same lesson from the other side. Philadelphia closed its schools, churches and gatherings about two weeks later in its epidemic than St Louis did. At the worst week Philadelphia's deaths ran at 257 for every 100,000 people, St Louis's at 31. Over the autumn Phil-

adelphia lost 719 in every 100,000 and St Louis 347. No American city had a second peak while its first measures held. But the cities that kept their first peak lowest met a second one sooner and higher, once the measures were lifted. Closing buys time. It does not end a disease that is still in the world outside.

A vaccine, where one existed, did what no closing could. It made the people inside safe from the disease, so that the stranger at the edge carried nothing they could catch. The measles of the Faroe Islands in 1846, which chapter 6 tells, reached nearly everyone who had not had it before. A village that had kept its vaccinations would have had nothing to close against.

Mawah and West Point

In 2014 Liberia ran the experiment twice within six weeks, with the same disease, in the same country.

On 20 August 2014 the government sealed West Point, a crowded district of Monrovia with about 70,000 people, meaning to hold it for 21 days. Nobody had asked the people of West Point, and nobody had said how they would eat. A boy named Shakie Kamara, fifteen or sixteen years old by the different accounts, was killed by the security men at the barrier. The cordon was lifted after 10 of its 21 days.

Mawah lies inland in Bong County, a fishing village of about 800 people on the St Paul River, with its rice fields on the far bank. Ebola came on 31 August with a visitor who was already ill. A resident who had been in contact with him fell ill on 9 September and died. From 9 to 16 September it kept six households of contacts apart on its own authority. Six more people died between 17 and 20 September. From about 20 September the chair of the district's Ebola task force, a local physician, sat with the chief and the elders and explained what the disease was and how it passed. The paramount chief was asked to join the task force, not handed an order. Only after about ten days of talking was a quarantine of 21 days put to the village.

The elders raised two objections, and both were practical. If the river crossing and the markets closed, the village could not reach its fishing grounds or its fields. And its clinic had closed. Both were answered. A

nurse was paid to come two days a week. A ration for 45 days, rice, maize, beans and lentils, was promised, and the village leaders shared it out when it came. The river was regulated, not closed: open in the morning for the farmers, shut at midday, open again in the evening, with two named canoe pilots for every crossing and the other canoes chained to trees.

The quarantine began on 1 October, the day the sick were taken to a treatment centre in the capital. The clinic reopened on 11 October and the food arrived on 12 October. The quarantine was extended by ten days and ended on 31 October. In all the village had 22 cases and 19 deaths, and no new case from 3 October to 21 November. The investigators who wrote it up refused to claim that the quarantine ended the outbreak, because the sick left on the same days it began. What they did claim was a method. Explain. Bring in the leader people already follow. Propose. Listen. Meet the objections in goods. Only then begin. Ten days of talking for 21 days of closing is the ratio to expect.

The water and the dead

Some epidemics pass every boundary, because they travel in water and on hands. Cholera is the plainest. When it reached Haiti in October 2010, about 6 in every 100 people admitted to hospital with it died in the first weeks. By January the figure was under 1 in 100, because treatment centres gave enough of the right drink in time. In the villages it went differently. Of 87 cholera deaths studied in one region, almost half happened at home, most without anyone seeking care, and the middle time from the first watery stool to death was 12 hours. Most of those families had thought no care was needed. Without rehydration about fifty in a hundred people with severe cholera die, and with it under one. Chapter 5 teaches the drink, and chapter 13 the water and John Snow's map of 1854.

The dead follow other rules than the living. Most bodies are safe. A dead body is the result of an epidemic, not its cause, and the dead of a flood or an earthquake bring no plague. A few are dangerous: the haemorrhagic fevers, cholera and the other illnesses of the stool, plague, typhus and smallpox. In Biombo in Guinea-Bissau in 1994, villages that did not disinfect their cholera dead had 2.6 times as many new cases in the week after a funeral as villages that did, and eating at the funeral was among the

risks. In Kissidougou in Guinea, on 4 December 2014, about a hundred people washed, touched and kissed one body at a burial. In all, 85 fell ill and 63 died, and 79 in every hundred of the sick had touched only the other mourners. The gathering was the danger as much as the body.

The old answer to a plague grave was lime, and some modern advice still repeats it. The better evidence runs the other way. Lime slows the decay it is meant to hasten and burns the hands that spread it. A grave is made safe by its depth, by its distance from water, and by the care of the people who handle the body before it goes in.

And here the record speaks with one voice. When Liberia ordered the cremation of its Ebola dead in August 2014, families stopped bringing their sick, and by October 391 of 742 treatment beds stood empty. The sick were hidden and buried at night. The burial teams of that year learned to send, with the four carriers and the sprayer, three people in ordinary clothes: a supervisor, someone to speak with the family, and someone from the family's faith. More than half of their method was about the family. A slightly less safe burial that the family accepts is the safer rule.

The Honest Broker's Weighing

Five reports carry this chapter. HY-07 and IN-13 are the strongest, and they mostly agree, because IN-13 was written to follow HY-07 into the village. Both are honest that almost none of the record is causal: Mawah's investigators claimed no cause, the Samoas are a natural experiment, and the 1918 cities were compared after the event. The lessons the book takes from them are lessons of method, which stand better than any claimed effect.

They disagree with NU-07 on the grave. HY-07 and IN-13 put lime or ash in an epidemic grave and set it 50 metres from water. NU-07, which takes the dead as its subject, refuses lime as useless and harmful. It sets 50 metres as the least distance from a well, 30 from a stream, and 250 as the aim for a new burial ground. The Bench follows NU-07 and marks the figures. The two also differ on a typhoid death: NU-07 handles it as cholera, IN-13 as an ordinary death.

Three errors must not travel. IN-13 says that Mawah's food arrived before the checkpoint went up. Its own dates say otherwise: the quarantine

began on 1 October and the ration came on 12 October. The promise came first and the food on the twelfth day. IN-13 also says the first cases in Philadelphia and St Louis came two days apart, then gives dates eighteen days apart, and the draft uses neither. And it counts sixteen months between Eyam's first and last plague burials, where the dates give fourteen. HY-07 corrects its own brief: the Ragusan islet was Mrkan, not Mljet, and the source's word is *trentina*, where this chapter's brief has *trentino*.

OR-05's alarm counts are its own arithmetic and must be tried on a real season before anyone trusts them. FO-01's cholera record from Haiti is well measured in hospitals and undercounted outside them. Its usual death count, one in three or four months, comes from FO-01's ordinary year before the Fall, while the book's shared figure is 5 to 9 deaths a year without care. The Bench prints the monthly alarm both ways.

Three questions stay open, and the Bench says so. The camp threshold for meningitis, two cases a week in 30,000 people, cannot be scaled down to 300. In a village one case is the alert, and no report takes meningitis as its subject. Whether adults with cholera need more salt than the household drink gives is unsettled (R2-05). And no report can say how often a village of 300 meets an epidemic in a decade (R2-09). The library found no base for it. The untreated cholera figure of fifty in a hundred is the book's shared number. SY-12 lists a figure of 25 in a hundred, also in the library, as untraced.

What the draft supplied: the shape of the disease table, the meningitis and polio rows from scattered lines in other reports, and the sentence on what a vaccine would have done, which is general knowledge.

The turn to the present

In the century before the Fall, the closed boundary moved to the edge of the nation. It stood at airports and ports, and its instrument was the thermometer. At Hong Kong's border in one epidemic, 90 million travellers had their temperature taken, and two cases were found. The village no longer kept a register of its dead, because a district did. It no longer named its carers, because a hospital had nurses. It no longer agreed in advance who would decide to close, because a ministry would decide, on the evening news, for the whole country at once.

What that hid was the work underneath. A nurse on a ward noticed the first case. A delivery van fed the people kept at home. A firm with a licence buried the dead. When the van and the ward are gone, every part of that work comes back to the village, and none of it can be learned in the week the illness arrives.

Who will carry the food to the edge, and who will take it from there to the hut? A village that has answered before the first case has done most of the work already. The gate is shut and the bread goes over it, and both were decided while everyone was well.

Now open the register.

AT THE BENCH

15.1 See: the alert and the count

1 case of any of these is an alert. Watery stools with dehydration at age 5 or over. Fever with a rash, with bleeding, or with a stiff neck (see 06.1). Sudden weakness of a leg or an arm. A newborn who stops sucking and stiffens. A mother's death in pregnancy or within 6 weeks of a birth. Any newborn death. Illness where animals are dying. A traveller who arrives ill.

Do not wait for fever. In one epidemic, 1 in 4 first cases had none.

A cluster is an alarm at once. 2 deaths alike in 1 community within 2 weeks. 3 ill alike within 2 weeks in 1 house, water source or gathering.

1. Tell the healer the same day. The healer tells the district within 1 day. Who carries word is the village's rule.
2. Each Sunday, count the daybook codes against the usual count (chapter 36).

Usual count a week	Watch at	Alarm at
0 to 0.5	3	4
1	4	5
2	6	7

Usual count a week	Watch at	Alarm at
3	8	9

Watch is twice the usual plus 2. Alarm is twice the usual plus 3, or watch 2 weeks running.

3. Watch: visit each house with a case within 2 days. Check its water and latrine.
4. Alarm: call the meeting, open the epidemic page, send word to the district.
5. Deaths in a month: OR-05 sets watch at 2 and alarm at 3. On 5 to 9 deaths a year, 3 and 4. Both untested.
6. At every death, ask before the washing: days ill, fever, stool, bleeding, rash, stiff neck, others ill alike. Whether every death is reported first is the village's rule.
7. Keep the epidemic page: 1 line per case, with house, dates, first sign, water, contacts, carer, lived or died.
8. Read the counts aloud without names. Never write a cause that accuses. Write the family's words instead.

A 2nd stiff neck within 2 weeks of the 1st is an alarm. Give each sick person 1 carer, apart. Send word now.

- **Help in time.** An antibiotic within hours. Most live.
- **Help too late.** Comfort as below. Tell the family the illness moved faster than any carrying.
- **No help at all.** A dim, quiet room. Sips if able to swallow. 1 person stays day and night. Tell the family that before antibiotics most such patients died. Nothing they did caused it.

Rungs. Hands: the alert list. Hearth: a glass, a clock. Garden and still: nothing more. Dispensary: daybook, epidemic page, messenger. Infirmary: tests. Hospital: the laboratory. Refuse the doubling rule at village scale.

Grades: single case alerts B. Watch and alarm counts D. Doubling rule at 300 people X.

15.2 Do: stop it or ride it out

Name the route first. All times here.

Disease	Spreads by	Isolate until	Isolation does	Grade
Cholera, typhoid, dysentery	Stool, water, hands	No quarantine. Cholera stool clear in 98% by week 3	Nothing alone. Water, latrine, ORS	As a substitute X. ORS A
Measles	Breath, 4 days before the rash	4 days after the rash. Contacts days 5 to 21	Slows it only	Helps, does not stop
Influenza	Breath, before illness shows	7 days after fever. Contacts 4 days, will fail	Keeping it out early works	Strict closing B. Masks on all D
Typhus	Body louse	Until deloused (chapter 14)	Works once lice are gone	Burning bedding C
Plague, bubonic	Rat fleas	No isolation. Fleas and rats together	Nothing	Killing rats alone X
Plague, pneumonic	Breath	Through the illness. Contacts 7 days	Works. The strictest	None given
Meningitis	Droplets	The library gives no time	1 carer	None given
Polio	Stool	The library gives no time	Little. Only a vaccine stops it	None given
Haemorrhagic fever	Blood, fluids, the dead	3 days clear of fever. Contacts 21 days	Works if begun within 3 days	1 carer B. Safe burial B
Unknown	Breath and fluids	Contacts 21 days	Shorten once named	None given

Keep the waiting sick apart from the confirmed. Half the fevers will be malaria

or typhoid.

Rungs. Hands: sort by route. Hearth: soap, boiled water. Garden and still: hot water for clothes. Dispensary: hut, chlorine. Infirmary: tests that name the disease. Hospital: vaccines, given before. Refuse isolation in place of the latrine.

15.3 Do: isolation that feeds

Never burn charcoal in a closed room. Heat the hut with blankets, warm drinks and a vented fire instead.

See: a case of a disease that isolation stops (see 15.2).

1. Separate the sick person, not the family. Move infants, pregnant women and the old to kin.
2. Keep a nursing mother with her baby unless the disease passes in milk.
3. Site the hut over 100 m from houses and within 30 m of water. Give it a latrine (chapter 13).
4. Mark a clean side and a dirty side. Take coverings off in a set order, a helper calling the steps.
5. Name 1 carer per patient: a healthy adult, a survivor first. Never anyone pregnant, nursing, under 15, over 60 or chronically ill.
6. Others keep 1 m away, eat apart, do not touch, do not sleep near. Cover the patient's mouth with a cloth, boiled daily.
7. Bring the sick in within 3 days of the 1st sign. Run 2 carers a shift from a rota of 6 or more.
8. Feed each person kept apart 2,100 kcal and 15 litres of water a day. Add 300 kcal in pregnancy, 500 when breastfeeding.
9. Store about 380 kg of grain for 30 people for 21 days.
10. Set food and water at the boundary at a fixed hour. The bearer steps back 2 m, then the carer collects.
11. If the rule and the drink clash, the drink comes first.

Prevent: decide the isolation and the food in 1 meeting. End as in 15.2 and 15.4.

Rungs. Hands: distance, 1 carer. Hearth: cloth, soap, food store. Dispensary: hut, rota. Infirmary: gowns, gloves, 1.5 t of grain for 150 people for 3 weeks. Hospital: isolation wards. Refuse sprayed rooms and damp reused masks.

Grades: 1 named carer B. Food plan B (IN-13), C (HY-07). Cloth over the patient's mouth C. Damp reused masks on carers D, possibly X. Spraying rooms X.

15.4 Do: closing the village

Whether, when and against whom the village closes is the village's rule. This is how closing held when it held.

See: the disease is near, and not yet inside.

1. Close only while the disease is outside. Once inside, closing keeps it in. Against cholera, typhoid and dysentery it does nothing.
2. Decide on the day the 1st word arrives.
3. Agree it first with the leaders people follow. Hear the objections. Meet them in goods.
4. Plan food for everyone cut off, in the same meeting. Say the end rule and date aloud at the start.
5. Hold anyone entering apart for 5 days against influenza, or the contact time in 15.2.
6. Keep a regulated crossing for the fields: fixed hours, 2 named pilots, soap at the landing.
7. With over 1 in 10 of the village under watch, tracing has failed. Nurse and feed instead.
8. End after twice the longest incubation with no new case. That is 42 days if unknown, 14 for pneumonic plague, about 10 for cholera.
9. Then watch quietly for 90 days.

Prevent: name the committee, the rota, the hut site and the food store in peacetime.

Rungs. Hands: the agreement. Hearth: food for 3 weeks. Dispensary: register, messenger. Infirmary: the district reserve. Hospital: nothing for a village. Refuse sealing without food, fever screening, prison, blaming a family, killing cats and dogs.

Grades: agreeing with leaders first B. End rule at the start B. Food before closing

B (IN-13), C (HY-07). Fever screening X. Sealing without food X. Fines rising to prison D, trending to X.

15.5 Do: the epidemic dead

Never store bleach in a drink bottle. Keep it locked and labelled in its own container instead.

See: a death from a disease on the alert list.

1. Most bodies are safe with whole skin and gloves. Dangerous: haemorrhagic fever, cholera, dysentery, plague, typhus, smallpox, anthrax.
2. Put no lime or ash in the grave. HY-07 and IN-13 advise it. This book follows NU-07, which refuses it.
3. Dig 1.5 to 1.8 m, 2 m for haemorrhagic fever. Leave 1 m of earth over the body.
4. Keep the base 1 m above wet season water. Dig in pairs, never alone. Step the sides below 1.2 m.
5. Site graves 30 m or more from a stream and 50 m or more from a well. Never uphill of a well. Choose level or lower ground instead. Aim for 250 m. Where is the village's rule.
6. Handlers are well adults with whole skin. People with cut hands, and in a fever epidemic the pregnant, sit with the family instead.

Haemorrhagic fever death:

7. Send 4 carriers and 1 sprayer in full cover. Send 3 in ordinary clothes: supervisor, family speaker, faith speaker.
8. Ask the family's consent and wishes before anyone dresses.
9. Use 0.5% chlorine for body and fluids: 1 part 5% bleach to 9 water. For skin, 0.05%: 1 to 99. Bleach is often weaker than its label.
10. Bury the same day. The family watches from 2 m. Watch the team 21 days.

Cholera or dysentery death. NU-07 adds typhoid, IN-13 does not.

11. Wear gloves. Wipe the body with 0.5% chlorine. Serve no funeral meal. Bury within 24 hours. Washers cook for no one for 3 days.

Plague or typhus death:

12. Fleas and lice first. Tie the handlers' clothes at wrist and ankle, then boil them. Burn the bedding.

Influenza or measles death: the ordinary burial of chapter 31. Restricting it buys nothing.

13. Keep the washing, change the contact. Use gloves, water poured without touch, or a dry washing, as the faith allows. The family chooses.
14. Never cremate against the family's wish. Bury by their rite instead.

Rungs. Hands: the family's consent. Hearth: gloves, soap. Garden and still: spades, boards. Dispensary: bleach stock, burial book. Infirmary: body bags, a trained team. Hospital: the mortuary. Refuse lime, mass graves and forced burial.

Grades: safe burial with a family speaker B. Disinfected cholera bodies and no funeral meal B. Burnt bedding after plague or typhus C. Lime X. Burial limits for influenza or measles X. Forced cremation X.

15.6 Prevent: the water, the many sick and the count

Never give anything by mouth to a person who cannot swallow. Lay them on the side and wet the lips instead.

See: watery stool in an adult during an outbreak. Treat it as cholera. Death can come within 12 hours.

1. Chlorinate every water point: 4 ml of 1% stock per 20 litres (chapter 13).
2. Every case drinks ORS from the 1st watery stool. Amounts by weight are in chapter 5.
3. Whether adults with cholera need more salt than the household drink of chapter 5 is open (R2-05). That drink has about 51 mmol of sodium a litre, WHO's 75 or 90. In doubt, add water.
4. Keep stool and vomit out of all water. Wash with soap after every patient.
5. Nurse many sick in 1 place (chapter 24). Carers work in shifts and sleep between them.
6. At the end, count the ill and the dead by age, house and water source. Read it aloud without names.
7. Write what helped and what failed on the epidemic page. Send it to the district (chapter 36).

How often a village of 300 meets an epidemic: the library found no figure (R2-09).

Rungs. Hands: early drinking. Hearth: ORS, boiled water, soap. Garden and still: latrines. Dispensary: chlorine stock, sachets, a cholera bed. Infirmary: drip fluids. Hospital: vaccines and sewers. Refuse isolation in place of water treatment.

Grades: ORS A. Boiling or chlorinating water A. Household sugar and salt drink B.

If it goes wrong

1. **The isolation breaks.** People slip out at night to the market. Cause: no food, or no end date. Do: feed first, then say the date and the counting rule aloud.
2. **The hut spreads the illness.** New cases among people sent in with something else. Cause: the waiting mixed with the confirmed. Do: separate them at once, 1 carer each.
3. **The sick are hidden.** Deaths heard of only after burial, fewer reports, more rumour. Cause: forced burial, fines or blame. Do: the family's rite, no punishment for any entry, a speaker of the family's faith.

Numbers to carry

- **1.** 1 case is the alert: cholera, measles, paralysis, bleeding fever, stiff neck (OR-05, SY-12).
- **2.** 2 or more deaths alike in 1 community is the cluster rule (OR-05).
- **Twice plus 2, twice plus 3.** Watch and alarm on the weekly count (OR-05).
- **2,100 kcal and 15 litres.** A day, for each person kept apart (IN-13).
- **42 days.** No new case for this long ends an unknown epidemic, then 90 days of quiet watch (IN-13).
- **30, 50, 250 m.** A grave from a stream, from a well at least, and from a well as the aim (NU-07).
- **50 against under 1.** Deaths in 100 with severe cholera, untreated and with rehydration (IN-11, FO-01).

THE LIBRARY

HY-07 Quarantine and isolation: from Ragusa 1377 to Ebola 2014, what worked and what it cost. IN-13 Epidemic control without a state: 1918, Ebola, plague and the village. OR-05 Records, surveillance and noticing the outbreak: the village register. NU-07 Care of the body after death and the public health of burial. FO-01 What people die of when the system fails: mortality after collapse, siege and sanction. IN-11 Cholera, typhoid and dysentery: outbreak control and case management. HY-04 Where the waste goes: latrines, composting, night soil and the diseases of bad sanitation. SY-10 The harm register. SY-12 What the library could not find. All are on the website.

CHAPTER 16

The Long Infections

A cough of two weeks with weight lost is tuberculosis until proved otherwise. Untreated, it runs for years, and about seven in ten of those with bacilli in the sputum die of it. A numb hand is lost to burns and blisters, not to the disease, unless someone looks at it every night.

OPENING

Lay a fingertip on the edge of the table and draw it slowly along. There is the grain, a nick in the wood, a crumb, the cool of the surface. You did not ask for any of it. The hand reports anyway, all day, and acts before you know. It lets go of the hot handle. It loosens on the knife. It shifts the stone in the shoe before the skin opens.

That reporting is so quiet it seems like nothing. It is the reason a hand is still whole at the end of a working life. A hand that cannot feel is not weaker. It grips as hard and works as long. It goes on gripping when it should let go, and one year it is shorter by a finger.

Most illnesses in a household arrive and leave inside a week or two. A child is hot on Monday and in the yard by Saturday, or she is not. The illnesses here keep a different time. A cough that was a cold in October is still there at midwinter, and the man has taken in his belt twice. A pale patch on a forearm has never itched. A young woman had a sore that came and went, and now a rash on her palms that does not trouble her. Nothing in any of it is urgent today.

That is the difficulty. A household learns to live with the cough that stays. It pulls the coughing man's chair nearer the fire. It lets the baby sleep in the same warm bed. Over a winter the illness becomes one of the family, and it is shared out among the people who sit closest.

The work these illnesses ask for is slow and plain. A scale used every week. A lamp held over a foot every night. A window left open. A name written in a book. It is the work of months and years, and it is done by the people who live in the house.

THE STORY

The cough in the house

The disease had many names: consumption, phthisis, the white plague, the wasting. In 1882 Robert Koch showed in Berlin that a single bacillus caused it. By then it had lived in the houses of Europe for centuries. In England between 1871 and 1880 it caused 36.8 per cent of all deaths at ages 15 to 44. It took the young adults, the ones who carried the water and earned the wages.

What it does without drugs is known only from the years before the drugs, and the figures are estimates. Clinics and sanatoria followed their patients, and those patients were chosen: richer, earlier or sicker than their neighbours. Pooled, the cohorts say this. Of adults whose sputum held enough bacilli to see under a microscope, about seven in ten died within ten years. Of those whose sputum showed nothing, about one in five died. The rest recovered, some for good and some to cough again in a hard winter. The illness ran about three years on average to recovery or death, and the deaths came early.

It passes in the air. In Baltimore, in a study reported in 1959, the air of a six-bed ward was piped over cages of guinea pigs for two years, and 71 were infected. Nineteen of the 22 infections that could be traced came from two patients, both untreated, both with heavy sputum. In Lima in 2007 the rooms of old hospitals were measured. With the windows shut, the modelled risk to someone sharing a room with an infectious patient

was 97 in 100. In a high-ceilinged room built before 1950, windows and doors open, it was 11.

The child is in the most danger. Before the drugs, an infant infected in the first year went on to meningitis or disease through the whole body in 10 to 20 cases in 100, and to disease of the lung in 30 to 40 more. Tuberculous meningitis in a child was fatal before streptomycin, and nearly all the deaths came within 30 days. The cough that stays does its harm in the shared bed, at night, in winter, with the window shut against the cold.

The mountain and the village

The first answer was to take the patient away. Edward Trudeau, consumptive himself, built cottages at Saranac Lake in the Adirondacks in the 1880s, with mountain air, rest and food. Of 91 patients who stayed from three to 44 months, 19 were called apparently cured and 26 arrested. The results measured who came in as much as what was done.

Pendrill Varrier-Jones took another road. On 12 February 1918 he moved 17 patients into Papworth Hall in Cambridgeshire and built a village around them, with cottages, families and light work. A survey over 25 years found that none of the 108 children born in Papworth village developed progressive tuberculosis, though they had been infected. It is the strongest record from before the drugs that a family can live beside an infectious adult, if the house is aired, the sputum burned and the family fed and paid.

Food carried weight then and carries it now. In Jharkhand, in a trial published in 2023, the households of patients received monthly rice and pulses, and new disease among them fell by about four in ten. Patients who gained 5 per cent of their weight in two months were the ones who lived. Across American cities from 1900 to 1917, a state sanatorium went with a fall in deaths of about 4 per cent at most. The sanatorium removed the patient from the crowded home, fed him and taught him to burn his sputum. That was most of what it did.

Then came the drugs. In 1948 the Medical Research Council in London gave streptomycin to young adults with spreading disease, in the first properly randomised trial. At six months 4 of 55 treated had died against 14 of 52 on rest alone. By the same six months, 34 of the 55 treated carried ba-

cilli the drug no longer touched. One drug alone bred its own failure, and the answer was two or three together. In Madras from 1956, the Tuberculosis Chemotherapy Centre gave a year of isoniazid and PAS to patients from crowded streets, half in a sanatorium and half at home. Five years on, relapse was 7 in 100 at home and 10 in the sanatorium. The families at home were no more often infected, because most had been exposed before anyone knew. With drugs, the sanatorium added nothing. Madras never tested rest and food without drugs, and must not be quoted as proving them useless.

The hand that cannot feel

Leprosy is the most feared of the long infections. The bacillus grows slowly, passes poorly between people and takes years to show. It settles in the nerves of the hands, the feet and the face. It leaves a pale or reddish patch that cannot feel a wisp of cotton, and later hands and feet that cannot feel a nail.

For centuries the missing fingers were taken for the disease eating the flesh. Paul Brand, a surgeon working with Robert Cochrane at the Christian Medical College in Vellore from the late 1940s, looked closely and found otherwise. The fingers were lost to injury. A cut, a burn from a pot handle, a blister from a new hoe, a nail in a sandal: each went unnoticed because nothing hurt, became infected and reached the bone. Pain had kept the hand, and ordinary life without it did the damage. His conclusion was that close attention to the smallest injury would prevent it. From 1966 at Carville, Louisiana, he showed that most foot ulcers came from small pressures repeated all day, a tight shoe or a pebble.

The drugs came later. Dapsone alone helped from the 1940s, then failed as the bacillus learned to live with it. From 1981 WHO advised rifampicin, dapsone and clofazimine together, six months for the mild form and twelve for the heavy, and by 2005 some 14 million people had been treated. A person stops passing it on within days of the first rifampicin.

What the village must not repeat is the colony. On 6 January 1866 a schooner landed the first twelve patients at Kalaupapa on Molokai, under a Hawaiian law. About 8,000 people are buried on that peninsula, and

the law stood until 1969. In Norway known cases fell from about 2,850 in 1856 to 575 in 1901, and the fall was later found not to be explained by isolation. Compulsion drives the next case into hiding, which is the surest way to spread the disease. The patch on the forearm must be something a person can show a neighbour.

Blood, milk and the years

Some long infections give no cough and no patch. HIV and the hepatitis viruses B and C pass in blood, in sex and from mother to child, and for years they may show nothing.

Before the drugs, HIV took a median of about ten years to become AIDS in a person infected at 25 to 34, and death followed in one to two years more. Those figures come from countries with hospitals, and after the Fall the years will be fewer. In Abidjan in 1999, among 771 people with both HIV and tuberculosis, a cheap daily antibiotic, cotrimoxazole, cut deaths from 25.4 to 13.8 per 100 person-years. Pooled trials give about three deaths in ten prevented.

A mother with HIV and no drugs passes it to her child in 25 to 35 cases in 100, part in the womb and labour and part in the milk. In Durban in 1999, among 549 women, babies fed only at the breast were infected no more often than babies fed formula, while mixed feeding roughly doubled the risk. Hepatitis B runs against what parents expect. Caught at birth, it stays for life in about 90 to 95 cases in 100. Caught after the age of five, it stays in fewer than 5 to 10. A birth dose of vaccine within 12 hours prevents about three quarters of the infections passed at birth.

Hepatitis A and E travel in water, not blood. Hepatitis E is mild in most and kills pregnant women. In Darfur in 2004 it killed 31.1 in 100 of the pregnant women it reached. The needle that spreads B and C is the one the healer holds. WHO estimated that unsafe injections in the year 2000 caused about 21 million hepatitis B infections, 2 million hepatitis C and 260,000 HIV.

The false cure is the worst harm here. In South Africa a health minister offered garlic, lemon and beetroot while the drugs were held back. A later study estimated that more than 330,000 lives were lost between 2000 and 2005, a modelled figure.

Oslo and Tuskegee

Syphilis begins with a painless sore that heals by itself. Weeks later comes a rash, often on the palms, which also passes. Then, for most, nothing for years. In Oslo from 1891 to 1910, Cæsar Boeck withheld treatment from about 2,000 people with early syphilis, believing that mercury held back the body's own response. When 473 were traced from 1925, 27.9 in 100 had cleared it alone. A larger re-study in 1955 found late disease of the brain and nerves in 6.5 in 100, of the heart and great vessels in 10.4 and of skin and bone in 15.8. Its cruellest course is in pregnancy. Untreated, about two pregnancies in three end in a loss, an early or small birth, a dead newborn or a child born infected.

At Tuskegee, in Macon County, Alabama, from 1932 to 1972, 399 Black men with syphilis were watched and not treated. Penicillin was kept from them after it became the standard in 1947. When a newspaper story ended the study in 1972, 28 had died of syphilis directly, 40 wives had been infected and 19 children had been born with it. Oslo was an honest error in a time without a cure. Tuskegee was a choice made against one.

One injection of long-acting penicillin cures early syphilis, and given in pregnancy it prevents about 97 in 100 cases in the baby. That injection belongs to the district, and the price of keeping it there is counted in babies. Gonorrhoea has outrun drug after drug. In China ciprofloxacin failed against 12.7 per cent of strains in 1995 and 93.8 per cent by 2003, and by 2020 the reliable cure was an injection.

The commonest of these infections is the plainest. A bladder infection in a woman burns and sends her to pass water every hour. In trials of a dummy tablet, about half of women felt better by the third day on nothing at all. The kidney is another matter. Fever with pain in one flank means the infection has climbed, and once it reaches the blood it kills 10 to 20 in 100 even in hospital. Cranberry, the household favourite, cuts the return of infection by about a quarter in women who keep getting it, and helps children too. It does nothing for the old in care, in pregnancy or for a bladder that cannot feel, and it treats no infection already present.

The Honest Broker's Ledger

IN-10 is the anchor for tuberculosis and is careful about its limits. It corrected its brief in four places: Görbersdorf opened in 1854 or 1855, not 1859, the 1948 trial counted deaths at six months, and the years 1882 for Forlanini and 1884 for Trudeau are unconfirmed. Its untreated odds, 70 and 20 in 100 over ten years, are weighted means of cohorts that ranged from 53 to 86, and a re-analysis gives about 63. The brief asked for a half who die, a quarter who recover and a quarter who linger. That rule is not in the library, and the chapter prints the library's figures instead. IN-10 gives no tablet table for children, only doses per kilogram, and the Bench says so. Its ethambutol dose is 15 or 20 mg per kg by WHO table, and both are printed.

IN-15 corrected its brief on cotrimoxazole. The deaths prevented in Abidjan belong to Wiktor's trial of 1999, not to the companion trial by Anglaret, which showed fewer illnesses but no fewer deaths. It gives Brand's book as 1985, not 1980, and dates his work at Vellore only to the late 1940s. Karigiri and the year 1947 from the brief are not in the library.

IN-14 could not find the brief's 8 and 19.5 per cent for infertility after pelvic infection, and the chapter uses neither. It gives nitrofurantoin twice or three times a day, and both are printed. It answers the brief's cranberry that does not work with a narrower truth from a 2023 review of 50 trials, and the Bench grades it by group. MA-11 holds the discharge that is not from sex, CH-10 the ringworm patch a healer might take for leprosy. IN-08 gives the one warning the leprosy Bench needs: steroids can wake a dormant gut worm, Strongyloides, decades after a stay in a warm country.

SY-10 has no row of its own for these infections and no course length to set against IN-10's, so nothing is printed twice on that ground. SY-12 records that the potency of tuberculosis drugs and antiretrovirals past their date is unknown. The library has no figure for a kidney infection without antibiotics, and none for HIV with no hospital at all.

The turn to the present

In a town with a clinic, these illnesses meet a test and a packet of tablets. An X-ray finds the tuberculosis and six watched months of tablets cure it. A blood test finds HIV, and one pill a day turns ten years into a long life.

A swab names the infection of sex, and an injection cures it. The modern way cured or held most of these and made them invisible.

The village will have the long cough back, and the numb hand, and the young man thinning for no reason. It will have a register, a scale, a window, food, a microscope at the district while the stain lasts, and a shelf of salvaged courses that will not last. Who holds that shelf, and who receives the last full course, is for the village and the owner to decide.

Is that enough? For the numb hand and for most bladders, nearly. For tuberculosis without drugs, it keeps the children safer and the patient fed, and seven in ten with bacilli in the sputum still die. For HIV, a cheap daily antibiotic buys some years, and nothing buys the decade back. Most of what follows is nursing, food and watching.

The cough that stays will outlast any shelf. The household that lives with it can still keep it from the children, feed the one who coughs and write his name down. Now the hands. ## At the Bench

16.1 See: the illness that stays

Ask how long, what weight was lost, and who sleeps beside them. Weigh on the same scale every week. Write it down.

Sign	Means	Go to
Cough over 2 weeks, age over 10, with weight loss, night sweats, evening fever or blood	Tuberculosis until proved otherwise	16.2
Child under 5: not growing, fever over 2 weeks, or a coughing adult at home	Tuberculosis in the child	16.2, 16.3
Pale or red patch that cannot feel cotton, or a thick nerve	Leprosy	16.4
Itchy ring, scaly edge, normal feeling	Ringworm	Chapter 26

Sign	Means	Go to
Genital sore, discharge, or pain low in a woman's belly	Infection of sex	16.5
Fever 38 °C or more with pain in one flank	Kidney	16.6 now
Yellow eyes with drowsiness, confusion or bleeding. About 80 in 100 die	Liver failing	District now

Grades. The 2-week cough rule B. The cotton test B.

Rung ladder. Hands: questions, scale, cotton. District: smear, 2 samples. Hospital: X-ray, culture, blood tests. Refuse: waiting on a cough past 2 weeks.

16.2 Do: tuberculosis in the house

Never give a leftover tuberculosis tablet for a cough. Instead, send every tablet to the dispensary for full courses (16.3).

For as long as the cough lasts, without drugs:

1. He sleeps alone in the airiest room. Window and door open.
2. No child under 5 in that room. No shared bed with any child.
3. Cough into cloth. Spit into a lidded pot. Burn the contents daily.
4. Sit together outdoors, not indoors.
5. Feed him about 1,200 kcal and 52 g protein a day above usual food, 6 months or more.
6. Feed thin adult contacts 5 kg rice and 1.5 kg pulses a month, about 750 kcal a day.
7. Weigh weekly. Aim for 5% gain by 2 months: 50 kg becomes 52.5 kg.
8. Send 2 sputum samples to the district, one at once, one on waking. A negative smear does not clear him.
9. Register: name, date, weight, who sleeps near.

Comfort: warm drinks, honey only over 1 year, propped up at night. No plant cures it.

Grades. Open windows B. Separate sleeping B. Food for contacts B. Pelargonium, koumiss, garlic D.

Rung ladder. Hands: window, pot, scale. Hearth: fire for the sputum, food. Garden and still: pulses and grain. Dispensary: register, lockbox. District: microscope, drugs. Hospital: culture. Refuse: tablet scraps, plant cures, sending the patient away by force.

Danger sign: coughing blood. A cupful at once, or over 600 ml in a day. Lay him on the bleeding side, where he feels the gurgle. Keep the mouth clear. Measure in a marked cup, with the time.

- **Help in time.** The district has tranexamic acid and sometimes blood, as aids only. Send a card: amounts, times, side.
- **Help too late.** He arrives pale and breathless. Send the card anyway. The district can still ease him.
- **No help at all.** Massive bleeding kills 50 to 100 in 100 untreated. Stay. Use dark cloths so the blood frightens less. Hold his hand. Tell the family a vessel in the lung gave way, and nothing they did caused it.

16.3 Do: the salvaged tuberculosis course

Never start a course you cannot finish. Never rifampicin alone, never isoniazid alone. Never add one new drug to a failing course. Instead, count the stock and treat fewer people completely.

The dispensary or district holds the stock, never in households. When not all can be treated, the district decides who. The library's order: a child with meningitis or spread disease, then a sputum-positive adult with children at home, then others. Potency past the date is unknown.

Course: 4 drugs daily for 2 months, 56 doses, then 2 drugs daily for 4 months, 126 doses. A named person watches every swallow and writes it on a card.

Weight (adults must be weighed)	Four-drug tablet daily, months 1 and 2 (isoniazid 75, rifampicin 150, pyrazinamide 400, ethambutol 275 mg)	Two-drug tablet daily, months 3 to 6 (isoniazid 75, rifampicin 150 mg)
Under 30 kg	District only, by mg per kg	District only
30 to 39 kg	2	2
40 to 54 kg	3	3
55 to 70 kg	4	4
Over 70 kg	5	5

Per kg, adults: isoniazid 5, rifampicin 10, pyrazinamide 25 mg. Ethambutol 15 mg, or 20 mg in WHO's 2006 table. Children, at the district: isoniazid 10, rifampicin 15, pyrazinamide 35, ethambutol 20 mg. The library has no tablet table for children.

A 50 kg adult needs 168 four-drug and 378 two-drug tablets (3 × 56, 3 × 126). 500 four-drug tablets alone complete no one's course.

1. Missed dose: add it at the end. Never double it.
2. Pyridoxine 25 to 50 mg daily with isoniazid, 100 mg if the feet tingle.
3. Rifampicin turns urine orange and weakens the contraceptive pill.
4. Weekly: yellow eyes, dark urine, vomiting, pain under the right ribs. Any one: stop all drugs, go to the district.
5. Monthly: each eye on a fixed letter chart. Any fall: stop ethambutol.

Streptomycin is an injection and stays at the district. Never in pregnancy.

Work every dose twice, with two people.

Grades. Full watched course A. Partial course X.

Rung ladder. Hands: the watched swallow. Dispensary: count, card, scale. District: smears, streptomycin. Hospital: resistance tests. Refuse: single tablets, courses started on hope.

Danger sign: the child with fever and a stiff neck in a house with a cough. Headache, vomiting, drowsiness, a fit, or a bulging soft spot. Carry the child to the district now. This child has first claim on the stock.

- **Help in time.** The district starts the full course. With streptomycin alone in 1948, 64 in 100 still died by 6 months.
- **Help too late.** The child cannot be woken. Send a card: fever start, fits, who coughs at home.
- **No help at all.** Before the drugs this was fatal, mostly within 30 days. Nurse in a quiet, dim room. Spoon fluids if the child swallows. Turn every 2 hours. Tell the family the illness was in the house before anyone knew, and no one is to blame.

16.4 Do: the numb hand and foot

Never walk barefoot on a numb foot. Never test water with a numb hand. Instead, wear soft shoes always and test water with the elbow.

Test as in the Opening, with cotton. Eyes closed, touch the patch with a wisp. No feeling: suspect leprosy.

Every evening, for life:

1. Look at hands and feet by lamplight: cracks, blisters, redness, heat.
2. Soak 20 minutes in water tested with the elbow.
3. Rub off hard skin. Oil while damp.
4. Shoes soft, never tight. A finger slides in at the heel. Fit them at day's end.
5. Pad tool handles. Lift pots with a thick cloth.
6. Ulcer: no weight on it at all. Measure weekly. No smaller in 2 weeks: the offloading is not complete.

Salvaged drugs, from the dispensary, rifampicin swallowed before the healer once a month. 5 patches or fewer, smear negative: 6 months. More than 5, a thick nerve, or smear positive: 12 months. Who receives the last course is decided at the district.

Weight (age if no scale)	Rifampicin, monthly, watched	Clofazimine, 12-month course	Dapsone, daily
Under 40 kg (under 10 years)	10 mg/kg	6 mg/kg monthly plus 1 mg/kg daily	2 mg/kg
40 kg or more, aged 10 to 14	450 mg	150 mg monthly plus 50 mg daily	50 mg
40 kg or more, aged 15 or over	600 mg	300 mg monthly plus 50 mg daily	100 mg

One full course beats three part courses. Never spread dapsone thinly. Dapsone with pallor, breathlessness or dark urine: stop it. Clofazimine darkens the skin. Say so first.

Reaction: sudden nerve pain, new weakness or numbness. Splint, rest, and prednisolone from the district within 6 months. Before any steroid, rule out a long cough. Over 15 kg and ever in a warm country: ivermectin 200 µg per kg once, first. Test nerves monthly for a year, then every 3 months.

No separation. Eat together, work together. Contacts aged 2 and over: one rifampicin dose at the district cuts their risk by about half for 2 years.

Grades. Evening inspection and oil B. Soft footwear B. Combined drugs A. Contact dose A. Chaulmoogra oil as a cure X.

Rung ladder. Hands: cotton, lamp, shoe. Hearth: warm water, oil. Garden and still: nothing that cures. Dispensary: smear, nerve register, drugs. District: prednisolone, casts, contact doses. Hospital: surgery to restore a hand. Refuse: colonies, compulsion, chaulmoogra.

16.5 Do: infections of sex

Never treat pain low in a woman's belly as infection until ectopic pregnancy is ruled out. Instead, ask about her last period and see 12.1.

Ask alone, without judgement. Treat the partner the same day. Record the syndrome, not the germ.

Syndrome	Village, by mouth, the same for every adult, no weight bands	District, by injection
Genital sore, treated as syphilis	Doxycycline 100 mg twice a day, 14 days, not in pregnancy. Pregnant: erythromycin 500 mg 4 times a day, 14 days, and the newborn treated. Add azithromycin 1 g once for chancroid	Benzathine penicillin 2.4 million units once, half in each buttock
Discharge from the penis	Cefixime 400 mg once, with doxycycline 100 mg twice a day for 7 days or azithromycin 1 g once	Ceftriaxone 250 mg (WHO 2021) or 500 mg (MSF, CDC) once, with the same tablets
Pain low in the belly, fever, cervix tender when moved	Doxycycline 100 mg twice a day and metronidazole 500 mg twice a day, 14 days	Ceftriaxone added. Pregnant: district only
Grey or frothy discharge with a smell	Metronidazole 500 mg twice a day, 7 days. Fails 10.9 in 100, a single 2 g dose 18.6	

Thrush: 12.4. Salvaged penicillin, amoxicillin, tetracycline and ciprofloxacin: assume they do not cure gonorrhoea.

What the district rung costs. In pregnancy the injection prevents about 97 in 100 cases of syphilis in the baby. Tablets do less, and erythromycin does not fully reach the baby. A village far from the district pays in stillbirths. Carry every pregnant woman with a sore, now or before, to the district once.

At the district: adrenaline ready, 30 minutes watched after penicillin,

never into a vein. Day 1 fever, in up to 40 in 100, is the Herxheimer reaction. Paracetamol, adult 1 g. Keep treating.

Swollen groin gland with a sore: the district draws the pus by needle through healthy skin. Never cut it open. The newborn's eyes are chapter 11's.

Grades. Treatment by syndrome B. Ceftriaxone A. Benzathine in pregnancy B. Condoms B. Douching X.

Rung ladder. Hands: asking, condoms. Hearth: wash outside only. Garden and still: no cure. Dispensary: tablets. District: injections, antenatal checks. Hospital: tests. Refuse: douching, mercury, injections at the village.

16.6 Do: the burning water and the kidney

Never give nitrofurantoin for fever with flank pain. It does not reach the kidney. Instead, give the kidney course and send to the district.

Bladder: burning, frequent, no fever, no flank pain, a woman not pregnant.

1. Drink 2 to 3 litres a day. Wait 48 to 72 hours. About half are better by day 3 on nothing.
2. Not better, or worse: 1 course.

Who	Drug and dose	Length
Woman, not pregnant, no weight bands	Nitrofurantoin 100 mg three times a day (MSF) or twice a day (guidelines), or fosfomycin 3 g once	5 days
Pregnant	Nitrofurantoin as above, stopped at 36 weeks, or cefixime 200 mg twice a day	7 days, cefixime 5
Girl aged 2 or over, by weight	Cefixime 8 mg/kg once a day	3 days

Who	Drug and dose	Length
Under 2, any boy or man	District	

Nitrofurantoin never in the last month of pregnancy, under 3 months of age, or with G6PD lack.

Kidney: fever 38 °C or more, pain in one flank. Child, pregnant, man, vomiting, faint, or not better in 24 hours: district now.

1. District: ceftriaxone 1 g, or gentamicin 5 mg/kg, into muscle once. Then ciprofloxacin 500 mg twice a day, 7 days. Child: ceftriaxone 50 mg/kg.
2. Tablets only: cefixime 200 mg twice a day, 10 to 14 days.
3. Adult drinks 1.5 litres a day. No ibuprofen.

A catheter gathers bacteria at 2 to 7 in 100 a day. Catheters are chapter 28's.

Grades. Extra water B. Cranberry for women with repeated infections A, children too. Cranberry in the old in care, pregnancy, a numb bladder, or as treatment X. D-mannose X. Bearberry (*Arctostaphylos uva-ursi*) leaf tea D: never over 7 days, under 18, in men, pregnancy, breastfeeding or kidney disease.

Rung ladder. Hands: water, the wait. Garden and still: cranberries. Dispensary: tablets. District: injections. Hospital: cultures. Refuse: nitrofurantoin for fever.

Danger sign: the kidney. Fever, shaking, flank pain, vomiting.

- **Help in time.** The district gives the injection, then tablets for 7 days. Send a card: temperature, pulse, what was given and when.
- **Help too late.** Confused, cold, pulse racing: blood infection. Even in hospital 10 to 20 in 100 died. Send the card anyway.
- **No help at all.** The library has no figure for this untreated. Give the cefixime or ciprofloxacin the shelf holds. Fluids by mouth. Paracetamol by weight. Stay. Tell the family the infection climbed from the bladder, and no one is to blame.

16.7 Prevent: blood, milk and the open window

Never use one needle, blade or razor on two people. Instead, one each, steamed at 121 °C for 20 minutes (chapter 1).

1. Never share razors or toothbrushes. Cups, plates and towels are safe. Hepatitis B carriers need no separate dishes.
2. Condoms while they last: about 4 in 5 fewer HIV infections.
3. Mother with HIV, or thought to have it: breast only for 6 months. No water, no porridge.
4. Newborn of a hepatitis B carrier: vaccine within 12 hours, where the district can give it.
5. Jaundice in 2 or more people in a week: boil all water, move pregnant women to the cleanest source. Water is chapter 13's.
6. Adult with HIV, known or thought: cotrimoxazole 960 mg once a day, the same for every adult. Children: the district, by weight. Rash with fever, blisters or a sore mouth: stop for ever.
7. Salvaged antiretrovirals are held centrally. Either fewer people continue longer, or all share and stop together. Never stop and restart again and again. Efavirenz or nevirapine: stop it 7 days before the rest, grade C.
8. Boil all milk. The cow's tuberculosis is chapter 14's, BCG chapter 17's.
9. Ask every pregnant woman about sores at the first visit (16.5).
10. The register stays closed, held by the healer.

When the shelf is empty, HIV runs about 10 years, then 1 to 2. Tell the truth in four steps. What is certain. The time. What will be done. No demand to accept it today. The end is chapter 31's to nurse.

Grades. One needle each A. Breast only B. Condoms B. Cotrimoxazole A. Birth dose A.

Rung ladder. Hands: needle, breast, window. Hearth: steam, boiled milk. Dispensary: cotrimoxazole, condoms. District: vaccine, antiretrovirals. Hospital: tests. Refuse: garlic, lemon or beetroot for a drug.

If it goes wrong

1. **The course stopped at 6 weeks.** Looks like: the cough back within months, worse. Cause: the shelf ran out, or he felt well and stopped.

What to do: never restart with one drug. Send to the district. Count before the next course.

2. **A kidney treated as a bladder.** Looks like: shaking and vomiting by day 2 on nitrofurantoin. Cause: flank pain missed. What to do: stop it, give the kidney course, carry to the district.
3. **A numb foot burned or blistered.** Looks like: a blister after a soak or a new shoe. Cause: water tested with the foot, a tight shoe. What to do: no weight on it, clean, cover, look daily, test water with the elbow.

NUMBERS TO CARRY

- 2 weeks of cough with weight lost: tuberculosis until proved otherwise (IN-10).
- 7 in 10 and 2 in 10: untreated deaths in 10 years, sputum positive and negative, estimates (IN-10).
- 56 then 126 doses, each watched. Never one drug alone (IN-10).
- 960 mg cotrimoxazole a day: about 3 HIV deaths in 10 prevented (IN-15).
- 25 to 35 in 100: HIV from mother to child without drugs. Breast only for 6 months (IN-15).
- 97 in 100: congenital syphilis prevented by one district injection (IN-14).
- 48 to 72 hours: the bladder's wait, with water, if no fever (IN-14).

THE LIBRARY

IN-10 Tuberculosis without streptomycin: the sanatorium, the sun and the honest outcomes. IN-15 Rabies, leprosy, HIV, hepatitis and the incurable: what can be done honestly. IN-14 Sexually transmitted and urinary infections. IN-08 Worms, lice, scabies and the skin parasites: cheap treatments. MA-11 Women's health across life: menstruation, pelvic pain, fistula, prolapse and menopause. CH-10 Skin: eczema, psoriasis, fungal infection, leg ulcers and acne, and the topicals that work. SY-10 The harm register. SY-12 What the library could not find. All are on the website.

CHAPTER 17

Vaccination Without a Factory

A vaccine in a cold cellar keeps for months or years and nobody knows which, the body's memory keeps for decades, and two doses of tetanus toxoid in a pregnant woman protect her baby through the one month it needs them.

OPENING

Many adults carry a small round scar high on one arm. It is a little sunk, paler than the skin around it, sometimes the size of a fingernail and sometimes smaller. It was made in childhood, in a minute, by a nurse who was gone by lunchtime. If you have one, find it with a fingertip and notice how little it asks of you.

The scar is the only part of that morning anyone can see. The rest happened inside. Cells in the skin met something they had not met before, a weakened germ or a harmless cousin of a dangerous one. They took its measure. A few of them were set aside and kept, and they are still there, waiting for a meeting that may never come. The body remembers what it has met.

That memory is the cheapest medicine there is. It needs no shelf and no key. It travels with the person, inside the person. It carries no printed date. Its one weakness is that someone had to arrange the first meeting, and arranging it safely took more than a nurse.

It took a factory that grew the right germ and weakened it to the right degree. It took a laboratory that tested every batch for strength and for anything that should not be there. It took a chain of refrigerators running from the factory door to the clinic, never too warm and never frozen. And it took arms, and someone to find them. Three of those four live in buildings that need power and roads. The fourth lives in every village.

Somewhere in every town there is a refrigerator with a few hundred doses in it. Small glass vials of tetanus toxoid, clear or faintly cloudy. A tray of measles vaccine as a dry pellet, with its water in separate ampoules. Some vials carry a printed square inside a printed circle, and the square darkens slowly with heat. When the power stops, the refrigerator becomes a cupboard. The vials inside are not yet useless. Nobody can say when they will be.

The people who carry the scar were taught early. Their bodies still hold the lesson.

THE STORY

The scab and the scratch

Smallpox killed about one in seven of those it reached in an ordinary city epidemic, and blinded or scarred many who lived. Those who survived never had it twice. People noticed this long before anyone could say why, and put it to use. In China, powdered scab was blown into the nose, a practice in writing by the sixteenth century. In Constantinople in 1717, Lady Mary Wortley Montagu watched old women scratch matter from a smallpox blister into children's arms, and wrote home about it. The practice came to be called variolation.

It reached Boston by another road. Onesimus, a West African man enslaved in the household of the minister Cotton Mather, told Mather he had been given a small dose of smallpox as a boy, and showed him the mark. When smallpox came to the town in the spring of 1721, Mather urged the physicians to try it. One agreed. Zabdiel Boylston began with his own son and two enslaved people of his household, and went on to inoculate more than two hundred others. About six of them died. In the town

at large, 5,759 of about 10,600 people caught smallpox and 844 died, about fourteen in a hundred. Among Boylston's patients the rate was about two, though the sources give anything from one to two and a half. The gap was wide.

It was not a trial. Those who chose to be inoculated were not like those who did not, and the counts were kept by men who wanted the method to succeed. Still, two against fourteen was hard to dismiss, and the practice spread. English inoculators later made the cut smaller and the dose lighter, and claimed deaths below one in five hundred. Historians still argue over how far to trust that figure.

There was a cost beyond the deaths. The inoculated person had real smallpox, mild, and could pass it on at full strength. A physician in Madrid pointed this out in 1784. Variolation protected the person who chose it and endangered the street. As a private gamble it was reasonable. As a public measure it seeded epidemics.

Nature has since closed the question. The last natural case of smallpox was a hospital cook in Merca, in Somalia, in October 1977, and the world was declared free of it in 1979. There is no wild smallpox left to inoculate with. If it ever returned, from a laboratory or a frozen grave, whether a village would do what Boston did is not a question this chapter settles alone. The book gives no method.

The cowpox chain

In May 1796, Edward Jenner, a country doctor in Gloucestershire, took matter from a cowpox sore on the hand of a dairymaid, Sarah Nelmes, and put it into the arm of James Phipps, aged eight. Six weeks later he inoculated the boy with smallpox. Nothing happened. Dairymaids had long said that cowpox kept smallpox away. Jenner tested the saying, but on few people. His book of 1798 rested on twenty-three cases, and only three of them were challenged with smallpox. His own evidence was thin. The evidence of the next two centuries was not.

Cowpox was mild and did not pass from person to person through the air. It had one problem. Cows with cowpox were rare. The answer was the human arm. A vaccinated child grew a blister in about a week,

and the clear fluid from that blister would vaccinate the next child. The chain had to be kept going, arm to arm, every week or so, or it died.

In November 1803 a ship left Corunna to carry the vaccine to Spain's American colonies. The physician Francisco Xavier de Balmis took twenty-two foundling boys, aged three to nine, and vaccinated them two at a time as the ship crossed the Atlantic, so that a fresh blister was always ready. Isabel Zendal, the rector of their foundling house, sailed with them and cared for them. The chain reached Venezuela, then New Spain, and later the Philippines. In all about sixty-two children carried it, and four of them died. In New Spain about 100,000 people were vaccinated, perhaps a fifth of those who could have been. The chain had held.

The voyage is usually told as a story of generosity, and it was one. It is also the plainest record of what an arm-to-arm chain needs. It needed children who had never been vaccinated, held back for the purpose. Where they were not offered, it took them: soldiers at Veracruz were ordered to the needle. And it needed someone in each port to keep the chain alive after the ship sailed. In Caracas a vaccination board was founded in 1804, and vaccination went on. Where no one took it up, the chain died within months. Balmis wrote that the vaccine had done not the least harm. He was wrong.

In June 1861, in the village of Rivalta in Piedmont, sixty-three children were vaccinated over a few days from the arm of one infant who looked well. The infant had syphilis from birth. Of the sixty-three, between forty-one and forty-six caught it, several died, and they passed it to their mothers and wet nurses. The arm carried whatever was in the blood, and nobody could see it. Britain banned arm-to-arm vaccination in 1898 and moved to lymph grown on calves. The arm chain is not a fallback. It passes on whatever the next child cannot be tested for.

What a village cannot make

A vaccine factory does four things. It obtains the right germ or toxin and weakens or kills it to the right degree. It tests every batch for strength, for sterility and for the wrong organism. It keeps the product cold from its door to the arm. And it finds the arms. A village of three hundred can do only the last.

The first three have been tried without a factory, and the record is plain. In 1885 Louis Pasteur treated a boy of nine, Joseph Meister, with a rabies vaccine made from rabbit spinal cord, and the boy lived. The vaccines made after his pattern, from the brains of sheep and goats, were given for most of the next century. They left between one and seven of every thousand people who received them with damage to the nerves, sometimes paralysis, and an imperfectly killed batch could give rabies itself. The World Health Organization asked for them to be replaced everywhere. Of all vaccines, this is the one a frightened village might think it could copy. It cannot.

In Lübeck, in the winter of 1929 to 1930, the laboratory of the city hospital prepared BCG, the tuberculosis vaccine, for newborn babies. Of 251 babies given it by mouth, 77 died, 67 of them of tuberculosis. A virulent strain from Kiel had been kept in the same room, and it had got into the vaccine. Nobody had tested the batch on an animal first. Two doctors were sent to prison. That laboratory had trained staff, incubators, microscopes and electricity. No dispensary after the Fall will have more.

In the Punjab in 1902, nineteen villagers were inoculated against plague from one bottle, and all nineteen died of tetanus. In St Louis in 1901, diphtheria antitoxin drawn from a horse that had tetanus killed thirteen children. In Bundaberg, in Queensland, in January 1928, twelve of twenty-one children died after injections from one bottle that had been opened and kept, and in which a germ had grown. The same thing happened in India in the 1990s and again in 2008, with measles vaccine mixed and kept too long. In April 1955 Cutter Laboratories in California released polio vaccine in which some of the virus had not been killed. It paralysed children who were given it, and others in their families, and killed some of them. The counts differ by source, from about 200 cases with 11 deaths to fewer than that among the vaccinated themselves. None of these places was a village.

Cutter was a licensed factory with a written method. Lübeck was a hospital. Both failed at the step a village cannot take at all, which is the test. What a village can make, in vaccines, is nothing. That is not modesty. It is the record.

The last vials

The vaccines already made are a different matter. Someone else made them and tested them. They need only to be kept, counted and given well.

Their lives differ. Tetanus toxoid is the hardiest. It keeps more than three years in a refrigerator, a year and a half at eighteen degrees, and months even at thirty-seven degrees. Dried measles vaccine keeps about a month at room temperature and a week at body heat. Once mixed with its water it must be used within six hours. Oral polio vaccine lasts about two days at thirty-seven degrees. The printed square on the vial darkens with heat, and when it matches the circle around it, the vial has had too much. The square knows nothing of cold.

Cold is the danger nobody expects. Tetanus toxoid and hepatitis B vaccine are bound to a fine powder of aluminium salt that clumps when frozen. After one freezing, toxoid in one study held about four fifths of its strength, and after two, about two fifths. A cool box packed hard against ice can ruin a tray in a night. A cellar that freezes in winter is the wrong place.

The best store a village has is under its feet. Two metres down, the ground holds close to the year's average temperature. In a temperate summer a cellar reads about eight to thirteen degrees, and there toxoid may keep a year and a half or longer. A spring box does the same if the jars are sealed and their lids sit above the water. In the tropics no cellar falls much below the mid twenties, and every clock runs faster.

Then the printed date passes. For tablets, the date marks the end of the time the maker proved the drug held most of its strength, not the day it turns harmful. For vaccines nobody has measured what comes after. No published study has tested tetanus toxoid past its date. Its strength is unknown, and probably not zero. A dose past its date cannot be counted as protection. This is the honest answer, and the book prints it as one.

So the doses must be spent in an order. The clearest bargain is toxoid for mothers. Two doses in pregnancy, four weeks apart, cut the deaths of newborns from tetanus by about ninety-four in a hundred. The mother's protection crosses into the baby, and the baby needs it for one month only, until the cord has healed. A village of three hundred sees perhaps six to nine births a year. A hundred doses given only to mothers would last six years or more. The cellar's clock is shorter than that. So the surplus

goes next to those whose work puts soil and dung into wounds. Toxoid given at the moment of a wound does not protect a person who was never vaccinated, not in time for that wound. It protects them for the next.

Rabies vaccine is held for bites, because one vial, given in small doses into the skin, can treat one bitten person. Five vials are five people. Measles vaccine goes to infants, and around an outbreak to those near it. That order is the library's reasoning, not a law. Who decides it, and how it is reviewed, is for the village to settle and say aloud once a year, with the year the toxoid will run out spoken in public. Rationing done in secret is how stock leaks away.

Under this book's rule, no vaccine is injected below the district. The healer at the infirmary gives it. When no healer is within reach, the vials stay sealed in the cellar and the logbook goes on. The village keeps what needs no needle: the clean cord, the wound left open, the sick child kept apart.

When the memory fades

The body remembers what it has met, but not everything for the same length of time. After a full course of tetanus toxoid the memory lasts about ten years, and after five doses it may last for life. Measles, from the vaccine or the disease, leaves memory that lasts for life in most people. Protection against whooping cough, from the vaccine or the illness, fades within a few years. A full course of polio vaccine protects for decades. So does hepatitis B vaccine, once it has taken. For an adult vaccinated as a child, much of the past still counts.

That is why the end of the cold chain does not bring every disease back at once. Each returns on its own timetable.

Tetanus returns at once, because it never left. It lives in soil and dung and needs no other person. The newborn's cord is its first door, and the wound is its second, and chapters 11 and 18 hold those doors. Even with a hospital, in one Mogadishu series, a quarter of adults with tetanus died.

Measles needs a supply of children with no memory, and every year adds some. In a district of three thousand, about a hundred a year. Within about two years there may be enough for an epidemic, and within five

for a large one. It kills between one and twelve in a hundred children it reaches, more among the hungry. Chapter 6 tells how to nurse it.

Whooping cough came back fastest wherever trust in the vaccine fell. In Britain, when coverage fell from about three children in four to three in ten in the 1970s, more than 100,000 cases followed, and thirty-six deaths. It kills babies in their first months, before any vaccine could have protected them.

Diphtheria takes longer, five to twenty-five years, as the adults' memory thins. After the Soviet Union broke apart, cases rose from about 1,400 in 1990 to more than 50,000 a year, and about 4,000 people died. Before antitoxin, a quarter to a third of those who caught it died.

Polio paralyses about one in two hundred of those it infects, and five to ten in a hundred of the paralysed die. Smallpox does not return. It is gone.

The Honest Broker's Weighing

One report carries most of this chapter, and it is careful but second-hand. HY-10 tells the history from Boston to Cutter from modern summaries. It did not read the primary works it names: Fenner's history of smallpox, Razzell on English inoculation, Pacchiotti's account of Rivalta, or Nathanson and Langmuir on Cutter. The figures wander as a result, and the chapter prints the wandering. Boylston's death rate appears as one to two and a half in a hundred. Rivalta's count is forty-six, forty-four or forty-one of sixty-three. Jenner's date is the fourteenth or the seventeenth of May. The Punjab deaths are dated March or October 1902. Cutter's count is about 200 cases by the surveillance tally and fewer by Offit's. I chose none of these, and the verification rows ask for the primary sources.

The second gap is the one that matters most at the Bench. HY-10 found no study of toxoid potency after its printed date, and neither IN-05 nor OR-06 has one. SY-12 lists it among the gaps no second round can close, because nobody in the world has measured it, and sends it to R2-06 only to confirm that. The Bench therefore prints "unknown" in the column, with a rule not to count such a dose. The cellar figures come from OR-06 and HY-10 through secondary sources, and OR-06's spring house figure was never measured.

The library is divided on frozen toxoid. WHO says to discard any vial known to have frozen. HY-10, reading a study of recruits who all reached protection on frozen toxoid, says frozen toxoid given as a full course beats none for a person never vaccinated. The Bench prints both and settles neither. The order of the last doses is HY-10's own reasoning, not a published rule. How long the memory lasts in an adult, vaccine by vaccine, the library hardly addresses at all, and those lines are general knowledge, marked. So are the births a year in a village, the toxoid ladder by number of doses and the stock arithmetic. No report on this chapter's shelf carries a recorded error. SY-10's harm register lists home vaccine making as an exclusion, and the Bench follows it.

The turn to the present

For three generations vaccination was something done for a family, not by it. A letter came, an appointment was made, a nurse took a vial from a refrigerator and the scar followed. The factory, the batch test and the cold van were never seen. The diseases were not seen either, which was the point. And when the diseases had gone from memory, some parents began to fear the needle more than the illness, because only the needle was in front of them. What does a village remember when nobody living has watched a child die of whooping cough?

Now the order of things is reversed. The vials will run out, some in months, some in years, none on a date anyone can print. The memory already taught will last much longer, in some people for life. The work is to keep the last vials cool and never frozen, to give them in an order the village chose aloud, to write down who has been taught and what, and to make no vaccine at all. The body remembers what it has met. The village must remember the rest, on paper. Now the cellar and the logbook.

AT THE BENCH

Work every dose twice, with two people.

17.1 See: the illnesses that come back

Look for these. Any one is danger.

1. A baby 3 to 14 days old stops sucking. The jaw clenches. The body arches at a touch. See chapter 11.
2. A stiff jaw or spasms days after a wound. See chapter 18.
3. A grey patch in the throat that bleeds when scraped. A swollen neck. Diphtheria.
4. Coughing fits ending in a whoop or vomiting. A baby who stops breathing or turns blue. Whooping cough.
5. Fever, then a leg or arm that goes floppy. Polio.
6. Fever, red eyes, then a spreading rash. Measles. See chapter 6.
7. After a vaccine session: 2 or more people ill within hours. Or abscesses from 1 lot.
8. A stiff neck or wasting in the weeks after a vaccine. Suspect the lot. See chapter 16.

Signs 3, 5, 6, 7 and 8 are alerts. Tell the healer today and the district within a day. See chapter 15.

- **Help in time.** Infirmary: antitoxin for diphtheria, antibiotics, sedation for tetanus. Many live.
- **Help too late.** Comfort as below. Tell the family the illness moved faster than any carrying.
- **No help at all.** A quiet room. 1 carer always present. Sips only if able to swallow. Diphtheria: keep the person lying flat and still. Tell the family: without care, most newborns with tetanus die. A quarter to a third with diphtheria die. Nothing they did caused it.

Grades: the signs above B. Lying flat in diphtheria B.

Rungs. Hands: the signs. Hearth: the family page. Garden and still: nothing. Dispensary: the register. Infirmary: antitoxin, antibiotics, vaccine. Hospital: breathing support. Refuse home-made serum of any kind.

17.2 Do: keep the salvaged vials

Never let toxoid or hepatitis B vaccine freeze. Instead, store it in a cellar or spring box that stays above 2 °C. Never pack a vial against ice. Instead, wrap it in 2 layers of cloth inside the cool box.

1. Fetch refrigerator stock on day 0 or 1 of the 7 day salvage route. See chapter 32.
2. Log each lot: vaccine, lot number, expiry, doses, where found, hours above 25 °C.
3. Read the square on each vial. Inner square lighter than its circle: usable. Same or darker: discard.
4. Store at least 2 m down, below frost. Vials in sealed jars. In a spring box, lids above water.
5. Read the thermometer at dawn and at the hottest hour. Write both.
6. 1 keeper, 1 second key. A sealed spare key with the council.
7. A second person counts the vials each month.
8. Lot suspected frozen: the healer shakes it beside a vial of the same lot frozen on purpose. Faster settling means frozen.
9. Known frozen: WHO says discard. The other reading: a full frozen course beats none for the never vaccinated. Healer decides.

Vaccine	2 to 8 °C	20 to 25 °C	37 °C	Frozen	Past the printed date
Tetanus and diphtheria toxoid	Over 3 years	Months	Months	Ruined	Unknown
Hepatitis B	Over 4 years	Months	Weeks	Ruined	Unknown
Measles, dry	2 years	1 month	1 week	Not harmed	Unknown
Measles, mixed	6 hours	Under 6 hours	Under 6 hours	Not applicable	Discard
BCG, dry	1 to 2 years	Months	Loses 1 fifth a month	Not harmed	Unknown
Oral polio	Up to 1 year	Weeks	2 days	Not harmed	Unknown
Rabies, cell culture	3.5 years or more	No figure	1 month	No figure	Unknown

Table figures. Cellar at 8 to 13 °C: toxoid 1.5 years or more.

Grades: cellar store C. Spring box C. Vial square B. Shake test B. Clay pot cooler: C in dry air, D in humid air.

Rungs. Hands: carry, log. Hearth: thermometer, jars, cloth. Garden and still: cellar, spring box. Dispensary: keeper, key, logbook. Infirmary: shake test, doubtful lots. Hospital: a refrigerator at 2 to 8 °C. Refuse the freezer and the hot shed.

17.3 Do: the vaccine session

Never inject a vaccine in the village. Instead, bring people to the healer's session at the infirmary. Never use 1 needle or syringe for 2 people. Instead, 1 new needle and syringe for each person.

The healer gives every dose. No healer within reach: the vials stay sealed. Keep the logbook. Use chapters 6, 11, 15 and 18.

The village's part:

1. Bring each person's family page (17.5).
2. Tell the healer: pregnant? Badly ill or starving? Weak immunity? A bad reaction to a vaccine before?
3. Live vaccines are measles, BCG and oral polio. Never in pregnancy or weak immunity.
4. Mixed vaccine: write the time on the vial. Discard at 6 hours or session end, whichever comes first.
5. Opened liquid vial: discard at session end.
6. Gather people before a vial is opened. A 10 dose vial opened for 1 person wastes 9.
7. Watch each person 15 minutes. Adrenaline in the room. See chapter 22.
8. Write: name, date, vaccine, lot, giver. In the register and the family page.

The same dose at every weight.

Weight	Vaccine	Dose	Ceiling	Interval	Age, only if no scale
Any	Tetanus toxoid	0.5 ml into muscle, by the healer	0.5 ml a dose	17.4	Any age
Any	Measles	0.5 ml, by the healer	0.5 ml a dose	2nd dose at least 4 weeks later	From 9 months. From 6 months in an outbreak
Any	BCG	0.05 ml under 1 year, 0.1 ml from 1 year, by the healer	As dose	Once	At birth. See chapter 16
Any	Hepatitis B	0.5 ml, by the healer	0.5 ml a dose	Birth dose	Within 24 hours of birth. See chapter 16
Any	Rabies	Chapter 22	Chapter 22	Chapter 22	Chapter 22

Table figures.

Grades: 1 needle each A. Discard at 6 hours A. The 15 minute watch B. Shared needle X.

Rungs. Hands: the questions, the watch. Hearth: the family page. Garden and still: nothing. Dispensary: register, adrenaline. Infirmary: the healer gives every dose. Hospital: the factory and the cold chain. Refuse a shared needle and a vial kept overnight.

17.4 Do: the last doses

Never give the last toxoid to whoever asks first. Instead, follow the order the village agreed aloud.

The order, to be settled by the village:

1. Tetanus toxoid to pregnant women.
2. Toxoid to those whose work puts soil or dung into wounds.
3. Rabies vaccine held for bites. 1 vial treats 1 person. See chapter 22.
4. Measles to infants of 9 to 12 months.
5. Measles to those near an outbreak.
6. BCG to newborns. See chapter 16.
7. Hepatitis B at birth. See chapter 16.
8. Everything else.

Every toxoid dose: any weight, 0.5 ml, ceiling 0.5 ml (17.3).

Dose	Gap after the last	Protects for
1st	At first meeting	Nothing yet
2nd	At least 4 weeks	1 to 3 years. In pregnancy, at least 2 weeks before the birth
3rd	At least 6 months	About 5 years
4th	At least 1 year	About 10 years
5th	At least 1 year	Most of adult life

Table figures. A woman with 2 doses in an earlier pregnancy needs 1 more in this one.

Toxoid at a wound does not protect the never vaccinated in time. Give it anyway if held. It protects next time. See chapter 18.

The arithmetic, each year:

1. Count doses held: vials times doses per vial.
2. Mothers' need: births a year times 2. A village of 300 has about 6 to 9 births.
3. Years of stock: doses divided by need.
4. Compare with the cellar's years in 17.2.
5. More stock than cellar years: the surplus goes down the order.
6. Say aloud, once a year, the year the toxoid runs out.

Example: 100 doses, 8 births, 16 doses a year. 100 divided by 16 is about 6 years. The cellar gives 1.5 years or more. Plan on the shorter time.

Grades: toxoid in pregnancy A. Toxoid at the wound for the never vaccinated D for that wound. A public order B.

Rungs. Hands: the count. Hearth: the ledger. Garden and still: the cellar. Dispensary: the order, read aloud. Infirmary: the healer gives the doses. Hospital: new stock. Refuse private favours from the cellar.

17.5 Prevent: the family page, and nothing made

Never make a vaccine from a scab, a blister, an arm, an animal or a brain. Instead, keep the clean cord (chapter 11), the open wound (chapter 18) and isolation (chapter 15). Never expose a child to measles or chickenpox on purpose. Instead, keep the sick child apart and nurse them (chapter 6).

1. Keep 1 page in the family book for each person.
2. Write the name and birth year.
3. Write every vaccine remembered, with its year.
4. Write measles, chickenpox and whooping cough had, with the year.
5. Write each toxoid dose and its date.
6. Copy the page into the village register. See chapter 15.
7. Recorded as vaccinated is not proof. Keep isolation rules for everyone.

Smallpox is gone. If it returned, variolation is the owner's and the district's question. This book gives no method.

Grades: family page B. Variolation B for the person, X as a public measure. Arm to arm X. Home vaccine X. Nerve tissue rabies vaccine X. Measles party X. Chickenpox party D.

Rungs. Hands: memory, asked aloud. Hearth: the family page. Garden and still: nothing. Dispensary: the register. Infirmary: the healer's record. Hospital: factory vaccines. Refuse every home-made vaccine.

If it goes wrong

1. **Frozen toxoid given.** The vial looked normal. Later, a vaccinated mother's baby gets tetanus. Cause: ice contact or a freezing cellar. Do: the shake test on every doubtful lot (17.2). Log it. Give a fresh course if stock allows.
2. **Abscesses or illness after a session.** Hot swelling at the site within days, or several ill within hours. Cause: a shared needle, or a vial kept too long. Do: stop the session. Keep the vial. Raise the alert (chapter 15).

3. **A vaccinated child with measles.** A child on the register falls ill. Cause: dead stock, a wrong record, or the gap before the dose. Do: nurse and isolate as any case (chapter 6). Check that lot's log.

NUMBERS TO CARRY

- **2 doses, 4 weeks apart.** Toxoid in pregnancy, the second at least 2 weeks before the birth (HY-10).
- **94 in 100.** Fewer newborn tetanus deaths after 2 maternal doses (HY-10).
- **Never frozen.** 1 freezing costs toxoid strength. A cellar that freezes is the wrong place (HY-10, OR-06).
- **2 m.** Cellar or spring box depth, vials in sealed jars (OR-06).
- **6 hours.** Mixed vaccine is discarded after this (HY-10).
- **15 minutes.** Watch each person after a dose, adrenaline in the room (HY-10).
- **2 years.** A measles epidemic becomes possible after vaccination stops (HY-10, SY-09).
- **Unknown.** Toxoid potency past its printed date (HY-10, SY-12).

THE LIBRARY

HY-10 Vaccination with no factory: variolation, arm-to-arm, rabies and what is honestly possible. OR-06 Stockpile, storage and the dispensary's shelf. IN-05 Antibiotics: salvage, expiry, choice and stewardship. IN-12 Measles, whooping cough, diphtheria and the childhood killers. SY-09 The salvage list and the first year. SY-10 The harm register. SY-12 What the library could not find. All are on the website.

PART FIVE

Injury

CHAPTER 18

Stopping the Bleeding and Cleaning the Wound

A bleeding limb can kill in minutes. A tourniquet must be reviewed by two hours and the limb may be lost by six. A wound closed on the first day may kill within three.

OPENING

Lay the flat of your hand on your forearm and press, as if something under it were running out. Hold it there. Notice how soon the arm wants to move and how soon the hand wants to lift and see. Within a minute the pressing is dull. Within three it aches. The hand that stays is harder work than it looks.

A man catches his thigh on a scythe. A child goes through a pane of glass. A woman slips with the axe in the woodshed. The blood is brighter than anyone expects, and there is more of it. The first person to reach them does not need to know anything about vessels or clotting. They need to put a cloth and a hand on the place the blood comes from, lean their weight on it, and not let go.

Most bleeding stops under a hand. Some does not, and for that there is a strap and a stick, which hurt, and save a life, and if left too long take the limb.

After the bleeding comes the slower danger. A wound that looks clean carries soil, threads of cloth, and the seeds of rot that live in dung. Sewn shut on the first day, it can go bad from the inside before the week is out. Left open, washed until the water runs clear and covered loosely, it usually heals, slower, with a wider scar.

So the work here comes in two halves, and both are a kind of staying. The first is ten minutes of pressure without lifting to look. The second is days of watching a wound left open, with a hand ready to open it again if it turns. There is a smell to a wound that is mending and a smell to one that is not. There is a jaw that will not open a week after a nail went through a boot. Anyone who looks every day can learn them. Neither half needs much. Both need someone who does not go away.

THE STORY

The oil that ran out

Surgeons of the early sixteenth century were taught that gunpowder poisoned a wound, and that the cure was oil of elder poured in nearly boiling. Ambroise Paré was a barber surgeon of about twenty seven with the French army at the siege of Turin in 1537, though some accounts put it a year earlier. After a day of heavy wounds the oil ran out. He dressed the rest with what he had, a cold salve of egg yolk, oil of roses and turpentine, and lay awake expecting those men to be dead of poison by morning.

At first light he went to them. The men with the cold salve had slept, with little pain and no swelling. The men he had scalded lay feverish, swollen and in great pain. He resolved never again to burn the wounded so cruelly, and he told the story in his books for thirty years.

It was not a trial. Which man got which dressing depended on when the oil ran out, and nobody counted. But the lesson outlived the salve. A wound is not made safe by hurting it. Later Paré made a second change of the same kind. At amputations he tied the cut vessels with thread instead of searing them with a hot iron. Thread and pressure close a vessel. Fire closes it too, and kills the flesh around it.

The salve has no modern support, and boiling oil and the hot iron are now counted among the harms. What remains is a way of standing at a wound: gentle with the flesh, hard on the dirt, and patient.

A strap and a stick

The tourniquet is nearly as old. A German field surgeon drew one in 1517, a stick to twist it appears before the end of that century, and a French surgeon at the siege of Besançon in 1674 is said to have tightened a band with a stick to stop a limb bleeding. For most of the twentieth century the strap had a bad name. Limbs were lost to bands left on for a day, and armies taught their medical orderlies to press and hold instead. As late as 2001 American army medical teams were still taught not to use one.

John Kragh, an army orthopaedic surgeon, counted. For seven months in 2006 he and his colleagues recorded every casualty with a major limb wound at a combat hospital in Baghdad, 2,838 people. Of these, 232 had tourniquets, 428 of them on 309 limbs. Kragh sorted them by one sign that anyone can feel, the pulse at the wrist. When the strap went on while that pulse could still be felt, nine in ten lived. When it went on after the pulse had faded, one in ten did. Five people who needed a tourniquet and never got one all died. Nerve damage followed in fewer than two in a hundred, no limb was lost to the strap alone, and bands left on for up to about two hours did no measurable extra harm. A larger count of 499 people from the same wars gave 96 in a hundred against 4.

The strap does not need a soldier. At the Boston Marathon on 15 April 2013, two bombs went off near the finish. Bystanders and first responders tied 27 tourniquets, every one made from belts and cloth, and none of the wounded who reached hospital alive died there.

Those figures need their edges stated. The soldiers were mostly young men, with surgeons hours away at most. Shock kills in its own right, so part of the gap between nine and one is the gap between the less and the more badly hurt, not only the timing of a strap. In the Sahel of Burkina Faso, where the wounded took almost twelve hours on average to reach care, a count of 100 casualties found that about one tourniquet in twenty was both needed and well placed. More than half of 24 amputations were made higher up the limb because of the band, and three of five deaths

came from the tourniquet itself. In a city with surgeons minutes away, one study found no benefit at all.

The strap is also easy to get wrong. On a training limb a shirt tied tight without a stick failed in 79 tests of 80. With a stick twisted in, it still failed about one time in three, and craft sticks snapped in half the tests. What holds is a band as wide as a hand, a rod of hardwood or iron, and a person who keeps twisting past the point where it hurts.

So the tourniquet saves lives where an artery is open and a surgeon is hours away, and it costs limbs where it stays on for days or goes on where pressure would have done. Both are true at once.

The wound left open

The wounds of 1914 were made in fields that had been manured for centuries. Shell fragments drove soil and cloth deep into muscle, and surgeons trained in clean city theatres cleaned and closed them as they would at home. Gas gangrene followed. The flesh swelled, darkened and crackled, a thin brown fluid ran from the wound, and men died within a day or two. By June 1915 British surgeons were reporting that cutting away every scrap of dead and dirty flesh and leaving the wound open cut the deaths from open thigh fractures from about eight in ten to under two. Gas gangrene fell from five or six wounds in a hundred in 1915 to about one by 1918.

Josep Trueta was a surgeon in Barcelona when the city was bombed during the Spanish Civil War, between 1936 and 1939. In three days of 1938 the city took 2,200 casualties. Building on the work of an American surgeon, Trueta made a method a tired team could repeat. Scrub the skin around the wound with soap, water and a nailbrush. Cut away all dead tissue, early, within six hours if possible. Leave the wound open, laid with greased gauze. Put the limb in plaster without padding and leave it shut for weeks, and do not open it for a fever alone. Close a wound at once only if the work was early and thorough, the edges meet without strain, and the same surgeon can watch it for a week.

He published in English in 1939. Of 1,073 open fractures, six people died, and gas gangrene was seldom seen. The lesson was learnt again in every war after. In northern Italy in 1944 about 25,000 wounds were closed several days after cleaning, and about one in twenty failed. In Korea

gas gangrene struck fewer than one wound in a thousand. Red Cross surgeons in today's wars close a wound after four or five days, almost never after eight, and only when it is clean. They judge it first by the person and then by the wound. Someone who is eating, smiling and sitting easily in bed is usually healing. The dressing comes off dry and dark, the base below is red and bleeds a little, and the smell is sharp but not foul. A grey base, pus and a rotten smell mean washing again and waiting.

The reason lies in the germs. A single stitch lowers the number needed to infect a wound by many times over. Gas gangrene grows in shut, airless, dead flesh, and it can show itself within six hours, usually within a day. A wound left open lets air in and pus out.

Washing has its own record. A Red Cross field manual puts the rule plainly: "If you can drink it, you can put it into a dirty wound." Trials agree. Clean tap water and sterile salt water infect wounds at about the same rate. In the largest trial of washing open fractures, 2,551 of them, high pressure, low pressure and simple pouring from a hung bag did equally well, and soap in the wound did worse than salt water: about fifteen in a hundred needed another operation, against about twelve. Soap belongs on the skin around a wound, not in it. What matters is the volume, and the patience to keep pouring.

The stiff jaw

Tetanus lives as spores in soil and dung. A nail through a boot in a byre, a splinter under a nail, a crushed finger, a wound packed with earth: the small deep wound is the worst, because the spore needs a place without air. Days later its poison locks the muscles while the mind stays clear. The jaw clamps, the back arches, and every touch or noise sets off a spasm. The person is awake through all of it. Death comes when the breathing muscles lock.

David Bruce, who studied tetanus for the British army, counted the cases among the wounded in France. In September 1914 about nine in every thousand wounded men developed tetanus. Antitoxin, injected after every wound, began in mid October, and by December the rate had fallen to about one and a half in a thousand. Once the disease had set in, half or more still died. Then came the toxoid, which teaches the body to

make its own antitoxin. The American army adopted it in 1941 and recorded twelve cases in the whole of the Second World War. Elsewhere the disease kept its old strength. Among Japanese prisoners in Manila in 1945, 473 fell ill with tetanus and 389 died. Surviving it gives no protection, and the next nail can do it again.

Without any care, tetanus kills almost everyone it takes. In a hospital with a breathing machine, one or two in ten die. Hospitals in Africa lose about four in ten. What lies between those figures is mostly nursing: a dark quiet room, turning, a clear mouth, sedation that does not tip into stopped breathing, and someone at the bed through two or three weeks. There is also a test that needs only a clean flat stick, laid against the back of the throat. A person without tetanus gags and pushes the stick out. A person with tetanus bites down on it. In 400 patients the bite was there in 94 in a hundred with tetanus and in none without.

Here the hand that stays does its longest work. It presses on nothing. It sits through nights in a darkened room, keeps the mouth clear, turns the body every few hours and does not leave when the spasms come.

The Honest Broker's Strap

The four wound reports can be trusted with a life on the figures that matter. WO-01 read the Kragh papers and the improvised strap tests and states their limits. WO-02 and WO-03 agree on the open wound and the late stitch, and their washing trials are large. WO-14 says openly that its First World War tetanus figures come from secondary summaries of Bruce, and the draft marks every one.

Four places are thin. The 3.8 cm minimum width for a tourniquet, which is quoted everywhere, could not be traced to any study by WO-01. SY-07's wall card says at least 4 cm and WO-01's kit asks for at least 5 cm. The Bench prints 3.8 cm as the library's floor, teaches 5 cm or a hand's width, and marks both. Trueta's record is given two ways: WO-02 counts 976 good and 91 poor results among his 1,073 fractures, and WO-03, through a later account, gives 6 deaths and 4 amputations. They count different things and do not conflict, but neither report read Trueta's own book. Paré's ligature, which the brief names, is in no wound report. WO-09 credits it to WO-02, which does not carry it. The draft supplied it from

general knowledge and marks it. A smaller slip: WO-03 sends the reader to WO-12 for honey, but honey is WO-02's.

Two lines are disputed. The smaller is boiling instruments. WO-03 and FO-11 give 10 minutes, WO-12 gives 20. SY-12 reads 20 for instruments, without settling it. The Bench prints 20 with 10 beside it, both, and teaches the pressure cooker as the real sterilising step.

The larger dispute is the strap itself. SY-01, the case against lay medicine, lists the tourniquet among the things the book must refuse to teach. Its reasons are serious. Its evidence on tourniquets comes from snakebite, where nearly half of victims in 71 studies had one and those who did fared worse. Lay skills fade: 39 in a hundred trained nurses failed to place one six months later. The Red Cross surgeons, who work where evacuation takes days, write that tourniquets save lives but endanger limbs. The Sahel count shows what happens when the strap goes on too often and stays on too long. One review advised against improvised straps for civilians. Almost every study comes from young men in rich armies with surgeons near.

WO-01, SY-05 and FO-06 answer that the five who needed a strap and lacked one all died, that 77 of 232 preventable deaths in one military review had no tourniquet, and that a limb bleed is decided in minutes by whoever is standing there, which is SY-05's clock rule. Both camps put pressure and packing first. The difference is what comes after. The standing default of this book follows WO-01: the tourniquet is taught, with a stick and the time written on the skin, as the military teaches it, and with conversion and restraint, as the Red Cross teaches it. It is never taught for snakebite.

The draft supplied the invitation, the order of the Bench, Paré's ligature and the three branches.

The turn to the present

In a hospital a bleeding limb is a few minutes of work. A nurse presses, a surgeon ties the vessel, blood comes from the bank. A wound is cleaned in theatre and stitched by someone who will see it tomorrow and open it if it turns. That is why the first day stitch is safe there. It was never the stitch that was safe. It was the watching behind it.

The hospital hid that. It also hid how long ten minutes is, because nobody in a ward presses for ten minutes alone. After the Fall the watching is the village's, and so is the pressing. The price is real. More limbs will be lost to straps left on, more wounds will heal slowly with wide scars, and some people with a stiff jaw will die who in a hospital would have lived on a breathing machine. What does a village owe the man with a locked jaw and no antitoxin? A dark room, a quiet house, and someone at his side, day and night, for as long as it takes. Some live through it. Many more never get it, because the wound was cleaned and left open.

The hand that stays is the whole of it, at the wound and at the bed. Now the cloth.

AT THE BENCH

18.1 See: the bleeding and the shock watch

Bleeding that kills spurts or pours. It soaks a cloth in minutes. Or a limb is torn off or crushed.

Count every 15 minutes. Write each count with the time.

Sign	Alarm
Pulse, 15 seconds times 4	Over 100, then rising
Wrist pulse	Gone: shock, the line between 90 and 10
Breaths, 30 seconds times 2	Faster at each count
Mind	Confused or quarrelsome, then quiet

An adult with a pulse of 120 to 140 and no wrist pulse has lost 1.5 to 2 litres.

A pink nail bed misleads early. Do not trust it.

Lay the person flat. Bleeding from the face: sit up, lean forward. Cover them. Below 35 °C blood clots poorly. Warm with bottles no hotter than 40 to 42 °C. Never warm a limb under a tourniquet.

Chest, belly and head: chapter 21. After birth: chapter 9.

Rung ladder. Hands: the counts, the clock, warmth. Hearth: blankets, bottles, a written sheet. District: blood from walking donors. Refuse: pouring in fluid to raise a pulse.

18.2 Do: pressure and packing

Never lift the cloth to look before 10 minutes. Instead, put a fresh cloth on top and press harder.

1. Shout for help. Note the time.
2. Glove or bag the hand if one is near. Do not wait for one.
3. Put a folded clean cloth on the wound.
4. Press with the heel of the hand, elbow locked, your weight over it.
5. Press for at least 3 minutes. Aim for 10.
6. A deep hole in a limb, armpit or groin: push cloth in, down to the bleeding.
7. Fill it until the cloth stands 2.5 to 5 cm above the skin. Press 3 minutes more.
8. Bind a firm bandage over it. Check the fingers or toes stay warm.
9. Count every strip in. Write the number. Count them out.
10. Still bleeding through: 18.3.

Never pack the chest, the belly or the skull. Instead, press over the wound and see chapter 21.

Soak packing with boiled water and remove it after 24 to 48 hours.

A trained helper may kneel on the groin above a thigh wound while another packs. Alone it fails within a minute. Raise the limb only if it costs no pressure. Never raise a broken limb.

Grades. Direct pressure B. Packing with gauze B, with clean cloth C. Pressure point alone X, as a bridge C. Raising the limb D.

Rung ladder. Hands: pressure, packing, a clock. Hearth: boiled cloth strips. Dispensary: gauze. District: the vessel tied. Refuse: cobweb, pepper, dung or ash in a wound.

18.3 Do: the tourniquet

The village teaches it as its standing default.

Never put a tourniquet on the neck, the trunk, the groin or over a joint. Instead, pack and press (18.2).

Never tie a band for a snakebite. Instead, keep the limb still and see chapter 22.

Never tie cloth without a rod. It fails 79 times in 80. Instead, use the rod.

Use it when pressure and packing fail on a limb, or a limb is torn off. Put it on before the wrist pulse fades.

Kit	Size
Band	At least 5 cm wide, a hand's width better, 1 to 1.5 m long
Library floor	3.8 cm, source untraced
Rod	Hardwood or iron, 15 to 20 cm

1. Bare the skin.
2. Place the band 5 to 7.5 cm above the wound. Never over a knee or elbow. Go above it.
3. Tie a half knot. Lay the rod on it. Tie a full knot over the rod.
4. Twist until the bleeding stops and no pulse is felt below.
5. It will hurt badly. Keep twisting.
6. Tie the rod down.
7. Write the time on the forehead and the band: TQ 14:20.
8. Still bleeding: a second band just above the first.
9. Leave it uncovered. Check it every 15 minutes.
10. Send for the district now.

Time on	Do
Up to 2 hours	Review. Convert if allowed
2 to 6 hours	Convert only if allowed. Else carry
Over 6 hours	Do not loosen. Leave it for the surgeon
Limb dead	Leave it on

Convert only if all 4 hold:

- Strong wrist pulse, clear mind.
- Someone can watch for 2 hours.
- No limb torn off.
- On for under 6 hours.

Conversion, by the healer trained in it:

1. Pack and press the wound 3 minutes. Bind it firmly.
2. Loosen the rod slowly, over 1 minute.
3. Leave the band in place, loose.
4. Watch the wound 10 minutes.
5. Bleeding again: twist again. Write the new time.

Keep the limb covered. Never heat it. Dark urine after a long tourniquet means muscle damage. Send.

Grades. Rod tourniquet before shock B. Cloth tied without a rod X. Conversion by 2 hours C.

Rung ladder. Hands: the band and the rod. Hearth: 20 or more kits. Dispensary: conversion. District: surgery. Refuse: a band with no time written.

18.4 Do: clean the wound

Never pour hydrogen peroxide into a deep wound. It has killed. Instead, pour water.

Never scald, sear or put caustic in a wound. Instead, wash it.

Clean as soon as the bleeding is held. Use water you would drink, or boiled and cooled. Doubtful water: 0.025% chlorine, about 5 ml of 5% bleach per litre.

1. Wash your hands with soap.
2. Scrub the skin around the wound with soap and a nailbrush. Keep soap out of the wound.
3. Pour from a bag hung 1.8 to 2.4 m up. Or squeeze a bottle with holes in the cap, with 2 hands.
4. Pour at least 0.5 litre into any wound, 1 to 3 litres into a deep one.
5. Pour until no dirt comes out. Then pour as much again.
6. Pick out grit, wood and cloth with boiled forceps.
7. Trim loose shreds of skin, 1 to 3 mm.
8. Stop there. Cutting dead muscle is the district's.

Boil instruments 20 minutes. Two reports give 10. Boiling leaves spores alive. Steam kills them: 121 °C, 20 minutes unwrapped, 30 wrapped.

Never use one blade or needle on two people. Instead, clean and boil between.

A broken bone in the wound: clean it here, splint it in chapter 19. A bite: wash it 15 minutes, then chapter 22. A burn: chapter 20.

Grades. Drinkable water B. Gravity bag B. Soap in the wound X. Picking out dirt B. Dilute chlorine in a dirty wound C. Peroxide in a deep wound X.

Rung ladder. Hands: water, soap, a brush. Hearth: boiled water, bottles. Dispensary: forceps, a pressure cooker. District: cutting dead muscle. Refuse: the 6 hour rule as a cliff edge.

18.5 Do: leave it open, close it late

Never close a bite or a dirty wound (SY-10). Instead, fill it loosely and look on day 4 to 5.

Stitch at once only a clean, sharp edged cut. Not crushed, bitten or punctured. Body within 6 hours, face and scalp within 12. A healer trained in chapter 23 does it. A hand cut under 2 cm needs no stitch.

1. Fill the deep wound loosely with dry boiled cloth. Never pack it tight.
2. Cover with a thick dry pad. Bandage it.
3. Leave it 4 to 5 days. Open sooner for fever, rising pain or a foul smell.
4. Every wound smells by day 4. That alone is no alarm.
5. On day 4 to 5, read it.

Day 4 to 5	Do
Eating, sitting up. Dry dressing. Red base, bleeds a little. Sharp smell	Ready. Close, or let it heal open
Pus, grey base, foul smell	Wash again. Look in 2 to 3 days
Face, neck	Close about day 3
Trunk, arm	Day 4 to 5
Leg	Day 5 to 7
Any	Seldom after day 8

A wound left open heals by itself, over weeks or months. A slow open wound with a wide scar is a success.

Honey may go on a cleaned wound. Never raw honey on a fresh deep wound. Sugar suits a wet, smelly wound. Change it twice a day.

Grades. The dirty wound left open B. Closing on day 4 to 7 B. Honey on an infected wound B. Sugar on an infected wound B. Aloe on an open wound X.

Rung ladder. Hands: the loose fill, the day 4 look. Hearth: boiled cloth, honey, sugar. Dispensary: the late stitch (chapter 23). Refuse: a few loose stitches in a dirty wound.

18.6 See: the wound that turns

Sign	Means
Redness spreading over 5 cm, a red line up the limb	Spreading infection
Over 38.5 °C, pulse over 110	Infection in the blood
Sudden great pain, swelling, thin brown fluid, sweet smell, pulse rising faster than temperature, bronze skin, blisters, crackle	Gas gangrene. Crackle comes late
A hot swelling that softens	Abscess
Pus still at 2 weeks	Something left inside

A closed wound turning: remove every stitch. Open it, wash it, leave it open.

An abscess: the healer opens and drains it. Do not pack it tight.

Gas gangrene: send now. In flesh dying of infection, a delay over 24 hours raised deaths about 9 times.

The 3 branches of the danger sign:

- **Help in time.** The district cuts away dead flesh or takes the limb. Carry the person flat. Send a card with every time and every count.
- **Help too late.** The person arrives in shock. The card still goes. The district decides.
- **No help at all.** Open the wound. Keep it clean. Ease pain. Give sips. Someone stays. Untreated gas gangrene kills. People in deep shock often grow calm near the end. Tell the family: the rot was deep in the flesh before anyone could see it. The cutting that might have saved them cannot be done here.

18.7 Prevent: tetanus at the wound

Never call a stiff jaw after a wound nerves. Instead, do the stick test.

These wounds carry tetanus: a small deep puncture, soil, dung or rust, wood or cloth left in. So do crushed flesh and more than 6 hours before cleaning. Clean every one (18.4). Leave it open (18.5). This needs no stockpile.

Toxoid is the healer's or district's to inject. Vaccination is chapter 17: the dose at 17.3, the schedule and the order of the last doses at 17.4.

Work every dose twice, with two people.

Weight	Dose	Ceiling	Interval
Any	0.5 ml of the vial as supplied, into muscle, by the healer	0.5 ml a dose	The schedule at 17.4

Kept at	Holds potency
4 to 8 °C	3 to 7 years
18 °C	1.5 years
24 °C	6 to 12 months
37 °C	2 to 6 months
Frozen	Ruined. Shake test first

Watch 3 to 21 days after the wound. Under 7 days is worse. The signs:

1. Fully awake through every spasm.
2. Spasms set off by touch, noise or light.
3. A clean flat stick on the back of the throat is bitten, not gagged out.

A case with no antitoxin:

1. Dark, quiet room. One person always there.
2. Lay on the side. Keep the mouth clear.
3. Turn every 4 hours.
4. Force nothing by mouth during spasms.
5. Open and clean the wound again.

6. Send for the district. Sedation is theirs (chapter 16).
7. Stay 2 to 3 weeks.

With hands alone, more than 8 in 10 may die. Nursing saves some of the rest. The newborn is chapter 11.

Drill every 3 months: press 10 minutes on a timer, band each other, write the time, convert. Keep a register of every bleed.

Rung ladder. Hands: the wound rule, the stick, the dark room. Dispensary: toxoid. District: antitoxin, sedation. Refuse: home made catgut, which spread tetanus.

If it goes wrong

- **The band is too loose.** Bleeding goes on or grows. The limb swells dark. Cause: twisted to pain, not to stop. Do: twist more. Add a second band above.
- **The dirty wound was sewn shut.** Pain, swelling and fever in 1 to 3 days, perhaps crackle. Cause: closed on day 1. Do: take out every stitch. Open, wash, leave open. Send for gas gangrene.
- **The stiff jaw sent home.** A wound a week ago, a jaw that will not open, called nerves. Cause: no stick test. Do: the test, the dark room, the district.

NUMBERS TO CARRY

- 10 minutes of pressure without looking, 3 at the least (WO-01).
- 90 against 10: survival with the strap before and after the wrist pulse fades (WO-01).
- 79 in 80: tied cloth fails without a stick (WO-01).
- 2 and 6 hours: review the strap, and its outer limit (WO-01, SY-07).
- 5 cm or a hand's width for the band. The library's floor of 3.8 cm is untraced (WO-01, SY-12).
- Water you can drink, at least half a litre, until no dirt comes out (WO-02).
- Day 4 to 5: look, and close if clean. Seldom after 8 (WO-03).
- 20 minutes to boil instruments, 10 in two reports (SY-12).
- 3 to 21 days: tetanus after a wound (WO-14).

THE LIBRARY

WO-01 Stopping the bleeding. WO-02 Cleaning the wound. WO-03 To close or not to close. WO-14 Tetanus, gas gangrene and the infected wound. SY-10 The harm register. SY-12 What the library could not find. SY-01 The case against lay medicine. SY-05 The twenty interventions that save the most lives per hour of training. SY-07 The red flag list. FO-06 The manuals that worked. All are on the website.

CHAPTER 19

Bones and Joints

A limb without blood below a tight splint dies in six hours. A shoulder is reduced within six hours or by the district. A bone knits in six weeks, or twelve.

OPENING

Run a thumb down the front of a shin. There is almost nothing between skin and bone there, so the edge of the shinbone can be followed from below the knee to the ankle, hard and a little sharp. It feels like the stillest thing in the body. It is not. Bone is living tissue, fed by blood, and when it breaks it bleeds, swells and begins at once to mend.

Within days a soft bridge starts to grow across the gap. Over weeks it hardens, and over months the bone reshapes itself along the lines of the weight it carries. The bone knits itself. No hand and no herb makes it knit faster. The healer's work is smaller and harder than it looks: to hold still what the body mends, in a line close enough to true, without squeezing it.

The squeezing is where the harm lives. A broken limb goes on swelling for a day or two after the fall, and whatever holds it does not swell with it. A bandage that fitted at noon can by midnight be closing the vessels to the hand. Below a binding that is too tight, the muscles of the forearm or the calf have hours, and the person in the bed is often a child who cannot say what is wrong.

So the first skill here is not setting a bone. It is looking at fingers and toes. They are the part of the limb that can still be seen once the splint is on.

Press one of your own fingernails until the pink under it turns white, then let go and watch the colour come back. Feel the fingertip for warmth, touch it, and move it. Colour, warmth, feeling and movement are the four things someone will check at the end of a splinted arm or leg, every hour, for two days and two nights.

THE STORY

The hand that finds the break

In the Yoruba towns of south-western Nigeria, a bonesetter examining a swollen arm looks for what a surgeon looks for: swelling, pain, an arm that will not work, a bend where there should be none, movement in the middle of a bone. When Omololu and his colleagues set the bonesetters' method beside the textbook in 2008, the lists matched. The bonesetter's eye was not the weak point. The weak point came later, in the binding.

The village has no X-ray, and much of the time it does not need one. A rule worked out by emergency doctors in Ottawa presses four points of the ankle and foot and asks the person to take four steps. Across 27 studies and 15,581 patients, it missed fewer than three breaks in a hundred. Without a picture of the bone, the rule is used the other way round. Pain at any point, or four steps impossible, and the ankle is splinted as broken.

That is the wider rule for the village. Painful swelling with tenderness over one point of bone is treated as a break, splinted for two weeks and examined again. For those two weeks the difference between a crack and a bad sprain hardly matters, because the splint is the same and so are the checks. What matters is never testing for a break by grinding the ends together to hear them grate. The ends are sharp, and the vessels and nerves lie beside them.

The nerves are the reason for the second look, beyond the injury. On the outer side of the knee a nerve runs over the head of the thin calf bone just under the skin, and a hard splint edge there can leave a foot that drops

for life. Every examination of a limb begins and ends with the hand or foot beyond it.

Plaster, and the two days after

Before the middle of the nineteenth century, a broken limb was held in wood, bark, card or leather, or in bandages stiffened with starch and egg white. In 1852 a Dutch army surgeon rubbed plaster of Paris into cotton bandage, wetted it and wrapped a limb that set hard within minutes. By about 1870 it was ordinary across Europe.

Plaster is gypsum, the soft white rock, heated until it gives up part of its water. In a slow oven at about a hundred and twenty to a hundred and thirty degrees, for an hour or two, it becomes a powder that sets again when wetted. Heated too hard it is dead-burned and will never set. Kept damp, it goes crumbly in the sack. A village with gypsum in the ground and an oven can make its own.

Plaster brought its own danger. Swelling after a break rises for a day or two, and a closed ring of plaster cannot give. The Red Cross surgical handbook puts the problem in two short lines: too tight is a tourniquet, too loose is a bone that never joins. Maurice King's handbook for district hospitals tells of a girl of eight whose undisplaced forearm break was put in a full cast. Her pain was treated with aspirin, and she lost her forearm. King's comment is plain: "Pain is not an indication for analgesia." Rising pain under a cast is a sign, and the answer is a knife through the plaster, not a tablet.

The library's harm register puts splints, bandages and casts in its first tier, and the fix it asks for is small. For the first two days after a break, only slabs, which cover part of the limb, or casts split down to the skin. Fingers and toes are checked every hour for 48 hours, not 24. Two of the library's sources disagreed on that number, and the register chose the longer one.

The checks are crude, and they have to be. In one pooled analysis of the closed muscle compartments of the leg, a single classic sign meant trouble only one time in four, but three signs together meant trouble 93 times in a hundred. The earliest sign is pain out of proportion to the injury, worse when the fingers or toes are stretched. The pulse at the wrist or ankle can

stay normal while the muscle dies. Textbooks give six to eight hours before the damage lasts, and cases have been reported within three.

A bed, a pin, a rope and a bag of stones

The thighbone is the hardest break to hold. Its muscles are strong enough to pull the ends past each other, and the thigh can hide more than a litre of blood. In 1875 Hugh Owen Thomas, a Liverpool surgeon from a family of Welsh bonesetters, described a splint for it: a padded ring at the groin, two side bars, and a pull at the foot. His nephew Robert Jones brought it into the British Army in the First World War. Writing in 1919, Henry Gray recorded that deaths from broken thighs had at one time been about 80 per cent, and that at Arras in the spring of 1917, of 1,009 cases, 15.6 per cent died at the clearing stations.

The figures are less clean than they look. The 80 per cent was a general impression, the 15.6 was counted at one stage of the journey, and wound care and the treatment of shock were improving at the same time. But nobody who carried a broken thigh before and after the splint doubted what it did on a stretcher.

A splint is for the carry. For the weeks in bed, the thigh needs a pull that can be kept up and adjusted, and the best village answer is the one George Perkins taught at St Thomas' Hospital in London from the 1930s to the 1950s. A steel pin is drilled through the shinbone just below the knee. A rope runs from the pin over the end of the bed to a weight. The bed is split, so that from the third day the patient can let the lower leg hang over the edge and bend the knee, ten to thirty minutes at a time, several times a day. The bone knits itself inside that long stillness, and the weight asks nothing of it except to stay in line.

The weight is a fraction of the patient. The Red Cross uses one kilogram for every ten of body weight, King and Perkins about one seventh, so a woman of sixty kilograms is pulled by six to eight and a half. Too little and the ends overlap. Too much and a gap of two millimetres opens, and a bone with a gap does not join. The line of the leg, groin to knee to ankle to second toe, is checked several times a day for two weeks, while the young callus can still be moulded.

The results from places without a surgeon's metal are steady. In 1981

Buxton reported 50 patients, 47 of whose thighs had joined by 12 weeks, all with knees that bent past 120 degrees. In Addis Ababa in 2012, of 68 patients one failed to join. In Sierra Leone in 2007, 92.6 per cent of 53 healed, but 42.6 per cent had an infection where the pin met the skin. King wrote that medical assistants soon learn to run the method well. Its price is two months of bed for the patient and two months of daily nursing for someone else.

Walking in plaster

The other road out of the bed runs through the work of Augusto Sarmiento in Miami in the 1960s. He found that a broken shin held in a below-knee cast, shaped to take weight on the tendon under the kneecap, healed while the patient walked on it. In 1995 he and his colleagues reported 1,000 closed shin fractures treated this way. Eleven failed to join, and in 95 of every 100 the leg ended no more than 12 millimetres short. For the upper arm, a series of 922 breaks in a plastic brace found fewer than 2 in 100 of the closed ones failed to join.

The case against him is fair. The series came from one centre with a devoted team, a third of the arm patients were never seen again, and a later pooling of trials found more failures with bracing than with plates. But the village is not choosing between a brace and a plate. It is choosing between a brace and two months in bed, or a brace and a crooked leg. King turns the long cast of a broken shin into a below-knee walking cast at about six weeks, and the material is ordinary plaster.

The same lesson has come back for other bones. For a broken collarbone, a sling caused less discomfort than the old figure-of-eight bandage in a trial of 1987, with the same result. For a broken wrist in people over sixty, trials in 2011 and 2021 found a cast as good as a metal plate. Joints held still too long go stiff. An adult hand not moved within ten days begins to lose its range, and every joint outside the splint moves from the first day.

Bones through the skin

Before antiseptics, an open fracture of a long bone killed about half of those who had one. In the Union army's count from the American Civil War, of 1,761 open fractures of the thigh, about 71 per cent of those whose fate was recorded died.

José Trueta, a surgeon in Barcelona during the Spanish Civil War of 1936 to 1939, built on an American method. He cut away dead tissue, left the wound open, packed it lightly with gauze soaked in petroleum jelly, and closed the whole limb in plaster for weeks without disturbing it. Of 1,073 open fractures, 6 people died. The plaster held the bone still, and the stillness let the tissues deal with the infection.

Two rules have survived from that time. The first is that the wound over an open fracture is never sewn shut at once. King lists primary closure among the avoidable disasters, and the wound is closed four to seven days later, or left to heal. The second came with antibiotics. In a review of 8 trials and 1,106 patients, antibiotics cut infection after open fractures by more than half, about one infection prevented for every 14 people treated. Cleaning the wound is chapter 18's work. The splint over it needs a window.

Putting a joint back

Hippocrates, in On Joints, described many ways of putting back a shoulder and advised that "the least troublesome should be selected". In Berne in 1870 Theodor Kocher worked out on cadavers a sequence of rotations that needed no pull at all, and reported it in 11 patients. The methods have multiplied since, and the trials show them doing about equally well. A pooling of 14 trials and 1,189 patients in 2023 found no method clearly better, with success between 80 and 97 in a hundred.

Timing and gentleness matter more. In a series of 106 shoulders put back without any drug, 93 in 100 went back when the attempt began within 90 minutes, against 73 in 100 later. Morphine dulls pain but does not relax the muscle that holds the joint out. What relaxes it is time, warmth, a calm voice and gravity, and the commonest failure is hurry. Ski patrollers put back 89 in 100. The old method of a heel braced in the

armpit has been dropped, after it harmed a patient of 69 on blood thinners.

The hip is different. Out of joint, it threatens the blood supply to the head of the thighbone, and the longer it stays out the more likely the head is to die: fewer than one in ten when it is back within six hours, up to four in ten overall. It needs three or four people and a trained hand. The knee is different again. About one knee in four that comes out of joint tears the artery behind it, and the pulse at the ankle can be normal while it happens. No study of traditional joint setting exists anywhere, so on dislocations the village has only the trials of hospitals and ski slopes to go on.

The bonesetter's record

In Nigeria about 85 of every 100 people with a broken bone go first to a bonesetter, in a country that had fewer than 200 orthopaedic surgeons for 140 million people. The bonesetter costs a fraction of the hospital, a median of about 30 dollars against 173 in one count, lives nearby, and does not threaten amputation. A survey in Ilorin found that people chose bonesetters for cost, acceptance and access, and that what pushed them from the hospital was staff attitude, delay and the fear of losing a limb. The library's report on African healing calls the bonesetter the surgeon's "absence made into an institution".

The hospital records read badly. In Jos, 60 of 70 amputations after injury followed treatment by a bonesetter. Across the published series, gangrene ran from 2.8 to 29.6 per cent. But those series count the people who reached the hospital because something went wrong. The ones who healed at home were never counted, and in Kerala, where 52 patients of traditional bonesetters were followed to the end, 71 per cent were satisfied and none had gangrene. The harm is real, and its size is unknown.

Where it comes from is known: binding too tight. The splint materials, bamboo, palm rib, raffia, bark and cardboard, are sound. In southern Ethiopia in 2005, Eshete ran ten one-day courses for 112 traditional bonesetters, on loose splints, the finger and toe check, and when to send. Amputations counted before and after fell from 49 to 25, and amputations for gangrene from 25 to 7. In Nigeria a year later, among 40 patients of trained bonesetters and 40 of untrained ones, gangrene came to one

against four.

The herbs, prayers and pastes that go with the setting belong to the healers who hold them, and this book does not print them. The village judges what is done to the body, not the belief behind it. Two plants are dangerous enough to name. Comfrey taken by mouth harms the liver, and its young leaves look like foxglove's, which has killed. The seeds of Senna occidentalis look like coffee beans, and in western Uttar Pradesh 9 of 10 children who fell ill after eating them died.

The Honest Broker's Splint

Some of this can be trusted with a life. The hourly check for 48 hours, the slab before the cast and the knife through the plaster rest on the harm register and on Eshete's courses, where teaching exactly these things cut amputations for gangrene by more than two thirds. The Ottawa rule rests on more than fifteen thousand patients. Antibiotics for open fractures rest on eight trials. The gentle shoulder methods rest on fourteen.

Some of it cannot. The bonesetters' complication series count only failures. The Thomas splint's 80 per cent is an impression. The healing times are rules of thumb: Perkins's doubling is a teacher's rule, and the common teaching that children heal in half the time has no primary source the library could find. Where sources differ, I have printed both: the traction weight, the weeks in traction, the sling for a collarbone, and the thickness of a slab.

One error must be corrected. The library's fracture report holds the Red Cross regimen for open fractures, penicillin into a vein four times a day for two days and then by mouth, and asks for a second source to confirm it. It files that question under the report on dislocations and sprains, which holds no penicillin at all. The question belongs to the fracture report and the report on antibiotics, and it is still open. Until it is answered, that regimen is a hospital's. It is an injection, and below the district this book gives none. The antibiotic for an open fracture in the village follows the harm register's rule instead: no written sign, no antibiotic (see 19.6).

The turn to the present

In a city hospital today, a broken shin is often nailed, a wrist plated, and a thigh fixed within a day. The metal is good, and for the thigh it gives back two months of a life. But for the collarbone, the wrist over sixty and many broken shins, the trials found the sling and the cast as good, and the skill to use them is fading. King warned that few full descriptions of the old methods remain. Health systems that pay by the operation have not hurried to write new ones.

The village needs little: plaster it can make or keep dry, a hand drill and two pins, a bed that can be split, a bag of stones on a scale, and a card for every patient with the bone, the date and the hour of the next check. It needs its bonesetter at a one-day course rather than at the edge of the village. And it needs the patience of a nurse who looks at fingers in the night. The bone knits itself. Everything at the bench is about holding it still, keeping the binding loose enough for the blood, and knowing when to send.

Now the splint.

AT THE BENCH

19.1 See: break, sprain or out of joint

Look beyond the injury first. Compare both sides. Write it down with the time.

Check	Good	Bad
Colour	Pink. A pressed nail pinks as fast as on the other side	Pale, white, blue
Warmth	As the other side	Cold
Feeling	Normal	Numb, tingling
Movement	Moves fingers or toes	Cannot, or stretching them hurts

Treat as a break: pain pressed on one point of bone, a wrong shape, a limb shorter or turned. At the ankle: any of 4 points tender, or 4 steps impossible. Treat as out of joint: a joint that will not move and looks square or empty (19.5).

Do not grind the ends. When unsure, splint as broken for 2 weeks, then look again. A sprain you can walk on: loose figure-of-eight bandage, walk from day 1. No weight at all: raise it 2 to 3 days, then a below-knee cast for 10 days.

Grades. Ottawa rule A. Ice for a sprain X.

Rung ladder. Hands: the checks, the 4 points, 4 steps. Dispensary: the fracture passport. Hospital: X-ray. Refuse: grinding the ends.

19.2 Do: the loose splint and the 48 hours

Never bind a splint tight. Never close a ring of plaster round a fresh break. Never cover a wound without a window. Never push a bone back through the skin. Instead: pad, use a slab or split the cast to the skin, cut a window over the wound, and splint the bone as it lies (19.6).

1. Give pain relief first, by chapter 26's ladder.
2. Pull gently along the limb into line. Stop if pain rises sharply or a bone end presses the skin.
3. Pad the kneecap, ankle bones, heel, wrist knob and the bone below the outer knee. Arm 2 to 3 layers, leg 3 to 4.
4. Splint the joint above and the joint below. Leave fingers and toes in sight. Bind with wide cloth, never cord.
5. Hold the ankle at 90°, the knee at 15°, the elbow at 90° thumb up, the wrist 15 to 20° bent back.

Use wood, bark, bamboo, card or plaster. A plaster slab covers at most two thirds of the limb's girth. Use 4 layers (King) or 6 to 8 (Red Cross), never more than 8. Dip water no warmer than 24 °C. Never let wet plaster set on a pillow. Make a full cast at day 3 to 5 and split it while soft.

Check every hour for 48 hours, then twice a day. Use the 19.1 table. Write each check on the passport.

Danger sign. Rising pain, pain on stretching the fingers or toes, pale, cold or numb. A normal pulse does not clear it.

1. Cut every layer to the skin along its whole length. Spread it open.

2. Keep the limb at heart level, not above.
3. Look again in 1 hour. Not better: send now for the district's knife (chapter 23).

Help in time: the hand pinks, or the district opens the muscle within hours. Help too late: the hand curls or the limb is lost. Tell the family on the first day. No help at all: cast off, limb at heart level, chapter 26 for pain. Tell the family the hand may not recover. Watch a dead limb for smell and fever.

Grades. Split cast D. Cast in the old B. Tight binding X.

Rung ladder. Hands: the pull, the checks. Hearth: cloth, wood, padding. Garden and still: plaster from gypsum. Dispensary: plaster bandages, a knife that cuts plaster. Hospital: the opened muscle. Refuse: pain relief to quiet a rising pain under a cast.

19.3 Do: closed breaks by region

Every joint outside the splint moves from day 1. Walking and rehabilitation: chapter 28.

Break	Hold	How long
Wrist	Back slab to the palm crease, knuckles free. Over 60: as it lies	3 weeks, 6 if unstable. Over 60: move at 4
Forearm	Slab above the elbow, elbow 90°	6 to 8 weeks
Upper arm	U-slab, collar and cuff	6 to 8 weeks
Collarbone	Sling, not figure-of-eight	2 to 3 weeks (WO-05) or 1 week as for a shoulder (WO-06)
Ribs	No splint. Deep breaths and a cough each waking hour. Breathless: chapter 21	
Ankle	Below-knee slab, foot 90°. Swollen: raise 20 cm, set within 2 to 7 days	No weight 6 weeks if unstable, from 2 to 4 if stable

Break	Hold	How long
Shin	Long leg cast, knee 15°. Walking below-knee cast from about 6 weeks	17 weeks on average

Sources differ. Perkins: arm spiral joins at 3 weeks, leg spiral at 6, leg broken straight across at 12. Firm takes twice as long. GPnotebook: arm 6 to 8 weeks, leg double. Children: often taught as half. Hungry or old: add half again.

Joined when: no tenderness, no warmth, the ends move as one, no pain at night.

Grades. Sling for collarbone B. Cast B. Walking brace C. Comfrey by mouth X.

Rung ladder. Hands: slings. Hearth: wood and card splints. Garden and still: plaster. Dispensary: 20 to 30 plaster bandages. Hospital: plates and nails. Refuse: comfrey by mouth, Senna occidentalis seeds.

19.4 Do: the thigh

Never wrap a bandage round a broken thigh before the pull is on. Never put a pin through a child's shin. Instead: pull first, then bind to a splint. For a child, use skin or gallows traction.

For the carry: keep pulling. Splint to a board from armpit to heel, or a ring splint. Pad between the legs, bind them together. Warm and flat. The thigh can hold over 1 litre of blood (chapter 18).

For the bed, if the village keeps traction:

1. Skin traction: strips along the leg below the knee, at most 5 kg. Child up to 12 to 15 kg: both legs hung straight up from a beam, buttocks just off the bed.
2. Pin traction: a pin through the shin 2.5 to 3 cm below the bump under the knee. Trained hand only.
3. Raise the foot of the bed 4 cm for every kg of weight.

Body weight	Red Cross, 1 kg per 10 kg	King, one seventh
40 kg	4 kg	5.5 kg
50 kg	5 kg	7 kg

Body weight	Red Cross, 1 kg per 10 kg	King, one seventh
60 kg	6 kg	8.5 kg
70 kg	7 kg	10 kg
80 kg	8 kg	11.5 kg

Weigh the stones.

4. Check the line several times a day for 2 weeks: groin, knee, ankle, second toe. Measure both legs. Aim for 1 cm short, accept 2 cm. No gap.
5. From day 3, bend the knee over the split bed, 10 to 30 minutes, several times a day.
6. Clean the pin daily. A loose pin is an infected pin. Send.
7. Check the heels and back daily. Sores: chapter 24.
8. Off traction at 4 to 5 weeks (Red Cross) or 6 to 8 (King), when the straight leg lifts without pain. No weight for 8 to 12 weeks.

Grades. Perkins traction C.

Rung ladder. Hands: pull and hold for the carry. Hearth: boards, rope, a split bed, stones. Dispensary: hand drill, 2 pins. Infirmary: 4 to 6 traction beds. Hospital: the nail. Refuse: forcing a thigh without traction.

19.5 Do: a joint out of place

Never use force. Never put a heel in the armpit. Never try more than twice. Instead: time, warmth, a calm voice, gravity, then the splint and the district.

Splint and send, do not try, if: 40 or over with a first shoulder dislocation, bruised upper arm, a fall from above own height, a vehicle or large animal, a child's shoulder, grinding, new numbness, a growing swelling, a white or cold limb, out over 3 weeks.

Shoulder. Start within 90 minutes if you can. Still out at 6 hours: the district.

First choice, face down:

1. Arm hanging over the table edge, 5 kg hung from the wrist.
2. Wait 5 to 10 minutes. Talk calmly. Do not pull harder.

3. Push the lower tip of the shoulder blade towards the spine. Hold 60 seconds.

Second choice, sitting: elbow at 90° against the side. Turn the forearm slowly outwards over 5 to 10 minutes. Pause when the muscles tighten.

After: the palm reaches the other shoulder. Check feeling on the outer upper arm. Sling 1 week, then move. Teach anyone who has dislocated once to put it back themselves.

Joint	Do	Who
Child's pulled elbow, under about 6	Turn the palm firmly face down	Anyone trained
Finger	Pull along it, push the end down. Tape to its neighbour 3 to 6 weeks	Anyone trained
Jaw	Thumbs wrapped thick in cloth. Press down on the back teeth, ease back	Anyone trained
Ankle with white skin	Pull the heel now. Back slab	Anyone trained
Elbow	Back slab 7 to 14 days. Never a full cast	Healer
Knee	Splint at 15°. Watch the foot 3 days. 1 in 4 tears the artery	Healer, then send
Hip	3 or 4 people, within 6 hours, 2 tries. No weight 6 weeks	District or trained healer only

The Who column is the draft's suggestion.

Lidocaine 1% into the shoulder joint, only if the owner allows it below the district. Ceiling 0.3 ml/kg, never over 20 ml. One dose. Wait 15 to 20 minutes.

Weight	Lidocaine 1%
30 to 39 kg	9 ml
40 to 49 kg	12 ml
50 to 59 kg	15 ml

Weight	Lidocaine 1%
60 to 66 kg	18 ml
67 kg and over	20 ml

No scale, no block. King's 10 ml of 2% is 200 mg, over the ceiling below 67 kg.

Work every dose twice, with two people.

Grades. Gentle shoulder methods A. Pulled elbow A. Lidocaine into the joint A. Hip within 6 hours B. Shoulder sling beyond 1 week X.

Rung ladder. Hands: all the methods above. Hearth: a padded table edge, a 5 kg weight. Dispensary: lidocaine. Hospital: sedation, surgery. Refuse: force, a third try.

19.6 Do: the open break, and what not to set

Never push a bone end back under the skin. Never sew the wound shut. Instead: cover with clean wet cloth, splint it as it lies with a window, and send.

1. Stop the bleeding and clean the wound by chapter 18.
2. A wound under 1 cm over an unmoved break may be treated as closed.
3. Antibiotic only on a written sign, by mouth, from the dispensary holder. No injection below the district.

Send by distance. The choice is the village's.

District	Do
Under 1 day	Cover, splint, carry now
1 day or more	Clean, cover, splint, carry. Change the dressing only if it smells or soaks through
None	Clean daily by chapter 18. Leave open. Watch for fever and smell

Must not set	Do instead
Spine	Do not move. Chapter 21

Must not set	Do instead
Pelvis	Sheet tied round the hips, legs bound, flat and warm. Carry flat
Skull	Chapter 21
Child's thigh without traction	Pull, splint, carry
Hip without a trained hand	Splint as it lies, carry

Grades. Antibiotics for open fracture A. Leaving open, then plaster C. Sewing shut X.

Rung ladder. Hearth: boiled cloth. Dispensary: the written sign. District: the knife (chapter 23). Refuse: keeping an open break at home when the district can be reached.

19.7 Prevent: stock, plaster, the bonesetter

- Keep 20 to 30 plaster bandages, sealed and dry.
- Make plaster: gypsum in a slow oven, 120 to 130 °C, 1 to 2 hours. A test spoonful sets in 5 to 15 minutes.
- Give every patient a fracture passport: bone, date, splint, checks, next look.
- Invite every bonesetter to a one-day course. Agree with them what to keep and what to stop. Keep: presence, cheap splints, early movement. Stop: tight binding, cutting the skin, forcing a thigh or elbow, keeping an open break or a cold limb. Never ask for restricted knowledge.

Grades. Training bonesetters C.

If it goes wrong

1. **The cold hand under a cast.** Looks: rising pain, pale, cold, numb fingers. Cause: tight binding. Do: cut to the skin now (19.2).
2. **The crooked or short bone.** Looks: the limb bent, turned or shorter at 2 weeks. Cause: lost line, too little pull, weight too soon. Do: check the line daily for 2 weeks and re-set early. Late: the district.
3. **The stiff joint.** Looks: a hand or knee that will not bend after the splint. Cause: held too long, not moved. Do: move every free joint from day 1. Chapter 28.

NUMBERS TO CARRY

- 48 hours: fingers and toes every hour under a new splint (SY-10, WO-05).
- 6 hours: a limb without blood. Damage seen within 3 (WO-05).
- 90 minutes and 2 tries: the shoulder (WO-06).
- 6 hours: the hip back, or the head may die (WO-06).
- 1 in 4: knees out of joint that tear the artery (WO-06).
- 1 kg per 10 kg, or one seventh: the thigh's pull (WO-05).
- 0.3 ml/kg of 1% lidocaine, never over 20 ml (WO-06, SY-10).
- 3, 6, 12: weeks to join for arm spiral, leg spiral and leg straight across (WO-05).

THE LIBRARY

WO-05 Fractures: reduction, splinting, traction and the traditional bonesetters. WO-06 Dislocations and sprains: reduction techniques through the ages. NU-05 Splints, braces, prostheses and aids from local materials. TR-07 African traditional medicine: the healer, the plants and the evidence. WO-01 Stopping the bleeding. SY-10 The harm register. SY-12 What the library could not find. SY-07 The red-flag list. All are on the website.

CHAPTER 20

Burns, Cold and Heat

A burn is cooled within three hours. A big burn needs fluid within the first hour and for two days. A cold body is warmed over hours, not minutes. A hot body is cooled in thirty minutes or dies.

OPENING

Lay one hand flat on your forearm, fingers together.
That hand, palm and fingers, covers about one part in a hundred of all the skin on the body. Every person carries their own measure, sized to their own skin, and it is the measure this chapter uses for a burn.

Under the hand the forearm feels a little cooler than the cheek or the neck would. Deeper in, where the heart and the liver lie, the body keeps its own weather: a few degrees either side of thirty-seven, day and night, January and July. It holds that weather by moving blood towards the skin or away from it, by sweating and by shivering. The skin is the wall that holds it all in. It keeps the body's water from leaking out, and the world's heat and cold from coming in too fast.

Three things break that weather, and each keeps a different clock. Fire breaks the wall itself. Where skin is burned, water seeps out of the blood into the flesh and through the raw surface, slowly at first and then by the litre, and a burn the size of fifteen of an adult's hands needs more drink than thirst will ask for. Cold wins slowly. The hands and feet are given

up first, then the mind grows dull and quarrelsome, and the person stops noticing that they are cold. Heat wins fast. When the body can no longer shed it, the core climbs past forty degrees, the mind goes, and only cooling in the first half hour reliably brings it back.

What helps is plain. Running water on a burn, for twenty minutes. A cup of salted, sweetened water every quarter of an hour for the fluid that leaks away. Wool, shelter, sugar and a slow hand for the cold. A tub of water for the heat. Much of what harms is plain too, and it feels right to the people who do it: ice on a burn and butter after it, a frozen foot rubbed by the fire, a cold grandmother lowered into a hot bath, a stone from the stove laid against feet that cannot feel it.

Lift the hand away. The skin under it is the wall, and this chapter is about what to do when the wall fails.

THE STORY

Tannin and the tap

For most of history the first thing put on a burn was something greasy, something cold, or something that made a crust. In 1925 a surgeon named Davidson, at the Henry Ford Hospital in Detroit, began painting burns with tannic acid, the substance that turns hide into leather. It tanned the raw surface into a hard brown shell, the pain eased, and within a few years tannin was the standard. Under the shell, infection grew unseen, and the acid soaked through raw skin into the blood. On 28 November 1942 the Cocoanut Grove nightclub in Boston burned with 492 dead, and the surgeons at the Massachusetts General Hospital dressed the survivors with soft petrolatum gauze instead of the crust. By 1944 liver damage was found commonest and worst in the burned who had been tanned, and tannin was abandoned. It looked like healing and was not.

Cooling is older than any of this, and the evidence for it is younger. In 2008 a group in Australia burned the skin of pigs to a set depth and compared twenty minutes of running water at fifteen degrees, running water at two degrees, ice, and nothing. Ice cooled the tissue fastest, and healed worst. Twenty minutes of cool running water healed best, better

than five, ten or thirty minutes, and it still helped when it was delayed for up to an hour. In people the evidence is from registries, not trials. In Queensland between 2013 and 2016, 2,495 burned children were followed. Nine in ten had some running water. Only 71 in a hundred had the full twenty minutes within three hours, and those who did were less likely to need a skin graft, with the odds cut by about two fifths. Among 2,897 burned adults in Australia and New Zealand, water first aid went with 13 in a hundred fewer grafts, about half the admissions to intensive care and shorter stays, and more water went with more benefit. Nothing in these registries was randomised, and the guidelines still disagree on the length, from at least ten minutes to at least twenty. This book takes twenty, because the pigs and the children both point there.

The water cools the burn, and must not cool the person. A small child with a large burn, under a hose for twenty minutes, can shiver, turn blue at the lips and grow drowsy, so the rest of the child is wrapped while the burn runs under the water.

No trial shows that butter, oil, toothpaste or a paste of turmeric deepens a burn. Every burns guideline is against them all the same, and the World Health Organization names paste, oil, turmeric and raw cotton as things never to put on. The harm is mostly in what they replace. A burn under butter is a burn not under water, and the twenty minutes that might have saved the middle layer of skin are gone.

The drink at Parkland

A burn kills in a known order. Smoke and fumes kill in the first hours. From the first hour to the second day it is shock: the vessels under burned skin leak, the blood thickens, its water runs into the swollen flesh, and the kidneys starve. The leak slows after one or two days. After the second day infection kills, then hunger over weeks, and over months the scar pulls joints into shapes that cripple. Around each deep burn lies a middle zone of skin that may live or die, and first aid, fluid and clean dressings decide which.

In 1968 Charles Baxter and Tom Shires at Parkland Hospital in Dallas published the sum the world came to use for the shock. For each kilogram of body weight and each per cent of skin burned, give 3.5 to 4 millilitres of

salt solution into a vein over a day, half of it in the first 8 hours, counted from the burn and not from arrival. It worked, and over the next decades hospitals gave more and more. In 2000 an American burn surgeon named this fluid creep. One study found 58 in a hundred people receiving more than the Parkland sum, against 12 in a hundred in Baxter's own series. Too much fluid swells the lungs, the throat and the belly. The lesson for a village is the hospital's lesson too: start lower, and let the urine say whether it is enough.

Before the drip was everywhere, burns were treated by mouth, and a review in 2010 gathered what that record holds. In Lima in 1956, 111 burned people were given 110 millilitres of salt solution for each kilogram, and more than half received too little. In 1966, vomiting stopped the drink in 30 in a hundred children and 51 in a hundred adults. In Denmark in 1968 Sørensen treated 26 people with burns up to 45 per cent with tablets of salt and baking soda dissolved in water, 5 grams of salt and 2.5 of soda to a litre, 150 to 200 millilitres for each kilogram on the first day. Eight in ten never needed a drip. In 1975 another series made the clock plain: of 58 burned people who arrived within an hour, only 4 could not drink, and of 23 who arrived after two hours, 16 could not.

A review commissioned by the World Health Organization in 2024 found 3 small randomised trials, 100 people in all, comparing drink with drip. Deaths did not clearly differ, but the trials were far too small to show a difference if there was one. In animals the drink was worse than the drip and better than nothing. In a pilot in Nepal, 9 of 15 people started on drinks were moved to a drip because they vomited. No study tested the mouth on burns over 55 per cent, and many guidelines stop it at 40. The mouth can carry a moderate burn through its two days of leaking if the drinking starts in the first hour, never stops at night, and is salted and sweetened. It cannot reliably carry a huge one.

Feet in Alaska

On the retreat from Moscow in 1812, Napoleon's chief surgeon is usually credited with teaching that frozen limbs should be rubbed with snow and warmed slowly, far from the fire. In 1947 two American physiologists showed in animals that frozen tissue did better when it was thawed fast in

warm water. William Mills tested the idea in Alaska in 1960 and 1961, in 130 frostbitten people and the records of 400 more, thawing in baths at thirty-eight to forty-five degrees, and later capped the water at forty-two. His amputation figures could not be traced. A modern series of 182 severe cases still lost tissue in 27 in a hundred. The rule that came out of this is short: thaw in water at thirty-seven to thirty-nine degrees, once. A foot thawed and frozen again does worse than a foot left frozen, which is why a person may walk out on frozen feet and must not walk on thawed ones.

The cold body follows its own physics. Water draws heat away about 24 times faster than air, which is why a fall into a river kills sooner than a night on a hillside. A shivering person inside dry insulation, with sugar in the stomach, warms by three to four degrees an hour, and nothing a village owns does better. Shivering is the body keeping its own weather by its own means, and most of the healer's work is to wrap it, feed it and let it shiver.

The danger comes when the core falls below about twenty-eight degrees. There the heart grows irritable, and rough handling can tip it into a rhythm that does not beat. A cold person stood up, walked, hauled upright out of water or lowered into a hot bath can collapse within minutes. Whether the core also drops further once rescue starts, the afterdrop, is argued over, because the studies rest on six to eight volunteers in cold tanks. The handling rules stand either way: keep them flat, move them gently, warm the trunk and never the limbs.

In May 1999, near Narvik in Norway, a young doctor fell through ice while skiing and was held in the water for about 80 minutes. Her core was measured at thirteen point seven degrees. She was rewarmed on a heart and lung machine and lived, though accounts of the details differ. Others have lived after six and a half hours of chest compressions. These cases are why fixed pupils and stiffness are no proof of death in the cold, and why the old rule says that no one is dead until warm and dead. The rule has a hard edge. In Tromsø, of 24 people in cold arrest rewarmed by machine between 1999 and 2013, 9 lived. A village has no such machine and will mostly lose them. Someone who stopped breathing first, under snow or water, and only then grew cold, has a far worse chance.

The cold kills most often indoors. A British survey in the winter of 1972 found about 1 old person in 10 living at home with a core below thirty-five and a half degrees. The old person who dies of cold is usually found

in their own bed, slow, confused and alone, and was cold for days before anyone touched them.

Chicago in July

Heat sickness runs from cramps and swollen ankles, through fainting, to heat exhaustion: weak, thirsty, sick, with a headache and a core below forty degrees. Rest, shade and salted drinks bring it back. Heat stroke is different. The core is above forty and the brain is failing: the person is confused, staggering, aggressive or unconscious. In the young it comes from hard work in heat, sometimes without warning. In the old it comes from a hot room over days.

At the Falmouth Road Race on Cape Cod the medical tent keeps tubs of iced water. Over 18 years, 274 runners with heat stroke were lowered into them, and none died. By 2019 the count stood at 454, still with no deaths. The rule there is to cool first and carry second, and to bring the core below thirty-nine degrees within thirty minutes of collapse. Immersion cools a body by about a tenth of a degree a minute. A fan alone cools about a fiftieth. Ice packs at the neck, groin and armpits do no better than the fan. Where there is no tub, a tarpaulin held by four people and filled with water does nearly as well.

In July 1995 a heat wave lay over Chicago for a week. Between 485 and 514 deaths were put down to heat, and between 696 and 739 more people died than in an ordinary July. Investigators went house to house and compared the dead with neighbours who lived. Being confined to bed raised the odds of dying about eightfold. Not leaving home each day raised them nearly sevenfold, living on the top floor nearly fivefold, and living alone more than twice. A working air conditioner, or a way to get somewhere cool, cut the odds to a third. In August 2003 more than 70,000 more people than usual died across Europe. The pattern is the same each time: old, ill, unable to move, alone, poor, high up under the roof, with nowhere cool to go. In a heat wave, who lives depends on who is visited.

The Honest Broker's Honey

WO-04 carries the burns in this chapter, and its strongest finding needs a warning beside it. In the Cochrane review by Jull and colleagues in 2015, honey healed partial thickness burns 4.68 days faster than conventional dressings, in 2 trials of 992 people, graded high quality. Against silver sulfadiazine, the cream most burn units used, honey healed 5.12 days faster, but on the weakest evidence. WO-04 grades honey on partial burns A. But most of these trials were run by one surgeon, Subrahmanyam in Maharashtra, and Jull himself warned of it. An earlier review scored every honey trial 1 out of 5 for method. The book keeps the A and prints the warning beside it. On full thickness burns honey is graded D. It cannot regrow lost skin, and early cutting away and grafting beat it by 13.6 days. A honey dressing must never become the reason a deep burn is not sent.

The second matter is a disputed line (SY-12, C21). HY-11, which read the cooling guideline in full, says about 10 in a hundred people with heat stroke die, and 33 in a hundred if the blood pressure stays low. FO-09, from a secondary source of 2025, says about 5 in a hundred. SY-12 judges HY-11 the better supported. The book prints both and does not settle it.

Third, HY-11 warns that the cooling evidence is in the wrong people. Falmouth's runners were young and fit, while those who die in heat waves are old and bedbound, and no cooling trial exists in them. The physics does not change with age, but the record is borrowed.

The cold also has a poisoned record. The freezing experiments at Dachau in 1942 killed between 80 and 90 prisoners, and a review in 1990 showed their data falsified. Nothing here rests on them.

WO-04's line for the burn the village cannot carry is its own inference from Birmingham's figures of 1949 and 1954 and later series. FEASTING after the FALL advises vinegar after a lye burn, and no source read supports it. The drink table at the Bench is the draft's own arithmetic.

The turn to the present

In a hospital a big burn is a bed in a burns unit. A drip runs from the first hour, and within a week the dead skin is cut away and grafted. A cold heart is rewarmed on a machine. Most of that is gone after the Fall, and the owner has decided that no drip will run below the district.

That decision has a price, and this chapter names it. Some people with burns between about 25 and 40 per cent will die who would have lived with a drip, because they vomit, or arrive late, or cannot be made to drink enough through the first night. Above 40 per cent the mouth will rarely be enough. The deep cold heart will mostly stop for good.

What does the village keep? More than it seems. Cool water, timed for twenty minutes. Salt, sugar and a cup, every fifteen minutes from the first hour, with a jug for the urine. Honey, boiled cloth and a plastic bag for a burned hand. Wool, sugar and gentle hands for the cold. A tub kept full through the summer, and a list of who lives alone.

It must also give up habits that feel kind. The hot-water bottle is the plainest case. Skin burns at forty-four degrees if the heat stays on it for hours, and at fifty in two or three minutes, and it can feel only comfortably warm while it burns. A filled bottle stays above fifty degrees for three hours. In Rotterdam, six men with diabetes did not find the burns on their numb feet for a median of 27 days, and five lost part of a foot or a leg. Stoke Mandeville, the English hospital for spinal injuries, banned the bottles outright in 1976, even covered.

The body keeps its own weather for as long as it can. When that fails, the village lends it water, wool or shade, by the clock, and learns which bodies it cannot carry. Now the water.

AT THE BENCH

20.1 See: the burn, how big, how deep, who goes beyond

Never guess a burn's size by eye. Instead, count it with the person's own hand.

1. Undress fully in a warm room. Write the time of the burn.
2. Count blistered, white, brown or leathery skin. Red skin alone does not count.
3. The person's own hand, palm and fingers, is 1%.
4. Large burns: the rule of nines. Count the unburned skin too. The two add to about 100.

Part	Adult and child	Under 1 year
Head and neck	9%	18%
Each arm	9%	9%
Front of trunk	18%	18%
Back of trunk	18%	18%
Each leg	18%	14%
Genitals	1%	1%

5. Depth. Blistered, moist, pink, painful: partial. White, brown or leathery, dry, painless, hairs pull out: full thickness. Judge again on day 3.
6. A deep burn right round a limb or the chest: the district within 48 hours.

The burned airway. Fire in a closed room, burns of face or neck, singed nose hairs, soot in mouth or spit, a hoarse voice: the throat may swell shut within hours. Sit them up in fresh air. Send now. Breathing is chapter 21's.

The lines are WO-04's, the choice is the village's.

Burn	Do
Child 10% or more, adult 15% or more	Drink by 20.3. Send for the healer
Deep burn of face, hands, feet, genitals, a joint, or round a limb	Dress, then the district
Over 40% in a young adult, 20% deep over 60, age plus % near 100, or serious smoke	Beyond the village. Comfort (20.3)

Household rule: any burn bigger than the child's own palm goes to the healer.

Grades. Rule of nines and the hand B.

20.2 Do: cool and cover

Never put ice, iced water, butter, oil or paste on a burn. Instead, cool running water for 20 minutes.

1. Stop the burning. Roll the person or wrap them in a blanket.
2. Take off clothes, rings and watches. Leave cloth that is stuck.
3. Cool running water for 20 minutes, within 3 hours of the burn.

4. No running water: pour clean water, or renew wet cloths, for the same time.
5. Wrap the rest of the body warm. A child shivers or the lips go blue: stop, dry, wrap.
6. Chemicals: brush off powder, then flood with water for at least 20 minutes. Eyes: lids held open, 20 minutes.
7. Cover with cling film laid on in strips, a clean bag, or boiled cloth. No cling film on the face.

Grades. Cool running water B. Ice X. Butter, oil, pastes X.

Rung ladder. Hands: water and a clock. Hearth: poured water, cloth, a clean bag. Refuse: ice, grease, flour, dung, ash, raw cotton, aloe instead of water.

20.3 Do: the drink for a big burn

Never give plain water as the main drink for a big burn. Instead, give oral rehydration solution (see 05.2).

Never give anything by mouth to a person who cannot swallow. Instead, lay them on their side and send.

For the awake who swallow, with no belly wound and no swelling throat.

1. Weigh. Start in the first hour.
2. A cup every 15 minutes, chilled if possible. Children keep breast milk and usual drinks on top.
3. Hours 1 to 8 from the burn: the amount in the table, each hour.
4. Hours 9 to 24: half that. Day 2: about a quarter of day 1, plus usual drinks.

Millilitres of solution per hour, hours 1 to 8.

Weight	ml per kg per % a day	10%	20%	30%	40%
10 kg child	3	20	40	55	75
20 kg child	3	40	75	110	150
50 kg adult	2	To thirst	125	190	250
70 kg adult	2	To thirst	175	260	350

Working: ml an hour = ml per kg per % × kg × % ÷ 16. At 70 kg and 30%: 2 × 70 × 30 = 4,200 ml a day, 2,100 ml in 8 hours, about 260 ml an hour.

5. Urine aim: adults 0.5 ml per kg an hour, 35 ml at 70 kg. Children about 1 ml per kg an hour. A marked jug. Nappies weighed dry and wet, 1 g about 1 ml.
6. Under the aim for 2 hours: raise the drink by a quarter. Over it with a swelling face: less.
7. Vomiting: stop 10 minutes, then sips. Still vomiting at 2 hours: a stomach tube by trained hands, or the district.
8. Restless, confused, cold hands, no urine: send. Breathless, tight belly: too much.
9. Chart every drink and void, with the time.

Grades. Salted drinks under 40% B. Over 40% D. Plain water in volume X.

Rung ladder. Hands: cups and a jug. Village: a stomach tube, trained hands. District: the drip. Refuse: anything home-made into a vein.

The 3 branches of the big burn:

- **Help in time.** Urine at the aim by hour 8, mind clear. Keep the cups going all night.
- **Help too late.** No urine, cold and confused at the district door. Send a card: time, size, weight, every drink and void.
- **No help at all.** A burn beyond the line in 20.1. They are often clear and talking for hours or days. Full pain relief, never held back for fear of shortening life. Drinks if wanted, warmth, family close. Tell them: a burn this size cannot be carried by drink alone, and nothing done hastened it. Keep the honey and the night watches for the burn that can live.

20.4 Do: the dressing and the first days

Never let a burned joint rest bent in the position of comfort. Instead, place it against the pull from day 1.

1. Paracetamol 30 to 60 minutes before every change (see 06.2). Stronger relief is the healer's.
2. Warm room, washed hands, scissors boiled 20 minutes from a full boil (chapter 1).
3. Wash the burn with soap and warm clean water.
4. Leave small blisters. Open large, bloody, pus-filled or joint blisters. Trim loose dead skin, never into bleeding.

5. Honey 15 to 30 ml on gauze, or equal parts honey and melted ghee or oil over boiled gauze.
6. Or banana leaf (*Musa* species): midrib out, boiled 5 to 10 minutes, used within 3 days.
7. Thick boiled cloth, then a bandage, firm not tight.
8. Hand or foot: a clean plastic bag tied loosely. Raise it. Move the fingers every hour.
9. Face: open, cleaned with warm boiled salt water.
10. Soaked outer layer: change at once. Whole dressing every 1 to 2 days, daily with pus or smell.

Infection: new pain, spreading redness, a colour change, the burn deepening, a bad smell. Fever, a racing pulse, a child who stops feeding: the healer now.

Feed from day 1: protein 2 g per kg a day for adults, 3 g for children. Milk, cooked eggs, oil, sugar. No raw eggs.

Positions. Neck: no pillow, a roll under the shoulders. Arm out at 90 degrees. Wrist back 20 to 30 degrees, knuckles bent, fingers straight. Knee straight. Ankle at a right angle. Move every burned joint through its range twice a day. Later months: chapter 28.

Still raw at 3 weeks: a graft at the district.

Grades. Honey on partial burns A, one surgeon's trials. Honey on full thickness D. Banana leaf B for pain, C overall. Positions B, the exact angles D.

Rung ladder. Hearth: honey, cloth, bags. District: grafting. Refuse: tannin crusts, silver sulfadiazine on clean partial burns.

20.5 Do: the frozen part

Never rub a frozen part, or warm it at a fire or on a hot stone. Instead, thaw it in water at 37 to 39 °C.

Never thaw a part that may freeze again. Instead, keep it frozen. Walking out on frozen feet is allowed.

1. Warm the cold body first (20.6).
2. Water at 37 to 39 °C. No thermometer: water an unhurt hand holds comfortably for 30 seconds.
3. The part clear of the sides. Keep the water moving and topped up.

4. About 30 minutes, until red or purple and soft.
5. Dry gently. Bulky dry dressings, between toes and fingers too. Loose, raised.
6. Leave blood blisters closed. Never walk on a thawed foot.
7. Ibuprofen by the table, every 12 hours.
8. Wait 1 to 3 months for the dead part to show its edge. Cut early only for spreading infection.

Ibuprofen about 6 mg per kg a dose, 12 mg per kg a day, never over 2,400 mg a day.

Weight	Dose	Syrup 100 mg in 5 ml	200 mg tablet
Under 10 kg	Healer only	No	No
10 to under 15 kg	60 mg	3 ml	No
15 to under 20 kg	90 mg	4.5 ml	No
20 to under 30 kg	120 mg	6 ml	No
30 to under 40 kg	180 mg	9 ml	No
40 to under 50 kg	200 mg	10 ml	1
50 to under 70 kg	300 mg	15 ml	1 and a half
70 kg and over	400 mg	20 ml	2

Work every dose twice, with two people.

No ibuprofen in pregnancy after 20 weeks, kidney disease, the dried out, or bleeding. Instead, paracetamol by 06.2.

Grades. Thawing in water A. Rubbing, snow or dry heat X. Aloe on thawed skin D.

Rung ladder. Hearth: a pot of water and a hand. Village: thermometer, ibuprofen. District: amputation at 2 to 3 months. Refuse: snow, fire, stove.

20.6 Do: the cold body

Never put a cold person in a hot bath or shower, or heat the arms and legs. Instead, wrap them and warm the chest, armpits and back.

See. Shivering and caring for themselves: cold. Shivering and clumsy, slow or confused: hypothermic. In doubt, hypothermic. A glass thermometer reads no lower than about 35.6 °C.

1. Out of wind and wet. Insulate from the ground.

2. Keep them flat. No standing, walking or lifting upright.
3. Under shelter, cut off wet clothes.
4. Wrap: waterproof layer inside, wool outside, head covered, face clear.
5. Awake and swallowing: warm sweet drinks, then food. No alcohol.
6. Heat to chest, armpits and back only, hand-hot, 40 to 42 °C, a cloth between.
7. Check the skin under the heat every 10 minutes.
8. Rest 30 minutes in the wrap before walking.

No breathing or pulse: feel the neck for a full minute. Then compressions (chapter 21). Go on through fixed pupils and stiffness. Few hands: at least 5 minutes of compressions, pauses no longer than 5 minutes. Plan for hours.

The 3 branches of the cold arrest:

- **Help in time.** A pulse returns. Flat and wrapped, then the district.
- **Help too late.** Send a card: time found, time compressions began, every pause.
- **No help at all.** Stop when the rescuers are spent, or breathing stopped before the cold. Tell the family: everything was done for as long as hands could do it. How long to go on is the village's rule.

Grades. Shivering in a dry wrap with sugar A. Hot bath, hand warmers, body to body X. Long compressions in the cold B.

20.7 Do: the hot body

Never delay cooling a hot, confused person to find transport. Instead, cool first, carry second.

Never lay ice packs straight on bare skin. Instead, immerse.

See. Hot, weak, clear mind, under 40 °C: heat exhaustion. Shade, rest, salted drinks. Over 40 °C and confused, staggering or unconscious: heat stroke. Normal temperature, confused, after much drinking: too much water. Salt, no more water, send.

1. Shade. Strip to underclothes.
2. Into water from the neck down, any water from 1 to 26 °C. Add ice if there is any.

3. One named person holds the head above water all the time.
4. No tub: a tarpaulin held by 4 people, filled with water, rocked.
5. No water for that: ice in wet cloths to cheeks, palms and soles, and fan.
6. Aim: below 39 °C within 30 minutes of collapse.
7. Stop at 39 °C. Dry, cover lightly. Watch for a second rise and for fits.
8. No paracetamol or ibuprofen for heat stroke. The water is the treatment. Awake: cool salted drinks.

About 10% die, 33% if the pressure stays low (HY-11). FO-09 says about 5%. Both printed.

The 3 branches of heat stroke:

- **Help in time.** Awake and talking at 39 °C. A day in the cool, watched.
- **Help too late.** Still confused after cooling, or fitting. Cool on the way. Send a card with temperatures and times.
- **No help at all.** Cooled, not waking, the pulse weak. On their side, kept cool, family close. Tell them: the heat had done its harm before the water reached it.

Grades. Immersion A. Tarpaulin B. Ice to cheeks, palms, soles B. Ice packs at neck, groin and armpits X.

20.8 Prevent: the house, the winter, the summer

Never put a hot-water bottle, hot stone or heated brick against numb, sleeping or cold skin. Instead, woollen bed socks and a warm room.

1. Heat for the awake who can feel: hand-hot, 40 to 42 °C, a cloth between, checked every 10 minutes. Never boiling water in a bottle.
2. No heat left on the sleeping, drunk, sedated, numb, confused, or babies.
3. Enclosed lamps, raised hearths, children kept from the fire. The burning house is chapter 13's.
4. Winter: a register of every house with someone old, ill or alone. A hand on each of them every day in a cold spell.
5. Summer: a tub kept full where people work. The same register, visited daily in a heat wave. The bedridden moved down from under the roof.
6. Heat work: 8 to 14 days to get used to it. Heavy work early and late. Drink to thirst, with salt.

7. Cold and wet: dry feet, socks changed daily.

Grades. Enclosed lamps B. Drinking to thirst A. Dry feet B.

If it goes wrong

- **The burn was iced or buttered.** Looks: a white, numb, deepening burn, or a greasy one. Cause: colder or softer felt better. Do: wash off grease with soap and cool water. Cool 20 minutes if within 3 hours. Dress by 20.4.
- **The drink fell behind.** Looks: little dark urine, cold hands, a restless child the first night. Cause: a late start, cups missed at night, plain water, vomiting. Do: sips every 5 minutes, raise by a quarter, chart, then the tube or the district.
- **The cold person collapsed once warm.** Looks: fainting or no pulse after being stood, carried upright, set by the fire or bathed. Cause: rough handling, heat to the limbs. Do: flat, compressions if no pulse, wrap, heat to the trunk only.

Numbers to carry

- 20 minutes of cool running water, within 3 hours. Never ice (WO-04).
- The person's own hand with fingers is about 1% of their skin (WO-04).
- Drink from 10% in a child and 15% in an adult. By mouth up to about 40% (WO-04).
- 2 ml for adults, 3 for children, × kg × % in 24 hours, half in the first 8 (WO-04).
- Over 40% in a young adult, 20% deep over 60, or age plus % near 100: beyond the village (WO-04, SY-07).
- 37 to 39 °C, about 30 minutes, once: thawing a frozen part (HY-11).
- 44 °C burns numb skin in hours, 50 °C in minutes (NU-08, SY-10).
- Over 40 °C and confused: below 39 °C within 30 minutes. About 10% die, 33% with low pressure, or about 5% (HY-11, FO-09, SY-12).

The library

WO-04 Burns: cooling, dressings, fluids, grafts and the honest limits. HY-11 Cold, heat, altitude and the elements. FO-09 Wilderness, expedition, polar and ship medicine. NU-08 Pain relief by non-drug means. NU-09 Spinal injury, paralysis and the long-term patient. SY-07 The red-flag list. SY-10 The harm register. SY-12 What the library could not find. All are on the website.

CHAPTER 21

Head, Chest and Belly, and Many Hurt at Once

A head that will not wake is watched hour by hour for a day. A sucking chest wound is covered in a minute. A rigid belly is at the district within six hours or the odds turn. When many are hurt, the sorting takes five minutes and saves more than the hands.

OPENING

Lay a flat hand on your belly, just under the ribs, and breathe in slowly. The hand rises. Under it the wall gives like risen dough, and a little more pressure meets nothing that objects. As the breath goes out, both sides of the chest settle together, left and right at once. In a mirror by a lamp, the black centre of each eye narrows in the light and widens in the shade, and the two stay the same size. A stranger could check all of this in half a minute.

These are three ordinary facts, in a face that answers when spoken to. This chapter is about the loss of each. The belly goes hard as a board, and the person lies still because every movement hurts. One side of the chest stops moving and the breathing quickens. A man who walked home after a blow to the head is hard to wake at midnight, and one pupil is wider than the other.

None of these can be mended in a village. The skull, the chest and the belly are closed rooms, and opening them belongs to trained hands with light, blood and a second person. What the village has is the hand that notices early, the clock that says how long, the position that keeps a throat open, the breath a neighbour gives, and the carry. Much of the dying in this chapter happens in the hours before help, and hours are what a village has.

Then comes the day when it is not one person but six. A cart overturns on the road. A roof falls in a storm. There are two healers and too few hands, and somebody has to walk past one hurt person to reach another. That is sorting, the hardest mercy, and it is still a mercy. It puts the hands where they can save a life.

Under the flat hand the belly is still rising and falling. Nobody had to sort anything.

THE STORY

The flying ambulance

In 1793, at Metz, a French army surgeon named Dominique Jean Larrey sent light carriages onto the field while the guns were still firing, to fetch the wounded during the action. Until then a wounded man lay where he fell, and a surgeon reached him a day or a day and a half later, if at all. Larrey's flying ambulances brought him to a surgeon within hours. In Egypt in 1798 he treated enemy wounded as his own.

His rule, written in the Russian campaign of 1812, was that the dangerously wounded came first, "without regard to rank or distinction". An officer with a cut hand had been seen before a private with a shattered leg. Larrey put the leg first. Yet he did not spend scarce hours on the clearly hopeless.

In 1846 a surgeon of the Royal Navy wrote the three parts down plainly. Treat first those who need care now and will benefit from it. Let the slightly hurt wait. Let the probably fatal wait too. Every sorting rule since is a version of those three sentences.

The modern hospital forgot how much the clock mattered, because it had shrunk the clock. Wounded soldiers in the Second World War reached a surgeon 12 to 18 hours after the wound. In Vietnam it was under 2 hours. After the Fall the village is back in Larrey's world. The surgeon is a day away, the ambulance is four neighbours and a door, and the sorting is done by whoever stands at the door.

The head that will not wake

A blow to the head hurts the brain twice. The first injury is done in the instant, and nothing in a village can undo it. The second comes over the following hours, from too little oxygen, too little blood pressure, swelling and clot, and too little oxygen is the largest part of it. The second injury is the one hands can prevent. A throat kept open, a body on its side, a head above the heart.

In 1974, at Glasgow, Teasdale and Jennett published a scale that people who were not brain specialists could use at a bedside. It scored the eyes in 4 steps, words in 5 and movement in 6. It was built for watching through the night. The point was never the number. It was the trend. A total that falls from 14 to 11 in two hours means a surgeon within the hour. Untrained people scoring filmed patients got the total right only a third of the time. So the Bench writes the three columns separately and never adds them.

The trend matters because of the clot. A bleed between the skull and its lining turns up in about 2 head injuries in 100, and one beneath the lining in about 8. Between the blow and the decline there may be a clear spell, usually 2 to 4 hours. The classic signs of a growing clot are a pupil widening on its side, falling consciousness, a slowing pulse and breathing that loses its rhythm. When present they are nearly always right. In one series of 249 patients they were missing in nearly two of every three with raised pressure. Their absence proves nothing, and the watch goes on.

Some heads no watch can save. Among people with penetrating head wounds who scored 3 to 5 once bleeding and breathing had been dealt with, 98 in 100 died even with surgery. At 6 to 10, 31 died. At 11 to 15, 8 died. The Red Cross surgeons say the greatest effort is owed to the patient who starts mild and gets worse. That is the patient the night watch is for.

The urge to quiet a restless patient after a head injury is old and dan-

gerous. The usual cause of the restlessness is a full bladder. Morphine or a sleeping draught hides the fall in the score that should have sent for help.

One side still

Penetrating chest wounds are about 10 in 100 of the wounded and about 25 in 100 of the killed. Of those who reach help alive, about 9 in 10 need nothing more than a tube between the ribs to let air and blood out. Only 5 to 10 in 100 need the chest opened.

The wound that kills fastest makes no noise. Air leaks from the lung into the space around it with each breath and cannot get out. The pressure builds, the lung collapses, and the heart is pushed aside. One side of the chest goes silent and sounds like a drum when tapped. The neck veins swell and the windpipe is pushed away from the bad side. For decades the answer was a needle in the upper chest. Across 24 studies and 8,046 patients the needle failed about a third of the time, and the practice moved to a small cut and a finger. A village can learn to see the signs. Letting the air out belongs to someone taught on a body, not on a page.

The sucking wound, where air whistles in through a hole in the chest wall, was for years covered with a square of plastic taped on three sides, so that air could leave and not enter. American military guidance dropped it in 2008. The evidence for it is weak, and a cover sealed on all sides can turn a sucking wound into the silent kind. Cover the hole, stay, and lift the cover if breathing worsens.

Broken ribs kill the old slowly. In a study published in 2000, patients of 65 and over with broken ribs developed pneumonia in 31 cases in 100 against 17 in younger patients, and died in 22 against 10. Each extra broken rib raised the odds of death by about a fifth. The bone is not what kills. It is the shallow breath that pain allows, and the lung that fills behind it. Binding the chest, once the standard treatment, makes the breath shallower still. The cure is enough pain relief to cough, and ten deep breaths an hour.

Thirty-six hours

In 1886 in Boston, Reginald Fitz described 257 cases of a belly inflammation that began in the appendix, and gave the disease its name. Three years later a Chicago surgeon began to operate early, and over about 2,000 cases his deaths fell from 11 in 100 to 2. How many died before anyone operated is not known. One estimate for severe cases is 20 in 100. Another source gives 17 in 100 for those operated within 48 hours and 67 for those operated on the ninth or tenth day. Between 4 and 20 in 100 settle on their own.

The clock was measured in 2006. Among 219 patients, the chance of rupture was 2 in 100 or less in the first 36 hours from the start of the pain. After that it rose by about 5 in 100 for each further 12 hours. A burst appendix spills the bowel into the belly. The belly goes rigid. The patient lies still.

Before antibiotics some surgeons chose to wait. In 1901 a Chicago surgeon published a resting method: nothing by mouth, no purgatives, the patient propped up. Of 565 patients, 3.5 in 100 died. But he operated on most of them in the end, so his figure is not a figure for rest alone. Where the body has walled the appendix off in a lump, rest still succeeds 80 to 90 times in 100. Modern trials have added antibiotics. In the largest, of 1,552 adults, 29 in 100 still needed the operation within 90 days. At sea, where no surgeon sails, 342 patients were treated without operation and 90.8 in 100 recovered.

The hole in a stomach ulcer runs a faster clock. Delay becomes dangerous at about 6 hours after the hole opens. The acid spilled into the belly turns to infection in about 12. In 1946 a surgeon treated 28 such patients with suction through a tube alone, and about 1 in 10 died. A trial in 1989 put 83 patients either to surgery or to the tube. Deaths were 5 in 100 in each group, but 11 of the 40 on the tube had not improved by 12 hours and needed the knife, and those over 70 did worse.

So the belly gives a village two clocks, 36 hours and 6, and a regimen that buys time but does not cure. The old remedy for belly pain, the purge and the enema, makes everything worse. An appendix that bursts on the second day kills as it did in 1890. What can change is the hour the carry begins.

Copenhagen

In August 1952 polio reached Copenhagen, and about 3,000 patients came to the Blegdam Hospital before the year was out. About 1,250 were paralysed. In 345 the virus had reached the part of the brain that drives breathing and swallowing. The hospital had one tank respirator and six smaller shell respirators. In the first three weeks, 27 of 31 such patients died, 19 of them within three days.

Henry Lassen led the hospital's team. At a meeting on 25 August, Bjørn Ibsen proposed a tube through an opening in the windpipe and a rubber bag squeezed by hand, for as long as it took. Up to 70 patients were breathed for at once. About 1,500 medical and dental students did the squeezing, in shifts of 6 to 8 hours, 4 to 5 students to a patient, some trained in under ten minutes. Over the epidemic they gave about 165,000 hours. Deaths among those patients fell from about 9 in 10 to about a quarter, or by other accounts lower still.

What Copenhagen proved is simple. A person whose breathing has stopped but whose brain and heart are sound can be kept alive by another person's hands, for weeks if need be, until the body recovers. It holds for polio, for an overdose of opium, for hemlock, for some snakebites and for the farm poisons that paralyse. A village has no tube, but breath given mouth to mouth through a thin cloth carries about 16 parts in 100 of oxygen, enough to live on. It does not hold for a neck broken high above the shoulders. Those patients do not recover their breath, and no relay lasts for ever.

The failure point was never the hands. It was the night, the third night, the moment nobody had written down who came next. The students had a hospital to organise them. A village has a wall and a stick of charcoal.

Sorting at the door

Nikolay Pirogov reached the besieged city of Sevastopol late in 1854. The wounded came faster than any surgeon could treat them, and he sorted them at the door. One account gives four groups. The hopeless went to the Sisters of Mercy and the priests. The urgent were operated on at once in the Assembly of Nobles. The less serious waited until the next day. The lightly wounded were dressed and sent back. Another account

gives five groups, but both agree on where the hopeless went. Not to the surgeon, and not into the street. To the nurses. With three teams working, his surgeons managed up to ten major amputations an hour. The hardest mercy, in Pirogov's hands, still had care written into it.

In 1983, at Newport Beach in California, a sorting rule was written that a lay person could run in about 30 seconds a patient. It sends the walkers to one place and marks the rest by breath, pulse and a simple command. No mass sorting system has been shown to save lives. What has been shown is the cost of sorting badly. After one train crash, 53 of every 100 patients were sorted too high. Frykberg and Tepas reviewed 220 bombings with 3,357 casualties. On average 59 in 100 had been sent forward who did not need to be, and the more were sent forward, the more of the gravely hurt died. Sending everyone to the healer is not the safe choice. It swamps the healer.

Lay people can sort. School staff given a 30-minute talk sorted correctly 79 times in 100 in an exercise. The Red Cross surgeons add that the sorter wears a band on the arm and does not treat. In their hospitals, patients who arrived within 6 hours died at 5.5 in 100 and those who arrived after 72 hours at 2.3, because the dying had died on the way. Sorting by distance happens whether anyone chooses it or not.

The danger runs the other way as well. In the flooded Memorial hospital in New Orleans in 2005, 45 bodies were found, and 23 of the 41 tested held morphine, a sedative or both. Patients were called dying who were not yet dying. The not-chosen are owed care, company and honesty. The sentence they are owed is that we do not have enough, never that nothing can be done.

The Honest Broker's Stretcher

Two reports carry this chapter, and both can be trusted once their weak figures are marked. WO-07 says where a number came from search summaries only, as with untrained scoring. WO-08, the library's fullest account of the belly, admits that no one knows how many untreated patients with appendicitis died, and its two figures, printed above and marked, measure different things.

The brief expected FO-08's belly odds to differ from WO-08's. FO-

08, the triage report, has no appendix, ulcer or head figures, so there is no conflict to print. The figures that do differ lie elsewhere. The 1946 suction series lost 10 in 100 in one source and 11 in another. The Red Cross puts burns over 50 in 100 of the skin in its comfort group in one document and over 40 in another. Copenhagen's fall in deaths is 90 to 25 in 100 in NU-09, which read West's 2005 review in full, and 90 to 15 or 20 in IN-16, from secondary accounts. Nobody obtained Lassen's own 1953 paper, and SY-12 leaves the village's endurance open as R2-12. The relay arithmetic at the Bench is mine.

IN-12, named in the brief, covers the childhood epidemics and gave one line: an untrained cut in a choking patient's neck kills. WO-07 gives full steps for letting air out of the chest and for placing a drain, at the village rung. I left the steps out, because they are cuts into the chest and chapter 23 owns the knife. SY-12's R2-10 asks for the primary ulcer series, still unread, so the resting regimen at the Bench carries its marks.

The turn to the present

The hospital hid three things from us. It hid the scanner that finds a clot before the pupil widens. It hid the helicopter that turned hours into minutes. It hid the machine that breathes, which made Copenhagen's students a memory. The golden hour of injury care began as one surgeon's opinion in the 1970s and was never tested in a trial. When it was finally made a rule, in Afghanistan in 2009, the time to a surgeon fell from 90 minutes to 43, and the share of the wounded who died fell from 13.7 in 100 to 7.6. Speed is real. After the Fall the village will not have it.

The district adds a little, and chapter 23 says how. An operation for a bleeding belly or a strangled hernia is on the district's list. An opening in the skull is not. At Lilongwe, burr holes in selected patients went with deaths of 6.8 in 100 against 43.9 in those not operated. At Lacor, in Uganda, all 3 patients died and the hospital stopped. The operation for appendicitis is not on the district's list either, which is why the resting regimen matters more after the Fall than before it.

What is left when the hour is gone? A position, a breath, a watch through the night, four bearers and a door, and somebody at the threshold who decides in thirty seconds and lives with it afterwards.

Sorting is the hardest mercy because a neighbour does it, by lamplight, with a coloured cloth, and because the not-chosen are still owed a hand to hold. Done in five minutes, it saves more than the hands.

Now sort.

AT THE BENCH

21.1 See: many hurt at once

Never mark anyone beyond help without a second look. Instead, sift every yellow, blue and black again within 30 to 60 minutes.

The sorter is named in advance and is not the healer. The sorter wears a band on the arm and does not treat (21.7).

1. Note the time. Shout: "Anyone who can walk, go to the green cloth." One person watches them.
2. Shout: "If you can hear me, raise an arm." Go first to those who do not move.
3. Stop major bleeding with pressure or a tourniquet (chapter 18). It is the only treatment the sorter gives.
4. Not breathing: open the airway once.
5. Count breaths for 15 seconds, times 4. Feel the wrist. Ask for a squeeze. Sort by the table, 30 seconds a person.
6. Tie the cloth to the wrist. Write the colour's first letter and the time on the forehead in charcoal. A tourniquet adds T and its time.

Colour	Means	Goes to
Red	Over 30 breaths, no wrist pulse, no squeeze, or breathing only after the airway was opened	The healer now, in the order found
Yellow	Breathing, obeys, cannot walk	Waits, sifted again

Colour	Means	Goes to
Green	Walks	The green cloth
Black	No breath after the airway was opened once	Sifted again

Blue is comfort care, given only by the healer with a second person, once every red is treated. Red Cross examples: a penetrating head wound scoring under 8, or massive bleeding with no blood. Also burns over 50% of the skin, 40% in other Red Cross documents. Never blue on a first look: a child, the cold, the drunk or concussed, anyone the decider knows.

Grades: the sift B, the Red Cross groups B, lay sorting C (FO-08, SY-07).

Rung ladder. Hands: the sift. Hearth: 4 cloths, charcoal, a watch. Dispensary: the log. Infirmary: a triage officer. Hospital: surgery and blood turn blues back to red. Refuse: first come, first served, and sorting by rank or kin.

21.2 See: the head that will not wake

Never give opium, morphine or a sleeping drug after a head injury. Instead, empty the bladder. Then put the mattress on the floor.

1. On the side, head above the heart, neck straight. Clear the mouth.
2. Chart every 30 minutes for 6 hours, then hourly for 18 hours.
3. Write each column. Do not add them.

Eyes	Words	Movement
4 open by themselves	5 knows where and when	6 obeys
3 open to voice	4 confused	5 reaches for the pain
2 open to pressure	3 wrong words	4 pulls away
1 none	2 sounds only	3 bends stiffly
	1 none	2 straightens
		1 none

4. Also write both pupil sizes, the pulse and the breaths a minute.
5. Danger signs. Any 1 means the healer now:

    - Any column falls 2 steps.

- One pupil larger than the other.
- Pulse below 60.
- Breathing loses its rhythm.
- A fit. Fits are chapter 25's.
- Vomiting starts again after it stopped.

6. Temperature twice a day. At 39 °C, uncover, sponge and fan.
7. Eyes that no longer blink: tape the lids shut.
8. Turn every 2 hours (21.4).

The 3 branches of the danger sign:

- **Help in time.** The columns hold or rise over 24 hours. They wake. Someone stays beside them 2 more nights.
- **Help too late.** The columns keep falling. Carry only if the district has someone trained to open a skull. A day's carry on a falling score often ends on the road.
- **No help at all.** Score 3, both pupils wide and fixed. Few live. Of penetrating wounds scoring 3 to 5, 98 in 100 died even with surgery. Keep them on the side, warm, lips wet, family close. Tell the family: the bleeding is inside the skull, and no hands outside a hospital can reach it. Nothing they did caused it.

Rung ladder. Hands: position, chart, clock. Hearth: charcoal and a wall, a mattress on the floor. Dispensary: a lamp for the pupils. Infirmary: tube feeding from 72 hours. Hospital: the scanner and the burr hole. Refuse: sedation, and opening a skull below the district (SY-10 H41).

21.3 Do: the unconscious, breathing and compressions

Never give anything by mouth to a person who cannot swallow. Instead, wet the lips with a cloth.

1. Breathing but unconscious: roll onto the side, upper knee forward, head tilted back, mouth pointing down. A possible neck injury rolls as one piece (21.4).
2. Not breathing, or only gasping: clear the mouth with a hooked finger. Tilt the head. Lift the jaw.
3. Feel the neck pulse for 10 seconds. In the cold, a full minute (chapter 20).

Pulse present: breathe for them.

- Adult: 10 breaths a minute, 1 every 6 seconds. A child is chapter 4's.
- Mouth to mouth through a thin cloth. A salvaged bag: squeeze about half of it.
- The chest rises just visibly. The belly rises: tilt further, blow softer.
- Relays of 1 hour, 2 people awake. A written handover at each change: time, who, breaths a minute, chest rose, anything vomited.

No pulse: compressions.

- Flat on firm ground. Heel of one hand on the centre of the chest, the other hand on top. Arms straight, shoulders over the hands.
- Press 5 to 6 cm deep, 100 to 120 times a minute. Let the chest rise fully between presses.
- 30 presses, then 2 breaths. Change the presser every 2 minutes. The library found no figure for depth, rate or ratio. These are the draft's, from common first aid teaching.
- Drowning: breaths always go with the presses, never presses alone (HY-11). Never press in the water.
- Lightning: breathe for the still ones first, add presses if no pulse (chapter 20).
- Cold: at least 5 minutes of presses at a time. If relays cannot keep them up, pauses no longer than 5 minutes (HY-11).

What it buys. The library found no figure for survival after presses without a defibrillator. In the cold, recovery from arrest without a heart and lung machine is rare (FO-09). The record: good recovery after 6 hours 30 minutes of presses in a cold arrest (HY-11). After lightning, a heart that has not restarted after long breaths and presses will not (HY-11). Grades: breathing by hand B (ME-14), long presses in the cold B (HY-11). Presses in a warm adult: the library gives no grade.

Danger signs: the chest stops rising, vomit in the mouth, the neck pulse goes.

- **Help in time:** a defibrillator or breathing machine within reach. Carry, the relay still breathing.
- **Help too late:** keep the relay going on the stretcher. Write the time presses began.

- **No help at all:** presses alone rarely bring a warm adult back. When the village rule says stop, sit with the family.

What relays need. 1 patient takes 48 person-hours a day, a breather and a watcher. At 6 hours each, that is 8 people. SY-07 plans 24 for 6 weeks. How long a village can keep it up is unknown (SY-12, R2-12).

When to stop:

- They breathe on their own for a full minute. A watcher stays beside them for the next hour.
- While breathing for them, the neck pulse goes: start compressions.
- Compressions in a warm adult: the library found no stopping time. The village rule sets one. Drowning: stopping after 25 minutes is reasonable (HY-11). Cold: chapter 20.
- Do not start for an obviously fatal injury or a chest too frozen to press (HY-11).
- Do not start for a head injury that scored 3, pupils wide and fixed before breathing stopped. Nor for a broken neck with no breath below the shoulders. Nurse them and stay.
- Relays that cannot hold: the village rule decides, never the tired breather.

Rung ladder. Hands: position, breath, presses. Hearth: the rota board. Dispensary: a bag with 2 mask sizes. Infirmary: relays for several patients. Hospital: the defibrillator and the machine that breathes. Refuse: one exhausted person alone.

21.4 Do: the spine and the carry

Never leave anyone strapped to a hard board longer than the move takes. Instead, pad them and turn them every 2 hours.

1. The spine is clear only if all 3 hold:
    - Alert, sober, no other painful injury.
    - No tenderness along the middle of neck and back.
    - Moves and feels all 4 limbs.
2. Otherwise keep them lying, with rolled clothing either side of the head.
3. A stab or bullet wound alone: do not immobilise. Treat the bleeding.

4. The log roll, 4 people:
    - The most skilled holds the head, hands over the ears, and gives every command.
    - 3 kneel on one side, at shoulder, hip and legs.
    - Roll as one piece. Nose, breastbone and navel stay in line.
    - Do not force a neck that resists or hurts more.
5. Signs of a cord injury: no movement or feeling below a level, a slow pulse with cold pale skin, a penis that stays erect.
6. Slow pulse and low pressure: raise the legs and keep warm. Do not pour in fluid.
7. The carry: on a board or a door. Over 1 km, 4 to 6 bearers taking turns.
8. District a day away: carry anyway. Long nursing is chapter 28's.

Rung ladder. Hands: alignment, the log roll. Hearth: a door, rolled cloth, a turning chart. Dispensary: a clean catheter (chapter 28). Infirmary: nursing and exercise. Hospital: surgery, seldom needed. Refuse: the rigid collar and the board as routine.

21.5 Do: the chest

Never bind or strap broken ribs. Instead, 10 deep breaths and a supported cough every hour while awake.

1. Look at both sides. Count breaths. Tap each side. Listen with an ear on the chest.
2. Sucking wound: cover it at once with something airtight. Tape 3 sides. Grade C. Stay beside them.
3. Breathing worse after the cover: lift it.
4. Danger signs: one side silent and drum-like, swelling neck veins, the windpipe pushed aside, rising breathlessness. This is air under pressure. Minutes count.
5. Letting the air out is a trained skill, taught hands-on, never from this page.
6. Sit them up.
7. Broken ribs: pain relief by weight first (chapter 6). Hug a folded blanket to cough. Blow through a straw into a bottle of water, 10 breaths an hour.
8. Over 65 with 3 or more broken ribs: a nursing emergency. Watch days 2 to 5 for fever, faster breaths, green or rusty phlegm.
9. A piece of chest that moves in when the rest moves out: the lung beneath is bruised. It gets worse over 2 to 3 days.

10. A drain from the district: the bottle stays on the floor, never above the chest. Never clamp it for the carry.

The 3 branches of air under pressure:

- **Help in time.** A trained hand lets the air out. Then a drain at the district.
- **Help too late.** Carry sitting up, with a card of times.
- **No help at all.** Sit them up in a relative's arms. Tell the family: air trapped inside pressed the lung flat, and it needed a trained hand. Because it is reversible, it is never on the comfort list while a trained hand can be reached (SY-07).

Rung ladder. Hands: looking, tapping, the cover, the cough drill. Hearth: plastic, tape, a straw and bottle. Dispensary: pain relief (chapter 6). Infirmary: the drain and the rib block (chapter 23). Hospital: chest surgery. Refuse: binding, and cuts into the chest by the untrained.

21.6 Do: the rigid belly

Never give a purgative or an enema for belly pain. Instead, nothing by mouth but sips, propped up, and watch the clock.

1. Write down the hour the pain began.
2. Danger signs. Any 1 means the district:
    - Belly hard as a board, the patient lying still.
    - Pulse over 120.
    - Fever over 38.9 °C after 36 hours of pain.
    - Green or brown vomit.
    - A groin lump stuck over 24 hours.
    - A woman with a missed period who faints. Go now.
    - Sudden belly pain in week 2 or 3 of typhoid.
3. The clocks. Appendix: rupture 2% or less in the first 36 hours, then about 5% more each 12 hours. Ulcer hole: dangerous after 6 hours.
4. Belly chart every 4 hours: pain, hardness, pulse, temperature, vomit. Worse on 2 charts in a row: send. Never decide on bowel sounds (grade X).
5. Bowel through a wound: a damp clean cloth over it. Never push it back. Go now, within 6 hours.

By distance. Within 6 hours: carry now, propped, sips only, a card of times. A day away: carry now, resting on the road. Out of reach: rest at home.

The resting regimen. Grade B for an appendix lump (WO-08). The ulcer tube is the district's, grade A only with a surgeon in reserve.

- Nothing by mouth but sips.
- Propped at about 45°.
- An adult who cannot drink needs about 1.5 to 2.5 litres a day.
- Antibiotics if held, by the dispensary's card.
- Examine again at 12 hours. Worse: carry, whatever the distance.

The 3 branches of the rigid belly:

- **Help in time.** The district takes over before 36 hours, or 6 for an ulcer.
- **Help too late.** Carry still, propped, with the card. Some live.
- **No help at all.** Comfort care (chapter 31). Mouth care, a held hand, pain relief. Tell the family: the belly burst inside, and only an operation could close it. Nothing they did caused it.

Rung ladder. Hands: the clock, the chart. Hearth: a backrest, a cup. Dispensary: antibiotics. Infirmary: operations for a bleeding belly and a strangled hernia, not the appendix (SY-07). Hospital: the operation within hours. Refuse: the purge, the enema, the untrained operation (SY-10 H41).

21.7 Prevent: the plan before the day

Never let the healer be the sorter. Instead, name a sorter and a deputy now.

1. Write the village rule for many hurt at once. Adopt it in public.
2. Keep cloths in 4 colours, charcoal, the log and the rota board in one known place.
3. Name 2 teams of 4 bearers, each with a door.
4. Drill the sift, the log roll and the relay once a year with the whole village.
5. Never sort by rank, wealth, kin or past favours. Ties: lots drawn before a witness (FO-08).
6. After every event, read the log aloud. Hear complaints then, not on the night.

Rung ladder. Hands: the drill. Village: cloths, log, rota board. District: a triage officer and a quiet room for blue.

If it goes wrong

- **The reds wait.** Yellows and greens fill the healer's place. Cause: no sorter. Do: stop, send walkers to the green cloth, sift again, hand sorting to the deputy.
- **The relay breaks at night.** The patient goes blue at 3 in the morning. Cause: nobody wrote down who came next. Do: breathe for them yourself, wake the next 2, write the board.
- **The clock was missed.** A head sedated for restlessness, or a belly watched past 36 hours. Cause: no chart. Do: chart now, empty the bladder, carry now.

Numbers to carry

- 30 seconds a person at the sift. Over 30 breaths, no wrist pulse or no squeeze: red (FO-08).
- Every 30 minutes for 6 hours, then hourly for 18: the head watch (WO-07).
- 36 hours: appendix rupture 2% or less, then about 5% more each 12 hours (WO-08).
- 6 hours: the perforated ulcer's window (WO-08).
- 120: a pulse over 120 with a rigid belly means go (WO-08).
- 10 breaths a minute for an adult, in 1-hour relays (ME-14).
- 2 hours: turn the unconscious and the paralysed (WO-07).

The library

WO-07 Head, spine and chest injuries without imaging. WO-08 The abdomen: when to open, when to wait. WO-09 Amputation and major surgery before antibiotics. FO-08 Triage and the ethics of scarcity. FO-09 Wilderness, expedition, polar and ship medicine. HY-11 Cold, heat, altitude and the elements. ME-14 Poisons, overdoses and the antidotes you can make. NU-09 Spinal injury, paralysis and the long-term patient. IN-16 Zoonoses, food poisoning and the animals we live with. IN-12 Measles, whooping cough, diphtheria and the childhood killers. SY-07 The red-flag list. SY-10 The harm register. SY-12 What the library could not find. All are on the website.

CHAPTER 22

Bites, Stings and Poisons

Anaphylaxis kills in minutes, so adrenaline goes into the thigh within five. Charcoal helps only within the hour. Rabies gives weeks to months before it shows and no hours after, so wash the bite at once and keep the dog.

OPENING

Swallow, and notice what happens after the tongue lets go. The tongue gathers and lifts. The throat takes over, and the thing is gone, out of reach of any choice about it. Whatever it was, water or bread or a berry from the hedge, the stomach now holds it for about an hour and then passes it on, and from there it goes into the blood. Most of what harms a body comes in this way. The rest comes through the skin, by a tooth or a sting.

A child of two finds a lemonade bottle under the sink and drinks from it. It holds lye from the soap pot. A man lifts a log from the woodpile and feels a prick at the wrist like a bramble. A woman picks wild garlic in April and cooks it for the family, and some of the leaves are not garlic. A dog that has never bitten anyone bites the boy who feeds it. A bee lands on a neck at the harvest.

Each of these starts a clock. After the sting, if the throat swells, the clock runs in minutes. After the swallow, it runs for about an hour, while the stomach still holds most of what went down. After the dog, it runs

for weeks, silently, and then it stops. What the household does in the first minutes is mostly simple, and mostly a matter of not doing the old wrong thing. Not cutting. Not sucking. Not tying. Not making the child vomit.

Every case here comes down to the mouth and what went into it, and the skin is only a second mouth. A jar on the shelf, a basket of leaves, a tooth through the skin, a sting. The body has its own slow ways with each, and most of them work if they are given time. The work of the house is to give that time, to keep the jar, and to know the few cases that need more than the house has. The house can do most of it.

Almost all of it starts with water. Running water and soap over a bite for a quarter of an hour. Air and open doors for the room where the brazier burned. A sip of water, and then nothing, for the burnt mouth. The jar kept, with its label on.

THE STORY

The jar on the shelf

Between January 2002 and December 2023 the poison centre at Marseille logged 513,750 reports. Of these, 2,197 were about one plant or fungus eaten in place of another, fewer than one call in two hundred. Just over half of those people fell ill, about one in twelve went to hospital, and one died. It followed monkshood eaten in place of a mountain umbel. The commonest confusion was oleander taken for bay, 289 times, with no death at all. With an ambulance behind it, most of them were a bad night.

What the voice on the telephone did was ask questions. What was it. How much. When. How heavy is the person. Those four questions are most of a poison centre, and a village can ask them without a wire. The answer to the first is in the jar, the plant or the leftover food, which is why the jar is kept. The answer to the third sets everything else. A swallowed thing waits in the stomach for about an hour before most of it moves on into the gut, where the blood takes it up. Charcoal given in the first 5 minutes holds three quarters or more of what is there. By 60 minutes it holds about a tenth.

In the house, the mouth and what went into it is mostly a child's mouth and whatever stood within reach. In Uyo, in Nigeria, seven in eight of the children who swallowed caustic came from homes where soap was made, and half were left with a narrowed gullet. Five millilitres of oil of wintergreen, a teaspoonful, killed a child of two and a half. Five millilitres of eucalyptus oil can poison a child badly. Iron tablets look like sweets, and for a child of 10 kg nine of the ordinary 65 mg tablets reach the level that is dangerous. After vomiting comes a quiet spell, and the quiet is not recovery. The bottle is the danger, not the child.

The black bottle

In 1831 a pharmacist named Touéry stood before the French Academy of Medicine and swallowed ten times the deadly dose of strychnine with 15 g of charcoal, and lived. A chemist had done the same with arsenic in 1813. Charcoal appears in Egyptian medical papyri of about 1550 BC, and still it took until 1963, and a review that called it the black bottle, for charcoal to reach the emergency rooms. For a generation after that it was given almost by habit. Charcoal is carbon riddled with fine passages, and many poisons cling to their walls and leave the body with it. Some do not. Alcohols, iron and other metals, salts, acids, lye, paraffin and lamp oil pass by.

It must also be swallowed by someone awake. A drowsy person can breathe it in, and so can a child who is forced. Paraffin and lamp oil kill children mostly by entering the lungs, not the gut, which is why nothing is done that might bring them back up. Charcoal from the hearth holds less, because its inner surface is a quarter to a fifth of the made kind. A briquette is never used. The black bottle is a modest friend, and it keeps for an hour.

Charcoal's good name was earned beside a much worse habit. For centuries the first thing done to the poisoned was to make them vomit, with a finger, with ipecac, with mustard, with salt. Salt kills. In Hamburg in 2005, doctors examined three people who had died after salt was given to make them sick, and found the salt in their blood had swollen the brain. At least five such deaths are on record, one of them a woman in 1974 who had taken a small overdose of aspirin. About a gram of salt for each kilogram of body weight can kill, which for a child of 15 kg is about three level

teaspoons. Vomiting brought on by any means empties little, delays what helps, and sends some of the stomach into the lungs. The oldest first aid for poison is the one that must stop.

The dog

On 6 July 1885 Louis Pasteur began treating Joseph Meister, a boy of nine bitten by a rabid dog, and the boy lived. Rabies still kills about 44,000 people a year, nearly all of them bitten by dogs, and four in ten of them children under fifteen. The virus travels from the bite along the nerves toward the brain, usually over two to three months, sometimes a week, sometimes a year. Once it reaches the brain and the person falls ill, death is near certain. A girl in Wisconsin lived in 2004 after doctors put her into a deep induced sleep, and at least sixty-four people treated the same way since have died. The time that matters is the time before the illness. Most of it is spent not knowing.

Two things fill that time. The first is washing. In a study published in 1962, guinea pigs given rabies virus in a wound were not protected by a single flush with soap, but repeated swabbing and flushing did protect them. No study in people shows that washing alone prevents rabies. The virus sits in a fatty coat that soap breaks, and fifteen minutes of soap and running water is the first thing the WHO asks of anyone bitten. The second is to keep the dog. A dog shedding the virus in its saliva falls ill within days, and a dog that stays well for ten days after a bite was not carrying rabies when it bit. A dog killed at once takes its answer with it.

Villages have always answered rabies by killing dogs. Between 2002 and 2006 Hampson and colleagues traced more than 3,000 bites and contacts among more than 1,000 suspect animals in the Serengeti and Ngorongoro districts of Tanzania. Each rabid dog passed the virus to about one other. That number was the same where dogs were seven times as crowded. Fewer dogs did not mean less rabies, and vaccinated dogs did. The dog that is counted and vaccinated keeps the village safe.

The islands of Indonesia tested the other way. On Flores nearly 300,000 dogs were killed over four years from 1997, about half of all the dogs there, and rabies stayed. Rabies reached Bali in November 2008. About 108,000 dogs were killed before vaccination began across the is-

land, and people went on dying at about four a month. When vaccination reached more than seven dogs in ten in most villages, deaths fell to about one a month. In one Balinese village the dogs that were killed were replaced within days by puppies nobody had vaccinated. Killing is quick. Counting is slow, and it works.

The snake

Snakes bite about 5.4 million people a year, and between 81,000 and 138,000 of them die, with about three times as many left without a limb or with lasting harm. In India alone, from 2000 to 2019, about 58,000 people died of snakebite each year. Nine in ten were country people, three in four died away from any clinic, more than one in four were children, and half were bitten in the monsoon, from June to September. In Bangladesh about three in a hundred reached a hospital. The rest went to the snake healer, and many lived, because about half of all bites by venomous snakes carry little or no venom. A remedy given a hundred times that seems to save fifty earns a name it has not earned.

Warrell studied puff adder bites in Nigeria in 1975 and wrote, thirty-five years later, the guideline the WHO uses for South-East Asia. His advice to the bystander begins with doing no harm. The bystander lays the person down, keeps the whole body still, splints the bitten limb, takes off rings, does nothing to the wound, and carries them lying down. Every movement of the limb's muscles squeezes venom onward. In volunteers given a tracer in the leg, it spread in nine of nine who walked and in four of thirteen who rested. Kraits bite people asleep on the floor at night, often without pain, and the bitten wake unable to lift their eyelids. They hear everything. In Bangladesh a paralysed child was nearly laid on the funeral pyre.

In 1979 Sutherland bound the bitten limbs of monkeys given tiger snake venom with a firm crepe bandage from the fingers upward, and a splint, and the venom stayed in the limb, where either alone had failed. Australia has taught the bandage ever since. It suits snakes whose venom paralyses, the cobras, kraits, mambas and their kin. For vipers, whose venom swells and kills the flesh of the limb, the same pressure adds harm. People taught the bandage get the tension right only five to thirteen times

in a hundred. It belongs to a place and a snake, and not to every bite.

Everything else the old first aid did makes things worse. Cutting the bite brought more swelling. Sucking it, in a test, drew out four parts in ten thousand of the venom. A tight band above the bite starves the limb, and in Brazil those who had one suffered severe damage around the bite at about four times the odds of those who had none. Ice, taught in Arizona from 1953, was followed by amputation in many children. Plant pastes applied to bites went with death or disability in eight of fifteen in one Nigerian series, against one in fifteen without them. The snake healer's cut is older than any of these, and no kinder.

What saves the badly envenomed is antivenom, matched to the snake and given at the district with adrenaline beside it. Thailand lost 178 people a year to snakebite in the 1950s and fewer than ten in recent years. Without antivenom, the paralysed can still be breathed for by hand, in relays, and some have walked out after more than a month. That is the village's share. It is a large one.

The bee and the minutes

Most stings are a bump and a bad hour. In a few people the whole body answers the venom at once. The vessels open and leak, and within ten minutes up to a third of the blood can leave them. The lips and throat swell, the breath whistles, the pulse fades. In the British register of deaths from this reaction, the heart stopped a median of fifteen minutes after a sting, five after a drug, thirty after a food. In England and Wales those killed by stings were mostly older, with a mean age of fifty-nine. The sting is the slowest of the three. Fifteen minutes is not long.

The register found two things a household can use. Adrenaline had been given before the heart stopped in only fourteen of every hundred who died. And standing up killed. Four people died within seconds of being moved more upright, and one after moving from a chair to a bed. A body whose blood has leaked out of its vessels cannot fill the heart from below. Lying flat with the legs raised costs nothing.

Adrenaline undoes the reaction, and it is the one drug in these pages that a household may inject. Into the thigh muscle it peaked in children in about 8 minutes. Under the skin it took 34. Into a vein, in a person

whose heart still beats, it can bring on a stroke or stop the heart, and British deaths have followed exactly that. So the rule is narrow. The thigh, and nowhere else. At least nine tenths of a honeybee's venom is in within twenty seconds, which is why the sting comes out at once, by fingernail or blade or pinch, whichever is nearest. Speed counts, not method.

The Honest Broker's Bottle

WO-13 can be trusted with a life on the snake and the dog. It rests on Warrell's 2010 guideline, read in full, and it marks its weak figures, among them the untraced claim that washing cuts rabies by nine tenths, which is not printed. Its rule for the pressure bandage, elapids only and never vipers, is the one printed at 22.3, and whether a village teaches the bandage at all is the owner's choice. CH-13 holds the anaphylaxis rules, and 22.2 follows it without change except the weight bands. ME-14 is the strongest report on poisons. It names an error in the most used village manual: Hesperian's New Where There Is No Doctor still advises a finger in the throat and salt water to make the poisoned vomit. That advice is named here so that it can be refused, and its never stands at 22.5.

ME-08 tells the charcoal story well, but it gives the chemist of 1813 the forename of a later chemist who was born in 1867, which cannot be right. The draft leaves the man unnamed. PH-10's Marseille figures come from a paper it read in full. Its claim that boiled autumn crocus did worse than raw rests on a series of 32 patients that ME-14 calls confounded, so it is not taught. The two charcoal curves differ: PH-10 gives 75 to 98 per cent held at 5 minutes and about 10 at 60, ME-14 about 47 at 30 minutes and 21 at 180, from different studies. Both say early or not at all. OR-10's animal manual gives charcoal at 1 g for 20 kg. OR-10 doubts it, and so does the draft.

Two lines stay open, and both are printed both ways. On killing dogs, OR-10 read the record and grades culling a failure as control, from Flores, Bali, Korea and Israel. WO-13 left the question unresearched. On the thorn apple, WO-11 gives about 0.1 mg of atropine a seed in one source and about 6 mg per 100 seeds in another. Neither is a dose. The library is thin in three places. It has no history of how poison centres began, only Marseille's twenty-two years. It has no mission hospital record for snake-

bite, so the Story uses Warrell's Nigerian series and Sutherland's bandage instead. And it measured hearth charcoal in one study only. The draft supplied the adder as Brandenburg's one venomous snake, the age column of the charcoal table and the four questions. Each has a row.

The turn to the present

Until the Fall, a frightened parent could ring a poison centre at any hour of the night. A voice asked what, how much, when and how heavy, and most of the time said to watch at home. Behind the voice stood antivenom in a cold room, adrenaline in every pharmacy, a machine to breathe for the paralysed and another to clean the blood when the kidneys stopped. Most of the good was done by the four questions. The rest saved the few. Charcoal was given by habit for forty years, and when toxicologists looked in 2005 they found no proof that it had changed what happened to anyone. Habit outlasts proof.

What is left when the voice on the telephone is gone? The four questions, asked by the healer with a pencil. The jar, kept. Water and soap on the bite by the clock. The still limb and the stretcher. The dog in a pen with water and food. The child lying flat with the legs raised, and the adrenaline in the thigh. None of it needs a factory except the adrenaline, and that runs out. When it does, the house still has the position, the hand and the company.

In the end every case is the mouth and what went into it, or the skin and what came through it, and the body's own slow answer to both. The household's part is to keep it from being made worse, to keep the evidence, to watch the hours, and to know the few cases where minutes count. The rest is waiting, and waiting well. Now the water.

AT THE BENCH

22.1 See: the bitten, the stung and the poisoned

Write the time of the bite, sting or swallow. Write every sign with its time.

Sign	Likely cause	Go to
Lips or throat swell, wheeze, faint pulse, minutes after a sting, food or drug	Anaphylaxis	22.2 now
Drooping eyelids, double vision, cannot swallow spit	Snake venom that paralyses	22.3, chapter 21
Bleeding gums or nose, dark urine, swelling spreading up a limb	Viper venom	22.3
Several ill in one room, headache, no fever	Carbon monoxide	22.5
Burnt mouth, drooling	Lye or acid	22.5
Fits within 15 to 90 minutes of eating a root	Water hemlock	22.5, chapter 21
Tingling at a healed bite, fear of water	Rabies	22.4
Adult breathing under 12 a minute	Any poison	Breathe for them, chapter 21

Early vomiting after a snakebite means venom in the blood. A paralysed person hears everything. Talk to them. Never call death while the heart beats. Instead, keep breathing for them.

The danger sign: throat closing, breathing failing or paralysis.

- Help in time: adrenaline, breathing by hand, antivenom at the district. Most recover.
- Help too late: breathe for them in hourly relays. Adrenaline every 5 minutes while stock lasts. Tell the family it may fail.
- No help at all: lay them as breathing is easiest. Warm, still, held, spoken to. Many reactions settle. Some do not. Tell the family the death came from the venom or poison, not from them.

Rung ladder. Hands: clock, counts, position. Dispensary: poison register, bag and mask. District: fluids by vein, antivenom. Hospital: machines for breath and kidneys. Refuse: folk tests for poison.

22.2 Do: anaphylaxis, adrenaline into the thigh

Adrenaline into the thigh is one of two injections allowed below the district. The other is the birth attendant's magnesium.

Never inject any other drug. Instead, give adrenaline, lay them down, send for the healer.

Never give adrenaline into a vein or a drip. Instead, the outer thigh muscle.

Never let them stand or walk. Instead, carry them.

Who holds it: the dispensary keeps the stock and the healer gives it. A household with someone on the allergy register is taught. It keeps 1 ampoule, a 1 ml syringe and a 25 mm needle.

1. Pull out a sting at once. Any way.
2. Weak pulse: flat, legs raised. Hard to breathe: half sitting. Unconscious: on the side. Pregnant: left side.
3. Read the label aloud. It must say 1 mg/ml.
4. Clear first. Faintly pink only by the owner's rule. Never brown, cloudy or with particles.
5. Inject the dose into the outer middle third of the thigh muscle. Write the time.
6. Not better at 5 minutes: same dose, other thigh. Repeat every 5 minutes while signs last.
7. Breathing stops: chapter 21.
8. Watch lying down for 12 hours, near adrenaline. Carry them home.
9. Enter the trigger in the allergy register.

Adrenaline 1 mg/ml into the thigh muscle. Ceiling 0.5 ml a dose. Interval 5 minutes.

Weight	Dose	Age, only if no scale
Under 10 kg	0.01 ml per kg. 5 kg: 0.05 ml	Under 6 months: 0.1 ml
10 to 14 kg	0.1 ml	6 months to 6 years: 0.15 ml
15 to 29 kg	0.15 ml	6 months to 6 years: 0.15 ml
30 to 49 kg	0.3 ml	6 to 12 years: 0.3 ml
50 kg and over	0.5 ml	Over 12: 0.5 ml, small for age 0.3 ml

Work every dose twice, with two people. Alone, give it. Do not wait.

No adrenaline: position, sting out, warm, still, stay. No plant replaces it. A swarm, over about 50 stings in an adult or 30 in a child: watch urine for 3 days.

Grades. Adrenaline into the thigh B. Clear expired adrenaline B. Faintly pink D. Flat with legs raised B. Fast sting removal B. Plants instead of adrenaline X.

Rung ladder. Hands: sting out, position, carry. Dispensary: adrenaline, syringes, register. District: fluids by vein. Hospital: infusion. Refuse: herbs or antihistamine first.

22.3 Do: the snakebite

Never cut, suck, burn or ice a bite, and never tie a band. Instead, keep the person and the limb still.

1. Lay them down. Keep the whole body still. Talk calmly.
2. Take off rings and tight shoes. Splint the bitten limb.
3. Do nothing to the wound. No paste, no drink of plants.
4. Carry them lying down, on the side if vomiting. Never let them walk.
5. Check every hour: eyelids, swallowing, bleeding, swelling, urine. Write it.
6. A band already on: loosen it slowly, not at once, watching the pulse.
7. Paralysis: breathe for them in relays, chapter 21. It can take weeks.
8. Send for the district. Antivenom only there, adrenaline drawn up first.
9. Pain: paracetamol by its weight table. No aspirin. No injections while blood will not clot, adrenaline excepted.

The pressure bandage. Only where every venomous snake paralyses and no viper lives. Bandage 10 to 15 cm wide, 4.5 m long or more. Wind from fingers or toes over the whole limb. As tight as for a sprained ankle, pulse still felt below. Splint over it. Never for a viper. The adder of Brandenburg is a viper.

Clotting test, dispensary only. 2 ml of blood in a clean dry glass tube. 20 minutes untouched. Tip once. Still liquid: viper venom. Test a healthy person's blood beside it.

Grades. Rest and splint B. Pressure bandage, elapids C, vipers X. Cutting, suction, band, ice, snake stone X. Plant pastes and drinks X. Antivenom A. Breathing by hand B. Clotting test B.

Rung ladder. Hands: still, splint, carry. Hearth: stretcher, bearers named. Dispensary: glass tubes, bag and mask. District: antivenom. Hospital: ventilator, dialysis. Refuse: the cut, the stone, the band.

22.4 Do: the dog bite and the 10 day watch

Never close a bite. Instead, wash it and leave it open (see 18.5).

Never kill the dog that bit unless it shows signs of rabies. Instead, pen it and watch it.

1. Wash under running water with soap for 15 minutes by the clock. Soap even in a deep bite.
2. Leave it open. The healer closes it about day 4 if clean.
3. Hand or cat bite: to the healer that day. Antibiotics cut hand bite infection from 28 in 100 to 2.
4. Catch the dog with a noose, never by hand. Muzzle it.
5. Pen it alone with water and food for 10 days.
6. Well on day 10: it was not carrying rabies when it bit.
7. Sick, dead, fled or killed: treat as rabies. Vaccine if the shelf holds it, chapter 17.
8. Wild animal or bat: no watch. Treat as rabies.

No vaccine: tell the family plainly. After a rabid dog's bite, rabies follows in about 1 in 2 face bites. It is 1 in 4 for the hand, 1 in 20 for the leg. It usually shows in 1 to 3 months.

Once signs show, there is no cure. A quiet dim room, no sound of running water, water and food offered, the family near. Carers keep saliva off skin and eyes. Tell the family nothing done after the signs could have changed it. Sedation and anything beyond comfort:.

Grades. Soap washing B in animals, D in people. The 10 day watch B (WO-13), C (OR-10). Cell culture vaccine A. Nerve tissue vaccine X. Induced deep sleep X. Antibiotics for hand bites A.

Rung ladder. Hands: soap, noose, pen. Dispensary: dog register, watch log. District: vaccine. Hospital: immunoglobulin. Refuse: killing the dog at once.

22.5 Do: the swallowed poison, the first hour

Never make anyone vomit. Never give salt water. Instead, lay them on the side, and give charcoal if allowed.

Never give anything by mouth to a person who cannot swallow. Instead, on the side.

1. Several ill in one room: open everything, carry them out. Do not go back in alone.
2. Count breaths for a full minute. Adult under 12: chapter 21.
3. Not fully awake: on the side.
4. Write when it was taken, and each sign with its time.
5. Keep the jar, plant, food and vomit, labelled, 72 hours. Find everyone who ate it.
6. Skin or eyes splashed: wash with water, gloved.
7. Charcoal only if all hold: within 1 hour, fully awake, drinks unaided, a poison it holds.
8. Taken on purpose: the same first hour. Stay with them. Then chapter 30.

Activated charcoal by mouth, once. Ceiling 50 g. Within 1 hour only.

Weight	Dose	Age, only if no scale
5 to 9 kg	5 g	Under 1 year
10 to 19 kg	10 g	1 to 4 years
20 to 29 kg	20 g	5 to 8 years
30 to 49 kg	30 g	9 to 14 years
50 kg and over	50 g	Adult

Weigh it. The library found no spoon measure. Stir into about 8 times its volume of water. Give over 15 to 20 minutes. Stop for coughing or drowsiness.

No charcoal for lye, acid, paraffin, lamp oil, alcohol or iron.

Poison	Signs	Do	Do not
Lye, bleach	Burnt mouth, drooling	Rinse the lips. Sips in the first minutes only if awake and not drooling	Vomiting, charcoal, vinegar
Paraffin, lamp oil	Cough, fast breaths	Side, count breaths	Vomiting, charcoal
Iron tablets	Vomiting, then a quiet spell	9 of 65 mg in a 10 kg child is dangerous. District	Charcoal

Poison	Signs	Do	Do not
Death cap group	Vomiting from 6 hours, then false calm	ORS through the calm, chapter 5. Watch 24 hours after any wild mushroom	Trusting cooking or silver
Oleander, foxglove, yew, monkshood	Vomiting, slow or uneven pulse. Monkshood: tingling lips	Flat, still, warm. Pulse every 15 minutes	Walking them
Autumn crocus	Vomiting and diarrhoea, sooner is worse	ORS, watch 7 days	Sending home early
Thorn apple	Hot, dry, red, wide pupils, wild talk, 24 to 48 hours	Shade, cool water on skin, quiet, someone stays	Tying them, leaving them

Thorn apple: about 0.1 mg of atropine a seed, or about 6 mg per 100 seeds. Both stand until checked. No dose is safe. The poison garden is chapter 34.

Grades. Activated charcoal within 1 hour: B for what it holds, D for lives saved. Hearth charcoal D. Salt water X. Ipecac, finger, stomach washing X. Universal antidote X. Breathing by hand B. Folk mushroom tests X.

Rung ladder. Hands: air, side, clock, jar. Hearth: ORS, shade. Dispensary: charcoal, scale, register. District: fluids by vein. Hospital: dialysis, antidotes. Refuse: salt water, the finger, vinegar on lye.

22.6 Prevent: the bottle, the shelf, the basket, the dog

Never store lye, bleach or oils in drink bottles. Instead, one marked container, locked.

Never burn charcoal in a closed room. Instead, outside, or under a flue that draws.

Never eat a wild root of the carrot family. Instead, grow carrot, parsnip and fennel (chapter 34).

1. Lock poisons, lye, oils, iron and medicines on one high shelf. One keeper holds the key.
2. Label skin oils: skin only, poison by mouth.
3. One species to a basket. Three separate confirmations before a wild plant is eaten.
4. Shoes and a light at night. Beds off the floor. Nets tucked in where kraits live.
5. Vaccinate 70 in 100 dogs each year while vaccine lasts.
6. Do not cull dogs for rabies. OR-10 grades culling X. WO-13 left it unresearched. Unowned dogs:.
7. Keep an allergy register. Nobody who has reacted to stings keeps bees.

Grades. Dog vaccination B. Culling X. Three confirmations C.

Rung ladder. Hands: the rules. Hearth: locks and labels. Garden: safe cousins grown. District: dog vaccine. Refuse: drink bottles for lye, and the cull.

If it goes wrong

- **Adrenaline held back.** The throat swells while the family waits or brews a tea. Cause: fear of the needle, or saving the ampoule. Do: inject now. Repeat at 5 minutes.
- **The snake healer first.** Hours lost, a cut, a band. Cause: habit, and dry bites that seemed cured. Do: lie down, splint, carry, check hourly, send.
- **Made to vomit.** Thirst, confusion or fits after salt water. Cause: the old remedy. Do: on the side, sips of plain water if awake, send.

NUMBERS TO CARRY

- 0.5 ml of 1 mg/ml adrenaline into the thigh for an adult, 0.01 ml/kg for a child, every 5 minutes. Grade B (CH-13, SY-10).
- 1 g/kg of charcoal, 50 g at most, within 1 hour, only if they can drink it themselves. Activated B, hearth D (ME-14, SY-10).
- 15 minutes of soap and running water on a bite (WO-13).
- 10 days of watching the dog that bit (WO-13, OR-10).

- 1 in 2, 1 in 4, 1 in 20: rabies without vaccine after a bite to the face, the hand, the leg (WO-13).
- Half of venomous snakebites carry little or no venom (WO-13).
- 72 hours: keep the specimen and the vomit (PH-10, ME-14).
- 70 in 100 dogs vaccinated stops rabies. Culling X (OR-10).

THE LIBRARY

WO-13 Bites, stings and envenomation: snakes, dogs, insects and rabies. ME-14 Poisons, overdoses and the antidotes you can make. ME-08 Minerals and simple chemicals. PH-10 The deadly lookalikes. OR-10 Animals and the healer. CH-13 Allergy, anaphylaxis and the immune body. WO-11 Local and regional anaesthesia and the old analgesics. SY-10 The harm register. SY-12 What the library could not find. SY-07 The red-flag list. All are on the website.

CHAPTER 23

The District's Knife

A local anaesthetic lasts an hour or two, ketamine's sleep fifteen minutes a dose. A sterile field lasts as long as the discipline. The district's knife is a day away, and this chapter is about what that day costs.

OPENING

Hold up one finger and press its tip against the edge of a table. Notice how exact the feeling is. You can tell the edge from the grain, and the grain from a crumb. That precision runs in along small nerves on either side of the finger, close to the bone. At the base of the finger they lie only a little way under the skin. A small amount of fluid laid beside them there, and the whole finger goes quiet. The nail can come off, the cut can be cleaned to its floor, the stitch can go in, and the person whose finger it is can watch and talk.

That quiet is lent, not given. It comes back on its own schedule, first as tingling, then as an ache. Whatever the hand does to the finger must be finished inside the loan. A deeper quiet, the kind that takes the whole person away, is shorter and dearer. It lasts minutes a dose, and it asks for someone whose only work is to watch the breathing.

The other half of the work is the room. The same finger, numb and open, takes up whatever touches it. A blade from a pocket. A thread licked to a point. A hand that was on a door a minute ago. None of these shows

anything on the day. The account comes due on the third or fourth day as heat and swelling, or in the second week as a jaw that will not open. A room is clean only while everyone in it keeps it so. It has no store of cleanness. It is made again for each person and lost at the first careless touch.

So a cut made on purpose costs two things. A loan of time, which runs out whether or not the work is done. And a discipline, which fails without a sound and is paid for later. A village can afford the first in small amounts: at the finger, at the edge of a wound, at the boil that needs opening. The larger loans and the stricter room sit a day's walk away, where a team keeps both.

THE STORY

The book of the iron

Al-Zahrawi worked at Madinat al-Zahra, the palace city outside Córdoba, and died about 1013. Around the year 1000 he finished the Kitab al-Tasrif, thirty books of medicine, and the last of them is surgery. It opens with a complaint about the surgeons of his day and the patients they killed, and it sets out when an operation is worth doing and when it is useless and dangerous. Then come about fifty conditions treated with the hot iron, ninety-nine chapters of operations, and a part on fractures and dislocations: reduce first, bind after. The drawings made the book last. About two hundred instruments are pictured, most of his own design, and a drawing of a tool survives copying and translation where a description does not (TR-04, WO-15).

The best pages are the refusals. He describes the operation for water on a child's brain and then declines to do it, because the children die anyway. He will not amputate once gangrene has passed the elbow or the knee. A man begged him to take off his hand, and he refused, fearing the man would die. Later he heard the man had cut it off himself and lived. He wrote that down too. His threads were wool, silk, flax and horsehair, and for wounds of the belly he describes the heads of large ants used as clips (TR-04).

The historians add a caution the book keeps. One of them, writing in 2000, set the deep operations of the great Arabic manuals against the record of what surgeons did, and found little sign that the deep ones were performed. The work that left traces was shallow: growths removed, abscesses opened, eyes (TR-04). A manual is what someone wrote, not what happened to the patient. And every operation in it was done on a person awake or half awake. The sponge soaked in wine, opium, mandrake and henbane appears in later European texts, and nobody recorded how often it worked or how often it killed (TR-04, WO-11).

The iron had one honest use, to stop bleeding that pressure and a tie could not. As a treatment for fever, pain or jaundice it still harms. Of four adults in one series branded for various complaints, two died (TR-04). The tradition that kept the book lives on as Unani medicine in India and Pakistan, and its account of itself is its own to give (SY-04).

The borrowed sleep

On 30 March 1842, in Jefferson, Georgia, Crawford Long held a towel wet with ether to the face of a young man named James Venable and cut a growth from his neck. Venable felt nothing. Long did not publish until 1849. On 16 October 1846, at the Massachusetts General Hospital in Boston, William Morton, a dentist, gave ether to a patient while a surgeon removed a tumour from his neck (WO-10). The textbooks keep Morton's date, because he did it in public.

Chloroform followed within the year. It was pleasanter to breathe and quicker, and it killed without warning. A girl of fifteen in the north of England died under it in January 1848 while a toenail was taken off. Later tallies put chloroform deaths near 1 in 2,000 administrations and ether near 1 in 14,600, figures that reach the library at second hand (WO-10). Ether's mercy is its order of failure. The breathing slows and stops before the heart does, so a watcher has warning and time to breathe for the patient. Its curse is fire. The vapour is heavier than air, pools on the floor, burns across a wide range of mixtures with a flame that can hardly be seen, and explodes with oxygen. At a women's hospital in Kathmandu in 1982 and 1983, junior doctors gave open drop ether for 535 caesareans and no mother died of the anaesthetic (WO-10, from an abstract). The

Red Cross and Médecins Sans Frontières no longer use it. The Red Cross manual puts the whole matter flatly: there is no such thing as a small anaesthetic. Every kind kills the same ways, by the breathing stopping, by the tongue falling back, by vomit drawn into the lungs, by the heart, by fire, and by wearing off with the knife still in (WO-10).

The drug that replaced it in poor hospitals was made by a chemist at Parke-Davis in 1962. Ketamine holds up the blood pressure, usually keeps the breathing going, and can be given into a muscle. It has stood on the WHO essential medicines list since 1985. In fifteen Kenyan facilities between 2013 and 2017, providers without an anaesthesia degree gave it for 1,216 operations after a short course. Oxygen fell briefly in 3 patients in 100 and for longer in 6 in 1,000, and 13 in 100 had hallucinations on waking. No death was put down to the ketamine. A later Kenyan series of 401 emergency caesareans lost no mother (WO-10).

The warning comes from Murambinda, a mission hospital in Zimbabwe with 120 beds for 250,000 people. It gave 2,410 anaesthetics from 1994 to 2001 and recorded one death in 344 linked to the anaesthetic, nearly all in emergency births, most after spinals. One woman with pre-eclampsia was given ketamine and never woke. Where a physician led the resuscitation, 4 in 5 lived. Where clinical officers led it, 9 in 10 died (WO-10).

Smaller sleeps came first, in the skin. In 1884 a young eye surgeon showed that cocaine dropped on the eye allowed an operation, and within months others were blocking nerves with it, one of them growing addicted on the way. Lidocaine was made in Stockholm in 1943 and is still the drug a village can salvage. It is safe within its dose and kills above it. Between 1968 and 2023 the American regulator received 22,050 reports of harm from local anaesthetics, 1,473 of them deaths, lidocaine the drug named most often (WO-11).

Every one of these is a loan. A finger numbed with lidocaine is lent an hour or two. Ketamine lends a quarter of an hour at a time, and each further dose is a new loan against the same breathing. The lender is whoever watches the chest rise.

Carbolic and the boiled pot

In Glasgow, from 1865, Joseph Lister treated wounds, dressings and instruments with carbolic acid. His figures from the Royal Infirmary, published in 1870, gave 16 deaths in 35 amputations before and 6 in 40 after. He conceded the numbers were small, and the hospital's death rate swung widely from year to year whatever anyone did (WO-12). By 1882 a surgeon in Birmingham had done a hundred abdominal operations on the ovary with three deaths, using boiled water and no carbolic at all. Lister later dropped his carbolic spray and told the Berlin congress of 1890 that he was ashamed to have recommended it (WO-12). Carbolic itself poisons. About a gram can kill, and it passes through skin.

What carried the gain was not the chemical. It was the habit of keeping germs out rather than killing them in the wound. German bacteriologists showed in 1881 that steam killed what dry heat and chemicals missed. Berlin surgeons steamed their dressings from 1886. Rubber gloves came into an American theatre in 1889, first for a nurse whose hands the antiseptic had cracked. In London in the 1890s a surgeon taught that nothing a hand had touched should touch a wound (WO-12). A century later the hands still decide, and the chemistry matters less than the care. At Kijabe in Kenya, 3,317 patients were operated on after surgeons scrubbed either with plain soap and water or with an alcohol rub. Their wounds became infected at the same rate, 8.0 in 100 against 8.3 (WO-12).

Boiling never finished the work. Twenty minutes from a full boil kills what grows but leaves the spores of tetanus and gas gangrene alive. Steam under pressure kills them. A stovetop pressure cooker passed 128 of 128 indicator tests in one study, and electric multicookers failed (WO-12). The thread carried its own danger. In Edinburgh in the 1920s catgut was found in all 11 cases of tetanus after operations, and in 1931 Britain brought catgut under regulation (WO-15). Needles carried theirs. In Roka, Cambodia, reused syringes gave 242 people HIV in 2014 and 2015 (WO-12). A clean field has no memory. It is made again for each patient, by people who know that a slip will show only days later, in someone else's body.

The técnicos of Maputo

At independence Mozambique had almost no surgeons. It trained técnicos de cirurgia, assistant medical officers with three years of training after school, and sent them to the district hospitals (MA-03, WO-08). At Maputo Central Hospital, Pereira and colleagues reviewed 2,071 consecutive caesareans and published in 1996. Técnicos had done 958 of them. The only difference from the obstetricians was superficial separation of the wound, 35 in 10,000 against 5 (MA-03). Across 14 técnicos and 10,258 operations, deaths after operation were 4 in 1,000 for emergencies and 1 in 1,000 for planned work. Seven years on, 88 in 100 técnicos were still in district posts. Almost none of the doctors were (OR-07).

The wider record agrees, with conditions. In one Malawi audit of 8,070 caesareans, clinical and paramedical officers did 65 in 100. At district hospitals 13 mothers in 1,000 died, and half of the dead were short of two or more units of blood (OR-07). A pooled analysis of 16,018 women put the odds of maternal death with clinical officers at 1.46 times those with doctors, with an interval that includes no difference, and more wound trouble (OR-07). In Sierra Leone, 230 men were randomised to hernia repair by associate clinicians or by doctors. At one year the hernia had come back in 0.9 in 100 against 6.9, and at five years there was no difference (CH-11). They used commercial mesh, which may not exist after the Fall.

Every one of these programmes had surgeons above it who trained, supervised and counted, and a larger hospital above that for the hard cases. The supervisor and the larger hospital are what the Fall removes. A first generation of operators without supervision should expect something nearer the 11 deaths in the first 100 appendix operations of an early Chicago surgeon than the técnicos' figures (WO-08).

The smallest team on record is two. On 15 August 1913, at Lambaréné in Gabon, a missionary doctor operated on a strangulated hernia in a converted fowl house while his wife gave the anaesthetic. He wrote that his precautions against infection were far from perfect, and the patient recovered (OR-07). The hospital he built fell into crisis after he died, and that is the other half of the lesson: a district that trains one operator has trained one person whose death closes the theatre.

Volume is the other limit. For 3,000 people OR-07 reckons about 30

major operations a year, fewer than one a week, and 1 to 2 caesareans a year for the absolute causes, where the mother is likely to die without one. FO-11 plans about 6 a year from a floor of 5 in 100 births. The two reckonings meet near the top, at about 6 or 7 (SY-12). An operator who does two caesareans a year will lose the skill. Whether the district trains one at all is the owner's decision.

Then the gap. Half of the Malawi mothers who died were short of blood, and no report in the library holds transfusion (SY-12, R2-02). OR-07 sketches a walking panel of 30 to 50 grouped donors across the ten villages. Whether to give blood that could not be screened, to a woman who will otherwise die within the hour, must be decided before the night it is needed.

The Honest Broker's Ceiling

WO-11 is the report to trust on local anaesthetic. Its ceiling is the Red Cross field figure: plain lidocaine at the lesser of 3 mg/kg and 200 mg, and no higher figure for lidocaine with adrenaline below the district. ME-09, the salvage report, prints 7 mg/kg and at most 500 mg with adrenaline. That is a line for a theatre that can treat a fit and a stopped heart. SY-12 records it as an error to be corrected before print (C8). This book does not use it, and a reader who meets it in ME-09 should strike it out.

SY-10's list of one-person drugs gives lidocaine injection to the village healer. The standing default keeps injection at the district, magnesium and adrenaline excepted. So this book puts the needle in the hand of a healer trained at the infirmary and working under it.

WO-10 is good history and careful on doses, but much of its record is secondary. The chloroform tallies, the Bangladesh series and the Kathmandu figures come through abstracts and summaries. It found no data on ketamine kept years past its date. It places ketamine into a muscle for short procedures at the village. SY-10 keeps every general anaesthetic at the district with a second person on the airway, and so does this book. WO-10 tells the history of making ether. Its own verdict is that a district should salvage, not make, and this book gives no method.

WO-12 is the strongest report on sterilising. It boils instruments for 20 minutes where WO-03 and FO-11 say 10 (C24). Both are printed.

The brief sent the village's small surgeries to WO-16, which holds the eye, the ear and the tooth. The abscess here comes from WO-14, the digital block from WO-11, the ingrown nail from CH-11, and the first day stitch from WO-03 through chapter 18.

MA-03 and WO-08 disagree on Pereira's técnicos, 958 against 978. SY-12 settles it by arithmetic for MA-03, but neither report read the full paper. The caesarean need is printed both ways (C13). TR-04 rests al-Zahrawi on one secondary account, and nobody read the standard edition. No report holds transfusion (R2-02). Lister's starting year is the draft's own.

The turn to the present

For a century the hospital hid both halves of the bargain. The anaesthetist stood at the head of the table behind a drape, and the patient remembered nothing of the person who had kept them breathing. The steriliser sat in a basement department, and the instruments came up in sealed paper with a date on it. Blood came from a refrigerator stocked by strangers. Above every theatre stood a bigger one to send the hard case to. Even so, one survey of African hospitals found only 62 sterilisers in 100 working (WO-15). The system trusted the date on the packet more than the hands that opened it.

What does a district owe a woman in obstructed labour, if it has a knife and nobody who has used it this year?

The record gives a plain answer. A small infirmary that refuses most of what it is offered, and does a few things well, saves people who are young and have decades ahead (OR-07). The rest is borrowed and kept. Sleep is borrowed a few minutes at a time and repaid with someone's whole attention. The clean room is a discipline, kept or lost at every touch, and it cannot be stored. Both can be learned by people without a degree, and both are a day's walk from most of the district.

Now the finger.

AT THE BENCH

23.1 See: the patient who needs the district

Never cut into a belly, chest, skull or eye below the district. Instead, send the same day.

Send today for:

- Labour longer than a day, or a head that does not come down (chapter 10).
- Bleeding after birth that will not stop (chapter 9).
- A hard, painful lump in the groin that will not go back.
- A rigid belly in a patient who lies still (chapter 21).
- A bone through the skin, or a limb cold and pulseless below an injury (chapter 19).

Do not wait for morning. Four bearers carry. A runner goes ahead. A strangulated hernia operated 24 hours or more after arrival carried 11 times the risk of death.

The district may attempt, with 2 trained people	The district refuses
Caesarean	Bowel resection, unless trained for it
Removal of the placenta by hand	Surgery on infants under 1 year beyond drainage
Opening the belly for ectopic pregnancy or a torn womb	Chest surgery beyond a drain
Strangulated hernia	The skull: the burr hole is named here, not taught
Cutting away dead tissue	Operations on the dying
Amputation of a dead limb	Operations a patient can live without, while stock is short
Chest drain, deep abscess	Tubes in the windpipe without a trained anaesthetist

Help in time: the team operates. Write every operation and every death in the register.

Help too late: the operation may still be offered. Tell the family the odds plainly. Write the delay down.

No help at all: warmth, pain relief if held, sips if they can swallow, never alone.

Tell the family: "This needs an operation we cannot give. We will keep her free of pain, and with you."

Grades. Caesarean by trained non-physicians A to B. Hernia repair by associate clinicians A.

Rung ladder. Hands: the signs and the clock. Hearth: the stretcher and bearers. Dispensary: pain relief, the runner. Infirmary: the operation, the anaesthetic, the donor panel. Hospital: banked blood, intensive care. Refuse: any cut into a body cavity below the district.

23.2 Do: local anaesthetic and its ceiling

Never give more than the ceiling in one procedure, however many sites. Instead, wait 10 to 15 minutes. The commonest mistake is cutting too soon.

Never use lidocaine with adrenaline in a finger, toe, ear or penis. Instead, use plain lidocaine and wait.

A healer trained at the infirmary gives it, working under the infirmary. Never the household.

Plain lidocaine. Ceiling: the lesser of 3 mg/kg and 200 mg. Once per procedure. Never a second full dose.

Weight	Ceiling	1% (10 mg/ml)	2% (20 mg/ml)
10 kg	30 mg	3 ml	1.5 ml
20 kg	60 mg	6 ml	3 ml
30 kg	90 mg	9 ml	4.5 ml
40 kg	120 mg	12 ml	6 ml
50 kg	150 mg	15 ml	7.5 ml
60 kg	180 mg	18 ml	9 ml
67 kg or more	200 mg	20 ml	10 ml

Use 1% where you can. Give about half to the old, the frail, liver or kidney disease and late pregnancy. No scale: weigh first. Never dose a child by guess.

Work every dose twice, with two people.

1. Weigh. Read the row. Write the mg and the strength on the card.
2. Check the vial. Clear, colourless, no specks. Cloudy: discard it.
3. New needle, new syringe. Never enter a vial with a used needle.

4. Draw back before each injection. Blood in the syringe: move the needle.
5. Inject slowly. Talk to the patient throughout.
6. Add up the ml after every site.
7. Wait 10 to 15 minutes. Test with a pin before cutting.

Stop at once for tingling lips, a metal taste, ringing ears, confusion or twitching. See If it goes wrong.

Grades. Infiltration and field block A. Digital block with plain lidocaine A to B. Drink to dull the knife X. Coca leaf for the mouth C.

Rung ladder. Hands and hearth: no injection. Cold and calm talk as aids only. Dispensary: salvaged lidocaine by the trained healer. Infirmary: nerve blocks, the lower dental block, lipid if held. Hospital: the spinal. Refuse: drink, thorn apple, the soaked sponge.

23.3 Do: the small surgeries of the village

The healer of 23.2 does these after supervised practice at the infirmary. Steam the instruments first (23.5).

The digital block.

1. Plain lidocaine only. 2% at 2 to 4 ml for one finger, split between the 2 sides of its base.
2. Count it against the ceiling in 23.2.
3. Wait 10 to 15 minutes. Test the tip with a pin.

The abscess.

Never cut a swelling that pulses. Instead, send it to the district.

Never open a hard swelling under both sides of the jaw. Instead, send today. The airway is at risk (chapter 27).

1. Find the soft point under red, hot skin.
2. Clean the skin. Ring the abscess with lidocaine. Abscesses numb poorly.
3. Cut over the softest point, long enough to drain freely.
4. Wash out with boiled, cooled water. Do not pack it.
5. Cover with a clean pad.
6. Antibiotic only for spreading redness, fever or a large abscess.

7. Look at 48 hours. Reopen if it fills.

The first day stitch.

Never close a bite or a dirty wound (SY-10). Instead, leave it open (18.5).

Only a clean, sharp cut. Body within 6 hours, face and scalp within 12.

1. Wash your hands. Lay out the steamed kit.
2. Enter at a right angle, 3 to 4 mm from the edge.
3. Take equal depth both sides. Come out the same distance from the edge.
4. Tie 4 throws, the first with 2 wraps.
5. Tighten until the edges just touch. Never white or puckered.
6. First stitch in the middle. Then halve the gaps.
7. Dry dressing. Look at 2 days.

The ingrown nail. The side strip is removed and its root destroyed under a digital block. Phenol cut regrowth from 41 in 100 to 14 (CH-11). Grade A. The steps are chapter 26's.

Grades. Abscess drainage without packing B. Interrupted stitches for a clean cut B.

Rung ladder. Hands: washing, pressure. Hearth: boiled water, clean cloth. Dispensary: steamed blade and thread, lidocaine. Infirmary: deep abscess, wound excision. Refuse: any cut deeper than the skin.

23.4 Do: the district's sleep

Never give a general anaesthetic without a second trained person on the airway (SY-10). Instead, use a local block, or wait for the team.

Never give ketamine in pre-eclampsia. Instead, use a local block.

Before any dose: bag and mask, working suction, an oral airway. Name the airway person. They do nothing else. Check for pre-eclampsia, high blood pressure, heart disease and psychosis.

Ketamine, 50 mg/ml. Into a vein over at least 60 seconds.

Weight	Into a vein, 1 to 2 mg/kg	Into a muscle, 6 to 10 mg/kg
10 kg	10 to 20 mg, 0.2 to 0.4 ml	60 to 100 mg, 1.2 to 2 ml
20 kg	20 to 40 mg, 0.4 to 0.8 ml	120 to 200 mg, 2.4 to 4 ml
40 kg	40 to 80 mg, 0.8 to 1.6 ml	240 to 400 mg, 4.8 to 8 ml
60 kg	60 to 120 mg, 1.2 to 2.4 ml	360 to 600 mg, 7.2 to 12 ml
80 kg	80 to 160 mg, 1.6 to 3.2 ml	480 to 800 mg, 9.6 to 16 ml

Further doses: 0.5 mg/kg into a vein every 15 to 20 minutes, or 5 mg/kg into a muscle every 20 to 30 minutes. The library gives no total ceiling. Never shorten the interval.

Caesarean: no more than 1 mg/kg into a vein before the baby.

Any other strength: stop. Work the dose again, with two people. Never put 100 mg/ml into a vein undiluted (WO-10).

Count breathing, colour and pulse every 5 minutes. Recover on the side. Watch until they speak sensibly.

Store below 25 °C, dark, never frozen. Discard opened vials. Life past the date is unknown. Counts and years: chapter 32.

Ether is the fallback when ketamine is gone. Only an anaesthetist the district has trained gives it. This book gives no method for giving or making it.

- No flame in the building. The vapour pools on the floor.
- Never near oxygen.
- Crystals at the cap: do not open or move the tin.
- An opened, stabilised tin: use within about a year.

Grades. Ketamine by trained non-anaesthetists B. Open drop ether in unskilled hands C. Chloroform X. Ether made locally D.

Rung ladder. Hands to dispensary: no general anaesthetic. Infirmary: ketamine with 2 people, ether as fallback. Hospital: intubation, the spinal. Refuse: chloroform, drink, thorn apple.

23.5 Prevent: the sterile room

Never use one needle, syringe or blade on two people (SY-10). Instead, clean and steam between.

Never take boiled, flamed or wiped for sterile inside the body. Instead, steam it.

One named keeper of the steriliser, with a log.

Method	Time	Use
Steam, stovetop pressure cooker, 121 °C	20 minutes unwrapped, 30 wrapped	Anything that enters the body
Boiling, from a full boil	20 minutes (WO-12), 10 in two reports	Things that touch skin only
Dry heat, 170 °C	1 to 2 hours, timed in the load	Needles and thread
Flame, to red	Seconds	A needle point for a splinter only
Alcohol 60 to 90%	None	Skin only, never instruments

1. Scrub every instrument clean first. What cannot be cleaned cannot be sterilised.
2. Let steam vent 10 minutes before closing the valve.
3. Time from full pressure. Pressure lost: start the clock again.
4. Above 1,000 m: double the time.
5. Dry 30 minutes with the lid ajar. A damp pack is not sterile.
6. Date each pack. Use within 4 weeks if dry and whole.
7. Never an electric multicooker.

Hands: scrub 5 minutes for the first case, 3 for later ones. Soap and water did as well as alcohol rub. Sterile gloves if held, clean if not.

The field: sterile touches only sterile. Hands above the waist. Wet is unsterile. One watcher calls a slip, and the item is changed.

Thread: sealed salvaged sutures first, good 12 to 24 months past the date. Never carbolic on a wound.

Grades. Sealed salvaged sutures C past the date. Silk B. Linen thread B. Fishing line C. Catgut made at home X. Electric multicooker X. Carbolic as the reason surgery grew safer C.

Rung ladder. Hands: washing, one person one blade. Hearth: boiling for skin things. Garden and still: soap, alcohol for skin. Dispensary: pressure cooker,

sealed thread. Infirmary: the sterile room, its keeper, its log. Hospital: the sterilising department. Refuse: multicookers, catgut made at home, carbolic.

If it goes wrong

- **Too much lidocaine.** Tingling lips, a metal taste, ringing ears, confusion, then a fit. Cause: sites added without a total, 2% given as 1%, no draw back. Do: stop. Side. Open the airway. Most fits end on their own. District: diazepam if trained, 20% lipid 1.5 ml/kg if held.
- **The airway under ketamine.** Crowing, gurgling, a chest that moves without air, blue lips. Cause: a fast dose into a vein, or the airway person distracted. Do: stop the operation. Lift the chin, thrust the jaw, suck out the mouth, breathe with bag and mask. Breathing usually returns within minutes.
- **The clean wound that turns.** Heat, swelling and pus on day 3 or 4, or a stiff jaw in week 2. Cause: boiled taken for sterile, a reused blade, a damp pack. Do: open and drain (chapter 18), tetanus care, then check the log and every patient from that run.

NUMBERS TO CARRY

- The lesser of 3 mg/kg and 200 mg of plain lidocaine, 20 ml of 1% at most (WO-11, SY-12).
- 10 to 15 minutes: wait before cutting (WO-11).
- Ketamine 1 to 2 mg/kg into a vein over 60 seconds, or 6 to 10 mg/kg into a muscle (WO-10).
- 1 mg/kg at most before the baby at caesarean (WO-10).
- 121 °C: 20 minutes unwrapped, 30 wrapped (WO-12).
- 20 minutes to boil instruments, 10 in two reports (SY-12).
- One needle, one syringe, one person, one time (WO-15).
- 958 of 2,071 caesareans by técnicos at Maputo (MA-03).
- About 30 major operations and 1 to 7 caesareans a year for 3,000 people (OR-07).
- Half the Malawi mothers who died at caesarean were short of blood (OR-07).

THE LIBRARY

WO-10 Putting the patient to sleep. WO-11 Local and regional anaesthesia and the old analgesics. WO-12 Sterile enough. WO-15 Making and salvaging the instruments. WO-14 Tetanus, gas gangrene and the infected wound. WO-08 The abdomen: when to open, when to wait. WO-16 Eye, ear and dental emergencies. OR-07 The district infirmary. MA-03 Obstructed labour, breech, twins and cord prolapse. CH-11 on the groin and the small surgeries. TR-04 Unani and the medicine of Islam. SY-08 The means ledger. SY-10 The harm register. SY-12 What the library could not find. All are on the website.

PART SIX

The Long Illness

CHAPTER 24

The Sickroom

Two hours between turns on a hard bed and four on a good one. Three days before a fold in the sheet is a wound. A stroke's first week decides the rest.

OPENING

Sit still for a minute where you are. Somewhere inside that minute you will move. A hip lifts, a foot slides, the weight goes from one side to the other. You did not decide it. Under the bone the skin had begun to go short of blood, a nerve said so, and the body answered before any thought arrived. In the night you do it again and again without waking. Hold still long enough and the place begins to ache, then to burn.

Press a fingertip hard on the back of your hand for three seconds and lift it. The skin is pale where you pressed, then pink again within a moment. That is the blood coming back. It comes back because you lifted the finger.

A person who cannot move does not lift the finger. The weight stays on the heel, the back of the head and the flat bone at the base of the spine, hour after hour. Nothing in the body need be wrong for this to begin. The harm comes from the bed, and from no one moving them.

Just notice, for the rest of today, how often you shift without meaning to. That small, constant restlessness is the work this chapter hands to someone else's hands.

Every household with a long illness keeps a guest who cannot leave the room. The guest cannot fetch water, cannot turn over, cannot open the window or say, at three in the morning, that the sheet has rucked under the hip. Hosts have always known what a guest needs: a clean bed, air, warmth, food at the hour, a cup within reach, and someone who comes when called. The sick need the same. Most of the harm done to them in bed is a host's harm, and most of the cure a host's care.

THE STORY

A barracks above the Bosphorus

Florence Nightingale reached Scutari, the British base hospital on the Asian shore across from Constantinople, in November 1854, with thirty-eight nurses. The hospital was a Turkish barracks. Its sewers ran beneath the wards, and that winter sick men lay in the corridors. The deaths rose through the cold months. In February 1855, the worst month, Nightingale's own figure was nearly forty-three in every hundred men treated. By June it was about two in a hundred.

That fall is the most quoted number in nursing. It is told as proof that nursing saves lives, and this book's own Preface tells it so. The record does not bear that reading.

In March 1855 a Sanitary Commission sent from London under Dr John Sutherland reached Scutari. It flushed the sewers, cut openings for air, closed the worst outbuilding and two hospital ships, and in its first week carted out 202 loads of filth. The deaths fell from then on, month by month. Nightingale herself laid the dying at the door of the drains, the crowding and the foul air. She never claimed the fall for her nurses.

Over the whole war, from June 1854 to June 1856, Scutari lost 11.9 in every hundred admitted. A sister hospital at Koulali lost 25.9. A timber hospital shipped out in parts from England, open from October 1855 at Renkioi, lost 3.8. A later historian went further and called Scutari a place where men were sent to die. Of 12,518 men sent there between October 1854 and April 1855, he counted 4,522 dead, against 5,341 of 41,395 who

stayed with the army in the Crimea. Others answer that the sickest were the ones sent, so the two groups cannot be set side by side.

So the dispute stands two ways, and this book prints both. One reading says the nurses cut the deaths from four in ten to two in a hundred. The other says the drains, the air and the space cut them, and the nurses were there when it happened. The library's verdict is the second. What Scutari leaves is narrower and harder: a house built to shelter the sick can poison its guests. Nightingale spent the rest of her life on that lesson. In 1860 her Notes on Nursing, written for women in ordinary houses, turned it all into rules for one room: air, light, warmth, quiet, cleanliness, a bed reachable from both sides, water and watching. In 1863 she wrote that the first requirement of a hospital is that it should do the sick no harm.

What the bed does

Nightingale held that a bed-sore is generally the fault of the nursing. The mechanism is old and certain. Weight on skin over bone closes the small vessels, and if it stays, the tissue dies from the bone outwards, so the hole beneath is wider than the mark on top. Animal experiments in 1961 found that steady pressure for about two hours did damage, while the same pressure lifted every few minutes did not. In 1990 a count of 19,889 residents of American nursing homes found 11.3 in a hundred arrived with a sore, and 21.6 had one by two years.

From this came the rule taught in every school of nursing: turn the bedfast person every two hours. The Red Cross manual of 1918 asked more, a turn every waking hour for the wasted. The two-hourly rule is the most obeyed rule at the bedside. It rests on no trial.

When trials came, they found the surface mattered more than the clock. In 2005 a team in Belgium divided 838 residents of nursing homes into groups turned at two, three, four or six hours, on ordinary mattresses or on soft foam. Sores of the second grade or worse came to 3.0 in a hundred among those turned four-hourly on foam, against 14.3 to 24.1 in the other groups. An American trial of more than 900 residents on good foam, turned at two, three or four hours, found no difference, with about two in a hundred getting a sore. In 2020 the Cochrane reviewers pooled

three trials of 1,074 people and found no difference between two and four-hourly turning, at the lowest certainty they grade. A tilt of thirty degrees, the body propped on pillows rather than rolled onto the hip, did at least as well as the full turn.

The one surface a village can make that has been tested is a sheepskin. In Melbourne in 2000, 441 hospital patients were divided at random to lie on a medical sheepskin or not. Sores came to 9.6 in a hundred with it and 16.6 without. Everyone knew who had the fleece, and the true effect is probably smaller. It is still the best cheap bed we know.

So the book prints two lines. On a hard bed, turn every two hours, by tradition and caution. On a sheepskin or a deep pallet, every three to four hours, and once or twice in the night. Waking a frail old person every two hours all night may itself bring on delirium, the one bedside harm with grade A evidence for its prevention. The interval is a judgement. Turning at all is not.

Bed rest was itself once a treatment. In 1999 a review of 39 trials across fifteen conditions and 5,777 people found that lying in bed improved nothing and made several things worse. Ten days in bed cost older people nearly a kilogram of muscle from the legs. Out of bed, as the illness allows, is the rule.

The mouth and the swallow

The pneumonia of the bedfast comes from the mouth. Saliva thick with germs slips past a weak swallow into the lungs, mostly at night and unseen. In eleven nursing homes in Japan, Takeyoshi Yoneyama and his colleagues gave 417 residents one of two kinds of care. Half had their teeth and mouths brushed by carers after every meal, with a dental clean once a week. Over two years pneumonia came to 11 in a hundred with the brushing and 19 without, days of fever to 15 against 29, and fewer died of pneumonia. The paper appeared in 2002. Pooled with later trials, care of the mouth cuts pneumonia by about four in ten. It is the strongest result in this chapter, and it needs a cloth and a cup of water.

Swallowing fails after a stroke, in deep weakness, in the drowsy and in the old. Testing the swallow before the first food after a stroke cuts pneumonia, by odds of about 0.60. But a failed test is a reason to change

the food, not to stop it. Among 11,093 people with stroke, those whose food was cut back after a failed test fared about four times worse by the odds. Nightingale thought thousands of the sick starved each year in the midst of plenty, for want of a spoonful at the right hour.

When the swallow fails and the person can still cough, a soft tube through the nose to the stomach carries water and food. Its danger is the lung. In England between 2011 and 2016, 95 tubes were found to have fed into the wrong place, and 32 people died, among more than three million tubes passed. Listening for a gurgle over the stomach, long the standard check, hears the same sound when the tube lies in a lung, and England dropped it in 2005. The check that holds is acid. Fluid drawn back with a reading of 5.5 or below came from the stomach in 98.9 of every hundred samples.

There is a limit. In advanced dementia, tube feeding has never shown a benefit and may do harm. A person who cannot take enough by mouth over several days, from an illness that will not turn, is dying, and their nursing belongs to chapter 31.

The fever nursed

By 1893 William Osler had cared for 229 people with typhoid at Johns Hopkins in Baltimore. Twenty-two died, 9.6 in a hundred, and 7.1 after he took up cold baths. Typhoid without care killed about fifteen in a hundred. Osler's own reckoning, read only at second hand, was that three in four recover anyway, that nursing and the stopping of useless drugs saved fifteen in a hundred more, and the bath three to eight. The library grades the bath D and the nursing B.

Fever is a sign, not the illness. Cooling is for comfort. Undressing, shade and moving air help, and a cool wet cloth on the face, palms and soles works with the body's own cooling. A lukewarm sponge comforts but barely moves the number. Cold baths and alcohol rubs do harm, and ice at the neck and groin does nothing useful. What the fever needs is someone to sit with it, offer the cup, count the breaths and know when to send.

Nursing the stroke

In Oxfordshire between 1981 and 1986, 675 people had a first stroke. Nineteen in a hundred died within a month. After a stroke from a clot, more than half of the deaths after the first week came from lying still: the chest, the legs, the skin. The bleed or the clot did its harm early. The bed did the rest.

Peter Langhorne, in Glasgow, asked in 2002 what the successful stroke units of the 1980s and 1990s had in common. They had no scanners and no clot-dissolving drugs. They had careful checks of the swallow, nursing and therapy, early movement, few catheters, quick treatment of infection, fever and high sugar, and one team that met each week. In 2020 his Cochrane group pooled 29 trials of 5,902 people. Organised stroke care cut deaths by odds of 0.76, and for every hundred treated gave about two more people alive and six more living at home. Every element but oxygen is within a village's reach.

Early is not the same as hard. In 2015 a trial of 2,104 people found that the earliest, most intensive getting up, within a day of the stroke, did worse than usual care: a good recovery in 46 in a hundred against 50. Another found lying flat or sitting at thirty degrees for the first day made no difference. Out of bed as the illness allows, in short spells.

Water under the skin

Fluid run slowly into the fat under the skin was common in the 1940s and 1950s. It fell from use after infants died of fluid given with no salt in it, or with too much sugar. The lesson the library draws is that the salt makes it safe. Water matched to blood is taken up. Plain water, or strong sugar water, draws water out of the body into the skin. In 2003 a trial in 96 people with an average age of 85 found fluid under the skin did as well as a drip in a vein. A review in 2020 found it at least as good, with fewer harms, and the serious harms were with sugar solutions run fast.

The rectum takes water too. Early in the twentieth century physicians kept the dying watered by enemas. In 1998 a series of 78 dying people took about a litre a day that way, and one in twenty stopped for discomfort. But water is not always kindness. In 2013 a trial of 129 people in hospice found

a litre a day under the skin did no better than a token 100 ml. The dying need a wet mouth more than a full vein.

A village cannot make fluid for a vein. The residues that cause fever and shock survive boiling and even the pressure cooker's hundred and twenty-one degrees. A needle under the skin, not into muscle or vein, is the gentlest of the needle routes, and whether it stays above the village is the owner's question (24.5).

The Honest Broker's Ledger

NU-01 carries this chapter, and it can be trusted with a life where it reads trials: turning, the sheepskin, the mouth, bed rest and delirium. It read the 1961 pressure work and Osler's reckoning at second hand, and did not read the Gills' 2005 study of Scutari. NU-02 is careful on the tube and on fluid under the skin, though its child rate rests on one textbook. NU-03 is sound on air and warmth. CH-02 read the stroke trials as abstracts.

Three places are thin. The first is the turning interval, which rests on no trial, so the Bench prints two lines by surface and grades any fixed interval D. The second is fluid under the skin below the district. Its evidence is good in the old and thin in children, and whether it is taught at all is the owner's, so 24.5 prints the library's view and marks it. The third is the village arithmetic, three to six bedfast people in 300 and about eight hours of care a day for each, which is NU-01's estimate from nursing homes and is printed as one.

Known errors are named here and not repeated. This book's Preface, and sample 14 of the Style Sheet, gave Scutari's fall as nursing's work. NU-01 shows it followed the Sanitary Commission, and both were corrected at the first edit, on 18 October 2026. NU-01's brief placed Yoneyama's trial in the Lancet. It appeared in the Journal of the American Geriatrics Society. IN-07's two teaspoons of salt to the litre is washing water, about 1.2 per cent, and never goes under the skin. NU-02's brief led with 5 per cent dextrose under the skin, and NU-02 rejects it. NU-03's brief miscited the journal of the Hobday and Cason review. Chapter 6's syrup row of 10 ml held 240 mg against a printed 250. The row now prints both figures, corrected at the same edit, and the Bench here prints only tablet rows. I supplied the metric bed, converted from NU-01's feet and inches.

The turn to the present

The hospital took the sick out of the house, and with them went the knowledge. Turning, the mouth, the swallow and the window became a ward's work done by strangers behind a door. Families learned to visit, not to nurse. The record suggests the house was never the worse place. Trials of acute illness treated at home found deaths no higher than in hospital. What the hospital did hold was trained hands in number: each extra person given to one nurse raised the odds of death by about 7 in a hundred.

The cost of losing it falls on the carers. Strained carers in one American study died 63 per cent more often over four and a half years. A sick person nursed by one exhausted daughter is a sick house, not a sick bed.

Who will turn the person in the bed when the hospital is gone? The household will, with a rota on the wall, a sheepskin, a cup, a cloth for the mouth and a chart. The guest is back in our house. What Scutari learned at its cost, and what the stroke units proved, is that a well-kept room is most of the treatment.

Enough history. Wash your hands.

AT THE BENCH

24.1 See: the chart and the daily look

Never keep a sick person's day in your head. Instead: write one line a day on the chart.

Line	How	Act when
Temperature	Mouth 2 minutes, armpit 5	37.5 °C by mouth (NU-01) against 37.7 °C (FO-07). Armpit 37.8 °C (OR-04)
Pulse	30 seconds, doubled	Adult over 120
Breaths	Full minute, unseen	Adult 30, or 22 with new confusion
Drink and urine	Cups. Passed or not	No urine for 12 hours

Line	How	Act when
Stool	A cross each day with none	3 crosses: 24.8
Skin	The 7 points: clear, red, broken	Red that stays: 24.3
Pain, sleep, mind	A word each	New confusion
The turn	Time and side	Past the line in 24.3

Once a day when steady. With a red flag, 4 times a day on the same page (02.8).

1. Look at and touch the 7 points daily. Back of head, shoulder blades, elbows, base of spine, hips, heels, ankle bones.
2. Press red skin 3 seconds. Pale, then pink: the pressure is easing. Stays red: stage 1.
3. Dark skin: feel for warmer, cooler, firmer or boggier than beside it.
4. Each morning, greet by name and say the day. Glasses and hearing aid in reach.

Red flags: cannot swallow saliva. A black patch over the base of the spine or a heel. A sore to bone, with fever. No urine for 12 hours with a tense lower belly. No stool for 5 days, belly swollen, vomiting. New confusion with fever. A carer without sleep for 3 nights. Any chart line past its mark.

Danger sign: any red flag.

- **Help in time.** Send word now. Keep turning, mouth care and drinks on the way.
- **Help too late.** Do the step for that line (24.3 to 24.8). Count 4 times a day.
- **No help at all.** Keep the person clean, dry, turned, the mouth wet, someone at the bed. Tell the family plainly what the sign means. When healer and family judge the illness will not turn, care passes to chapter 31.

Grades: daily look at the 7 points C. Orientation, sleep, movement and water together A.

Rungs. Hands: count, look, touch. Hearth: slate. Garden and still: a watch with a second hand. Dispensary: thermometer, a nurse's visit 2 times a week. Infirmary: night counts. Hospital: monitors. Refuse: the chart kept in a head.

24.2 Do: set up the room

Never an unflued fire where the sick sleep. Instead: heat stones outside, wrap them, carry them in.

Never hot water or stone against skin, under the person, or in bed overnight. Instead: 2 layers of cloth, beside the body, out before sleep.

1. A room or corner with a window. 2 openings on different walls if possible.
2. Bed into the light and left there. Reachable from both sides.
3. Bed about 2 m by 90 cm, 60 to 65 cm high. Sheepskin or deep chaff pallet, and a draw sheet.
4. Beside it: chair, covered bucket, basin, cup in reach, clock, chart.
5. Own plate, cup and spoon. Boil them and the linen 10 minutes.
6. Air 2 times a day: 30 minutes with 2 openings, 90 with 1. Person covered.
7. Room about 18 to 20 °C. Protect the first sleep.
8. Infection: 15.3. Waste and linen: 13.4.

Heat for pain: 40 to 42 °C, cloth between, look every 10 minutes. Never in an infant's bed. Numb skin burns at 44 °C in hours, 50 °C in minutes.

Grades: 2 openings B. Heat carried in B. Unflued fire X. Bed reachable from both sides C.

Rungs. Hands: window, light, a named carer. Hearth: boiled linen, wrapped stones, bucket. Garden and still: a proper bed, sheepskin. Dispensary: thermometer, a detached sickroom. Infirmary: a ward with night cover. Hospital: heated wards. Refuse: the brazier and the shut room.

24.3 Do: turn and keep the skin

Never rub red skin over bone. Never a ring cushion. Instead: take all weight off the red place (chapter 28).

Never drag a person up the bed. Instead: 2 people lift on the draw sheet.

The two-hourly rule rests on no trial. Choose by the bed.

Bed	By day	By night
Hard: boards, straw, thin mat	Every 2 hours	Every 2 hours
Sheepskin, deep pallet, foam	Every 3 to 4 hours	1 or 2 turns

1. Tilt 30 degrees, not onto the hip. Pillows behind the back, between knees and ankles.
2. Heels clear: a pillow under the calves. Write time and side on the chart.
3. Wash daily, water about 40 °C. Face, neck, ears, arms, hands, chest, belly.
4. Turn: back, buttocks, thighs, legs, feet. Genitals last. Dry each part. Keep the rest covered.
5. Smooth the bottom sheet. A fold under the hip is a wound in 3 days.
6. Wet skin from urine or stool: wash, dry, then fat or oil.
7. Each joint through its range, 5 times, 2 times a day.

What you see	Do
Red that stays (stage 1)	No weight on it. Look every 4 hours. Settles in 1 to 3 days
Blister or shallow sore (stage 2)	Clean water, cover, keep dry, no weight
Crater with fat showing (stage 3)	Honey or sugar packing, 1 or 2 times a day (chapter 18)
Bone or tendon (stage 4)	Red flag. Send
Purple or black under whole skin	No weight, no rubbing, do not open

Grades: turning at all B. Any fixed interval D. 4-hourly on foam B. 30 degree tilt C. Sheepskin B. Hard ring X.

Rungs. Hands: tilt, pillows, look. Hearth: draw sheet, chaff pallet, fat. Garden and still: sheepskin, proper bed. Dispensary: the visiting nurse. Infirmary: foam. Hospital: air mattresses. Refuse: the ring and the hard rub.

24.4 Do: the mouth, the swallow and the tube

Never feed anyone who cannot be woken to sit up and hold their head. Instead: wet and clean the mouth.

Never trust a gurgle over the stomach. Instead: test the drawn fluid for acid.

1. After every meal clean teeth, gums, tongue and cheeks. Soft brush, frayed twig or cloth.
2. Not eating: clean and wet the mouth at least 2 times a day.
3. Before every meal, sit fully upright. 3 teaspoons of water, 1 at a time.

4. Cough, wet voice or changed breathing: nothing thin this meal. Porridge, mash, soft egg instead.
5. Half a teaspoon at a time. Stop when tired. Upright 30 minutes after.
6. A failed test changes the food. It never stops the feeding.
7. Cannot take meals: 180 to 240 ml of liquid food every 2 to 3 hours. Child: chapter 7.
8. Adult who has barely eaten for days: slow start and thiamine by 07.4, where the disputed start is printed.

The tube: trained hands only, dispensary and above.

9. Only for the drowsy who coughs when the back of the throat is touched.
10. Never if they cannot cough, or after a caustic. Never after a head blow with fluid from the nose, or against resistance.
11. Size: adult 8 to 12 Fr. Under 5 years 5 to 8 Fr. School age 8 Fr.
12. Measure nose to earlobe to breastbone tip. Adult: add 10 cm. Mark it.
13. Sit up, chin slightly down. Wet the tube. Pass it along the floor of the nose.
14. Advance as they swallow. Pull out at once for coughing, choking, a changed voice, blue lips.
15. Draw back fluid. pH 5.5 or below: stomach. Nothing goes down before this.
16. No fluid: 10 to 20 ml of air, left side, wait up to 1 hour. Still none: pull it.
17. Flush 20 to 30 ml of water before and after each feed. Check the nostril mark every time.

Cannot take enough for several days, and the cause will not turn: the person is dying. Say so. Chapter 31.

Grades: mouth care A. Swallow test B. Acid check B. Gurgle X. Tube in advanced dementia X.

Rungs. Hands: mouth care, swallow test, spoon. Hearth: thick food. Garden and still: boiled soft tubing, home-made indicator paper. Dispensary: made tubes, pH strips, a healer who has passed 50 tubes. Infirmary: night checks. Hospital: X-ray of every tube. Refuse: tea before the test.

24.5 Do: water by rectum, and under the skin

Never home-made fluid into a vein or a bone. Instead: the mouth, the tube or the rectum.

Never sugar water under the skin or in the rectum. Instead: 9 g of salt weighed into 1 litre.

Injection below the district is not taught. Whether a needle under the skin counts is the owner's. Until then it is a district method.

Who and route	Rate	Most
Child, by weight, either route	Rectum: none found. Under the skin: 20 ml for each kg over about 1 hour, against 1 ml a minute	05.4
Adult, rectum	100 ml an hour, up to 250 ml	400 ml an hour for 1 to 2 hours, then rest 2 to 4. About 1 litre a day
Adult, under the skin	1 ml a minute a site, about 20 drops	1.5 litres a site in 24 hours, 3 litres over 2 sites. Never over 1 litre in 2 hours

Rectum, any rung:

1. Not after rectal injury or surgery, nor with a growth, bleeding piles, packed stool or a bleeding disorder.
2. Clean warm water, oral rehydration solution, or the salt water above. Body warm.
3. Left side, during and 30 minutes after. Never the right side.
4. Soft greased tube, pencil thick, in 20 to 40 cm. Never force it.

Under the skin, the library's view:

5. Sterile saline, or the salt water boiled 15 minutes, covered, used within 24 hours.
6. 2 teaspoons of salt is about 12 g. That is washing water only.
7. Not in shock, heart failure, breathlessness with crackles, or bleeding disorders.
8. A new needle every time, 21 to 25 gauge, at 45 to 60 degrees into a pinched fold.

9. Thigh, belly away from the navel, below the collarbone, between the shoulder blades. Never groin or breast.
10. Lump still there at 1 hour: halve the rate. Hard, red, hot or sore: move it. New site every 3 days.

Stop all fluid for new breathlessness, a wet cough or puffy eyelids. Stop too if they cannot lie flat, or breaths rise 5 or pulse 15. One chart for both routes: time, route, ml, urine, swelling.

Grades: saline under the skin in older adults A, in children C. Salt-free or strong fluid X. Rectal B in adults, D in children. Extra fluid for the dying: no gain (chapter 31).

Rungs. Hands: spoon and cup. Hearth: weighed salt water, a funnel. Garden and still: a balance, soft tubing. Dispensary: salvaged saline and butterfly needles, held until the owner rules. Infirmary: under the skin, and the vein while salvaged fluid lasts. Hospital: made fluid. Refuse: anything home-made into a vein.

24.6 Do: the fever nursed

Never cold baths, alcohol rubs or ice packs for fever. Instead: undress, fan, cool cloths on face, palms and soles.

Never aspirin under 16. Instead: paracetamol by weight (06.2).

1. Temperature, pulse and breaths 4 times a day. Lines as 24.1.
2. Under 2 months: 37.5 °C or more, or cold, is a danger sign (chapter 6).
3. Light cover, shade, moving air. Lukewarm sponge for comfort only.
4. Small drinks often. Chart cups and urine.
5. Paracetamol for distress, not for the number.
6. Fever past 3 days: find the cause. Any red flag in 24.1: send. Child: 06.1.

Weight	Dose	500 mg tablet	Most in 24 hours
Under 34 kg	06.2	06.2	06.2
34 to under 50 kg	500 mg	1	4 doses, 2 g
50 to under 67 kg	750 mg	1 and a half	4 doses, 3 g
67 kg and over	1,000 mg	2	4 doses, 4 g

Every 4 to 6 hours. At most 4 doses and 60 mg/kg in 24 hours. Adults at most 1 g a dose, 4 g a day. Never round up. 1 person gives and writes each dose.

Work every dose twice, with two people.

Grades: undressing and fanning B. Lukewarm sponge B for comfort, D as treatment. Alcohol rub X. Cold bath X. Paracetamol A. Nursing a long fever B.

Rungs. Hands: undress, fan, count. Hearth: cloths, drinks. Garden and still: shade, a fan. Dispensary: thermometer, paracetamol. Infirmary: the cause found. Hospital: tests. Refuse: the cold bath and the alcohol rub.

24.7 Do: the stroke's first week

Never food or drink before the swallow test. Instead: wet the lips and clean the mouth.

Never get the person up hard in the first 24 hours. Instead: short spells sitting out once awake and steady.

1. Note the time it began. Check sugar if a meter exists (chapter 25).
2. Drowsy: on the side, airway clear. Awake: any comfortable position.
3. Swallow, mouth and tube as 24.4. Turning as 24.3.
4. No catheter. Bottle, pad or commode.
5. Do not bring a high pressure down with tablets in the first days.
6. Sit out from about day 2, in short spells.
7. Fever, cough or a wet voice after meals: stop food by mouth, sit up, send.
8. Aspirin: chapter 25. After the first week, and the 3 months: chapter 28.

Grades: organised stroke nursing A. Swallow test B. Hard getting up within 24 hours X. Lowering pressure in the first days X.

Rungs. Hands: swallow test, turning, sitting out. Hearth: thick food, sheepskin. Garden and still: commode. Dispensary: 2 people trained in stroke nursing, a sugar meter. Infirmary: a stroke bay of 4 to 6 beds. Hospital: scanner, clot drugs. Refuse: tea in the first hour, the catheter for convenience.

24.8 Prevent: the bowel, the bladder and the carers

Never one person nursing a bedfast person alone past 7 days. Instead: name 2 carers and a reserve before the first night.

1. 2 days without stool: water or juice before breakfast, more drinks, sit up, rub the belly clockwise.
2. 3 days: adult enema of warm soapy or salty water, 40 to 43 °C. Give 1 to 2 litres, left side. Child: the healer decides.
3. 5 days with a swollen belly or vomiting: greased gloved finger, remove the hard mass. Stop for bleeding.
4. No urine for 12 hours, tense above the pubic bone: sit up, warm water over the perineum. Nothing: red flag.
5. A catheter: bag below the bladder, never disconnected, out soon. The paralysed: chapter 28.
6. Split the day in 3. No one holds all 3 more than 2 days running.
7. The rota goes on the wall. The carer eats and sleeps first.
8. A carer who falls ill leaves the room that day. The reserve comes in.
9. A long illness is no shame on a house. The village nurse visits 2 times a week.

Village of 300: about 3 to 6 bedfast at once, about 8 hours of care a day each. Each needs a bed, 2 sheets, a draw sheet, a sheepskin, 2 buckets, a basin and 3 carers. Many sick at once: 15.3.

Grades: higher staffing B. Rota and enema not graded by the library.

Rungs. Hands: rota, belly rub, sitting up. Hearth: enema can, bucket. Garden and still: commode. Dispensary: the nurse, a register of the bedfast. Infirmary: catheters, night cover. Hospital: laxatives on demand. Refuse: the lone carer.

If it goes wrong

1. **Food in the lung.** Looks like a cough or wet voice at meals. Fever follows in 12 to 48 hours. Cause: feeding the drowsy, flat or hurried. Do: stop, sit up, clear the mouth, test again. Fever: send.
2. **A sore despite the turning.** Looks like red that stays over a heel or the base of the spine. Cause: a fold, a drag, a ring, wet skin, a hard bed turned too seldom. Do: no weight on it, smooth the sheet, add a sheepskin, turn sooner, keep it dry.
3. **The carer breaks.** Looks like missed turns, a blank chart, shouting. Cause: one person, no relief, no sleep. Do: the reserve comes in today, and the carer sleeps.

NUMBERS TO CARRY

- 7 points looked at and touched each day. 3 seconds to blanch.
- Turn every 2 hours on a hard bed, 3 to 4 on a good one. No trial behind either.
- 30 degrees of tilt. 30 minutes upright after food.
- 3 teaspoons of water before every meal.
- pH 5.5 or below: the tube is in the stomach.
- 9 g of salt to 1 litre, weighed. 1 ml a minute a site.
- Organised stroke nursing: 6 more people living at home in every 100.
- 7 days: the longest anyone nurses alone.

THE LIBRARY

NU-01 Nursing as the main medicine: Nightingale's statistics and the care of the bedridden. NU-02 Fluids by mouth, tube and under the skin: hydration for the one who cannot drink. NU-03 The sickroom: isolation, air, light, warmth, water and the household as hospital. NU-08 Pain relief by non-drug means. CH-02 Blood pressure, stroke and the heart without drugs. SY-10 The harm register. SY-07 The red-flag list. SY-09 The salvage list and the first year. All are on the website. The guest who cannot leave the room is the oldest test of a house.

CHAPTER 25

The Chronic Body

A fit that lasts five minutes is an emergency. An allergy kills in minutes, and adrenaline must be in the thigh within them. Type 1 diabetes without insulin kills in months. High pressure kills in decades, which is why it is last.

OPENING

Purse your lips as if to cool a spoonful of soup, and breathe out through them slowly. The breath out grows longer. The chest empties further than it does through an open mouth, and the next breath in comes deeper without being asked. People whose chests have narrowed over years learn to do this many times a day, on the stairs, at the woodpile, in the night.

Most illness in this book comes and goes. A fever breaks or it does not. A bone knits. A wound closes. The illnesses here stay. A body that cannot move sugar out of the blood. Vessels held at a pressure they were not made for. An airway that narrows on a cold morning. A brain whose cells, now and then, flash all together. A body that answers a bee or a peanut with everything it has. None of these is cured in a village, and most were not cured in a hospital either. They were managed, by someone, every day.

That is the shape of the work. It is the daily bread of a condition: what is done every day, without end, and how a household lives with it. The

tablet at night that must never stop suddenly. The look at the feet. The salt left out of the pot. The inhaler kept from frost. The box with the ampoule, in the coolest dark place in the house, that everyone knows how to find. None of it is dramatic. Most of it is remembered or forgotten at the table.

Each of these conditions keeps its own clock. An allergy that closes the throat kills in minutes. A fit that runs past five minutes is unlikely to stop alone. Sugar without its drug kills in months. Pressure kills in decades, so quietly that most of those it kills never felt it. What follows runs by those clocks, the fastest first.

Breathe out once more through pursed lips. The chest knows how. Much of what follows is like that: small, plain, repeated, and worth more than it looks.

THE STORY

The minutes

The sting, the swelling throat and the first ten minutes belong to chapter 22. What belongs here is the rest of a life. Between a quarter and a half of those who once reacted with the whole body to a food, a drug or a sting will do it again, and nobody can say whose next time will be worse. So the allergy becomes a condition, and the household carries it.

British records show who carries it. Food killed the young, and about three in four of them had asthma as well. Stings killed the middle-aged and the old. In Pumphrey's register of deaths, published in 2000, medicines killed fastest, a median of five minutes from the first sign to the heart stopping. After the Fall the village will cause these reactions itself, with every injection of penicillin or antivenom, so the adrenaline is drawn up before the needle goes in.

The drug in the box ages. In 2000 Simons and colleagues tested 34 autoinjectors up to ninety months past their date, and on average they still held about three quarters of their dose. In 2017 forty devices up to four years out all held at least four fifths. Colour told the loss better than the

date. Clear and expired is better than none. Pink is partly spent. Brown is never used.

About five in every hundred reactions return hours later without a new exposure, at a median of about twelve hours. That is what the long watch is for.

One finding runs the other way. In the LEAP trial of 2015, infants at risk who ate smooth peanut from their first year had far less peanut allergy at five. Smooth paste, never a whole nut.

The fall

About six in every thousand people have epilepsy, two in a village of three hundred and nearly twenty in a district. Where drugs are scarce they die at about twenty in a thousand a year, from long fits, from sudden death in sleep and from drowning, at nearly nineteen times the expected rate. So much of the daily care is no drug at all. It is a guard on the hearth, company at the river, and no work alone at heights.

Since 2015 epilepsy doctors have set two times for a long fit. At five minutes it is unlikely to stop alone. At thirty, harm to the brain becomes likely. A common cause is a drug that has stopped.

On 12 May 1857, in London, Sir Charles Locock was reported to have said that potassium bromide had stopped the fits in all but one of fourteen or fifteen women. The report is shaky, and the first sound evidence came from Samuel Wilks in 1861. Bromide moves with salt. Less salt raises it until it poisons, more lets the fits return, so a household on bromide keeps its salt steady.

In 1912, in Freiburg, Alfred Hauptmann gave a new sleeping drug, phenobarbital, to patients who slept badly on bromide, and their fits fell. It is still among the cheapest drugs in the world, and in rural China in 2006 it halved the fits in about two thirds of 2,455 patients. It leaves the body slowly, so one dose at night is enough and a missed day does little harm. Stopping it suddenly is what kills. Even a slow stop costs something. In a British trial of 1991, among people two years free of fits, 59 in 100 of those slowly taken off stayed free two years more, against 78 of those who kept taking it. When stock runs short, the taper is planned months ahead.

In 1921, at the Mayo Clinic, Russell Wilder proposed a diet so rich in fat that the body behaves as if fasting, because fasting had been seen to stop fits. In a British trial of 2008 it more than halved the fits in 38 of 100 children, against 6. It costs fat, which a village may lack. And where pigs roam, a pork tapeworm causes about a quarter of all epilepsy. Latrines and penned pigs prevent it.

The narrow airway

Asthma kills about 442,000 people a year. When Britain examined its asthma deaths in 2014, 45 in 100 of the dead had had no help in their final attack, and most had worsened for days. The danger lies in the slow days as much as in the last hour. A reliever used more and more is a warning.

Ephedra, ma huang, is the green stem Chinese medicine gave for wheeze. Nagai isolated its ephedrine in Japan in the 1880s, and Chen and Schmidt at the Peking Union Medical College brought it into Western medicine in the 1920s. It opens the airway slowly and raises the pressure and the pulse. In 2000 Haller and Benowitz reviewed 140 American reports of harm from ephedra supplements, with ten deaths, and the United States banned them in 2004. The figures for a dose disagree fivefold, and the village takes the lower.

Coffee opened the airway a little for up to two hours in small trials, a bridge while help is fetched. Steam does nothing and scalds children. Five millilitres of eucalyptus oil can poison a child.

A salbutamol canister holds two hundred puffs. The drug keeps for years past its date, but the valve fails, and heat above fifty degrees can burst it. In a trial of 1999 with 88 children, a sealed plastic bottle of half a litre did nearly as well as a factory spacer. A polystyrene cup did not.

The other narrow chest is made in the kitchen, by smoke from cooking fires in closed rooms. In Guatemala a chimney stove halved the carbon monoxide women breathed and cut their wheeze by more than half. The stove belongs to FEASTING after the FALL. Pursed lips, a slow daily walk and a seat by the open door are the care.

The diet that bought months

Before 1922 a child who began to drink without end, to wet the bed again and to grow thin while eating had little time left. The breath smelled of pear drops, though a fifth to a third of people cannot smell it, and near the end the breathing grew deep and sighing.

Elliott Joslin, in Boston, kept a ledger. Of every thousand patients whose illness began between 1897 and 1914, 824 were dead within ten years. Of those whose illness began between 1914 and 1922, 386. Of those who fell ill between 1922 and 1926, 61. The last change was insulin. The middle one was hunger.

Frederick Allen, at the Rockefeller Institute in New York from 1914, fasted his patients until the urine was free of sugar and then fed them the least food that kept it so. Joslin took up the method in 1916. Of Allen's series, 43 in every hundred were dead by late 1917, and three in four children under ten by early 1918. Some died of the diet. Elizabeth Hughes, found diabetic in 1919 at eleven, reached Toronto in August 1922 at about 20 kilograms, down from 34. She lived to seventy-three. In children the diet bought months, sometimes a year or two, at that price.

Banting and Best made their pancreas extract in Toronto through the winter of 1921 to 1922. On 11 January 1922 Leonard Thompson, fourteen and wasting, was given the first injection at the Toronto General Hospital. It was impure, his sugar barely fell, and an abscess formed. Twelve days later, after James Collip had cleaned the extract, a second course cleared the ketones from his urine. Thompson lived until 1935. That spring the batches lost their strength, nobody could say why, and at least one patient died when the supply gave out. The men who found insulin could not make it reliably for months. A district cannot make it at all.

So the daily bread of type 1 diabetes, while the vials last, is a book. The units, the meals, the thirst and the urine, written every day, with the date each vial was opened and the date the stock runs out. Insulin keeps better than its name. In a Kenyan refugee camp, in a study of 2021, vials kept where the day swung between twenty-five and thirty-seven degrees held full strength for four weeks, while vials at a steady thirty-one degrees lost up to about a seventh. A clay pot that cools at night beats a warm shelf. Frost spoils it.

When the last vial is empty, this patient will die, a child within months,

an adult with some pancreas left within a year or two. In rural Mozambique life after diagnosis has been put at about seven months. What can be done is to make those months good: water, salt, warmth, company, and the truth told early. A starvation diet for a child adds hunger to dying and does not change the end.

Thyroid hormone is different. It survives drying and works by mouth. In 1891 George Murray gave a woman whose thyroid had failed an extract of sheep gland, and she lived twenty-eight more years. But gland of unknown strength gives too little or slowly too much, which brings a fluttering heart and brittle bones. Salvaged levothyroxine is kept dry and given first to those with no gland, the pregnant and children.

Bread, salt and walking

Type 2 diabetes is a different illness with the same name, and the Fall may treat it kindly. In Cuba between 1991 and 1995, when food and fuel ran short and people walked and cycled, deaths from diabetes fell by half. Measured eating is the treatment. In Newcastle in 2011, eleven people lived on about six hundred calories a day for eight weeks, and seven of ten were free of diabetes twelve weeks later. In a larger British trial of 2018, 86 in 100 of those who lost fifteen kilograms were in remission at a year. The tablets that make the body release insulin whatever the food drop the sugar dangerously in a hungry village, so they stop as food falls. The feet are looked at every evening (chapter 16).

Pressure gives no sign for decades. Riva-Rocci's cuff is chapter 2's story. The wrong cuff on a thick arm reads nearly twenty too high, and spring dials drift, so every dial is checked against a column of water.

In 1914 Volhard and Fahr described the malignant phase of high pressure, which killed within about two years. In 1967 the Veterans Administration trial gave 143 American men with very high pressure tablets or dummy pills. Twenty-seven on dummy pills had a stroke, heart failure or worse, against two on tablets, and the trial was stopped at eighteen months. In Framingham, Massachusetts, a report of 1996 found that high pressure had come before 91 in every 100 cases of heart failure. Every twenty points more of the upper pressure doubles the risk of dying of a stroke.

Salt is most of the answer. In the INTERSALT study of 1988 the Yanomamo of the Amazon, who used almost no salt, had a mean pressure of 96 over 61 that did not rise with age. In 2021, in six hundred Chinese villages with nearly 21,000 people, a salt in which a quarter was potassium cut strokes by about a seventh and deaths by about an eighth. Potassium salt can kill people whose kidneys are failing, and they were left out. Walter Kempner, at Duke from about 1939, held malignant pressure down on rice and fruit with almost no salt. Salt is cut for the sitting, not the labourer in heat, and rehydration salts are never refused for pressure (chapter 5).

High pressure strains the heart until it fails. In anyone living on white rice or flour the healer first rules out beriberi, which thiamine cures. Years of pressure and sugar also wear the kidney down quietly. Without dialysis it cannot be replaced, and what is left is protected by keeping pressure and sugar down, with no potassium salt, and by comfort at the end. The stroke is nursed in chapter 24.

The Honest Broker's Logbook

CH-13 is the strongest report here. It corrected its own brief, whose claim that clear expired adrenaline keeps over nine tenths for years overstates the data. It can be trusted with a life. It gives fixed doses by age, SY-10 gives 0.01 ml/kg for every child, and 25.2 prints both, weight first. On who holds the adrenaline the library divides. CH-13 and chapter 22 keep it in the dispensary with the healer. ME-10 and SY-10 put an ampoule in every allergic household. Both are printed, and the owner chooses.

ME-10 rightly refuses to describe making any hormone. Two of its lines are not reproduced. It asks for six hours of watching on the ground that a quarter of those resuscitated die later. Pumphrey's figure is that 28 in 100 of the fatal cases had been resuscitated and died later, which is another thing. The watch is printed as CH-13's twelve hours with ME-10's six beside it. And ME-10 reads Joslin's 824 and 386 as deaths among children aged ten or under, where CH-01 and SY-08 read deaths within ten years of onset. The Story follows CH-01.

Its recipe for a urine sugar reagent is not printed, because the copper salt is a poison. Its seven months in Mozambique rests on secondary ac-

counts. CH-02 checks the dial against mercury, the Bench against water, as chapter 2 does. CH-03 holds the ephedra gap that SY-12 lists as C7: the British lay ceiling of 600 mg a dose and 1.8 g a day, against Chinese practice at 3 to 9 g a day and PH-08's 3 g a dose. The village takes the British figure, with the other beside it. CH-04's midazolam repeat is printed both ways, 10 minutes from Hesperian and 5 from MSF. Its taper sum is wrong: 15 mg every 2 to 4 weeks takes 120 mg to nothing in 4 to 8 months, not 2 to 4. The Bench prints the corrected figure.

The library is thin in four places. No report covers the failing kidney. No one has counted anaphylaxis deaths where no adrenaline exists, or tested pink adrenaline in people. No report gives the strength of the rescue ampoules, so the draft supplied 5 mg/ml, as chapter 10 uses for diazepam. And nobody has measured how much ephedrine passes from stem to cup.

The turn to the present

Until the Fall, the chronic body was kept by the repeat prescription. Each month the pharmacy filled the box, and the box went on the shelf by the kettle. Insulin sat in the refrigerator door, the adrenaline pen in a school bag, the pressure tablets in a plastic week with seven lids. People lived for decades with illnesses that had killed their grandparents in months, and hardly thought about it. That was the gift.

Much of what was in the box can be stretched, and some of it replaced. Diet does better than tablets for type 2. Salt does much of the pressure drug's work. Phenobarbital keeps for years, and a slow taper can end it gently. Two cannot be made at all, insulin and adrenaline. So what does a household do when the last vial is opened?

It does what households did before the box. It knows who among them is ill, and how. It keeps a book and a cool dark place. It sits the breathless up, lays the allergic flat, times the fit and puts nothing in the mouth. It cooks with less salt, walks, and looks at the feet. It counts the stock and says the date aloud. This is the daily bread of a condition, and it was always most of the care. The drug was the rest. Now the box.

Work every dose twice, with two people.

25.1 See: which long illness is in danger today

Keep one register: name, weight, illness, drug, dose, stock, run-out date. Any row below: go now.

Sign	Likely cause	Go to
Lips or throat swell, wheeze, faint pulse, minutes after a food, drug or sting	Allergy	25.2 now
Fit past 5 minutes, or a second before waking	Long fit	25.3 now
Cannot finish a sentence, blue lips, silent chest	Severe asthma	25.4 now
Sweating, shaking, confused, on insulin or a sugar tablet	Low sugar	25.5 now
Thirst, vomiting, deep sighing breaths, drowsy	High sugar	25.5
Over 180/110 with headache, blurred sight or confusion	Malignant pressure	25.6, send today
Breathless lying flat, 2 kg gained in 3 days	Heart failure	25.6

Elsewhere: stroke, chapter 24. Fit in late pregnancy, chapter 10. Fit with fever in a child, chapter 6. Hot diabetic foot, chapter 16.

Rungs. Hands: a clock. Dispensary: cuff, strips, register. Refuse any remedy before the sorting.

25.2 Do: the allergy that kills in minutes

Adrenaline into the thigh is one of two injections allowed below the district. The other is magnesium (chapter 10).

Never give adrenaline into a vein or a drip. Instead, the outer thigh muscle.

Never let them stand or walk. Instead, carry them.

Never give a tea, a tablet or an antihistamine first. Instead, adrenaline now.

1. Weak pulse: flat, legs raised. Hard to breathe: half sitting. Unconscious: on the side. Pregnant: left side.
2. Read the label aloud: 1 mg/ml. Clear first. Faintly pink only by the owner's rule. Never brown or cloudy.
3. Inject into the outer middle third of the thigh. Write the time.
4. Not better at 5 minutes: same dose, other thigh. Repeat every 5 minutes while signs last.
5. Wheeze after adrenaline: salbutamol (25.4). Settled adult: cetirizine 10 mg for itch.
6. Watch lying down, near adrenaline, 12 hours (CH-13) or at least 6 (ME-10).
7. Enter the trigger in the allergy register.

Adrenaline 1 mg/ml into the thigh muscle. Ceiling 0.5 ml a dose. Interval 5 minutes. The dose by weight is the one table at 22.2, which this chapter does not repeat.

Who holds it, two readings. The dispensary keeps the stock and the healer gives it (CH-13). Or each allergic household keeps 1 ampoule, a 1 ml syringe and a 25 mm needle (SY-10, ME-10).

Store in the carton, dark, 15 to 25 °C, never frozen. Check every 6 months against white paper.

Before any penicillin or antivenom injection: adrenaline drawn up, patient lying, 30 minutes of watching.

The danger sign: the throat still swelling after 2 doses.

- **Help in time.** A dose every 5 minutes, fluid by vein at the district. Most recover.
- **Help too late.** Keep giving while stock lasts. Tell the family it may fail.
- **No help at all.** Flat, or as breathing is easiest. Warm, held, spoken to. Many reactions settle. Some do not. Tell the family the reaction caused the death, not they.

Grades. Adrenaline into the thigh B. Clear expired B. Faintly pink D. Flat, legs raised B. Antihistamine first X, for itch B. Plants instead of adrenaline X. Smooth peanut for infants A.

Rungs. Hands: position. Hearth: the box. Dispensary: ampoules, syringes. Infirmary: fluid by vein. Refuse adrenal extract.

25.3 Do: the fit that does not stop

Never put anything in the mouth or hold them down. Instead, cushion the head and time it.

Never give more than 2 rescue doses. Instead, keep them on the side, count breaths, send.

Never stop phenobarbital or bromide suddenly. Instead, the taper at 25.6.

1. Write the time. Move fire and sharp things away. Something soft under the head.
2. Jerking stops: on the side. Count breaths.
3. At 5 minutes, or a second fit before waking: a rescue dose, by a trained person only.
4. Say the route aloud. Midazolam between gum and cheek. Or diazepam into the rectum, syringe without needle, 1 to 3 cm in, buttocks held 1 minute. No injection.
5. Still fitting: diazepam again at 5 minutes. Midazolam again at 10 (Hesperian) or 5 (MSF). Never a third.
6. Count breaths every 5 minutes for 1 hour. Adult under 8: lift the chin, rouse, breathe for them (chapter 21).
7. Restart the usual tablets once they can swallow. Diabetic: sugar in the cheek (25.5). Drinker: chapter 30.

Read the label: 5 mg/ml. Any other strength: the healer works the ml twice.

Weight	Diazepam 5 mg/ml, rectal	Midazolam 5 mg/ml, cheek	Age, only if no scale
Under 5 kg	0.1 ml per kg	0.04 ml per kg	Under 2 months
5 to 9 kg	0.5 ml	0.2 ml	2 to 11 months
10 to 14 kg	1 ml	0.4 ml	1 to 3 years
15 to 19 kg	1.5 ml	0.6 ml	4 to 5 years

Weight	Diazepam 5 mg/ml, rectal	Midazolam 5 mg/ml, cheek	Age, only if no scale
20 to 29 kg	2 ml	0.8 ml	6 to 9 years
30 to 49 kg	2 ml	1.2 ml	10 to 14 years
50 kg and over	2 ml. Healer may give 4 ml. Old: 2 ml	2 ml	Over 14

That is diazepam 0.5 mg/kg, ceiling 10 mg under 12 years and 20 mg after. Midazolam 0.2 mg/kg, ceiling 10 mg.

The danger sign: still fitting at 30 minutes, or an adult breathing under 8 a minute.

- **Help in time.** Drugs by vein at the district. Many fits stop.
- **Help too late.** Side, airway, warmth. Tell the family the fit outran what the village holds.
- **No help at all.** Side, airway, warmth, someone stays. Some fits stop alone. Tell the family nothing they did caused it.

Grades. Buccal midazolam A. Rectal diazepam A. Side, timing, nothing in the mouth B. Sudden phenobarbital stop X. Anything in the mouth X.

Rungs. Hands: clock, side. Hearth: a fireguard. Dispensary: rescue doses, phenobarbital. Infirmary: drugs by vein. Refuse restraint and scarification.

25.4 Do: the asthma attack

Never use steam or eucalyptus. Instead, sit up, calm, the inhaler.

Never give a sedative or a syrup. Instead, stay and count breaths.

Never give ephedra to a child, a pregnant woman, or without a cuff. Instead, the inhaler, coffee, send.

1. Sit them up, leaning forward, out of smoke. Speak slowly.
2. Spray an old canister into the air first. No mist: the next one.
3. Salbutamol 100 µg a puff through a sealed 500 ml bottle, 1 puff at a time. 2 to 10 puffs every 20 minutes for the first hour.
4. Better: 2 to 4 puffs every 4 to 6 hours for 1 to 2 days.

5. Prednisolone if held, once a day, by the table.
6. No inhaler, adult: strong coffee, 1 to 2 cups, a bridge only.

Weight	Prednisolone once a day	Age, only if no scale
Under 10 kg	Healer only	Under 1 year
10 to 19 kg	10 mg	1 to 5 years
20 to 29 kg	20 mg	6 to 9 years
30 to 39 kg	30 mg	10 to 12 years
40 kg and over, adults	40 mg	Over 12

Children 3 days, adults 5. That is 1 mg/kg, ceiling 40 mg (UK). MSF gives 1 to 2 mg/kg, ceiling 50 mg, for 5 days. Taken over 3 weeks: never stop suddenly.

Ephedra stem, adults only, at the dispensary with a cuff. UK lay ceiling: 600 mg a dose, 1.8 g a day. The village uses this. Chinese practice: 3 to 9 g a day. Stop if the upper pressure rises 20 or the pulse passes 120. At most 3 days. Never in pregnancy, heart or thyroid illness, high pressure, prostate trouble, or over 65. The plant: chapter 33.

The danger sign: cannot finish a sentence. Adult breathing over 30, child of 2 to 5 over 40. Pulse over 120. Silent chest, blue lips, drowsy. Relief lasting under 4 hours.

- **Help in time.** Puffs every 20 minutes, prednisolone, oxygen at the district. Most recover.
- **Help too late.** Puffs on, sitting up. Tell the family it came after days of worsening.
- **No help at all.** Sitting up, cool air, a calm voice, someone holding them. Tell the family nothing they did caused it.

Grades. Salbutamol through the bottle A. Prednisolone A. Ephedra stem C. Coffee C. Steam X. Eucalyptus D. Smoked stramonium C, a district decision. Datura by mouth X. Chimney stove B.

Rungs. Hands: sit up, pursed lips. Hearth: a chimney. Garden: ephedra (chapter 33). Dispensary: inhalers, prednisolone, cuff. Infirmary: oxygen. Refuse steam and sedatives.

25.5 Do: the low sugar and the insulin box

Never put drink or loose sugar into a mouth that cannot swallow. Instead, paste inside the cheek, on the side.

Never lower insulin because the urine shows no sugar. Instead, lower it only after a low, with the healer.

Never stop insulin in type 1 because they are not eating. Instead, a cup of fluid every hour, salted and sweet in turn.

Low sugar: sweating, shaking, confusion, anger, then a fit.

1. Awake: 15 g of sugar, 1 level tablespoon, or 120 ml of juice. Under 15 kg: 2.5 g under the tongue.
2. Recheck at 15 minutes. Not better: again. Better: a meal with starch.
3. Not awake: honey or sugar paste inside the cheek, on the side.
4. On a sulfonylurea: feed often, watch 72 hours.

The insulin box.

1. Count every unit, divide by the daily dose, write the run-out date on the wall. Tell the patient.
2. One insulin strength in the village. Read the vial aloud. U-100 in a U-40 syringe gives 2.5 times the dose.
3. Below 25 °C, a place that cools at night. Never freeze. Date on opening, use for 28 days.
4. Logbook daily: units, meals, thirst, urine. A new lot: the healer resets the dose.
5. Who gets the last vials: a rule set in advance.

Type 2, adults: measured eating, a daily walk, 15 kg lost. Stop sulfonylureas as food falls. Metformin 500 mg a day, at most 2 g, stopped for vomiting, diarrhoea or fever. Feet every evening (chapter 16).

The danger sign: thirst, vomiting, deep sighing breaths, drowsy.

- **Help in time.** Insulin, fluid by vein or under the skin, 72 hours of nursing at the district. Most live.
- **Help too late.** Fluid by mouth, warmth, on the side when drowsy. Tell the family the stock ran out, not their care.

- **No help at all.** Water, salt, warmth, company. The coma itself is not painful. Tell the family the date early, and that the illness ended it.

Grades. Salvaged insulin, rationed A. Allen diet for children X. Diet to remission in type 2 A. Metformin A. Sulfonylureas in famine X. Foot inspection A. Fenugreek seed B minus. Cassia cinnamon X.

Rungs. Hands: the signs. Hearth: sugar, a cool pot. Dispensary: insulin, logbook. Infirmary: fluid by vein. Refuse insulin from gland, and every plant sold as a cure.

25.6 Prevent: pressure, salt and the stock

Never trust an unchecked dial. Instead, check it against water every 3 months (02.6). Out by more than 4 mmHg: out of use.

Never give potassium salt to anyone with failing kidneys or scanty urine. Instead, beans, greens and potatoes.

Never stop phenobarbital suddenly. Instead, the taper below.

1. Seated 5 minutes, bare arm at heart level, a cuff that fits. 3 readings, average the last 2, on 2 days.
2. Salt in food about 5 g a day, a level teaspoon. Heavy sweat: about 1 g more an hour. Diarrhoea: full ORS (chapter 5).
3. Potassium salt, a quarter potassium chloride, only from a clean source.
4. Walk daily. Lose weight if heavy.
5. Hibiscus calyx, 10 g a day for 4 weeks, then measure. Not in pregnancy.
6. Salvaged tablets: first over 180/110 with signs, then past stroke or heart failure. Who gets the last.
7. Heart failure: thiamine if the diet is white rice or flour. Sleep sitting up. Weigh daily: 2 kg in 3 days is fluid.
8. Stroke: do not lower the pressure (chapter 24).

Phenobarbital stock. No new patient without 12 months and a taper in hand. Under 6 months left: taper first those 2 years free of fits. Under 3 months: taper everyone, lowest risk first.

Weight	Cut each step	Every
Under 15 kg	7.5 mg	2 to 4 weeks
15 kg and over, adults	15 mg	2 to 4 weeks

That is at most about 1 mg/kg a step. From 120 mg it takes 4 to 8 months. The family holds a rescue dose throughout. No swimming, fire or heights alone. Lock the box. An overdose kills.

The danger sign: over 180/110 with headache, blurred sight or confusion.

- **Help in time.** Tablets from the reserve, the district today. Many live for years.
- **Help too late.** Rest, almost no salt, the rice diet under the healer. Tell the family a stroke may come.
- **No help at all.** Rest, quiet, little salt, someone near. Tell the family years of pressure did this, not they.

Grades. Salt cut A. Potassium salt A. Walking and weight A. Rice diet B. Hibiscus calyx B. Hawthorn for pressure X. Phenobarbital A. Bromide B. Penned pigs B.

Rungs. Hands: walking. Hearth: less salt. Garden: beans, greens, hibiscus. Dispensary: checked cuff, tablets. Infirmary: reserpine under watch. Refuse rauvolfia root below the district, and foxglove outside chapter 34.

If it goes wrong

- **The fits after the tablets ran out.** Fits return days after the last tablet. Cause: stock ended uncounted. Do: 25.3 now, restart any dose held, then the taper rules.
- **The low after a new vial.** Sweating and confusion the day a fresh lot is opened. Cause: a strong vial after a weak one, or the wrong syringe. Do: sugar (25.5), then the healer checks vial, syringe and dose.
- **The adrenaline in the window.** Found pink or brown on the day it is needed. Cause: heat and light. Do: a clear one if any, pink only by the owner's rule, flat, stay. Then move the box.

NUMBERS TO CARRY

- 0.5 ml of 1 mg/ml adrenaline into the thigh for an adult, 0.01 ml/kg for a child, every 5 minutes (CH-13, SY-10).
- 5 minutes: a fit this long gets the rescue dose. 2 doses at most (CH-04, SY-10).
- 15 g of sugar, recheck at 15 minutes. Watch 72 hours after a sulfonylurea low (CH-01, ME-10).
- 824, 386 and 61 per 1,000: type 1 deaths within ten years, before insulin, on the diet, with insulin (CH-01, SY-08).
- 4 to 8 months: a phenobarbital taper from 120 mg. Never stop suddenly (CH-04).
- 600 mg a dose, 1.8 g a day: ephedra stem for a lay adult. Chinese practice 3 to 9 g a day (CH-03, SY-12).
- 15 kg lost: 86 in 100 with type 2 diabetes in remission at a year (ME-10, CH-01).
- 20 points more of upper pressure doubles the risk of dying of a stroke (CH-02).

THE LIBRARY

CH-01 Diabetes after the Fall. CH-02 Blood pressure, stroke and the heart without drugs. CH-03 Asthma and the lungs. CH-04 Epilepsy: the ketogenic diet, bromides and the care of seizures. CH-13 Allergy, anaphylaxis and the immune body. ME-10 Insulin, thyroid, epinephrine and the drugs that cannot be made. SY-08 The means ledger. SY-10 The harm register. SY-12 What the library could not find. All are on the website.

CHAPTER 26

Pain, Skin, Gut and the Small Surgeries

A boil points in a week. Cellulitis crosses the pen line in a day. A hernia that does not go back has six hours. Appendicitis has a day or two. Most pain of the back is better in six weeks without anyone's help.

OPENING

Look at the back of your hand, or at your shins, and find the oldest mark you can. A pale line where a tin lid caught you. A small pit left by a childhood spot. A knuckle that once swelled for a week and is now the same as the others. Press it gently with a fingertip. Nothing hurts. Whatever happened there was finished long ago, by the body, in its own order. The bleeding stopped in minutes. The swelling went down in days. New skin crossed the gap in a week or two, and the line went on fading for a year after anyone stopped looking.

Most of what brings a person to a healer goes that way. The back that seized while lifting a sack. The boil that rises on the neck. The knee that grumbles on cold mornings. The cramp under the ribs after a heavy meal. Each asks for time and for small, regular attention: warmth, a clean cloth, a walk each day, a bandage put on well every morning. Given those, the body does the rest, more slowly than the patient wants and more surely than anyone's cleverness.

Patience is not the same as waiting. Waiting sits still. Patience watches. It looks again at the red edge on a leg in the evening, to see whether it has

moved since the morning. It feels whether the lump in a man's groin still slides back when he lies down. It asks the woman with the sore back, each week, whether her legs still feel like her own.

A few things in this chapter do not heal with time, and time is what kills them. A swelling in the groin that stays out and hardens. A belly that goes rigid while the person lies still. A fever that arrives with a colic in the side. At first each looks like its gentler cousin. The skill is in telling them apart early, while there is still a day to spend.

So the healer's work here is mostly to keep company with slow mending, and to keep one eye open for the case that will not mend at all.

THE STORY

The back that mends

In 1779 Percivall Pott, surgeon at St Bartholomew's Hospital in London, published a short book on a palsy of the legs. He had seen it in children and adults whose spines had bent forward into a sharp angle, and he noticed that a collection of matter often lay beside the bend. He advised letting it out. He did not know the cause. It was tuberculosis of the spine, and others named it after him. Even in the twentieth century it killed. In a series of 914 people published in 1951, as the first drugs arrived, about one in six died, and one in four of those whose legs had failed.

Pott's patients were the rare ones. Most backs that hurt are strained, not ruined, and they mend. When 33 groups of people were followed from the first weeks of a new back pain, 11,166 people in all, the average pain on a scale of 100 stood at 52 at the first visit, 23 at six weeks, 12 at half a year and 6 at a year. That fall happens with or without anyone's help, so anything given in the first six weeks looks as though it worked. In Sydney, 1,172 people who brought a new back pain to their doctors were followed for a year. Eleven had a serious cause behind it, eight of them a broken bone. The three questions that picked out the eleven were age over seventy, months of steroid medicine and a real injury.

So the healer's work with a back is mostly to wait well. Bed rest, the old advice, makes it worse. People told to stay active recover a little faster than

people told to lie down, and the old lose strength and bone in bed, and some die there. For pain that lasts past three months, exercise of almost any kind lowers it by about 15 points on 100, across 249 trials and 24,486 people. A heat wrap eases a fresh back for the first days. Paracetamol does not. In a trial of 1,652 people with new back pain, those who took it regularly recovered in a median of 17 days, those who took it when needed in 17, and those given a dummy tablet in 16. In other trials, liver tests went wrong nearly four times as often on paracetamol as on a dummy.

Two things spoil the waiting. The first is the back that returns. Of 250 people who had just recovered, 69 in 100 had another bout within a year. That is the ordinary course of a back, not a failure of care. The second is Pott's back and its cousins. Numbness in the saddle where a person sits, trouble passing or holding water, both legs weakening: the nerves at the foot of the spine are being crushed, and an operation helps only within a day or two. Fever with back pain after a boil or a birth. Night sweats and wasting with a cough in the house. A cancer in the past. These are the backs that time does not mend, and the healer asks about them at every visit, not only the first.

The milk cure

Bertram Sippy of Chicago began treating stomach ulcers in 1910 by a method he published in 1915. The patient went to bed for about four weeks and drank milk and cream every hour, 90 millilitres at a time, with powders of alkali in between. Solid food returned slowly over weeks. Ulcers healed under it, and for most of the century an ulcer was treated as a disease of acid and nerves.

It had two flaws. The first was a disease of its own. Doctors at the Mayo Clinic described poisoning by alkali in Sippy's patients in 1923, and in 1949 Burnett named the milk-alkali syndrome in six men, four of whom died. Calcium rose in the blood, the blood turned alkaline and the kidneys failed. Alkalosis appeared in between 2 and 18 in 100 people on the regimen. The second flaw was that the ulcers came back. Left to itself an ulcer heals and breaks down again for decades. In one trial, among people whose ulcers had healed but whose infection was left alone, 95 in 100 ulcers of the duodenum and 74 in 100 of the stomach had returned within

two years.

In Perth, from 1979, the pathologist Robin Warren kept seeing curved bacteria on samples of inflamed stomach lining. Barry Marshall grew them. In 100 people examined in a row the bacteria were present in 58, and in almost all of those with an ulcer. Marshall drank a culture himself, and by the tenth day his stomach lining was inflamed. The paper of 1985 described it as happening to a volunteer. The bacterium is now called *Helicobacter pylori*. Clear it with a fortnight of the right drugs together and the duodenal ulcer stops returning: across 27 trials, 12.9 in 100 came back after treatment against 64.4 in 100 without it.

This is the one place in the chapter where patience was the wrong answer for most of a century. The ulcer healed with rest and milk, and the healing hid the cause. For a village it changes two things. A salvaged course, given once and given whole, can end years of pain. Given badly, as one drug alone, it breeds bacteria the drugs no longer touch. And the commonest harm to the stomach lining is still the one in the medicine box: aspirin, willow and the anti-inflammatory tablets. Most stomach pain eases when they stop.

What cannot wait is bleeding. Vomited blood, vomit like coffee grounds, a black and tarry stool with a fast pulse. Even with endoscopy and blood banks, 8.6 in 100 people died within a month of an ulcer bleed, and 23.5 in 100 after the ulcer burst through.

The stones keep the same rule. An inflamed gallbladder settles with rest, fluids and usually an antibiotic in 87 bouts of 100, and in 96 of 100 mild ones, with about 1 death in 200. One in five has another bout. The first gallbladder was taken out in Berlin in 1882, and that operation remains the district's. A stone in the tube from the kidney passes by itself about three times in four if it is under 5 millimetres, in about 17 days. The colic is fierce, and it is mostly survivable. The exception is fever. A blocked kidney that is also infected kills, and among 1,712 such people deaths were 19.2 in 100 without draining the kidney and 8.8 with it.

The truss and the radical cure

Between a quarter and two fifths of men will have a groin hernia in their lives, and between 3 and 6 women in 100. For three hundred years

before safe surgery most of them had a truss, a pad held over the opening by a spring or a belt. It eased the drag and let a labourer work. It cured nothing, and a man who trusted it could miss the first hours of the one complication that kills, when a loop of gut is caught in the opening and its blood is squeezed off.

How often that happens depends on the kind of hernia. In London, 476 groin hernias were followed. The common kind, which comes through above the groin crease, strangulated in 2.8 in 100 by three months and 4.5 in 100 by two years. The femoral kind, below the crease and commoner in women, strangulated in 22 in 100 by three months and 45 in 100 by 21 months. The risk was highest in the first months after the lump appeared. In America, 720 men with small hernias that barely hurt were randomised to an operation or to watching, and the watched men did as well, with about two stuck hernias for every thousand years of waiting.

In 1887 Edoardo Bassini of Padua presented a repair that sewed the muscle down to the ligament of the groin. His monograph of 1889 described 262 operations, with the hernia returning in about 3 in 100 over up to four years. A collection of about 3,000 such repairs by Bassini and his contemporaries, after antisepsis and before any antibiotic, showed deaths under 1 in 100. It is the best record there is of what a careful, clean repair does with no drugs at all.

The record for the stuck hernia is the opposite. In Lilongwe, between 2013 and 2019, 297 people arrived with groin hernias that would not go back, and 5.4 in 100 died. Those who waited 24 hours or more after arrival for their operation, more than half of them, died eleven times as often as those operated on sooner. Nothing in that figure concerns skill. It concerns the clock.

The hernia that slides back when a man lies down can wait for years. The one that stays out, hardens and hurts has hours. The skill is in telling them apart, and in having the bearers ready.

Where there is pus

The surgeons' oldest rule for an abscess is short: where there is pus, let it out. Before antibiotics, about 6 in 100 people with a large abscess died. In modern trials of skin abscesses opened and washed, drainage alone

cured about 7 in 10, and an antibiotic added between 7 and 14 more in 100. Packing the empty cavity with gauze added pain and nothing else, in eight trials of 485 patients and a trial of 433 abscesses beside the back passage. A warm cloth on a boil has no trial at all. It comforts, and it cannot empty what the blade must.

A boil is a small abscess round a hair. It rises, reddens, softens and points, and most open themselves within a week. The danger lies in where it sits. Infection from an upper tooth can travel along the veins beside the nose to a channel of veins behind the eyes, and announces itself with fever, a swollen lid and an eye pushed forward. A boil on the upper lip or beside the nose sits over the same veins. A hard swelling under both sides of the jaw can close the throat. Those are the boils nobody squeezes.

Cellulitis is the same germs spreading through the skin instead of gathering in one place. Between 1900 and 1950, the published series counted 2,528 deaths among 23,657 people with cellulitis or erysipelas treated without any drug, about 1 in 10. With penicillin, 1 of 325 died. No common infection in this book shows the cost of losing antibiotics more plainly. Without them the old care remains: rest, the limb raised, and a line drawn round the redness so that tomorrow's edge can be set against today's. Impetigo, the crusted infection of children's faces, travels on hands and fingernails. Handwashing with soap cut it by a third in the squatter settlements of Karachi, and clearing scabies from whole island communities in Fiji cut it from about 1 child in 4 to 1 in 12.

The leg ulcer is the slowest of all. It opens above the inner ankle of someone whose leg veins have failed, and it can stay open for years. In 1885 Paul Gerson Unna of Hamburg wrapped such legs in a bandage set with zinc paste that dried firm round the calf. Each step pressed the calf muscle against the firm wrap and pushed blood upward. Firm bandaging is still the best-proven treatment in this chapter: across 14 trials, compressed legs healed about 1.8 times as often within a year. Honey added nothing in a trial of 368 people. The bandage carries one danger. On a leg whose arteries are narrowed it shuts off what little blood arrives, and feeling for pulses at the foot finds that narrowing in only 43 in 100 who have it.

Most skin heals with time and clean cloth. The boil on the upper lip, the red edge that has crossed its line by evening, the ulcer with a hard rolled edge that has not shrunk in three months: those are the ones to send.

The Honest Broker's Ledger

The named people of this chapter are the draft's choice. Marshall and Warren carry the turn of the Story, because they show patience spent on the wrong cause for most of a century. Pott, Sippy, Bassini and Unna stand beside them. The owner may prefer another from CH-05 or CH-09 to CH-11.

One error must not travel. ME-06 prints a card of doses by weight whose child rows for paracetamol point to IN-02's aspirin method. SY-12 calls it the most dangerous single error in the library. The table at the Bench comes from SY-10 and chapter 6, and the card is not used.

The age for salicylates is disputed. ME-02 sets no aspirin or willow under 12. IN-02, ME-06 and WO-11 set no aspirin under 16 and no willow under 18. SY-12 records it as C23 and settles on the stricter. This book prints both and follows the stricter: never aspirin under 16, never willow under 18.

Paracetamol appears twice. SY-10 holds its dose: 15 mg/kg, four doses, 60 mg/kg a day, 4 g for an adult. CH-05 holds that for the back it did no better than a dummy tablet and raised liver tests, and grades it X there. Both stand. The Bench gives paracetamol for colic, the boil and the fresh hurt, and not for the back.

Every cut here that needs a numbing injection belongs to the healer of 23.2, working under the infirmary, with plain lidocaine at the lesser of 3 mg/kg and 200 mg. ME-09's higher figure is not used. No injection is taught below the district in this chapter.

The library is thin in three places. CH-10, the skin report, does not cover boils, cellulitis or impetigo, so those figures come from WO-14, HY-01 and HY-06, and nobody tested honey on impetigo. WO-16, which the brief named, holds the eye, ear and tooth, so its use here is the face and the jaw. The untreated death rate of appendicitis rests on one figure of about 20 in 100 and another of 67 in 100 by the tenth day, both unverified in WO-08 and FO-02. The draft supplied the face and palm lines at the Bench, the warm cloth's timing and the ibuprofen bands, each marked.

The turn to the present

Appendicitis was named in Boston in 1886, from 257 cases. A few years later the leading physician of his day wrote that many recovered without treatment and that over 40 in 100 came back. Both were true, and neither helped the patient on the third day. In two New York hospitals, the chance that an inflamed appendix had burst stayed at 2 in 100 or less for the first 36 hours of pain, then rose by about 5 in 100 for every further 12 hours. In Finland, 530 adults whose scans showed a simple appendicitis were given antibiotics instead of an operation, and 73 in 100 still had their appendix a year later. By five years, 39 in 100 had had another bout. A village has the antibiotics for a while, if they were salvaged. It has no scan, so it cannot know which appendix it is treating.

The modern hospital hid all of this. Every belly, every stuck hernia, every bleeding ulcer went through the same door, and the door was open at night. Paracetamol was the household's first answer to a sore back, and when a trial set it beside a dummy tablet, the dummy recovered people a day sooner.

What does a village owe a belly it cannot open? A clock written down. A chart kept every four hours. Nothing by mouth, the patient propped up, the salvaged antibiotic if there is one, and the stretcher ready while the chart is still improving. In 1901 a Chicago surgeon used that resting method to choose the hour to operate. After the Fall it will often be the whole treatment, and its honest record is that most settle and some die.

Most of this chapter heals with time and attention: the back in six weeks, the boil in one, the stone in a few, the leg ulcer over months of morning bandages. Patience is the treatment, and it is never idle. It is the line drawn on the skin, the question asked at every visit, the chart kept through the night. The healer's skill is to know which case does not belong to time.

Now the warm cloth.

AT THE BENCH

26.1 See: what time will not mend

Sign	Means	Do
Numb saddle, urine or stool not held or not passed, both legs weak	Nerves crushed at the base of the spine	Send today. Surgery helps within 24 to 48 hours
Back pain with fever, night sweats, weight loss, past cancer or an angle in the spine	Infection, tuberculosis or cancer	Fever: send today. Others: this week
Sudden worst-ever headache, or with fever, new weakness, first over 50, or in pregnancy	Bleeding or infection inside the skull	Send today
Groin or navel lump that will not go back, hard and tender	Stuck hernia	26.5
Rigid belly in a still patient. Green vomit, swollen belly, no stool or wind	Burst or blocked gut	Nothing by mouth. Send now
Vomited blood or coffee grounds. Black tarry stool with a fast pulse	Bleeding ulcer	26.4. Send
Colic with fever over 38 °C or shaking	Infected blocked kidney	Strongest antibiotic. Send within the hour
New indigestion over 55. Indigestion with sweating	Cancer, or the heart	Send
Boil beside the nose with a swollen lid. Hard swelling under both sides of the jaw	Spread to the brain or the airway	Send today. Chapter 27
Lump hard, fixed, over 5 cm or growing fast. Ulcer with a rolled edge, not smaller in 3 months	Possible cancer	Never cut it. Send

The 3 branches of the stuck hernia and the rigid belly:

- **Help in time.** Carry the person lying, knees bent. Nothing by mouth. Send a card with the hour it began.
- **Help too late.** The person arrives with a hard belly and a fast pulse. The card still goes. The district decides.
- **No help at all.** Prop the person up. Sips to wet the mouth. Pain relief by chapter 31. Someone stays. Gut whose blood is cut off dies and poisons the belly. This patient will die. Tell the family: the gut was caught, and only an operation could free it.

Rungs. Hands: the questions, the clock. Hearth: stretcher and bearers. Dispensary: thermometer, chart. Infirmary: the operation. Refuse: waiting past the clock.

26.2 Do: the pain ladder

Never aspirin under 16, never willow under 18. Instead, paracetamol by weight. **Never 2 of aspirin, willow and ibuprofen together.** Instead, 1 of them, with paracetamol beside it. **Never heat on numb skin, the sleeping or the drunk.** Instead, cloth between, and look every 10 minutes.

1. Ask the questions of 26.1 at every visit.
2. Back: walk daily, a little further each day. No bed rest.
3. Heat in cloth, 20 to 30 minutes, several times a day.
4. A swollen joint: cold in cloth, 15 to 20 minutes.
5. Back pain past 3 months: exercise twice a week for 8 to 12 weeks.
6. Colic, a boil, a fresh injury: paracetamol. Not for the back.
7. Inflamed pain in an adult: ibuprofen, or willow by chapter 33. Never both.
8. Burning feet on a poor diet: thiamine 50 mg 3 times a day.
9. Opium for pain that stays: not started. Chapter 31.

Work every dose twice, with two people.

Paracetamol 15 mg/kg every 4 to 6 hours. At most 4 doses and 60 mg/kg a day. Adults 1 g a dose, 4 g a day. Ibuprofen from 3 months, 5 to 10 mg/kg. At most 3 doses and 30 mg/kg a day. Adults 400 mg, 1,200 mg a day.

Weight	Paracetamol (syrup 120 mg in 5 ml)	Ibuprofen (syrup 100 mg in 5 ml)
Under 1 month	Healer only (06.2)	No
4 to under 6 kg	60 mg, 2.5 ml	No
6 to under 8 kg	90 mg, 3.75 ml	50 mg, 2.5 ml
8 to under 12 kg	120 mg, 5 ml	75 mg, 3.75 ml
12 to under 17 kg	180 mg, 7.5 ml	100 mg, 5 ml
17 to under 25 kg	250 mg, 10 ml	150 mg, 7.5 ml
25 to under 34 kg	375 mg	200 mg
34 to under 50 kg	500 mg	300 mg
50 to under 67 kg	750 mg	400 mg
67 kg and over	1,000 mg	400 mg

No ibuprofen with black stool, an ulcer, kidney disease, the dried out, pregnancy or dengue. Give paracetamol instead.

Grades: staying active B. Bed rest X. Exercise B. Heat wrap A. Paracetamol for acute pain A, for the back X. Ibuprofen A. Willow bark decoction C, adults.

Rungs. Hands: moving. Hearth: heat, cold, a stick. Garden and still: willow, adults. Dispensary: paracetamol and ibuprofen, locked. Infirmary: amitriptyline for nerve pain. Refuse: bed rest, any salicylate for a child.

26.3 Do: the boil, the abscess and the red skin

Never squeeze or cut a boil beside the nose or on the upper lip. Instead, warm cloth, and send if the lid swells. **Never open a swelling in the palm, the neck, or one that pulses.** Instead, send to the district. **Never pack an opened abscess.** Instead, a clean pad.

The boil.

1. Warm wet cloth, 10 minutes, 4 times a day. It comforts only.
2. Cover with a clean pad. Wash hands after.
3. Most point and burst within a week. Wipe and cover.
4. Soft, pointing, not burst: the healer of 23.2 opens it (23.3).

Cellulitis.

1. Draw round the red edge with a pen. Write the date and hour.

2. Rest. Raise the limb.
3. Look morning and evening.
4. Past the line, a red streak, over 38.5 °C or pulse over 110: dispensary antibiotic by its card.
5. Still spreading after 2 days of antibiotic: send.

Impetigo.

1. Soak the crusts with soap and boiled, cooled water. Lift them gently. Twice a day.
2. The child's own cloth. Boil the cloths. Cut the nails.
3. Itching in the house: treat everyone for scabies at once.
4. Honey: no trial found. Write down any use and the result.
5. Puffy face or dark urine in the weeks after: send.

Grades: drainage without packing A. Packing X. Warm cloth D. Handwashing against impetigo B.

Rungs. Hands: pen line, raising, washing. Hearth: boiled water, soap. Dispensary: the healer of 23.2, the antibiotic card. Infirmary: deep, face and neck abscesses. Refuse: packing.

26.4 Do: the gut

Never milk and alkali for an ulcer. Instead, small meals, and stop the pain tablets. **Never one antibiotic alone for an ulcer.** Instead, the whole salvaged course or none.

The ulcer.

1. Stop aspirin, willow and ibuprofen. Small regular meals.
2. Chalk 0.5 to 1 g when needed. At most 4 g a day, for 2 weeks. None in kidney failure.
3. Back after 2 weeks, or for months: the dispensary holder's course (CH-09).

The bleeding ulcer.

1. Lie flat. Raise the legs if faint. Nothing by mouth for 24 hours.
2. Pulse every hour for 6 hours, then every 4. Write each vomit and stool.

3. No aspirin, no ibuprofen. Send.

The gallbladder.

1. Colic under the right ribs after food: paracetamol.
2. Fever and tenderness there: nothing by mouth for 24 to 48 hours. Dispensary antibiotic.
3. Yellow eyes, shaking fever, or no better by 72 hours: send.

The kidney stone.

1. Colic from loin to groin. Take the temperature.
2. Over 38 °C: strongest antibiotic now. Send within the hour.
3. No fever, adult: ibuprofen or paracetamol. Diclofenac 50 mg 3 times a day by mouth if held.
4. Strain the urine through cloth. Not passed in 6 weeks: district.

The appendix.

1. Pain moving from the navel to the lower right. No appetite, sickness, fever.
2. A woman who could be pregnant: send today.
3. Under 36 hours and a surgeon within reach: send now.
4. No surgeon: nothing by mouth but sips. Prop up at about 45 degrees. Antibiotic if held.
5. Chart every 4 hours. Worse on 2 charts running: send.

The bowel that stops. Vomiting, swollen belly, colic, no stool or wind. Look in both groins and at the navel. Nothing by mouth. Constant pain, fever, rigid belly, or no better at 48 hours: send.

Piles. Fibre, water, no straining. New bleeding from the back passage over 40: finger examination at the dispensary.

Grades: rest for the gallbladder A. Antibiotics for appendicitis B. Fibre for piles A. Milk and alkali X. Cabbage juice D. Tranexamic acid for a gut bleed X.

Rungs. Hands: the clock, the chart. Hearth: chalk, strained urine. Dispensary: antibiotics, the ulcer course. Infirmary: an appendix abscess, banding piles. Hospital: endoscopy, the gallbladder. Refuse: purges and enemas for belly pain.

26.5 Do: the hernia and the small surgeries

Never push on a hernia stuck over 24 hours, red, tender, or with vomiting or fever. Instead, nothing by mouth, and send now. **Never a truss over a hernia that does not go fully back.** Instead, send.

The hernia that goes back.

1. A man, small, little pain: watch. Register it with its date.
2. Femoral, a woman, an infant, or new: district repair within weeks.
3. Who may repair, after how many supervised repairs:.

The stuck hernia. Send within 6 hours of sticking where the district can be reached.

1. Lie the person down, hips bent. Pain relief first.
2. Gentle steady pressure towards the opening, 5 to 15 minutes. Never force.
3. Goes back: watch 24 hours. Pain, fever, vomiting or a hard belly: send.
4. Stays out: nothing by mouth. Send now.

The ingrown nail.

1. Soak the foot in warm water. Lift the nail corner over a wisp of clean cotton.
2. Returning or infected: the healer of 23.2 removes the side strip under a digital block (23.3).
3. Grease the skin round it. Salvaged liquefied phenol on the root bed, 1 to 3 minutes.
4. Rinse with alcohol. Daily salt soaks. Drainage lasts 2 to 4 weeks.
5. Not in pregnancy, poor circulation or a numb diabetic foot.

The register. Every boil opened, every nail, every hernia: name, date, what was done, by whom, the 48 hour look. Every sending: hour, sign, result.

Grades: watching a small painless hernia in a man A. Taxis within its limits B. Truss D, X over a hernia that stays out. Phenol for the ingrown nail A.

Rungs. Hands: the kinds of hernia, the clock. Hearth: soaks. Dispensary: taxis, the register. Infirmary: repair. Refuse: any cut into a hernia below the district.

26.6 Do: the leg ulcer and the skin

Never bandage firmly a leg short of blood. Instead, a light dressing, and send.

Short of blood: no foot pulse, a cold white foot, pain at rest, a black toe. Also an ulcer on toes or heel, or diabetes with numb feet.

1. Feel both foot pulses. Write them down.
2. Wash with boiled, cooled water. Pad from toes to knee.
3. Bandage from the toes up in figures of 8. Firmest at the ankle. Stop 2 fingers below the knee.
4. Check the toes at once, at 1 hour and at evening. Pain, pale, blue, cold or tingling: take it off.
5. Rise on the toes 10 times every hour. Leg up when sitting.
6. Not smaller in 3 months, or a rolled edge: send.
7. Firm bandaging without a Doppler:.

A bleeding varicose vein: lie down, leg up above the heart, press on the point with cloth. Teach everyone who lives with the old.

Ringworm and athlete's foot: Whitfield's ointment twice a day for 2 to 6 weeks. Never a steroid cream on ringworm. Warts: most go alone. Salicylic acid paint on small areas only.

Grades: compression A. Calf exercise B. Honey on a venous ulcer X. Whitfield's ointment B. Salicylic acid for warts A. Duct tape X.

Rungs. Hands: pulses, leg up. Hearth: boiled cloth bandages. Dispensary: salvaged stockings. Infirmary: the Doppler. Refuse: firm bandage on a pulseless foot.

26.7 Prevent: the next stone, the next ulcer, the next boil

1. Drink 2.5 to 3 litres a day, more in heat. Lemon juice 120 ml a day.
2. Calcium foods with meals. Less salt. Fibre.
3. Soap for hands. Own towels.
4. Numb feet: look every evening.
5. Pain tablets locked and counted.

If it goes wrong

- **The gut bleed from a pain tablet.** Black stool, faint on standing, coffee-ground vomit. Cause: ibuprofen with willow or aspirin, or weeks of ibuprofen in the old. Do: stop them all. 26.4, the bleeding ulcer. Send.
- **The groin lump called a gland.** A tender lump below the crease in a woman, then vomiting and no wind. Cause: a femoral hernia not recognised. Do: nothing by mouth. Send now.
- **The bandage on a leg without blood.** Pain, pale or blue toes, a new black patch. Cause: firm bandage on narrowed arteries. Do: cut it off. Leave the leg level. Send if colour has not returned in 1 hour. ## Numbers to Carry
- 6 weeks: acute back pain falls from 52 to 23 on 100 on its own (CH-05).
- Paracetamol 15 mg/kg, 4 doses, 60 mg/kg a day, 4 g adult (SY-10).
- No aspirin under 16, no willow under 18 (SY-12 C23).
- 24 hours: the limit for taxis, and a delay of 24 hours raised hernia deaths 11 times (WO-08).
- 36 hours: appendix rupture 2 in 100 or less, then about 5 more each 12 hours (WO-08).
- 10.7 in 100 died of cellulitis without drugs, 0.3 with penicillin (WO-14).
- 19.2 and 8.8 in 100: deaths in an infected blocked kidney, undrained and drained (CH-09).
- 43 in 100: arterial disease found by feeling pulses (CH-10).

THE LIBRARY

CH-05 Pain that stays: arthritis, back pain, neuropathy and the non-drug and plant evidence. CH-09 Gut, liver and kidney: ulcers, reflux, gallstones, stones and the chronic belly. CH-10 Skin: eczema, psoriasis, fungal infection, leg ulcers and acne, and the topicals that work. CH-11 Hernia, haemorrhoids, varicose veins and the small surgeries. WO-14 Tetanus, gas gangrene and the infected wound. WO-08 The

abdomen: when to open, when to wait. WO-16 Eye, ear and dental emergencies. WO-15 Making and salvaging the instruments. WO-11 Local and regional anaesthesia and the old analgesics. HY-01 Clean hands. HY-06 Vectors. ME-06 Willow, meadowsweet and the salicylates. IN-02 Fever. SY-07 The red-flag list. SY-10 The harm register. SY-12 What the library could not find. All are on the website.

CHAPTER 27

Eyes and Teeth

A knocked out tooth has thirty minutes. A splash of lye has twenty minutes of water. A red eye with pain and a cloudy window is sent the same day. A cataract waits years, and the waiting is the problem.

OPENING

STAND near a window with a small mirror. Cover one eye with your hand for a slow count of ten, then take the hand away and watch that eye. The black at its centre shrinks as the light reaches it. That black is not a thing. It is an opening, and you are looking through it into the dark inside the eye. Everything you have ever seen came in through that opening, through the clear dome in front of it and through a small lens behind it, the size of a lentil and as clear as boiled water.

Clear is the whole of it. The front of the eye is a window, and it has no blood vessels, so that it can stay wet and clear. The lens behind it cannot renew itself, so over a lifetime it yellows and clouds. A scratch on the dome, a lash turned in to rub it, a splash of something strong, a lens gone white: after any of these the light still arrives, and cannot get in. The person behind the eye is unchanged. Their world goes from faces to shapes, from shapes to shadows, and then to a brightness with no edges.

Now run your tongue along the back of your front teeth. That smooth surface is the hardest thing the body makes. It has no blood and no nerve,

and once it is lost it does not grow back. After something sweet, the film on it turns sour within a few minutes and the surface begins to soften. Within half an hour to an hour, saliva brings it back. A sweet taken with a meal makes one sour hour. The same sweet taken in ten pieces through the day makes ten.

Eyes and teeth are lost slowly, and then suddenly. A lash rubs for years before the dome turns white. A cavity aches on and off for a season, and then one morning the cheek is hot and swollen. Most of what a village can do for both is ordinary: water, a washed face, a clean cloth, a meal with no sweet between. A few things cannot wait at all. A splash of lye has minutes. A tooth knocked out whole has half an hour. And one thing waits years, for a district that can open the eye and let the light back in.

THE STORY

The army's ophthalmia

When Napoleon landed in Egypt in 1798 with about 35,000 men, an eye disease went through the camps so fast that about a thousand of them lost their sight. His chief surgeon, Dominique Larrey, saw that it passed from man to man, and he printed a memoir on it in Cairo. The soldiers carried it home, and Europe called it Egyptian ophthalmia. Armies across the continent had men partly blinded and sent back to their villages, where it spread again.

It was trachoma, and it was old. A small organism lives in the moist lining under the eyelid. Infected again and again in childhood, the lining scars. Over years the scar tightens, the lid curls inward, and the lashes brush the clear front of the eye with every blink. Each blink scratches. The dome turns grey, then white. The blindness comes in the forties and fifties, decades after the infections that caused it. Its bodies were first seen in scrapings from the lid in 1907, and it was first grown in Beijing in 1957. From 1892, inspectors at Ellis Island turned back immigrants' eyelids with a buttonhook to look for it, and a scarred lid could send a family back across the sea.

The remedy that held up was the plainest one. Flies carry the discharge from child to child, and a face crusted with it draws them. In 1995 Sheila West and her colleagues worked with 1,417 children in Kongwa, Tanzania, where some villages were helped to wash children's faces and others were not. Where faces were washed, the odds of severe trachoma fell by more than a third. A child seen with a clean face had about half the odds of any trachoma and about a third the odds of the severe kind.

The later record is less tidy. A review of the trials in 2015 could not settle whether face washing alone prevents trachoma. In Ethiopia, when mass treatment with azithromycin stopped, infection in children rose from about one in nine to about one in three, despite the washing and the latrines. So the plan the world settled on has four letters: surgery for the turned lid, an antibiotic for the infection, the face washed, and water and latrines around the house. The face washed is the part a village holds. On its own it is not enough.

The lid surgery belongs to the district. Nurses trained for it do as well as eye surgeons, though the lashes return in 20 to 40 in every 100 within a year. For the few lashes that rub before the lid has turned far, the village can pull them. In Ethiopia in 2011, a trial followed 1,300 adults with a few inturned lashes. Half had the lashes pulled at home, again and again, and half had the operation. Pulling failed more often, in 13 of every 100 against 2. Yet sight and the clouding of the dome came out the same in both groups.

The lens and the needle

The second way the light is lost is from behind. The lens clouds with age, with sun, with sugar in the blood and with injury. In 2020 about 15 million people over fifty were blind from cataract, against about 3.6 million from glaucoma. A district of 3,000 holds perhaps 10 to 25 blind people, and about half of them have cataract.

The oldest operation on the eye is couching. The Sanskrit texts under Sushruta's name, written down in the third or fourth century, describe a needle that pushes the clouded lens down and out of the line of sight. In West Africa, Fulani couchers practise it today. Their method is their own. It is named here and not described. The patient sees light at once,

and the family sees a miracle. The record that follows is otherwise. In Nigeria's national blindness survey, 42.7 in every 100 eyes operated for cataract had been couched, and 73 in every 100 of the couched eyes were blind. In Plateau State, one couched eye in five could not see light at all. The dropped lens sits inside the eye, and inflammation and pressure follow over months.

Jacques Daviel took the lens out of the eye altogether, in 1747 by one account and in 1750 by another, and in 1753 he reported 182 successes in 206 operations. The whole lens was taken out from the same year. A plastic lens was set in place of the old one from 1949, and from 1967 a machine broke the lens up with sound and drew it out through a small cut. That last way needs power, parts and money. An eye whose lens is removed with nothing put in its place needs spectacles of about +10 to see. In one Nigerian series, 65 in every 100 poor results came from eyes whose operation had worked and whose spectacles were never given.

Sanduk Ruit, working in Nepal, put the cheaper way to the test. In the small incision operation the surgeon makes a tunnel in the white of the eye, slides the lens out whole and sets a rigid plastic lens in its place. It needs no stitches and no machine. In 2007 Ruit and colleagues randomised 108 Nepali patients between this operation and the machine. Six months later, 89 in every 100 saw well enough to walk, work and know a face without spectacles after the small incision, and 85 after the machine. With spectacles, 98 in 100 did in both groups. At Aravind in Madurai, about 600 such operations took under four minutes each, and 95 in 100 eyes reached that standard, for under 15 dollars with a lens costing under 5.

A cataract is a window frosted from the inside. Nothing laid on the glass will clear it. What a district needs is a person with steady hands, weeks of practice on fruit and goat eyes, a first hundred cases under supervision, a store of lenses and a register of every eye. Before the Fall it was a morning's work. After the Fall it is a year of training and a box of salvage, and the people waiting are already blind.

Reading is lost more gently. From about forty the lens stiffens, and print must be held further away. A friar preaching in Florence in 1305 or 1306 said that spectacles had been invented not twenty years before. Reading glasses bought ready, sorted by strength, serve most people as well as glasses made to measure.

The sugar record

From 1945 to 1949, the Swedish Medical Board ran a feeding experiment at Vipeholm Hospital in Lund, a home for people with intellectual disability. The account published in 1954 covers 436 residents over five years. One group took 30 g of sugar a day, all at meals, and averaged about a quarter of a newly decayed tooth surface per person each year. Another took 24 sticky toffees a day, about 300 g of sugar, with roughly two parts in five eaten between meals. They averaged about four newly decayed surfaces each a year, roughly fifteen times as many. The residents could not consent. By 1949 about fifty of them had teeth described as destroyed. The confectionery makers supplied money and sweets. One of the team later wrote that no ethics committee would accept it today. Sweden's answer was lördagsgodis: sweets on Saturday, and not between.

Tristan da Cunha, an island in the South Atlantic, gave the same answer without anyone being fed anything. In 1938 its people ate under 2 g of sugar a head a day. In 1937 only 2 in every 100 teenagers had decay. Then a fish cannery opened. By 1966 sugar was 150 g a head a day, almost a third of all the food's energy, and 17.5 in every 100 teenagers had decay. Among adults in their forties it rose from 11 in 100 to 32. Japan ran the experiment backwards. In 1946 sugar fell to 0.2 kg a head a year, and as supply returned from nothing to 5 kg a year, decay in children's molars doubled.

The mechanism is the sour hour of the Opening. Bacteria in the film on the teeth turn sugar to acid. Within two to five minutes the film is acid enough to soften the surface, and it takes thirty to sixty minutes to recover. It is how often, more than how much. The World Health Organization advises under a tenth of energy as free sugar and better under a twentieth, about 25 g a day.

Cleaning does a different job. Cleaned teeth keep healthy gums, but cleaning without fluoride hardly changes the count of cavities. The chewed stick of *Salvadora persica*, the miswak, cleans as well as a brush. Fluoride in water does protect: in 1942 a study of 21 American cities found the protection levelled off above about 1 part per million, and Grand Rapids added it to the town water on 25 January 1945. But fluoride in well water is a lottery. In Tibet, where brick tea is boiled for hours, nearly half the adults in one survey had bones thickened and stiffened by it. A village

does not add fluoride. It cuts the sweet between meals.

The key, the forceps and the gas

For most of history a bad tooth was a danger to life. In London's Bills of Mortality of the early 1600s, "teeth" stood fifth or sixth among the causes of death. Infection from a lower tooth can run into the floor of the mouth. Wilhelm von Ludwig described that hard swelling in 1836, and it still carries his name. It lifts the tongue, closes the throat and kills by suffocation. In a series published in 1940, 24 of 44 patients with it died. Three years later the same surgeon and a colleague reported 2 deaths in 20. Today about 8 in 100 die. Infection from an upper tooth can run behind the eye to the veins at the base of the brain, and before antibiotics that was close to always fatal.

Removing the tooth was its own danger. The pelican of the fourteenth century levered against the neighbouring teeth. The dental key, first in print in 1742, turned the tooth out sideways and could break the jaw, and a later writer called it "dangerous and barbarous". Pierre Fauchard (1678 to 1761) published *Le Chirurgien Dentiste* in Paris in 1728, the first book to treat the care of teeth as a craft of its own. Forceps shaped to fit the roots arrived in 1841.

Every extraction before 1844 was done awake. On 11 December 1844 in Hartford, the dentist Horace Wells breathed nitrous oxide while a colleague drew one of his own teeth. He felt nothing. At a demonstration in Boston the next January the patient cried out, and the gas was counted a failure.

What brought the deaths down was the order of things: let the pus out, take the cause away, and then give the medicine. In a trial of 2018, hot lower molars taken out at once did no worse than cold ones. Antibiotics alone, without removing the source, only buy time.

A tooth knocked out whole is a different clock. The living cells on its root dry and die in air. Within half an hour of drying most are dead. In milk, or in the cheek, they live for hours. Put back quickly, the tooth can root again.

The Honest Broker's Ledger

CH-08 is the report to trust on the eye. It holds the trachoma trials, the couching record and Ruit's trial, though Ruit's figures come from the abstract. CH-07 is the report to trust on the tooth. It read the knocked out tooth guideline of 2020 in full. HY-12 holds the sugar record and is honest that its Vipeholm figures come from secondary accounts. WO-16 is the most practical. It carries the extraction step by step, the chemical burn and the dangerous face.

The brief swapped two reports. It placed Ruit in CH-07 and Vipeholm in CH-08. Ruit is in CH-08, and Vipeholm and Tristan da Cunha are in HY-12. The brief also dates Vipeholm 1945 to 1955. HY-12 gives 1945 to 1949 for the feeding and 1954 for the paper, and this draft follows HY-12. WO-16 says that CH-07 and CH-08 do not exist in the library. They do, and they supersede its short pages on trachoma and fillings.

WO-16 teaches the injected block at the village, step by step, and CH-07 agrees and suggests ten supervised blocks before practice, a figure it gives no source for. WO-11 sends the lower molars to the district. SY-10 gives lidocaine injection to the village healer. The standing default keeps injection at the district, magnesium and adrenaline excepted. So this book follows chapter 23: the needle is held by a healer trained at the infirmary and working under it. WO-16's injection steps are not reproduced. On the extraction itself CH-07 and WO-16 agree, step for step, apart from the needle.

Three lines and one grade differ, and all are printed both ways. The water for a splash in the eye is 20 minutes in chapter 20 and at least 30 in WO-16. A knocked out tooth may wait in plain water as a last resort in CH-07, and never in WO-16. Salt water may go into an eye in WO-16, and only boiled water in CH-08. Pulling lashes is graded A in CH-08 and C in WO-16. SY-10's never list holds no line on the eye. Its only eye row is couching, graded X.

Some figures are thin. The deaths from Ludwig's angina before antibiotics are given as more than half everywhere, and only CH-07 traced a series, through its abstract. CH-07's advice that a loose tooth can come out after a minute of firm pressure is its own reasoning, not a trial. Nobody has tested a village dilution of iodine in an eye. No known errors are recorded for these four reports. The slips found here are named

above and not repeated.

The turn to the present

For a century the hospital hid how plain most of this was. The dentist's chair came with a drill, pictures of the roots, a cartridge of anaesthetic and a bill. The eye clinic had a microscope and a cabinet of drops. People forgot that most teeth were lost to sweets eaten between meals, and that much blindness began with a crusted face and a fly. The confectioners paid for the experiment that proved the harm of their sweets, and the sweets went on selling.

What does a village owe the person who can no longer see?

The library's answer is plain. Blindness is not death. A rope along the path to the latrine and the water, a fixed place for every tool and bowl, work for the hands, for memory and for the voice. A name on the district's list, and a seat on the cart when the eye surgeon comes. The eye is a window, and most of what a village does is keep the glass clean: water, a washed face, nothing poured in that does not belong. When the window clouds from inside, the village keeps the person among the lit things until the district can let the light back in.

Now the lamp.

AT THE BENCH

27.1 See: the red eye and the white pupil

Never put steroid drops into a red eye. Instead, wipe it with boiled, cooled water and look again tomorrow.

1. A lamp, and a second person to steady the head.
2. Test each eye alone: print at arm's length, fingers, a moving hand, light. Write it down with the date.
3. Hold a card with a hole 1 to 2 mm wide before the weaker eye. Sharper: spectacles will help (27.6). Not sharper: disease.

Send the same day:

- Pain with blurred sight.
- A grey or white patch on the dark centre, or pus behind it.
- A pupil that is not round, or wide and fixed.
- A hard, painful eye with vomiting. Never a drop that widens the pupil.
- A wound into the eye. A card cone over it, nothing pressing.
- A newborn with pus in the eye (chapter 11).

A red, sticky eye with normal sight and no pain mostly settles in 2 to 5 days. Wipe it with boiled water and a cloth kept for that person. Chloramphenicol drops if held. Opened drops are thrown away at 28 days.

A white pupil with fading sight is cataract. Write the name on the district list. **Never couch a cataract.** Instead, wait for the district's surgeon. Sight fading at the sides without pain may be glaucoma, and the village has no test for it. A child blind at dusk: vitamin A (chapter 7). Sugar sickness and the eye: chapter 25.

Grades. Pinhole as a test B. Chloramphenicol drops A. Steroid drops in a red eye X. Couching X.

Rung ladder. Hands: the vision written down. Hearth: boiled water. Dispensary: sealed drops. Infirmary: the cataract list, lid surgery. Hospital: the cataract operation. Refuse: couching, steroid drops.

27.2 See: the swelling under the jaw

Toothache that lingers or wakes them at night is an inflamed nerve. Tender to tap, with a gumboil, is an abscess (27.4). Pain from day 2 to 4 after an extraction is a dry socket (If it goes wrong).

The danger signs:

- Hard swelling under the jaw on both sides.
- The tongue pushed up, drooling, a muffled voice.
- Fewer than 2 fingers fit between the front teeth.
- Noisy breathing, or saliva that cannot be swallowed.
- A swollen eyelid after an upper toothache.
- A sore in the cheek of a hungry child.

Any one: sit them upright, never flat. Start amoxicillin and metronidazole now (27.4). **Never cut or inject into the swelling.** Instead, send the same day.

Help in time: the district drains the neck, takes out the tooth and keeps the airway open.

Help too late: the mouth no longer opens and the breathing is noisy. The district may still cut an airway. Tell the family the odds plainly.

No help at all: upright, never alone. Morphine if held, by the one trained person (chapter 23). Tell the family: "The swelling is closing his throat. We cannot open it here. We will keep him upright, free of pain, and with you."

Rung ladder. Hands: the signs, sitting upright. Dispensary: the antibiotics. Infirmary: drainage. Hospital: the airway. Refuse: lying flat, waiting for morning.

27.3 Do: the splash and the speck

Never pour vinegar, milk or anything else to neutralise a splash in the eye. Instead, pour water.

1. Brush off powder first: lime, cement, wood ash.
2. Pour at once. Do not stop to test sight.
3. Hold the lids open. Let the water run away from the good eye.
4. Pour under both lids. The patient looks every way.
5. Pour for at least 20 minutes. WO-16 says 30, and 30 is better. Use 10 litres for lime or lye.
6. Rest 10 minutes. Still stinging: 15 minutes more.
7. A white gone pale, not red: to the district today.

Lye at home: chapter 1.

The speck. Wet a cloth corner with boiled water. Lift the speck in one sweep. Nothing seen: the patient looks down, and the upper lid is folded back over a matchstick. Two tries at most. Nothing stuck on the dark centre. Not if the eye may be cut. Look every day for 4 days. Worse pain the next day is an ulcer.

What may go into an eye:

Yes	Never
Boiled, cooled water	Urine, animal milk, oil
5 g of salt in 1 litre, for pouring (WO-16). CH-08 allows boiled water only	Plant juices, traditional eye medicine
Sealed drops or ointment made for eyes, in date	Honey, kohl, any skin antiseptic
Povidone iodine only as a sealed 1.25% eye preparation	Steroid drops. Iodine stock diluted at home

Breast milk does no harm in a sticky white eye. In a red eye with pus it wastes days.

Grades. Water for a chemical splash B. The daily look C. Breast milk D. Raw honey D. Plant saps X. A pad to heal a scratch X.

Rung ladder. Hands: pour, lift, look daily. Hearth: boiled water, salt water. Dispensary: sealed drops. Hospital: the ulcer. Refuse: neutralising, plant juices.

27.4 Do: the abscess and the extraction

1. A soft swelling on the gum may be opened by the trained healer with a sterilised blade (chapter 26).
2. Warm salt rinses, 5 g in 250 ml, many times a day. Spit them out.
3. Take the cause away: the tooth.
4. Antibiotics for a spreading swelling, fever, or swelling across the middle. Add metronidazole for a foul or spreading one.
5. Review at 48 to 72 hours. Not better: back to the tooth.

Amoxicillin every 12 hours, metronidazole every 8 hours, both for 5 days. Amoxicillin suspension 250 mg in 5 ml. Metronidazole suspension 200 mg in 5 ml.

Weight	Amoxicillin	Metronidazole	If no scale
Under 6 kg	District (chapter 11)	District	Under 2 months
6 to under 10 kg	200 mg, 4 ml	80 mg, 2 ml	2 to 11 months
10 to under 15 kg	300 mg, 6 ml	120 mg, 3 ml	1 to 2 years
15 to under 20 kg	400 mg, 8 ml	160 mg, 4 ml	3 to 5 years

Weight	Amoxicillin	Metronidazole	If no scale
20 to under 30 kg	500 mg tablet	250 mg tablet	6 to 9 years
30 to under 40 kg	750 mg	400 mg tablet	10 to 12 years
40 to under 50 kg	1 g	400 mg tablet	13 to 14 years
50 kg and over	1 g	500 mg tablet	15 and over

About 25 mg/kg of amoxicillin and 10 mg/kg of metronidazole a dose. Never over 1 g of amoxicillin or 500 mg of metronidazole a dose.

Work every dose twice, with two people.

Pain: paracetamol (06.2), ibuprofen (20.5), a clove on cotton held against the tooth. **Never hold an aspirin against the gum.** Instead, swallow it. Clove oil is locked away: 5 to 10 ml poisoned a 2 year old.

Who extracts is for the owner. The numbing injection is held at the infirmary, by the healer trained there (chapter 23). Without it, the village takes out only a tooth that already moves 1 mm. Press it firmly with cotton for 1 minute first. A firm tooth comes out without it only for spreading infection with no district in reach. Even with the injection, numbing fails in 44 to 81 of every 100 hot lower molars.

Never extract a tooth not named by two people. Not with a stiff jaw and swelling on both sides. Not a part grown wisdom tooth, a bleeder, or anyone on blood thinners. Pregnancy is no bar (chapter 8).

1. Name the tooth. A second person confirms it. Say it aloud and write it down.
2. Instruments at 121 °C for 20 minutes, or boiled for 20 (10 in two reports).
3. Free the gum with the probe.
4. Elevator between the tooth and the one in front. Never lever on a good tooth.
5. Forceps 150 for upper teeth, 151 for lower. Beaks up the root, the jaw supported.
6. One root: turn. Several roots: rock, slowly widening. Never hurry.
7. Count the roots against the socket.
8. Bite on gauze for 30 minutes, a child 2 hours.

No rinsing for 24 hours. Salt rinses twice a day from day 2. No routine antibiotic after a simple extraction.

Grades. Draining an abscess B. Early extraction of a hot tooth B. Extraction under local anaesthetic by a trained lay healer B. Antibiotic as the only treatment X. Dental key X. Aspirin on the gum X.

Rung ladder. Hands: the tooth named twice. Hearth: salt, clove. Dispensary: antibiotics, forceps. Infirmary: the injection, firm teeth. Hospital: the neck, the sinus, the jaw (chapter 19). Refuse: the key.

27.5 Do: the knocked out tooth

Never put a baby tooth back. Instead, press a clean cloth on the gap.

1. Hold the tooth by the crown, never the root.
2. Dirty: rinse 10 seconds in milk or salt water. Never scrub.
3. Put it back the right way round, within 15 minutes if you can.
4. If not, keep it in milk or inside the cheek. Never dry.
5. Plain water is poor but better than dry (CH-07). WO-16 says never water.
6. Most root cells die within 30 minutes dry. After 60, replant anyway and expect to lose it.
7. Splint to the neighbours with fine wire or strong thread for 2 weeks.
8. Amoxicillin (27.4). Tetanus care (chapter 18). Soft food, salt rinses.
9. Look weekly for a month. Swelling or a gumboil: take it out.

Whether to replant where nobody can follow up.

Grades. Replanting within 15 minutes B.

Rung ladder. Hands: crown, socket, milk. Hearth: the splint. Dispensary: amoxicillin. Refuse: a tooth carried dry.

27.6 Do: the lashes and the lenses

1. 5 lashes or fewer touching the eye: pull them.
2. Forceps boiled 20 minutes. Grip at the root of the lash. Never break it.
3. Pull again when they regrow.
4. 6 or more, or the lid curled in: the district (chapter 23).

Reading glasses by age, tested with small print at 40 cm:

Age	Strength
35 to 45	+1.00
45 to 50	+1.50
50 to 55	+2.00
Over 55	+2.50

A salvaged lens that focuses the sun to a spot 50 cm away is +2. At 33 cm +3, 25 cm +4, 10 cm +10. An eye without its lens needs +10.

Grades. Pulling lashes A in CH-08, C in WO-16. Spectacles bought ready A. Lid surgery A.

Rung ladder. Hands: the pinhole, the print card. Dispensary: spectacles sorted by strength. Infirmary: lid surgery. Refuse: burning or freezing the lashes.

27.7 Prevent: the sugar rule, the stick and the washed face

Never store lye, bleach or oils, clove oil among them, in a drink bottle. Instead, a locked shelf and a label: "skin only, poison by mouth".

1. Sweet things only at meals. Honey, cane juice and dried fruit count.
2. Never juice or sweet tea in a baby's bottle.
3. Teeth never outrank survival. Rehydration drink and food for the hungry are never cut.
4. Clean every mouth once a day. Use a cloth on a finger, or a chewed stick of a known safe kind, 15 to 20 cm by 5 to 8 mm.
5. Adults clean the teeth of children under 5.
6. Never add fluoride.
7. Look into every child's mouth weekly when food is short.
8. Wash every child's face every day. Latrines and flies: chapter 13.
9. Cover the eyes when threshing.

Gums in pregnancy: chapter 8. The diet: FEASTING.

Grades. Sweets cut between meals B. Supervised cleaning B. Chew stick against a brush B. Face washing B. Cleaning alone against cavities X.

Rung ladder. Hands: the rule, the stick, the washed face. Hearth: salt, the cloth. Dispensary: a yearly look in every mouth. Refuse: added fluoride, sweets as rewards.

If it goes wrong

- **The bleeding socket.** Looks: blood still welling through the gauze. Cause: a rinse too soon, a lost clot, a bleeder. Do: fresh gauze, bite 20 minutes without looking. Still bleeding: a stitch across the socket at the infirmary. Then send.
- **The dry socket.** Looks: deep pain from day 2 to 4, bare bone, a foul smell. Cause: the clot lost, smoking. Do: rinse gently with warm salt water. Lay a cotton pledget with ground clove in a drop of honey in the socket. Change it when pain returns.
- **The scratch that becomes an ulcer.** Looks: worse pain the next day, a grey patch, falling sight. Cause: rubbing, a dirty cloth, a plant scratch. Do: send the same day. No pad. Write the vision down each day. ## Numbers to Carry
- 15 minutes to put a tooth back, 30 dry at most (CH-07, WO-16).
- At least 20 minutes of water for a splash in the eye, 30 better (WO-16).
- 2 fingers between the front teeth, or send (CH-07).
- 30 minutes biting on gauze, a child 2 hours (WO-16).
- 5 lashes or fewer to pull, 6 or more to the district (CH-08).
- 28 days for an opened bottle of drops (CH-08).
- 0.27 against 4.02 newly decayed surfaces a year, at meals against between (HY-12).
- 89 and 85 in 100 seeing well without spectacles at 6 months (CH-08).

THE LIBRARY

CH-07 Teeth: extraction, abscess, fillings and dentures with what you have. CH-08 Eyes: trachoma, cataract, spectacles and conjunctivitis without an ophthalmologist. HY-12 Teeth: preventing decay and gum disease with chew sticks, salt, diet and cleaning. WO-16 Eye, ear and dental emergencies. WO-11 Local and regional anaesthesia and the old analgesics. SY-10 The harm register. SY-12 What the library could not find. All are on the website.

CHAPTER 28

Walking Again

The bladder is emptied every six hours or it is damaged in days. A sore starts in two hours on one spot and takes months to close. The old who break a hip and do not walk again in a month mostly die within the year.

OPENING

STAND up from the chair you are in, and try to do it without your hands. Notice what your body does before you have thought about it. The feet slide back under the knees. The trunk leans forward until the nose is over the toes. Only then do the thighs push. You learned this before you could speak, by falling many times, and you have not thought about it since.

A first step is not one movement but a hundred, fitted together so long ago that they feel like one. Weight shifts onto one foot. The other lifts, swings and lands heel first. The arms swing against the legs. Beneath all of it the body keeps quieter work going. The bladder fills and sends word. The skin under the sitting bones grows uneasy after a while, and you shift your weight without knowing why.

An injury to the spine cuts the line those messages run along. A stroke damages the place where the movements are kept. A broken hip and a month in bed leave the muscles too thin to carry what the brain still knows. In each case the knowledge has to be found again, or the work it did has to be taken over by someone's hands and someone's clock.

Most of what follows is that taking over. The bladder that no longer sends word is emptied by the hour. The skin that no longer complains is lifted by the hour. The leg that has forgotten is asked again, a few minutes at a time, several times a day. None of it is quick. The body relearns at its own pace, and the household learns patience beside it.

There is a second kind of walking again, and it belongs to the old. Here the body is not broken in one place but thinning everywhere: the grip, the thighs, the balance, sometimes the memory. Much of that can be slowed. Some of it cannot be cured, and the care of it must not pretend otherwise.

THE STORY

The ward at Stoke Mandeville

In 1917 a young orderly named Ludwig Guttmann worked in a hospital at Königshütte, in Upper Silesia. A miner was brought in with a broken back. He was put to bed, and the staff waited. He died about four weeks later, of infection climbing from the bladder and of the sores on his back. It was the usual end.

Before the 1940s, a man whose spinal cord was cut through was not expected to live long. The figures we have come from war, because armies kept count. An American surgeon reported that 80 in a hundred of his country's cord injuries in the First World War died within two weeks. British series of the same war lost between 47 and 65 in a hundred early. Of 339 such men in one London hospital, 160 died of infection of the urine. A British surgeon of the bladder called the bladder the surgical failure of the war.

The figure that came down to later writers is 80 per cent. It is real only in a narrow sense. It was an estimate, made in 1937, of British soldiers, over three years. Nobody counted the civilians, the women or the old, and nobody followed the men home. What can honestly be said is wider and vaguer: most people with a complete injury died, some within weeks, most within three years.

On 1 February 1944 Guttmann opened the National Spinal Injuries Centre at Stoke Mandeville, with one patient and 26 beds. His staff was

one sister, one auxiliary and eight army orderlies. He made the nursing the treatment. Every man was turned every two hours, day and night, on packs of pillows. A sore was taught as a failure of the ward, not of the man. The bladder was emptied by a catheter passed without touching its tip, and taken out again rather than left in. Hot-water bottles had burned more of his men than anything else, so he banned them, even wrapped. By the end of that first year six paraplegic men were working in a factory.

The results came slowly. Of the first 3,000 people treated, from 1944 to 1963, about 16 in a hundred had died, or about 11 by a corrected count. Among the old soldiers of the First World War, 58 in a hundred had died. Penicillin arrived in the same years, and the two cannot be cleanly separated. But turning needs no drug.

The same lesson was learned again in Botswana in this century. Before a spinal unit opened there, about 85 in a hundred of those sent home were thought to die within a year, an estimate made in 2010. After it opened, 10 of 50 people died in hospital, nine of them with injuries of the neck. Nobody died within two years of going home. Ten years on, 10 of 39 had died, four of them from pressure sores, at an average age of 42. Each year about half had a sore and two in five an infection of the urine. Their catheters were washed and used again at home.

The skin was the other half of it. Across the world about one person in three with a spinal injury has a pressure sore at any time, and in Africa about two in five. In Sri Lanka in 1997, three in four of the paralysed were found to die within 18 to 24 months. When families were trained and given proper chairs and cushions, sores fell by 71 per cent. The chair itself mattered less than people thought, and the cushion more. In India, 60 in a hundred of the hospital wheelchairs given away by charities were abandoned. A man paralysed in 1966 spent his life teaching small workshops in poor countries to build their own chairs. The village chair in this book runs on two bicycle wheels behind and two small ones in front.

The clean catheter

In 1970 a urologist named Jack Lapides met a woman of 30 with multiple sclerosis whose bladder no longer emptied. He taught her to pass a rubber catheter herself, every two to three hours, and to wash it with soap

and water between times. Within four weeks her urine was free of infection, without antibiotics. He published the method in 1972.

His reasoning was simple and has largely held. A bladder is harmed more by being stretched than by germs. An overfilled bladder loses its blood supply and with it its defence, so infection takes hold. Emptying it often matters more than emptying it sterile. He told his patients to empty on time even if there was no soap to hand.

The trials since have mostly agreed with him. A review in 2021 gathered 23 trials of 1,339 people. It found no clear difference in infection between sterile and clean technique, or between a catheter used once and one washed and used again. The evidence for both is thin: the first comparison rests on one small study, and the second on 97 people. Over the long run the clean catheter looks kinder than the one left in. Among 316 people followed for 18 years, complications came to about 27 in a hundred on the clean catheter and 54 with a catheter left in through the urethra. Of 60 people who began it in the early 1970s, none of those still followed had worse kidneys ten years later. In Chiang Mai, 28 men used one silicone catheter each for about three years, washing it between uses. Their kidneys stayed normal, though ten had a fever in the past year.

The old alternative was to press the bladder empty through the belly. After the Tangshan earthquake of 1976, 74 people with paralysed legs did this for more than 20 years. A third ended with swollen kidneys and nearly a third with stones.

The clean catheter is simple and it never stops. Six times a day, every day, including the one before sleep. In the United States only about one in five who began it were still using it 30 years on. The method does not tire. People do.

The forgotten step

For most of the last two centuries the injured and the newly paralysed were put to bed and kept there. A London physician wrote in 1947 of the dangers of going to bed, and he was right. When 39 trials of bed rest were gathered in 1999, it had helped in none of the 15 conditions tested. Ten days in bed costs an old person about a kilogram of leg muscle and an eighth of the strength of the knee.

The stroke shows how the body finds its way back. In Copenhagen, Henrik Jørgensen and his colleagues followed 804 people admitted with stroke, and published in 1995. At the start, 51 in a hundred could not walk. At the end, 21 had died, 18 could not walk, 11 walked with help and 50 walked alone. Almost all of the walking that returned had returned within 11 weeks. Copenhagen had learned something like it before. In the polio epidemic of 1952, a city hospital with one tank respirator kept paralysed chests breathing with about 1,500 students squeezing bags by hand, in shifts, and deaths among them were said to fall from about 90 in a hundred to about 25.

Later trials found a simple test. A person who can sit unsupported on the edge of the bed for 30 seconds on the second day, and lift the weak leg against gravity, will almost always walk alone by six months. One who can do neither by the ninth day will walk alone about one time in ten. They also found that harder is not better. In a trial of 2,104 people, those who were got up very early and for long sessions did slightly worse than those given ordinary care. Short sessions, often, served best. Practising the real task, standing up and walking and reaching, served better than exercises that only resemble it. Each session asks for a first step again, and each is small. That is how the body relearns.

The broken hip of the old is harder. Before the 1950s the hip was held in traction, often for months. When the trials were gathered in 2008, traction for a break below the neck of the bone gave about the same deaths as an operation, with slower recovery and more deformity. Gathered series of hips left unoperated found 36 in a hundred dead at 30 days and 60 at a year, but two thirds of those were too ill for surgery. With an operation, about a quarter die within the year. In 2022 a trial in very frail old people, median age 88, let them and their families choose. Of those who chose no operation, most died within a month. Their last weeks were no worse, and half their relatives called the dying good.

The bed itself kills. In New York, among 532 people with a broken hip, those kept still longest died more often in the next six months, and far more often if they had needed help to walk before. Yet strength comes back at any age. In 1990 ten frail people aged about 90 trained their thighs hard for eight weeks, and their strength rose by 174 per cent. In a trial of 100 people with an average age of 87, it rose by 113 per cent against 3, and they walked faster.

The thinning years

In New Haven, Mary Tinetti followed 336 people aged 75 and over, and published in 1988. In a year 32 in a hundred fell, and one fall in 17 broke a bone. Of those with no risk factors, 8 in a hundred fell. Of those with four or more, 78 did. Sedative drugs carried the heaviest risk of any she found. Nearly half of those who fell without injury could not get up again on their own, and the long lie on the floor did its own harm. Later trials showed that the falls can be cut. Across 108 trials, exercise for balance and strength cut falls by about a quarter, and by a third when the two were joined. Home safety cut them by a fifth. New glasses, oddly, raised them. In Dunedin in 1997, 233 women over 80 were given a few leg exercises to do at home, with a visit now and then. Their falls dropped from 1.34 a year to 0.87. Nothing in it needed more than a chair and a weight a village can sew from sand.

Dementia takes longer and leaves less. It doubles with every five years of age. A psychologist in Bradford argued that much of the misery around it was made by the people nearby, who hurried, scolded, ignored or talked across the person who could still feel all of it. His argument ran ahead of his evidence. The trials since have given it partial support: group sessions of talk and memory helped a little, and music lifted mood, though not agitation.

The drugs went the other way. Antipsychotics were given widely to calm the agitation of dementia. Across 15 trials, 3.5 in a hundred died within weeks on them, against 2.3 on a dummy pill. In 2009 Clive Ballard and his colleagues followed 165 residents of care homes who had been taken off these drugs or kept on them. At three years, 30 in a hundred of those kept on were alive, against 59 of those taken off.

The end of dementia is known, and it is not a cure. Among 323 people with advanced dementia followed in 2009, more than half died within 18 months. Nearly nine in ten had trouble eating, and two in five had pneumonia. Feeding by tube has never been shown to help. The care that serves them is the care of chapter 31.

The cost falls on the carer. Spouses who were strained by caring had 63 per cent higher deaths over four years than people of the same age who did not care. Counselling and a support group for the family put off moving into care by a median of 557 days.

The Honest Broker's Estimate

The figure this chapter began with, 80 per cent, is an estimate repeated until it sounded like a count. It was one surgeon's reckoning of British soldiers, made in 1937 over three years. Other figures from the same years run from 47 per cent dead early to more than 95 per cent in the Balkan wars. The book prints the range and the vague truth beneath it, and attaches no single figure to civilians. The figure lasted half a century because it was round, and because no one was paid to count the dead after discharge.

The Stoke Mandeville results come from an imperfect scan of Guttmann's own book, and the corrected rate is his correction. The bed count at opening is 26 in one source and 28 in others. The Copenhagen fall from 90 to 25 in a hundred is reported, not read in the original.

The clean catheter rests on Lapides, on trials that are small, and on reuse graded low. His patients had antibiotics in reserve. No series anywhere reports clean catheterisation in people without antibiotics at all. The library found no source for a catheter made by hand, so the book prints none.

Two reports disagree with each other, and the book prints both. On the catheter, NU-09 holds six hours for life, and WO-07 allows six to eight hours after the first week. On the chair, the lift is printed every 15 minutes, and NU-05 gives 15 to 30. A third disagreement is settled. WO-07 advises rings of tyre tubing placed around the bony points. NU-01 and chapter 24 forbid a hard ring, which leaves a ring of dead skin. The book follows NU-01. No errors are recorded against the four main reports, and none is carried here.

The hip without surgery has no trial for the early rising the Bench prints. The family programme for stroke failed its largest trial, in India, where visits stopped at two months and families lost heart. The frailty checks by hand have not been tested as written.

The turn to the present

The ward at Stoke Mandeville needed no machine it could not replace. It needed pillows, a catheter, soap, a clock and people who would get up at night. Botswana showed that the same work holds in a poor country.

It also showed what happens at home when the work thins: the sores and the infections came back each year.

So the work of this chapter is labour, not supplies. A paraplegic person who learns the catheter, has a chair with a good cushion and a household that turns them can live for decades. Someone with a high neck injury needs a rota of carers that a single family cannot keep. The old woman with a broken hip needs to be sat up within days, and the old man who wanders at night needs company more than a drug.

What does a village owe a person who will never walk again? It owes the schedule. Six emptyings a day, a lift every quarter of an hour, a turn every few hours at night, and a second carer so the first can sleep. Everything else in this chapter rests on that.

The first step is relearned in the body and in the house together. The leg relearns what it knew. The household relearns how to wait for it. Neither can be hurried, and neither can be skipped.

Now the body below the injury.

AT THE BENCH

28.1 See: the body below the injury

The first days and the carry are chapter 21. This chapter starts when the person is home.

Level of injury	What follows	Carer hours a day
Top of the neck (C1 to C4)	Breathing fails unless someone breathes for them	24
Low neck (C5 to C8)	Arms partly work, hands weak	8 to 16
Chest (T1 to T9)	Arms and hands work	3
Low back (T10 to L1)	Legs weak or limp	2
Below L1	Bladder and bowel still affected	0 to 1

Hours are for the home, not the first months.

Red flags. No urine, or the catheter will not pass. Fever with shaking or pain in the loin. A sore that is black, deep or foul. A neck injury with new breathlessness. One leg swollen and hot. Talk of dying. A carer who stops.

The pounding headache. Injuries at or above the lower end of the breastbone (T6) can drive the blood pressure dangerously high. A full bladder or bowel below the injury sets it off.

Signs: pounding headache, flushed sweating face, goose pimples, stuffy nose, blurred sight, slow pulse.

1. Sit them up. Legs down.
2. Loosen everything tight: belt, straps, shoes.
3. Empty the bladder now. Check the catheter for kinks.
4. Then the bowel, gently, with a gloved finger. Use numbing jelly if held.
5. Then look for a sore, a burn, a tight shoe, a nail.
6. With a cuff, take the pressure every 1 to 2 minutes.

Most attacks end when the bladder empties. The district may hold a drug for those that do not.

- **Help in time.** Send word if the headache stays after bladder and bowel. Keep them sitting.
- **Help too late.** Keep sitting, keep loosening, check bladder and bowel again.
- **No help at all.** Sit upright, someone beside them. Tell the family plainly: this can kill, and the cause is usually below.

Spasm: a new rise usually means trouble below. Check bladder, urine, skin and bowel first. Move every joint through its range, 10 times, daily.

Pain: burning pain below the injury is common, in more than half. Chapter 26.

Sex: desire and pleasure often remain. Sex can set off the pounding headache. Never an erection drug with a nitrate. A pregnant woman may not feel labour. Tell the midwife early.

Mood: one in four or five grows deeply low. At every weekly visit, ask about thoughts of dying (chapter 30).

Grades: sit up, loosen, empty the bladder B. A drug for the headache C. Family training with catheters and cushions B.

Rungs. Hands: sit up, loosen, the catheter. Hearth: boiled water, soap, a clock. Garden and still: cushion, chair. Dispensary: catheters, a cuff, the visiting nurse. Infirmary: the drug for the headache. Hospital: a spinal unit. Refuse: the catheter left in for years without change.

28.2 Do: the clean catheter

Never force a catheter. Instead, stop, wait, breathe slowly, try once more. Still stuck: send now.

Never use oil or Vaseline on it. Instead, a water-based jelly, or clean water.

Never leave the bladder longer than 6 hours. Instead, empty on time, soap or no soap.

Who learns: the person, if the hands work. If not, two named carers.

Kit: a catheter, size 12 to 14 for adults. A marked jug. Soap. A clean jar with a lid. A clock.

1. Wash both hands with soap.
2. Wash the opening with clean water, front to back.
3. Wet the tip with jelly or clean water.
4. Pass it gently until urine flows. Wait until it stops.
5. Press lightly low on the belly. Draw it out slowly.
6. Measure. Write the time and the ml.
7. Wash the catheter. Store it dry in the jar.

Times: waking, mid-morning, midday, mid-afternoon, evening, bedtime. Never skip bedtime.

Last amount	Next emptying
Up to 400 ml	In 6 hours
401 to 500 ml	In 4 hours
Over 500 ml	In 3 hours, and drink less

NU-09 holds 6 hours for life. WO-07 allows 6 to 8 hours after the first week. This book prints 6.

Drink 1.5 to 2.5 litres a day, less after evening. WO-07 says at least 3 litres. The aim is under 500 ml each time.

Catheter	Clean it
Rubber or silicone	Wash with soap, then boil 15 minutes
Clear plastic	Do not boil. Soap, rinse in boiled water, dry. A bleach soak at 0.6% was tested, time unknown

Replace it when cracked, stiff or crusted. Count the stock (chapter 32).

Infection: fever, shaking, new leaking, new spasms, loin pain, foul urine with feeling ill. Cloudy urine alone is not infection. Send word.

Grades: clean catheter over one left in B. Clean over sterile B. Reused catheter C. Under 500 ml C. Boiling plastic C. Pressing the belly to empty, for years X.

Rungs. Hands: the clock. Hearth: soap, boiled water, jar. Dispensary: catheters, jelly. Infirmary: antibiotics, the stuck catheter. Refuse: the made catheter.

28.3 Do: the bowel

1. Same hour each day, or every second day, after a meal or hot drink.
2. On a pot, or on the left side.
3. Reflex bowel (injury above the low back): gloved, oiled finger 2 cm in. Gentle circles about 1 minute. Repeat 3 or 4 times, 5 to 10 minutes apart.
4. Limp bowel: remove stool by finger daily, or after each meal.
5. Bright red blood: be gentler.
6. No result in 3 days: check for a hard plug.

Never a medicine to stop leaking stool. Instead, check for a hard plug. Leaking is often overflow round it.

No routine enemas or strong laxatives.

Grade C. Thin evidence.

28.4 Do: the skin, the bed and the chair

Never a hot-water bottle or hot stone on numb skin (SY-10). Instead, woollen socks and blankets.

Never a ring cushion (NU-01). Instead, pillows that bridge the bone.

Never rub or massage over a bone. Instead, take all weight off it.

Skin burns at 44 °C in hours, at 50 °C in 2 to 3 minutes. A bottle stays over 50 °C for 3 hours.

Surface	Turn in bed
Hard bed	Every 2 hours
Sheepskin or deep pallet	Every 2 to 3 hours

Chapter 24 allows 3 to 4 hours on a good surface. That is for skin that feels. Numb skin gets the shorter line.

Heels clear of the bed. Pillow between the knees.

In the chair: lift or lean every 15 minutes. NU-05 gives 15 to 30. Push up on the arms, or lean far forward, then to each side. Each sitting bone must come clear.

Sit up to 2 hours at first. Check the sitting bones after. Red must fade within 20 minutes. If not, shorter next time.

Look	Stage	Do
Red that stays when pressed 3 seconds	1	No weight on it. Look every 4 hours
Blister or shallow sore	2	Clean water, cover, keep dry, no weight
Crater, fat showing	3	Honey or sugar packing (chapter 18)
Bone or tendon	4	Red flag. Send
Purple or black, skin intact	Deep	No weight. Do not open

Grades: turning at all B. The 2 hour interval C. Training and cushions C. Hard ring X. Hot-water bottle on numb skin X.

Rungs. Hands: lift, turn, look. Hearth: pillows, wool. Garden and still: sheepskin, foam cushion, a made chair. Infirmary: surgery for stage 4. Refuse: the ring and the hot bottle.

28.5 Do: walking again after stroke or a broken hip

The swallow is chapter 24. The cause of stroke is chapter 25. The traction is chapter 19.

Write a plan on paper by the bed. One goal a week. Measure metres walked each day. One person leads.

After stroke:

1. Day 2: sit on the bed edge 30 seconds unsupported. Lift the weak leg.
2. Both done: walking alone is likely. Neither by day 9: plan for help.
3. Week 1: 5 to 10 minutes, 3 to 6 times a day.
4. Weeks 2 to 4: 30 to 60 minutes a day, in short sessions.
5. Practise the real task: sit to stand, 10 times. Walk. Reach.
6. Never pull up by the weak arm. Rest it on a pillow or table.
7. Weeks 5 to 12: outside, with a stick, then steps.
8. The arm: a mitt on the good hand for practice hours. Little returns after 4 weeks with no movement.

By 3 weeks (mild) or 6 weeks (severe), tell the family how much walking to expect.

The broken hip, no surgery:

- Fit, break below the neck: traction (chapter 19). Bend the ankles 20 times every hour. Full weight at 8 to 12 weeks.
- Frail, or a break of the neck: sit out day 1 to 3. Stand with a frame and 2 helpers by day 3 to 7. Weight as pain allows.
- **Help in time.** The district operates within days if it can.
- **Help too late.** Sit them up anyway. Turn, feed, move every joint.
- **No help at all.** Pain relief (chapter 26), turning, company. If walking does not return, tell the family the year may be short. Chapter 31.

Grades: rehabilitation versus none A. Task practice A. Very early, long sessions X. Early rising after an unoperated hip D.

28.6 Do: the crutch, the frame and the chair

Order: parallel bars, frame on wheels, crutches, one stick, nothing.

Crutch length: armpit fold to sole, plus 5 cm.

1. Top 2 or 3 fingers below the armpit.
2. Elbow bent 15 to 30° at the grip.
3. Weight on the hands. Never on the armpit.
4. Tips 15 cm forward and 5 cm out.
5. Straight hardwood 2.5 to 3.5 cm, or a padded forked branch. Tyre rubber on the tips.

Stairs: up with the good leg first. Down with the crutches and bad leg first.

Check the hands each week for numbness.

Chair: four wheels, two bicycle wheels behind, never one wheel at the back. Seat 2 to 3 cm wider than the hips. A cushion with a washable cover. Tip test with a helper behind.

Review in 1 month, then every 3. Ask if crutches would do instead.

Grades: weight on the hands B. Chair, cushion and training C. Donated hospital chairs X.

28.7 Do: the forgetting mind

Never an antipsychotic for the agitation of dementia (SY-10). Instead, look for the cause below.

Agitation: check pain, full bladder, constipation, hunger, thirst, cold, fear, infection.

Change over hours or days is delirium, not dementia. Look for infection, thirst, a full bladder, constipation, a drug, pain. Recheck every 4 hours for 2 days.

1. Same routine daily. A walk in daylight. A real task.
2. A board with the day and date.
3. Answer the feeling, not the fact. Never hurry, mock or scold.
4. Songs from their youth.
5. Wandering: walk with them. Tell the neighbours. Sew the name in the coat.
6. Lock away only the dangers. Never tie anyone down.

7. Toilet every 2 to 3 hours by day. Light the way at night.
8. Leaking with a cough, in one who can follow: pelvic floor squeezes daily.

The carer: a named second carer. One night off in four. A half day off each week.

Grades: company and stimulation B. Antipsychotics for agitation X.

28.8 Prevent: the fall and the thinning

Strength: legs, two sets of 10, three times a week. Sand ankle weights 0.5 to 1 kg. Add 0.5 kg when easy. Balance daily. Tai chi twice a week, if taught.

Visits at weeks 1, 2, 4 and 8. Without them, half stop by month 3.

House: no loose rugs. A light on the night path. Rails at hip height. Bed and chair at knee height. White on step edges. Ash on ice.

Shoes: firm, closed, low heel, a back. Not loose slippers.

Never stop a sleeping drug suddenly (SY-10). Instead, cut by a quarter every 2 weeks.

Work every dose twice, with two people.

Protein over 65, 1.0 to 1.2 g/kg a day:

Weight	Protein a day
40 kg	40 to 48 g
50 kg	50 to 60 g
60 kg	60 to 72 g
70 kg	70 to 84 g

Never a large yearly dose of vitamin D.

Frail: three of these. The belt two notches looser. Everything an effort. Cannot wring a wet cloth. Slow to walk 4.5 m. Sits most of the day.

Up from the floor: roll, hands and knees, crawl to a chair, one foot flat, push. Cannot: a blanket over you, bang and shout.

A knock at every old person's door by 10 each morning.

Grades: exercise A. Home safety B. Sedative withdrawal B. New glasses alone X.

If it goes wrong

- **The missed night emptying.** Pounding headache at 3 in the morning, flushed face. Cause: a tired carer slept past it. Do: 28.1 steps now. Then a second carer for nights.
- **The sore at the base of the spine.** Red, then open, in week 2 or 3. Cause: turns missed when the first week's care tired, or too long in the chair. Do: no weight on it at all, 28.4 stage table, find the gap in the rota.
- **The carer who stops.** Short temper, no sleep, falling ill. Cause: one person doing it all. Do: name a second carer now. Send word to the visiting nurse.

Numbers to carry

- Empty the bladder 6 times a day, never past 6 hours (NU-09, WO-07).
- Under 500 ml each time, 1.5 to 2.5 litres drunk a day (NU-09).
- Turn every 2 hours on a hard bed, lift in the chair every 15 minutes (NU-09, NU-05).
- Skin burns at 50 °C in 2 to 3 minutes (SY-10).
- Sit 30 seconds and lift the leg on day 2: most walk alone by 6 months (NU-04).
- Unoperated hip: 36 in 100 dead at 30 days, 60 at a year, mostly the very ill (CH-12).
- Exercise cuts falls by a quarter (CH-12).
- Antipsychotics in dementia: 30 against 59 in 100 alive at 3 years (CH-12, SY-10).

The library

NU-09 Spinal injury, paralysis and the long-term patient. NU-05 Splints, braces, prostheses and aids from local materials. NU-04 Rehabilitation: walking again after fracture, stroke, amputation and long illness. CH-12 Ageing, frailty, dementia and the long illness: care without institutions. NU-01 Nursing as the main medicine. WO-07 Head, spine and chest injuries without imaging. IN-14 Sexually transmitted and urinary infections. MI-04 Depression and anxiety without pharmaceuticals. SY-10 The harm register. All are on the website.

PART SEVEN

The Mind

CHAPTER 29

Trauma, Grief and the Lay Counsellor

Most distress after a disaster fades in a month without help. Screening before that month finds the wrong people. Six to eight structured sessions is what the trials tested. A counsellor who sees no one for three months loses the skill.

OPENING

Think of a small fright from years ago. A foot that missed a stair. A dog that came at you from a gate. A pan that caught fire on the stove. Put a hand flat on your chest and run the moment through once, as you would tell it at a table.

The heart under your hand barely changes. The breath stays where it was. When it happened, the same moment sent the heart racing and the hands shaking, and for a night or two it came back uninvited as you fell asleep. You told it to someone that evening, and again the next week, and somewhere in the telling it grew shorter. The details that frightened fell away. The ones that made people laugh stayed. Now it fits in two sentences, and it is yours.

That is what most minds do with most frights, and with most losses. They go over the thing and talk it over, and each time it comes back a little smaller. Nobody taught them. The body did it, and the people at the table helped.

A few memories do not shrink. They come back at full size, in the present tense, with the smell and the noise still in them, months after the danger has gone. The person avoids the road, the river, the room. Sleep goes, then work. Telling such a memory once, to a stranger, in the first raw days, does not shrink it. Sometimes it fixes it in place.

Just notice, the next time someone tells you about something that went wrong, whether you are hearing the first telling or the tenth. You can usually hear the difference.

This chapter is about that difference: the many who need company, food and time, and the few who need their story told again, in order, with someone trained, until it is smaller.

THE STORY

The epidemic that did not come

In 1939, as Britain prepared for bombing, its planners expected the raids to fill psychiatric beds. The Blitz came, and the casualties of the mind never arrived in the numbers predicted. People were frightened, grieved, slept badly and went to work.

The modern record says the same with better arithmetic. After the attacks of September 2001, about 7.5 in 100 Manhattan residents met the criteria for post-traumatic stress disorder at one month. At four months the figure was 1.7, and at six months 0.6. Pooled across 54 studies, about two in three people exposed to a terrible event stay steady, one in five is ill for a while and recovers, and about one in ten is still ill a year later. A smaller group falls ill late.

Distress is not disorder. Fear, tears, anger, numb days and broken nights after a catastrophe are the ordinary answer of a sound mind to an extraordinary event. Disorder is what remains after a month and stops a person working, feeding a family or living among others.

The harm came from kindness in a hurry. From the early 1980s, Western services took the old belief that what is not spoken festers and pressed it into a single session with a stranger, held within days of the event, often compulsory for rescue workers. They called it psychological debriefing.

In a trial among burns patients published in 1997, 26 in 100 of those debriefed had the disorder at 13 months, against 9 in 100 of those left alone. After road accidents, those debriefed were worse three years on. A Cochrane review in 2002 found no benefit and concluded that compulsory debriefing should cease.

What failed was the early, single, compulsory telling. Listening to someone who chooses to speak was never on trial, nor were a meal, a dry bed, the names of the missing read out each day, and work by the end of the first week. Those carry the two in three. Treatment for everyone in the first weeks did no good. Treatment for those still ill a month or more later did.

The bench outside the clinic

In Harare, Dixon Chibanda and his team set wooden benches in quiet corners outside 24 primary care clinics. On them sat community grandmothers, the *ambuya utano*, already employed by the city's health service and trained for nine days. Their patients came with *kufungisisa*, the Shona word for thinking too much. The grandmothers gave no advice. They worked through one problem after another with the person, in three named phases: opening the mind, uplifting, and strengthening. After four sessions, people were invited to a peer group, Circle Kubatana Tose.

In the trial, published in 2016, 573 people were randomised. At six months, 13.7 in 100 of those who sat on the bench were still above the line for depression, against 49.9 in 100 of those given enhanced usual care. Thoughts of suicide at follow-up were 2.3 in 100 against 12.3. No harm was found.

The detail that matters most is seldom quoted. Patients received a median of five sessions, three days apart. The first lasted about an hour and the rest 30 to 45 minutes. The whole course ran in about three weeks, and four hours of a grandmother's attention did what the clinic alone had not.

The bench was not alone. In Rawalpindi, Lady Health Workers trained for two days and supervised every month left 23 in 100 depressed mothers still depressed at six months, against 53 in 100 visited by untrained workers. When unpaid peers gave the same course, about a third of them left, and the effect shrank to almost nothing. The teaching was short in

every trial that worked. What lasted was the role, held in place by pay and a supervisor.

A life read back

Frank Neuner and his colleagues worked in the Nakivale settlement in southern Uganda, home to 14,400 refugees. In their survey there, 62 in 100 of the refugees sampled met the criteria for the disorder. For the trial published in 2008, they trained nine refugees from the camp, five women and four men with no previous training of any kind, on a six-week course. Then 277 Rwandan and Somali refugees were randomised to narrative exposure therapy, to flexible counselling, or to monitoring alone.

The method is plain to describe. Over six sessions, usually two a week, each one to two hours long, the counsellor asks the person to tell their whole life in order, from birth, slowing at the worst moments and staying in them until the fear begins to fall. The counsellor writes it down and reads it back at the next session. Each time, the worst memory is told in its place, with a before and an after. At the end the person is given the written account in their own language.

Nine months later, 70 in 100 of the narrative group no longer met the criteria, against 65 in 100 given counselling and 37 in 100 only monitored. Fewer than 4 in 100 left the narrative sessions early.

Three things held the trial up. Supervision was weekly, with sessions observed and every testimony reviewed. People using drugs or with psychosis were excluded. And the camp was stable: each household received beans, maize meal and oil every month and had land to farm. In an earlier, hungrier camp, the untreated had not recovered on their own in the same way.

In eastern Congo, Judith Bass and her colleagues trained village psychosocial assistants to run group cognitive processing therapy for women who had survived sexual violence, with one individual session and eleven in a group. In 2013 they reported that at six months, 9 in 100 of the women in the therapy villages still had probable depression or anxiety, against 42 in 100 of those given individual support. One village was dropped from the trial because its assistant was judged not competent.

This is the story told again until it is smaller, done with care: in order, in private, a set number of times, ending in the present, and with someone always watching the counsellor's work.

What the mourners kept

In 1907 Robert Hertz published an essay drawn largely from the Ngaju of south Borneo and their double burial. As he read it, the body, the soul and the mourners passed through the same waiting time together. The flesh decayed, the soul wandered, and the close kin lived under restrictions. Only when the bones were dry did the final feast release everyone into ordinary life. Mourning ended when the community said it had ended.

Many living faiths keep a calendar of the same shape. In Judaism the first seven days are *shiva*, when the community brings food and prayer to the mourners at home. In Islam most mourning lasts three days, and a widow mourns four months and ten days. Japanese Buddhist rites fall on the seventh and forty-ninth days, then at set years. Company is densest in the first week. There is a turning point at about a month, a release at about a year, and a yearly return.

Some customs are not for an outsider to describe. In Aboriginal Australia the time of mourning is Sorry Business. A public guideline written with Aboriginal communities says the family sets the time and that many communities do not speak the name of the dead for a period. It also says there are rules for men and for women that are restricted. This book names them and does not describe them. The same holds for the Lakota wiping of the tears and the inipi lodge, which belong to the nations that hold them.

The body grieves too. The widowed die sooner, about 1.4 times as often in the first six months, and mostly the men. In the first day after the death of someone close, the risk of a heart attack is about 21 times the usual.

Most mourners carry the loss without treatment. Of 205 older Americans followed from before a spouse died, nearly half stayed steady throughout. Grief keeps no fixed stages. But about 1 in 10 people bereaved by a natural death develop prolonged grief, the longing still at its first strength long after, with work, food and other people abandoned. After sudden or

violent deaths, pooled studies put it near one in two, and a child's death is the heaviest of all. Help offered to every mourner does little and fades. Help for those still struggling at six months works.

Fambul Tok and the telling in public

Sierra Leone's war of 1991 to 2002 killed more than 50,000 people. In 2007 an organisation called Fambul Tok, family talk in Krio, began to bring villages back together. With the chiefs' consent and months of preparation, a village held a two-day bonfire ceremony at which victims said what had been done to them and those who had done it asked forgiveness, with prayer and dancing. A peace tree, communal farms and groups of Peace Mothers followed.

Economists randomised 100 sections, with 200 villages and 2,383 people, and followed them for up to 31 months, until Ebola cut the last visits short. The reconciliation worked as reconciliation. Trust in former fighters rose by 22 per cent and social networks grew 11 per cent stronger. The same villages grew sicker in mind. The disorder was found in 11 in 100 against 8 in 100, depression rose by 47 per cent and anxiety by 37 per cent. Both the gains and the harms lasted nearly three years.

Rwanda's gacaca courts, revived from 2002 to try those accused after the genocide, pointed the same way. A survey of 1,200 Rwandans found more depression and more of the disorder among those who had testified. In a controlled study, survivors who took part grew worse while the prisoners who took part improved.

Telling atrocity before the whole village can mend a community and harm the people who tell. The Acholi of northern Uganda received people back from the Lord's Resistance Army with a cleansing that asks for no account, a public sign that the returnee may eat at the family's table again. No one has measured its effect on the mind, but it avoids what the trials condemned. Mato oput, the cleansing ceremony at Hollow Water and the gamba rites of Mozambique belong to their holders, and are named here only.

The healer's own mind

The people who carry everyone's grief carry their own. Among 212 international aid workers followed from before a posting to months after it, depression rose from about 10 in 100 to about 20, and stayed there after they came home. National staff in northern Uganda fared worse, with about two in three at high risk of depression. The healer after the Fall stands where they stood: local, little paid, living among the patients and unable to leave.

What protected healers was mostly the shape of the work, not courage. In two reviews, changes to the work did about two and a half times as much as courses for the individual. In one trial at the Mayo Clinic, doctors given an hour every other week with a small group of peers, over nine months, grew less cold towards their patients, and the gain held a year on. Removing 24-hour shifts cut serious errors by about a quarter in another. Debriefing the healer on the day of a death has the same record as debriefing anyone else.

Loneliness has its own famous figure, and it fell when it was checked. The comparison with heavy smoking traced back to a study that never measured loneliness. After full adjustment, being isolated, with few people seen, raises the risk of death by about a quarter. Feeling lonely, once health is counted, adds little or nothing in two large cohorts. It predicts misery and depression. The healer should be spared loneliness because it hurts, not because it kills.

The Honest Broker's Ledger

MI-01 carries this chapter and read Nakivale in full. It read the debriefing review through two summaries, which give the one-year odds ratio as 2.88 and as 2.51. Both point to harm, and both are printed. MI-02 read the Friendship Bench paper and is the most careful report here. MI-03 is sound on grief, thin where it adapts a grief treatment for lay hands. MI-10 read the Fambul Tok trial only as a summary. MI-12 and MI-13 rest mostly on abstracts.

Some lines differ and are printed both ways. MI-01 asks five questions at day 28, give or take 5. MI-04 asks the nine PHQ-9 questions about the last two weeks, with a line at 10 and no wait. Spoken aloud, the PHQ-9

caught 27 in 100 cases in Cameroon, and Harare moved its line to 11. MI-01 asks for supervision every week. MI-02 finds district groups meeting fortnightly to monthly. MI-01 says to speak the names of the dead at the village rite. MI-03 says each family decides, because naming breaks Sorry Business and similar rules. Prolonged grief may be named at six months by the WHO's criteria and at twelve by the American ones.

Known errors are named here and not repeated. MI-01 describes the Friendship Bench as six weekly sessions of 45 minutes. They were a median three days apart. MI-01 credits the pooled one in two prolonged grief after unnatural death to Lundorff 2020. MI-03 traces it to Djelantik 2020. TR-16 gives the grandmothers' training as eight days, and the paper says nine. The brief dates Nakivale to 2004, and the trial the library read was published in 2008. The claim, repeated by the United States Surgeon General in 2023, that loneliness is as deadly as fifteen cigarettes a day, is wrong. The paper behind it measured social ties, not loneliness.

I supplied the two courses side by side, the order of the Bench, and the three-month rule for a counsellor's skill, which is this book's figure for hand skills applied to talk. The care of the body after sexual assault, violence in the home, and the healer's own care beyond MI-12 are gaps the library names. They are not filled here.

The turn to the present

For most of history the frightened and the bereaved were carried by the people around them, by a calendar of rites and by work. The twentieth century added a stranger with a single session, and the record suggests the old carriers did most of the good while the stranger sometimes did harm.

What the clinic did hold was the few: the one in ten whose memory does not shrink, the mourner still frozen at six months. For them the trials are clear. In Harare, Nakivale and Congo, a neighbour with a written course, a fixed number of sessions and someone checking her work did far better than the care on offer.

Who will find the one in ten when the clinic is gone? Two neighbours per village, chosen for patience, taught in days, watched for weeks, supervised for as long as they work, and kept by the village while they do it.

Everyone else goes on doing what villages always did: the meal, the rite, the visit and the work.

Let the memory be told again, in order, beside someone trained, until it is smaller. Then let it go back into a life.

Now, the bench.

AT THE BENCH

29.1 See: distress, disorder and the danger signs

Sign	First 4 weeks	After 4 weeks
Fear, tears, anger, numbness	Expected	Look closer if daily
Memories, dreams, avoiding reminders	Expected	Count the days (29.2)
Cannot work or care for the house	Watch	Review at 3 months
Longing for the dead	Expected	Ask at 6 months (29.6)

1. Check the body first. Hunger, pain, fever and drink look like a troubled mind.
2. Low mood with a rash on sun-exposed skin: pellagra, chapter 7.

Red flags: talk of being better off dead. Voices that command, or loss of touch with the shared world. Shaking, sweating and confusion after drink stops. No food or water for 2 days. A child who stops speaking, playing or eating. The dead seen with fear, not comfort. Chest pain or collapse after a death.

Danger sign: any red flag.

- **Help in time.** Do not leave the person alone. Send word to the district now. Dying, psychosis, withdrawal: chapter 30.
- **Help too late.** Someone with them every hour. Food, water, warmth, a quiet room. The watch and the safe keeping of means: chapter 30.

- **No help at all.** Stay. Feed, warm, treat pain. Say: "I do not know if this will pass. I am not leaving." Tell the family plainly what you fear and what you will do.

Grades: watchful waiting with a dated review B. Food, warmth, sleep and reunion first B to C.

Rungs. Hands: look and listen. Hearth: food, warmth, a dark place to sleep. Garden and still: work by week 1. Dispensary: the ledger and the review. Infirmary: a trained counsellor and the watch. Hospital: psychiatry. Refuse: treating every frightened person as ill.

29.2 Do: the first month and the review

Never hold a meeting where people must tell what happened and how they felt. Instead: meet for news, names, decisions and shared work.

Never give drink or sedatives to calm the frightened. Instead: company, water, food and a dark place to sleep.

1. Day 0 to 1: water, food, shelter, dry clothes. Write the dead, missing and found in one book.
2. Read the names daily at a fixed time and place. Say what is not known.
3. Never hand a lone child to an unknown adult.
4. 2 named people walk the village 2 times a day for 14 days.
5. Look for the badly hurt, the helpless, and those who may hurt themselves or others.
6. Sit with the distressed. Offer water or food, not questions.
7. If someone chooses to tell, listen. Do not press. Do not repeat it.
8. Give work by the end of week 1, 8 hours at most.
9. Sleep after a shock: chapter 30.

The review. The library holds two screens. Both are printed. Neither is settled.

	MI-01 review	MI-04 screen
When	Day 28, plus or minus 5. Never before	Any time. Asks about the last 2 weeks
Questions	The 5 below	PHQ-9: 9 questions, each 0 to 3

	MI-01 review	MI-04 screen
Line	3 yes among 1 to 4, or yes to 4 on 4 days or more	10 or more. Harare used 11
Then	Review at 3 months	The course in 29.4

Ask in private, in your own language, about the last 7 days:

1. Have memories or dreams of it come back unwanted? On how many days?
2. Have you kept away from places, people or talk that remind you?
3. Have you been jumpy, watchful, or unable to sleep?
4. Have you been unable to work or care for your household? On how many days?
5. Have you thought you would be better off dead, or of harming yourself?
6. Any yes to question 5: do not leave them alone. Chapter 30, the same hour.
7. Write the answers and the date in the ledger.
8. Review everyone at 3 months, flagged or not. Some hide it. Some fall ill late.
9. Expect 3 in 10 flagged to be well. A screen is not a diagnosis.

Grades: compulsory single-session debriefing X. Sedatives or drink to prevent the disorder X. Psychological first aid D. Not pressing people to tell B. Review at 4 weeks, treatment at 3 months B.

Rungs. Hands: the walk, the names, listening. Hearth: food, water, a dark room. Garden and still: work within the week. Dispensary: the ledger and the review. Infirmary: the 3-month course. Hospital: trauma specialists. Refuse: group telling in week 1, sedatives, drink.

29.3 Do: choose, train and keep the counsellor

1. Choose 2 per village. 1 cannot be checked or stood down.
2. Prefer standing and patience to schooling. Avoid anyone related to many households.
3. Teach for 5 to 9 days. Half of every day is role play.

4. Teach listening without advice, the 7 steps, slow breathing, and asking about suicide.
5. Then watched practice: 2 clients, 5 sessions each, 15 hours, over 2 weeks or more.
6. Admit only on a role play scored by a second person against a written scale.
7. Expect 1 in 4 to 1 in 2 to fail at first. Retrain, score again, re-score yearly.
8. These hours count toward the 300 hours of chapter 35 (35.2), which skips its 8 hours on mind and grief for a trained counsellor and logs the 15 watched hours as practice.
9. No case for 3 months: role play with your partner before the next case.
10. Supervision, never none. MI-01: every week. MI-02: a district group of 4 to 6, fortnightly to monthly.
11. Register: name, date, session, better or worse. Never what was said.
12. Say at the start: "This stays with me and my supervisor. If a life is in danger, I must act."
13. Payment. Unpaid volunteers left at about 1 in 3. Paid peers did not leave.

Grades: lay problem-solving under supervision A. Unpaid volunteers as a lasting service X. Peer supervision with no one above: untested.

Rungs. Hands: a listener who gives no advice. Hearth: a quiet corner. Garden and still: a bench, a notebook. Dispensary: 2 counsellors, a register. Infirmary: the supervisor. Hospital: psychologists, psychiatrists. Refuse: 1 counsellor, alone, unsupervised, unpaid.

29.4 Do: the problem-solving course

For distress and for depression that is not dangerous. Dangerous depression: chapter 30.

1. 6 sessions, about 3 days apart, within 3 to 4 weeks.
2. Session 1, about 60 minutes: confidentiality, what has happened, what the course is.
3. Slow breathing. Breathe out fully. In for a count of 3, out for 3. 6 together.
4. Sessions 2 to 6: about 40 minutes each.
5. List the problems. Sort: solvable, unsolvable, unimportant. Choose an easy one.
6. Define it so another could see it. List every answer. Keep those within reach.
7. Plan the day, the time and what is needed. Review it next session.

8. Give no advice. Ask: "What would you tell a friend in your place?"
9. Session 3: plan one thing they used to do, on a named day.
10. Session 4: ask who they can talk to. Invite them to a group.
11. Session 6: review. Agree what to do next time. Say it has ended.
12. Low mood: add a morning hour outdoors and brisk work 3 times a week.

Stop and send: worse after 3 sessions, look for an illness of the body. New talk of dying: bring in the second counsellor and chapter 30. A case carried home for 2 weeks: hand it on. Never past 8 sessions.

Grades: lay problem-solving A. Lay behavioural activation A. Exercise 3 times a week A. Morning light A to B.

Rungs. Hands: listen, plan one thing. Hearth: meals together. Garden and still: garden tasks. Dispensary: the 6 sessions. Infirmary: failed cases. Hospital: therapy and drugs. Refuse: advice, endless sessions.

29.5 Do: the life told in order

Only at 3 months or later, for those still ill. Only by a counsellor with weekly supervision.

Never start with current danger, psychosis, drink or withdrawal, a plan to die, no consent, a day unfed or 2 nights unslept. Instead: company and 29.4. Fix the cause, then start in a week.

1. Offer. Never impose. They may stop at any time.
2. 6 sessions. At most 2 a week. 60 to 120 minutes each.
3. Session 1 explains only. The signs are a known response. Most people get better.
4. Sessions 2 to 5: the whole life in order, from birth. Never the worst event alone.
5. Slow down at the hard moments. Stay until the fear starts to fall.
6. Write as they speak. Read it back at the next session.
7. End every session in the present: the date, the place, who is at home.
8. Spend the last 10 minutes on today and tomorrow.
9. Session 6: give them the written account in their own language, if they want it.
10. If keeping it is dangerous, burn it together.
11. Ask the 5 questions of 29.2 at the end, at 3 months and at 6 months.

Stop the session at once for lost touch with the room, panic, or talk of harm.

12. Say their name, the place and the day.
13. Ask for 5 things they see, 4 sounds, then the feel of the chair.
14. Water. Open the door. Walk outside together.
15. Do not return to the account that day.
16. Hand them to someone who will stay tonight.

Stop the course if sleep worsens over 3 sessions, the account loops twice, drinking rises, self-harm talk begins, or they avoid you. Keep visiting. Stopping is not failure.

After sexual violence: the body first, chapters 12 and 16. Never send her back into danger. Never require her to tell. In Congo, village workers ran 1 individual and 11 group sessions. The library lacks its steps, so offer 29.4 or 29.5. Protect a child who tells of abuse before any other step. Violence in the home is a gap (chapter 36).

Grades: lay narrative exposure with supervision A. Group therapy by village workers A. Either without supervision: untested, refuse.

Rungs. Hands: none. Hearth: a quiet room. Garden and still: paper and pen. Dispensary: the trained counsellor, weekly supervision. Infirmary: the supervisor and the sessions that go wrong. Hospital: trauma therapists. Refuse: exposure work unsupervised, or for anyone excluded.

29.6 Do: grief

Never press the bereaved to tell their feelings. Instead: do practical things together. Let them talk if they want.

1. Ask the family what the rite needs, who must come, how long mourning lasts.
2. Impose no form. Restricted rites stay with their holders.
3. Night 1: someone stays with each close mourner. Never leave a suddenly widowed old man alone.
4. Days 1 to 7: food carried in 2 times a day. Chores done. Children cared for.
5. Check daily: eating, drinking, sleep, chest pain, breathlessness, talk of joining the dead.
6. Chest pain or collapse: treat as the heart and send now.

7. No fasts or night vigils for the old, the pregnant, the sick or children.
8. Offer a viewing. Describe the body first. Accept a refusal. In an epidemic: chapter 15.
9. Weeks 1 to 4: visit 2 times a week. Talking to the dead is normal.
10. Day 30: the family's rite, or a meal.
11. Release from work: 7 days in full, a month of light duties.
12. Register each death. Visit at 1 week, 1 month, 3 months, 6 months, 1 year.

Naming the dead at a village rite. MI-01: say the names aloud. MI-03: each family decides.

13. At 6 months, or 6 months after the culture's mourning ends, visit and ask.
14. Do you long for them most days? Is the pain as strong as at first?
15. Do you feel part of you died? Do you avoid reminders? Do you feel numb?
16. Has life lost its meaning? Do you feel alone? Can you work, eat and care for others?
17. Daily longing, 3 others, and cannot function: probable prolonged grief.
18. WHO criteria allow this at 6 months. American criteria wait 12, or 6 for children.
19. Offer 29.4, or 29.5 by a supervised counsellor. Ask question 5 of 29.2.
20. Longing alone: ask again at 12 months.
21. Hold a yearly day for all the dead. 2 people visit the distressed that week.

The child who grieves: tell the truth in plain words. Keep meals and sleep the same. Let them attend the rites if the family agrees. Silent, not playing or not eating: chapter 30. After a child's death, watch both parents, mothers for 3 years. Never blame the mother. Never seek a culprit by divination. The dying: chapter 31.

Grades: first-week company C. A small rite A. Viewing offered B. Stage teaching X. Grief help for all X. Help at 6 months for the distressed A. Forced widow cleansing X, ban. Divination X.

Rungs. Hands: sit, cook, keep the fire. Hearth: food 2 times a day. Garden and still: the meal and lights for the rite. Dispensary: the register, the 6-month visit. Infirmary: the supervisor, the suicidal. Hospital: grief therapy. Refuse: rites that require a widow to have sex, divination, fasts for the frail.

29.7 Prevent: the healer and the village

Never let 1 healer carry the village alone. Instead: 2 trained people, 2 keys and a named deputy.

Never debrief the healer on the day of a death. Instead: a short talk about what happened, within 72 hours.

1. 1 full day off in 7, with the deputy covering.
2. No more than 3 nights in a row on call.
3. 1 hour every 2 weeks with peers or the supervisor: cases, errors, deaths.
4. A week of leave 2 times a year. No make-up nights after.
5. A named person to talk to who is not a patient.
6. 7 days of mourning leave when someone close dies.
7. Signs of failing: coldness, missed visits, register errors, drinking or taking stock, hiding a death.
8. 1 sign: a private talk that week. 2 or more: stand down a week with cover.
9. Talk of not wanting to go on: chapter 30, the same day.
10. A weekly circle of 6 to 12, for 60 to 90 minutes, with 2 keepers.
11. Only the one holding the object speaks. Anyone may pass. No advice unless asked.
12. Welcome a returner with a meal at the family's table. Ask for no account.
13. Keep justice apart from healing. No victim testifies in a healing rite.
14. Never use public testimony as a treatment.
15. Visit those who live alone. Count everyone who sleeps in the village.

Grades: changes to the work over self-help A. A fortnightly peer hour A, one trial. Rest after nights B. 2 healers: inference. Talking circles D. Public testimony as healing X.

Rungs. Hands: a friend to talk to. Hearth: meals with non-patients. Garden and still: a day off. Dispensary: 2 healers, 2 keys, a rota. Infirmary: the peer group. Hospital: staff health services. Refuse: 1 healer alone, public testimony, compulsory debriefing.

If it goes wrong

1. **The account opened and not closed.** Looks like shaking, blankness or reliving, then worse sleep and more drink. Cause: no exclusion check, one session, no last 10 minutes on today. Do: the stop steps in 29.5, company tonight, a visit within 24 hours, supervision first.

2. **The counsellor drifts or breaks.** Looks like the same 12 clients for a year, advice in place of steps, missed supervision. Cause: 1 counsellor, no keep, no supervisor. Do: pair her, re-score the role play, restore supervision, settle her keep.
3. **The yearly day brings people down.** Looks like nightmares, drink and withdrawal the week after. In Rwanda, 65 in 100 surveyed reported trauma symptoms after the commemoration. Cause: the rite reopens the loss, and no one follows. Do: 2 people visit the distressed that week.

NUMBERS TO CARRY

- 2 in 3 exposed stay steady, 1 in 5 recover, 1 in 10 are still ill at a year (MI-01).
- Day 28, plus or minus 5: MI-01's review. PHQ-9 at 10, any time: MI-04's screen.
- 26 against 9 in 100: the disorder at 13 months, with debriefing and without (MI-01).
- A median of 5 sessions, 3 days apart, about 4 hours: the Friendship Bench course (MI-02).
- 70 against 37 in 100 well at 9 months at Nakivale, with weekly supervision (MI-01).
- 1 in 10 after a natural death, about 1 in 2 after a violent one: prolonged grief (MI-03).
- 11 against 8 in 100: the disorder after Fambul Tok, with trust up 22 per cent (MI-10).
- About 1.26 for isolation after adjustment, about 1.0 for loneliness once health is counted (MI-13).

THE LIBRARY

MI-01 Psychological trauma after collapse: what the evidence says works and what harms. MI-02 Lay-delivered mental health care: the Friendship Bench, Problem Management Plus and task-shifting. MI-03 Grief, mourning and ritual across cultures: how the bereaved are carried. MI-04 Depression and anxiety without pharmaceuticals. MI-10 Indigenous trauma healing: sweat lodges, talking circles, whānau ora and the data. MI-12 The healer's own mind: burnout, moral injury and the limits of one person. MI-13 Loneliness, meaning and the social body. TR-08 Native North American healing: ethnobotany, sweat lodge, ceremony and the data. SY-04 The romance of the indigenous and the ethics of taking. SY-10 The harm register. All are on the website.

CHAPTER 30

The Broken Mind, Addiction and the Wish to Die

A drinker who stops may fit in the first two days and turn delirious from the third, and the delirium can kill. The decision to die is often made in minutes, and the means put out of reach before those minutes save the most lives. In the long run about half of those with schizophrenia recover.

OPENING

Sit beside someone in the house for one minute, say nothing, and notice what your hands want to do. They want to fetch something, mend something, offer advice. A minute is long when nothing is being done. Most of us fill it.

The broken mind does not ask for advice. A man who hears voices through the wall at night is not helped by an argument about the wall. A woman shaking on her second morning without a drink needs water, a hand on the arm and someone who knows what the third day brings. A boy who has decided he is a burden will not say so to anyone who is busy. What each of them needs first is someone who stays.

The old phrase for this is keeping company. It means sitting up with the one who cannot sleep, eating at the same table, walking to the field together and saying little. It is not treatment in the sense the dispensary gives the word. Every treatment in this chapter rests on it. The drugs that help

the broken mind help more in company, and they run out long before company does.

Keeping company is also watching. The one who sits beside the frightened sees the hands, the breath, the food left on the plate. The one who sits beside the despairing notices what is within reach, and moves it. That is most of what this chapter asks, and it is harder than it sounds.

Most of what breaks the mind passes. Not all of it, not always, and not without cost. A household that can sit with its frightened, its shaking and its despairing will lose fewer of them than a household that locks them away or leaves them alone. The minute you just spent is where the skill begins.

THE STORY

The town of boarders

In Geel, in Belgium, the legend of Saint Dymphna was written down in the thirteenth century, and the mad came to her shrine as pilgrims. Her church was built in 1349, and a sickroom was added to it in 1480. The pilgrims who did not get better did not always go home. They lodged in the farmhouses around the town, and the farmers took them in for pay. Under the Church the difficult ones were sometimes chained and beaten, and the story should be told with that in it. In 1850 the state took the boarding over and forbade both the chain and the beating, and in 1861 it opened a hospital to stand behind the families. The families did the work.

By the late 1930s almost 4,000 boarders lived in a town of about 16,000 people. There were about 1,300 in the early 1970s and 550 in 2000, and today there are somewhere between 120 and 500, by different counts. A family takes no more than three. A boarder brings about 40 euros a day, and the family keeps half. The boarder sleeps in the family's house and eats at the family's table. The arrangement is seven centuries old, and nobody has ever measured what it does for the boarders.

In America, Linn and colleagues followed veterans placed in foster homes and reported in 1980 that they did better in houses with children

in them, with fewer boarders and in smaller homes. The homes that supervised and stimulated their boarders most did worse. That is Geel set down in a table. The boarder needs a household, not a regime. Geel calls it boarding. This book calls it keeping company, and Geel has done it for longer than anyone.

The house in San Jose

The usual expectation of schizophrenia, in the years when Geel was shrinking, was a life of relapse. The World Health Organization tested that expectation. In its studies of first episodes, two years on, 37 in 100 patients in the centres of poorer countries were fully in remission, against 15.5 in 100 in the rich ones, and only 16 in 100 in the poorer centres had taken drugs without a break. Harrison's follow-up, published in 2001, found 48 in 100 of those with schizophrenia recovered fifteen and twenty-five years on, and about 16 in 100 had recovered late, after years of illness. About half come back.

In 1971 Loren Mosher and Voyce Hendrix opened a house in San Jose, California, and called it Soteria. Six to eight young people in a first psychosis lived there with staff who had no professional training. The work was called being with. Drugs were held back for the first six weeks, and stays ran to about three months. Between 1971 and 1979, 179 people came, most of them by lot, and the project closed in 1983. Two years on, among the 129 who completed, the Soteria group had done better by about half a standard deviation, and more in schizophrenia. Yet 58 in 100 had taken drugs at some time and 19 in 100 throughout. Calton's review of 2008 found three trials with 223 people and equal results with less drug.

Then the body. In Butajira, in rural Ethiopia, Teferra and colleagues followed 307 people with schizophrenia, and 38 of them were dead within five years. Almost half died of infection and 13 in 100 of hunger, at an average age of 35. Those who took their drug less than half the time died at almost three times the rate. The village may do well with the mind and badly with the body.

The chain and the hold

The oldest answer to the frightening mind is the chain, and it has not gone. In 2020 Human Rights Watch found people shackled in about 60 of the 110 countries it examined. On 6 August 2001 at Erwadi, in Tamil Nadu, a fire killed at least 25 people who were chained where they lay. Moral treatment is remembered as the end of the chain, and it was kinder than what went before. Yet at Tuke's Retreat at York, opened in 1796, about 10 in 100 of the patients were under restraint at any one time. Kindness and restraint lived in the same house.

Hospitals replaced the chain with the hold, and the hold kills too. In 1998 the Hartford Courant counted 142 deaths in restraint in American institutions over ten years. In Sweden, Tyr and colleagues gathered 52 deaths in restraint between 1992 and 2024, and 9 in 10 of them happened face down, most in people who had taken stimulants. Strömmer's review of 168 people in the agitated state the police call excited delirium found 62 in 100 dead, and tying the wrists to the ankles raised the odds about fiftyfold. Geel forbade the chain in 1850. A village can do no less.

The shaking hand

In 1953 Victor and Adams described 206 people withdrawing from drink. Twelve in 100 had fits, 18 in 100 saw or heard things that were not there, and 5 in 100 went into delirium tremens, the shaking, sweating, terrified confusion that comes from about the third day. Treated, it kills 1 to 4 in 100. Untreated, the figure in the record runs as high as 35. Each withdrawal makes the next one worse, so the man with three bad stops behind him is the one to watch. In 1969 Kaim and colleagues found chlorpromazine no better than a dummy for the delirium, and it brought the most fits. The diazepam family of drugs prevents the fits, at about a sixth of the rate without them. A village will rarely have enough.

Opium runs the other way. Its withdrawal is miserable and rarely dangerous: a week of aching, running eyes, gooseflesh, loose bowels and no sleep, and then it lifts. Those who died of it in the record died of dehydration in custody, where no one gave them water. The danger comes after. When the methadone stopped in Crimea in May 2014, about 800 people lost it, and by January 2015 between 80 and 100 of them were dead, mostly

of overdose and suicide. In the two weeks after leaving prison, Merrall found, a former user is 3 to 8 times as likely to die of an overdose. The body forgets its tolerance in days, and the old dose kills.

In 1971 Lee Robins followed American soldiers home from Vietnam. Of the men who came back that September, 43 in 100 had used narcotics there and about 20 in 100 had been dependent. At home, fewer than 1 in 100 were addicted again eight to twelve months later, and 5 in 100 within three years, against relapse in more than 90 in 100 of addicts treated in America. The drug was the same. The place, the company and the supply had changed.

What keeps people off is the company they keep afterwards. In the community of Alkali Lake, Phyllis and Andy Chelsea stopped drinking in 1971 or 1972, and by the middle of the 1980s the community reported that 95 in 100 of its adults were sober. That figure is the village's own and was never checked from outside. The trials say the same thing more quietly. Mutual help on the pattern of Alcoholics Anonymous raised the share who stayed off by about a fifth in Kelly's review of 2020, and lay counsellors in Goa raised remission from 26 to 36 in 100 in Nadkarni's trial of 2017. Neither needs a pharmacy.

The locked shed

Before the 1960s Sri Lanka recorded about 5 suicides a year for every 100,000 people. By 1995 it recorded about 47. The government then took the most poisonous farm pesticides off sale, one group at a time, in 1984, 1995, 1998 and between 2008 and 2011. Gunnell found the rate halved by 2005. Knipe, Gunnell and Eddleston reckoned in 2017 that it had fallen by 70 in 100 from its peak and that about 93,000 lives had been saved. The office that registered pesticides cost about 200,000 dollars a year, about 43 dollars for each life. Attempts did not stop. Fewer of them ended in death.

Britain had shown the same thing twice. Between 1960 and 1971 the gas piped to its kitchens was changed to a kind that is far less poisonous, and Kreitman showed in 1976 that the country's suicides fell by about a third, from 5,714 a year to 3,693. In September 1998 the packs of a common painkiller were made smaller, and over the next eleven years Hawton

counted 43 in 100 fewer deaths from it, about 765 people. None of these changed a single mind. They changed what was within reach.

The reason is the clock. Among people who had made a nearly fatal attempt, about a quarter had decided in under five minutes, and in a second study about half had decided within ten. A crisis that lasts minutes can be outlasted. Of those who live through an attempt, about 2 in 100 die by suicide within a year and 7 in 100 within nine years. More than 9 in 10 do not.

The box that failed belongs here too. In 2017 Pearson and colleagues gave lockable boxes for pesticides to households in 180 villages of Sri Lanka's North Central Province, about 224,000 people. Deaths did not fall. One year on, 72 in 100 boxes were kept locked, and three years on, 53. A lock in the house is opened by the person who lives there. A store kept by someone else, away from the house, has never been tested, and the Bench proposes it as the guess it is.

In 2005 Gould found that asking 2,342 schoolchildren about suicide did not raise their thoughts of it. The World Health Organization followed 1,867 people seen after an attempt in five countries, and among those given a short talk and a run of contacts afterwards, 0.2 in 100 had died by suicide at eighteen months, against 2.2 in 100 among those given the usual care. A visit and a letter are within any village's means.

The Honest Broker's Ledger

MI-05, on psychosis, can be trusted for the long course of the illness and for the drug schedule, which it takes from Médecins Sans Frontières. Its Geel has no figures for how the boarders fared, because none exist, and its Soteria rests on one small study, partly not random, measured among completers and weaker when everyone is counted. MSF's English guide caps haloperidol at 15 mg a day and its French edition at 20 mg. Both are printed at 30.2, and the lower is followed.

MI-06, on withdrawal, is the strongest report here. On the hours of the withdrawal fit, MI-06 and SY-10 agree at 6 to 48 hours after the last drink. Within MI-06 the onset of withdrawal is given two ways, within about 8 hours (Schuckit 2014) and at 6 to 24 hours (WHO 2009), and both are printed. SY-10 gives no diazepam dose. MI-06 gives two: a loading course

of 20 mg every 2 hours until drowsy, which needed a median of about 60 mg, and the WHO fixed course of 10 mg four times a day, 140 mg over five days. Both are printed at 30.4, with the shared ceiling of 120 mg in 24 hours. Its phenobarbital by mouth is MI-06's own reasoning, grade D, with no trial. A figure of 15 to 37 deaths in 100 untreated circulates without a source and is not used.

Restraint is disputed (SY-12, C11). On one side are the deaths: 142 in America in ten years, 52 in Sweden with 9 in 10 face down, and the hobble tie at about fifty times the odds. On the other, de Boer and colleagues argued in 2023 that the causal link between restraint and these deaths has not been proven. Both are printed. The floor rule at 30.3 is fixed whichever side is right, and how long a hold may last is the owner's decision.

Kava is disputed too (SY-12, C19). PH-09 grades it B for anxiety, from older pooled trials of extracts. MI-11 reports the largest recent trial, 171 people over 16 weeks, which found no benefit and more abnormal liver tests. On effect MI-11 is better supported. Whether the Pacific water drink harms the liver is open in four reports, and the water drink is graded D in TR-15 and C in TR-10.

MI-08, on suicide, is strong on means and on contact after an attempt. Its central village store is its own inference, grade D. SY-10's harm row on the healer's stock prints a fatality figure for one poison, and this book does not reproduce it. MI-09, on sleep, corrects two errors elsewhere in the library. PH-01 reports valerian's pooled benefit as if from 16 studies when it came from 6 of them, and MI-04 sends the reader to MI-09 for suicide, which belongs to MI-08. The gap is ME-09, whose salvage list holds no antipsychotic, no thiamine and no phenobarbital for withdrawal, and only 200 mg of diazepam for a village over ten years (SY-12, R2-04). The weight bands, the under-18 lines and the frail lines at the Bench are the draft's.

The turn to the present

In the twentieth century the broken mind left the household. It went to the asylum, then the ward, then the clinic and the long injection. Much of that did good. In Leucht's review of 2012, the drug cut relapse within a year from 64 in 100 to 27. The drinker went to a unit to be dried out, and the one who had tried to die went to an emergency room for an hour and

home. The household learned to call someone. It forgot how to sit up.

The skill it forgot is the one the record keeps finding. Geel's households, the house in San Jose, the counsellors in Goa, the contacts after an attempt and the poisons taken off sale by a government all worked the same way. Someone stayed, or something was moved out of reach, for long enough. Who will sit up with him tonight?

After the Fall the call goes nowhere, and the drugs will run out within years. What remains is the oldest care there is. Keeping company is not soft. It is the watch that lasts three days, the hand that counts the tablets, the neighbour who comes on the third morning of the shaking and in the seventh week after the funeral. It is a chair beside a bed.

Now pull up a chair.

AT THE BENCH

30.1 See: body or mind

Never call new confusion madness until the body is checked. Instead, look for the body's cause first (24, 28).

1. Ask when it began. Hours: think of the body. Weeks: think of the mind.
2. Look for fever, drowsiness, a recent birth, a head blow, a poison, a wild plant, a last drink or pill.
3. Delirium: began in hours, comes and goes, lost for day or place, sees things. It is the body's until shown otherwise.
4. Psychosis: knows day and place, hears voices, holds fixed false beliefs.
5. Ask every person in this chapter about death (see 30.6).

Grades: body cause sought first B. Antipsychotic for delirium X.

Rungs. Hands: asking. Hearth: lamp, watch. Garden and still: nothing. Dispensary: thermometer, malaria test if held. Infirmary: the cause treated. Hospital: tests. Refuse: sedating the confused.

30.2 Do: psychosis at home

Never an antipsychotic for agitation in dementia or delirium. Instead, look for the cause (see 30.1, 28). **Never 2 antipsychotics together.** Instead, 1 drug and 1 prescriber. **Never stop an antipsychotic suddenly.** Instead, taper over at least 4 weeks.

1. 2 watchers, in shifts of 4 hours.
2. Ground floor room, mattress on the floor, nothing sharp, door open, low light.
3. Water every hour. Food 3 times a day. 1 visitor at a time.
4. Calm, brief words. No blame, no shouting, no argument with the voices.
5. A note each shift: sleep, food, water, talk of death.
6. By day, work alongside. No drink. No daily cannabis.
7. A weekly family meeting with the healer. Learn the early signs.

The salvaged drug. Who holds it and who starts it:. Read the strip, not the colour.

Work every dose twice, with two people.

Weight and age	Drug and dose, by mouth	Interval	Ceiling a day
Under 18, or under 40 kg	District only		
40 kg and over	Haloperidol. Days 1 to 3: 0.5 to 1 mg. Days 4 to 7: 1 mg. Week 2: 2.5 mg. After 2 weeks, if needed: 5 mg	Twice a day	15 mg (MSF English) or 20 mg (MSF French). Use 15

Weight and age	Drug and dose, by mouth	Interval	Ceiling a day
40 kg and over	Or chlorpromazine. Week 1: 25 to 50 mg at night. Then 50 mg morning, 100 mg night. Then 100 mg 3 times a day	As stated	300 mg
40 kg and over, agitated, not on an antipsychotic	Haloperidol 5 mg with promethazine 25 mg	Once more after 60 minutes if needed	2 doses, then the district
40 kg and over, agitated, already on one	Diazepam 10 mg	Once more after 30 to 60 minutes	2 doses, then the district
Old or frail, 40 kg and over	Half of each dose	Same	Haloperidol 5 mg
Dementia, Parkinson's, heart disease, past fever and stiffness on the drug	Never		

Twisting of the neck or eyes: the district's biperiden, if held. How long: first episode 7 to 12 months. Long illness at least 1 year. Mania 8 weeks after it settles.

Stock: no new long-term patient without 12 months plus a 3 month taper in hand. At 5 mg a day that is about 365 tablets of 5 mg plus 45. Under 6 months left: begin tapers. Under 3: taper all. Cut a quarter a step. If early signs return, go back 1 step.

Danger sign: fever, stiff muscles and confusion on an antipsychotic.

- Help in time: stop the drug. Cool. Fluids by mouth. Send.
- Help too late: cannot drink. Side, cool, send. Never restart it.
- No help at all: cool cloths, sips, company. About 7 in 100 die even with care. Tell the family that stopping the drug was right.

Grades: family work A. Antipsychotic to prevent relapse A. Gradual taper B. Soteria house B. Geel foster care B to D. Abrupt stop X.

Rungs. Hands: the watch. Hearth: a ground floor room. Garden and still: food. Dispensary: the strip, locked and counted. Infirmary: the drug started, the stock plan. Hospital: injections, wards. Refuse: chains, 2 antipsychotics at once.

30.3 Do: the hold

Never face down. Instead, face up or on the side. **Never a knee or weight on the back, chest or neck.** Instead, 1 person per limb. **Never wrists tied to ankles, never chains or ropes.** Instead, release, and stay with them. **Never alone.** Instead, at least 4 people and 1 leader who speaks.

First: a quiet room, 1 calm voice, others back. Offer food, water, a seat, sleep. Ask what would help. Wait.

Hold only to stop an assault, stop self-harm, or give a drug the district ordered:

1. 2 named adults decide.
2. At least 4 people, 1 per limb. 1 leader at the head speaks throughout.
3. Watch the breathing and the lips without a break.
4. Release within minutes. The maximum is the owner's.
5. Release at once if breathing changes, or the person goes quiet or limp.
6. Afterwards: water, a seat, company. No locked room.
7. Write down who, why, how long, who decided.

Danger sign: silence after a struggle, gurgling, blue lips, a limp body.

- Help in time: release at once. Turn on the side. Open the airway. Stay.
- Help too late: no breath. Breathe for them, 10 breaths a minute. Send.
- No help at all: tell the family plainly what happened. Record it for the council.

Grades: calming by voice B to C. Chains, prone or long restraint X.

Rungs. Hands: the voice, 4 people. Hearth: a quiet room. Garden and still: nothing. Dispensary: the agitation dose (see 30.2). Infirmary: the decision reviewed. Hospital: trained staff. Refuse: chains, ropes, face down, locked rooms.

30.4 Do: alcohol withdrawal

Never stop heavy drinking unwatched. Instead, a watcher, a score and a taper. **Never a sedative dose under 12 breaths a minute, or if not woken by voice.** Instead, withhold and watch. Under 10, breathe for them (chapter 21). **Never more than 2 rescue doses for a fit.** Instead, side, airway, send. **Never an antipsychotic alone for withdrawal.** Instead, the diazepam family or the spirit taper.

1. Ask the hour of the last drink. Signs start within about 8 hours (Schuckit) or at 6 to 24 hours (WHO). Worst at 36 to 72 hours.
2. Fits at 6 to 48 hours. A first fit then is withdrawal, not epilepsy (25).
3. Delirium from about day 3, for 1 to 8 days.
4. Score 3 to 4 times a day for 3 days. 1 to 4 mild. 5 to 14 moderate. 15 or more severe.

Sign	Score
Sweating, anxiety, agitation, hallucinations, lost for time or place	0 to 4 each
Tremor	0 to 3
Temperature: 37.0 °C or less, 37.1 to 37.5, 37.6 to 38.0, 38.1 to 38.5, over 38.5	0, 1, 2, 3, 4

5. Thiamine before any food or sugar (07.4). Fluids, and ORS if sweating or vomiting (05).
6. A watcher always, day and night.

Weight and age	Diazepam by mouth, 2 ways	Phenobarbital by mouth, infirmary only: 120 mg every 2 to 4 hours while the score is 5 or more. Ceiling in 24 hours, 60 mg tablets	Thiamine by mouth
Under 18, or under 40 kg	District	District	District
40 to under 50 kg	By score: 10 to 20 mg when the score is 5 or more, score again in 1 to 2 hours. Or load: 20 mg every 2 hours until drowsy but woken by voice, then 10 mg 4 times on day 2, twice on day 3, 5 mg twice on day 4. Or fixed (WHO): 10 mg 4 times a day on days 1 and 2, then 30, 20 and 10 mg a day on days 3 to 5. Ceiling 120 mg in 24 hours	6 tablets, 360 mg	100 mg 3 times a day for 6 weeks
50 to under 60 kg	As above	8 tablets, 480 mg	Same
60 to under 70 kg	As above	10 tablets, 600 mg	Same
70 kg and over	As above	11 tablets, 660 mg	Same

Old, frail or yellow	By score only, 10 mg a dose, and the district	Never	Same

No scale: use the lowest adult row. Phenobarbital only if sober 6 hours, woken by voice, 12 breaths a minute or more. Never with liver failure, pregnancy, other sedatives or drink. Never over 15 mg/kg. Who gives it:.

The spirit taper, if no diazepam is held:

1. Grain or sugar spirit of known strength only (33). 1 unit is 25 ml of 40 per cent spirit.
2. Find the units that keep the score under 5. Split into 4 to 6 doses. Hold 2 to 3 days.
3. Cut 1 tenth of the starting amount each day. Done in about 10 days.
4. Over 25 units a day, or signs return: cut every 2 to 4 days.
5. Someone other than the drinker holds the bottle.
6. A fit, confusion or fever: back to the last amount, and send.
7. Stopping outright is safe only under 10 units a day with no past fits.

Danger sign: a fit, or confusion with fever, after day 2.

- Help in time: side, airway, diazepam if held, thiamine, fluids. Send.
- Help too late: a second fit, or cannot be woken. Side, airway, breath count. Send.
- No help at all: cool, sips, a watcher, a low lamp. Tell the family that delirium can kill even with care, and that they did not cause it.

Prevent: a weekly meeting of those who stopped. A lay counsellor. The still and its rules (33).

Grades: diazepam family A. Dosing by score B. Spirit taper C. Phenobarbital by mouth D. Thiamine C. Antipsychotic alone X. Mutual help A. Lay counselling B.

Rungs. Hands: the watcher, the score. Hearth: water, ORS. Garden and still: measured spirit for the taper. Dispensary: diazepam and thiamine, locked. Infirmary: phenobarbital. Hospital: injections. Refuse: unwatched stops, spirit of unknown strength.

30.5 Do: opium, and the pills on the shelf

Never the old dose after a withdrawal. Instead, tell them: "Your old dose will now kill you." The healer starts low (31). **Never raise a sedative to ease its taper.** Instead, hold the step another week.

1. Say it plainly: opium withdrawal is miserable and rarely kills.
2. Short-acting opioids: starts at 6 to 12 hours, worst at 24 to 72, over in 7 to 10 days. Methadone: starts at 24 to 72 hours, lasts 14 days or more.
3. Fluids 2 to 3 litres a day, ORS (05). Warmth, walking, company.
4. Taper any supply left by 10 to 20 per cent a week.
5. Pregnant: no withdrawal without the district.

Weight and age	Loperamide by mouth
Under 18, or under 40 kg	District only
40 kg and over	4 mg, then 2 mg after each loose stool. Ceiling 16 mg a day

Clonidine, grade B, needs a cuff and belongs to the infirmary (MI-06).

Sedatives and sleeping pills from the shelf:

1. Count on day 1. Keep 2 days in reserve. Spread the rest.
2. Cut about 1 tenth of the dose a step. Each step at least 7 days.
3. Equal to diazepam 10 mg: lorazepam 1 mg, alprazolam 0.5 mg, clonazepam 0.5 mg, temazepam 20 mg, zopiclone 15 mg, zolpidem 20 mg.
4. Pooling household stocks:.

Tobacco withdrawal does not kill. Cannabis: see 30.2.

Grades: fluids B. Loperamide C. Slow sedative taper B. Ibogaine X.

Rungs. Hands: company, the truth. Hearth: water, warmth. Garden and still: nothing (34). Dispensary: loperamide, the counted taper. Infirmary: clonidine, a cuff. Hospital: substitution drugs. Refuse: iboga, the old dose.

30.6 Do: the wish to die

Never leave a person with a plan alone. Instead, the 72 hour watch. **Never a lock box in the house as the answer.** Instead, the village store with 1 keeper

(32). **Never speak of the method or the place after a death.** Instead, speak of the person.

See: talk of death, giving things away, hopelessness, a loss, drink, a past attempt, leaving care, a suicide nearby.

1. Sit, in private. Ask, using the word: "Are you thinking of killing yourself?"
2. If yes, ask in order: How? Do you have what you would need? When? Have you tried before? What stopped you?
3. Listen. Do not argue. Do not promise secrecy.
4. Thoughts, no plan: safety plan, contact within 1 week. A plan or past attempt: add means out, contact next day. Means at hand, a time chosen, or an attempt in 72 hours: the watch, means out now.
5. Safety plan on 1 sheet, in their words: warning signs, what helps alone, who distracts, 2 people to tell, the healer, what is moved.
6. Means out the same day, with their knowledge. Guns and farm poisons to the village store. Medicines counted, a few days left, held by another. Spirits out. Write down what went where. Guns back only after review at 3 months.
7. The watch: someone in sight or hearing for 72 hours, at night and washing too. Shifts of 4 hours, 2 people at night, at least 6 watchers the person trusts. The healer daily. Review at 72 hours.
8. After an attempt: the body first (22). Then steps 1 to 7.
9. Contact: days 1, 3 and 7. Weeks 2, 4, 8 and 12. Months 6, 12 and 18. Then a letter 4 times a year.
10. Treat the cause beneath: drink (30.4), psychosis (30.2), low mood (29).

After a death in the village: tell the family in person. 1 voice speaks for the village. No method, no place. Within 3 days, ask each of the most exposed, as in step 1: family, friends, the finder, the young, anyone who has tried before. The funeral honours the person, not the manner of death. No lasting memorial at the place. Visit the closest weekly to week 12.

Danger sign: a plan, the means and a time.

- Help in time: the watch, means out, the plan. The crisis passes.
- Help too late: an attempt. The body first (22), then the watch and the contacts.
- No help at all: a death. Sit with the family. Tell them plainly it was suicide, that it is not their shame, and that the village will keep visiting.

Grades: asking A, safe. Contact after an attempt A. Safety plan B. Means out of the house B. Central store D. Household lock box X. Silence X. Memorials that glorify X.

Rungs. Hands: asking, the watch. Hearth: the house cleared. Garden and still: spirits held (33). Dispensary: the store, 1 keeper, the record (32). Infirmary: care after an attempt. Hospital: the ward. Refuse: silence, the lock box, stories of the method.

30.7 Prevent: sleep without the draught

Never alcohol, opium or salvaged pills as a sleeping draught. Instead, the rules below. **Never a sedative for an old person who snores, falls or is confused.** Instead, side lying, warmth, company.

1. Rise at the same time every day, within 30 minutes.
2. Outdoors 30 to 60 minutes in the first hours of light. Work by day.
3. Nap at most 30 minutes, not after mid-afternoon.
4. Bed only when sleepy. Awake and fretting about 15 minutes: get up, dim light, back when sleepy.
5. A waking at midnight in a long winter night is normal.
6. Sleepless over 3 months: keep a diary 1 to 2 weeks. Efficiency = hours asleep ÷ hours in bed × 100.
7. Under 85 per cent: time in bed = average sleep plus 30 minutes, never under 6 hours. Widen or narrow by 15 to 30 minutes weekly.
8. Not for mania, poorly controlled fits, loud snoring with pauses, pregnancy, or dangerous work.

Weight and age	Valerian root tea, 150 ml boiling water, covered
Under 18	No (Health Canada). EMA allows from 12. Use 18
18 and over, any weight	2 to 3 g dried root a cup, 30 to 60 minutes before bed. At most 3.6 g a dose, 4 cups a day. Judge after 2 to 4 weeks. Never with drink or pills

Dig valerian only from a planted bed. Never a root without its smell.

Kava is not a sleep medicine. Extract X. Water drink D or C, liver question open.

Grades: sleep window taught by a lay person A. Hygiene rules alone X. Valerian C. Alcohol or opium as a draught X. Pills for long sleeplessness X.

Rungs. Hands: the rules. Hearth: a candle marked in hours. Garden and still: valerian, lemon balm, chamomile. Dispensary: diaries, a sleep keeper. Infirmary: sedative tapers. Hospital: clinics. Refuse: the nightly bottle, the draught for the old.

If it goes wrong

- **The quiet after the hold.** The struggle stops, the body goes limp. Cause: face down, weight on the back. Do: release, side, airway, breathe for them (30.3).
- **The fit on day 2.** A drinker cut off from drink fits a day later. Cause: an abrupt, unwatched stop. Do: side, airway, diazepam if held, then the score and the taper (30.4).
- **The stock runs out.** Voices return, or sedative users fit. Cause: no taper begun with 6 months left. Do: back to the last dose, then taper slowly. Count stock monthly.

Numbers to carry

- 6 to 48 hours after the last drink: the withdrawal fit (MI-06, SY-10).
- 1 to 4 in 100 die of delirium tremens treated, up to 35 untreated (MI-06).
- 15 mg: haloperidol a day at most, 5 mg in the old (MI-05).
- 48 in 100 with schizophrenia recovered at 15 to 25 years (MI-05).
- 70 in 100 fewer suicides after the pesticide bans. Household lock boxes: 0.93, no benefit (MI-08).
- 0.2 against 2.2 in 100 dead at 18 months, with and without contact after an attempt (MI-08).

The library

MI-05 Psychosis and severe mental illness in a village: Soteria, Open Dialogue, Geel and moral treatment. MI-06 Withdrawal and addiction when supply ends: alcohol, opioids, benzodiazepines, tobacco. MI-07 Children's trauma, attachment and resilience: what protects. MI-08 Suicide: prevention in small communities, means and postvention. MI-09 Sleep, rest and the nervous system: the oldest medicine. MI-11 Plant and ritual medicines of the mind: ayahuasca, psilocybin, iboga, kava, cannabis. SY-10 The harm register. SY-12 What the library could not find. All are on the website.

PART EIGHT

The End

CHAPTER 31

The Good Death

The last days are counted in breaths. Twelve a minute, hold the dose. Ten, wake them and wait. Eight, naloxone if there is any. The body is kept a day in the heat and two at most in the cool, and buried without lime.

OPENING

Hold the back of your hand a few centimetres from your mouth and breathe out slowly. The air is warm on the skin. It went in cooler than it comes out, and the difference is heat your body has given away. Now lay the same hand on your forearm. That is the same warmth, made the same way, by a body burning its food slowly to stay at blood heat. Every breath carries a little of it off, day and night, and nobody notices.

Now count your own breaths for one full minute. Notice how hard it is not to change them once you are watching. The number is small and steady. From one quiet minute to the next it barely moves.

At the end of a life that number moves. It slows, or it stops and starts again, or it comes from the jaw instead of the chest. The household changes its pace to match. Someone sits close and counts without meaning to. Someone else brings a blanket, because warmth is still a thing that can be given when food and water no longer help.

Most of the care of the dying is like that blanket. It is old, it costs nothing, and it can be learned in an afternoon: a wet cloth at the lips, a pillow

moved, a window opened, cool air across the face, a hand that stays. Families and neighbours gave it for as long as people died at home. Some of it is a drug, the oldest strong one there is, and the drug is governed by the same small number you have just counted.

When the counting ends, there is still work. The warmth goes out of the body slowly, and the family has water, cloth, a shroud and a spade to deal with, and a name to write down.

THE STORY

The sleeping juice

The opium poppy, *Papaver somniferum*, is an annual of the poppy family whose dried latex is opium. It is grown as a summer crop in temperate countries and a winter crop in the subtropics, from Afghanistan and India to Laos and Poland. The ornamental poppies of cottage gardens are the same species and carry the same drug: one Estonian sample of garden capsules averaged 0.36 per cent morphine. Opium itself runs from 8 to 19 per cent morphine, which is why nobody can tell the strength of a lump or a home bottle by looking at it. A plot 10 metres by 10 gives between 0.2 and 0.55 kg of opium, which by the library's arithmetic is 7 to 20 months of strong relief for one dying person. This book names the plant, says where it grows and what a plot gives, and gives no method of growing it or of making anything from it. Whether a village grows it at all is the owner's question, and the record that bears on it is in this section.

In 1803 an apothecary's apprentice in Paderborn, Friedrich Sertürner, began to work on opium. By 1817 he had published his full account of its sleeping principle, morphine. This book tells that as history only and gives none of the process. What matters here is what he did next. He tested the substance on himself and three young volunteers, about 30 mg at a time, repeated within the hour. The first dose brought flushing, the second drowsiness, the third confusion and a near faint. He then proposed 15 mg as the dose. The first human trial of morphine was an overdose, and it taught the lesson every later page repeats. The danger lies in the dose

given too fast, one on top of another, before the last has shown what it will do.

A century and a half later, Cicely Saunders opened St Christopher's Hospice in Sydenham, south London, in 1967, and changed the clock rather than the drug. Before her, strong pain relief in British hospitals came on demand, after the pain had returned and the patient had asked and a nurse had come. She gave it by the clock, in a dose that carried the patient to the next one, so the pain never climbed back. A pain service in Cologne followed 2,118 patients over ten years on that rule. On 82 per cent of the days the drug went by mouth. Relief was good in 76 per cent of patients and satisfactory in 12, and laxatives were needed on 42 per cent of days (Zech 1995). The ladder has never been tested against a control (Jadad 1995), and 1 in 8 still had poor relief with a full hospital behind them.

The record on dependence is plain once the words are kept apart. Dependence comes to anyone on regular doses for more than a week or two. It is a property of the drug, not a fault in the person, and the answer is to step the dose down, not to withhold it. Addiction is the habit taken for its own sake. In Laos in the early 1970s it was 3 to 4 times commoner in villages that grew the poppy, 7.0 to 9.8 addicts per 100 people against 1.8 to 2.3 in villages that neither grew nor traded it (Westermeyer 1979). That is the cost a growing village would carry among its living. For its dying, the danger the record shows is the dose measured by guess. A teaspoon of tincture given where the weaker paregoric was meant has killed (Kelly and Vaida 2003).

What the untreated record shows

Medicine kept, without meaning to, a record of cancer left alone. At the Middlesex Hospital in London, 250 women with untreated breast cancer had usable notes between 1805 and 1933. From first symptom to death took a median of 2.7 years. Eighteen in 100 were alive at 5 years, and the longest lived 18 years (Bloom 1962). Untreated lung cancer ran a mean of about 7 months (Wao 2013). A child with leukaemia, before the first drugs of 1948, lived a median of 3.9 months (Tivey 1952).

What a village can know is plain: a lump that grows, a sore that will not heal, bleeding with no cause, weight that falls away. What it can do

is most of what a hospice does. At St Christopher's in 1985, Mary Baines cared for 38 of 40 dying patients with a blocked bowel without a drip or a stomach tube, using drugs for the pain, the colic and the sickness (Baines 1985). A cancer wound that smells comes to 5 to 10 in 100 cancer patients, and honey did as well as silver dressings in 69 of them (Lund-Nielsen 2011). Pain comes in about two thirds of advanced cancer (van den Beuken 2016), so a third of these deaths need no strong drug at all.

What the village cannot do is cure, and the record of those who sold a cure is long. Laetrile failed its trial (Moertel 1982). Black salve burns healthy skin, destroys noses and eyelids and leaves the cancer under the scab (Eastman 2014).

The other thing a village can do is tell the truth as the person wants it. When doctors in southern Europe, Japan and Africa were surveyed, fewer than 40 in 100 told patients their diagnosis (Holland 1987). When patients with cancer were asked, 87 in 100 wanted all the information (Jenkins 2001). Between those two figures lies a simple practice: ask the person first.

A neighbourhood in Malappuram

In 2001, in Malappuram district in Kerala, Suresh Kumar and the people around him began the Neighbourhood Network in Palliative Care. Its volunteers were not helpers to a clinic. They owned the units, raised the money locally, found the sick in their own streets, visited them and called in a nurse or doctor for what they could not handle. Each gave at least 2 hours a week. A first visit ran 90 to 120 minutes and later ones 30 to 45. By Kumar's account in 2007 there were more than 60 units covering more than 12 million people. On 15 April 2008 the state made palliative care part of primary health care and the duty of local government (G.O. 109/2008), the first state anywhere to do so as far as the library could find. Morphine reached Kerala's dying at least 4 times as readily as the Indian average, and no misuse was found (Rajagopal, Karim and Booth 2017).

Elsewhere the world's morphine went where the money was. In one count of 2017, 3.6 per cent of it went to low and middle income countries, and 0.03 per cent to the poorest (Knaul 2017). Kerala's lesson cuts both ways. The neighbours did the visiting, but trained nurses, supervising doc-

tors and a legal drug supply stood behind them. A village that copies the visits without the supervision and the drug has copied the part that does not work alone.

The last days

The last days have signs. In two palliative units in the United States and Brazil, a team recorded 10 bedside signs every 12 hours in 357 people with advanced cancer, of whom 203 died (Hui 2014, 2015). A handful of signs found with eyes and fingers alone meant death within 3 days in more than 95 of every 100 people who showed them: no pulse at the wrist, breathing that moves the jaw, breathing that swells, stops and starts again, urine falling away, and the rattle. Their absence meant nothing.

The commonest distress of the last two weeks is breathlessness, in 57 of 100, with pain, the rattle and confusion each in about half (Kehl 2013). Cool air helps. Fifty breathless patients held a small fan to the face for 5 minutes and then to the leg, and breathlessness eased more with the face (Galbraith 2010). The leg is what makes the trial useful: the effect is cool air on the face, not attention. Oxygen did no better than room air in 239 patients (Abernethy 2010). A folded leaf or a stiff card does the fan's work.

The rattle is fluid in the throat of someone too deeply asleep to clear it. In the one trial that qualified for review, no drug beat a dummy (Wee and Hillier 2008), and nothing shows it distresses the person, who is usually unconscious by then. It distresses the family, and the care is for them: the person on their side, and the plain words that this is not drowning.

Thirst at the end is a dry mouth. In 129 hospice patients, a litre of fluid a day given by needle relieved nothing that 100 ml did not (Bruera 2013). A wet cloth every half hour to two hours, with fat on the lips, does more.

The best news here is a negative trial. In 2017, 247 people with delirium in 11 Australian palliative services were given risperidone, haloperidol or a dummy for 3 days, and the causes were sought in every group. Both drugs did worse than the dummy, and those on haloperidol died sooner, with a hazard ratio of 1.73 (Agar 2017). What helped was the search: a full bladder, a packed bowel, pain that cannot be spoken, thirst, a new infection, a dark strange room, too many people, withdrawal from drink or tobacco, and the opium itself. Vivid dreams, visions and sudden jerks are too much

opium, arriving before the breath slows. The answer is less of it, with the light by day, a known face, water at the lips and sleep at night.

After the breath

After the last breath the warmth goes out of the body over hours, and the care passes from the person to the household. The commonest fear about the dead is that they spread disease, and for ordinary deaths it is wrong. Karl Western, writing in the Pan American Health Organization's manual of 2004, gave the line to carry: "a dead body is the result of an epidemic, not its cause." Disaster victims die of injury, drowning or fire, and most organisms in a body do not outlast it by more than about 48 hours, HIV and Ebola excepted (ICRC 2016).

The exception is the death from certain fevers. In Kissidougou, Guinea, a man who had died of Ebola was buried on 4 December 2014 by about 100 people who washed, touched and kissed the body. Eighty-five confirmed cases followed in six villages, and 63 people died. Only 18 of the 85 had touched the body. The other 67 had touched only other mourners (Victory 2015). For these few diseases the gathering carries the fever as surely as the body, and chapter 15 holds that burial.

Two old habits around the grave rest on nothing. Six feet comes from London's plague orders of 1665, a decree with no reason given, which later lapsed. A metre of earth over the body is what the modern manuals ask (Hoffman and Healing, ICRC 2016). Lime is the other. The 2004 manual called quicklime almost certainly necessary after a mass disaster, and the 2016 field manual reversed it. In Belgium six pigs were buried with no lime, slaked lime or quicklime, and both limes slowed decay over months (Schotsmans 2012). A grave needs depth, distance from water and a name in a book. It does not need lime.

The Honest Broker's Account

NU-06 carries the dying, and can be trusted where it reads trials: the delirium trial, the fan, the oxygen trial and the fluid trial were read at least as full abstracts. ME-05 carries the drug, gives no process, read WHO and MSF directly and says what it did not read, Sertürner's 1817 paper among

them. CH-06 read the untreated series mostly through abstracts and a book chapter. NU-07 read the 2016 field manual and is frank that its distances from water are its own inference.

Four places are thin. The first is the hold line for opium. No report read a primary source that sets 12 breaths a minute for holding a dose in palliative care, and ME-05 holds at 10. The Bench prints 12, 10 and 8 as three actions, and holds the next dose below 12 by the owner's ruling. The second is that nearly all the evidence on the last days is about cancer, while most deaths after the Fall will come from infection, injury, childbirth, hunger and age. The third is the claim that the dying do not become addicts. No report measured it in the dying. What exists is Kerala's access without misuse and the general record on dependence, and the chapter says no more than that. The fourth is the hospice record itself. Zech, and the two studies finding that sedation in the last days did not shorten life (Sykes and Thorns 2003, 237 deaths, Maltoni 2009, 518 patients), were written by services grading their own patients. The turning rule for the last hours and the time a body may be kept rest on practice and manuals, not trials, and are graded so.

Known errors are named here and not repeated. ME-05's brief gave a wrong ratio between opium tincture and paregoric, and ME-05 corrects it to 25. ME-05's brief also put the plot yield too low. IN-13 and HY-07 tell burial teams to put lime or ash in the grave and give 50 metres from water as the standard. NU-07 rejects the lime and treats 50 metres as the floor for a well, not the aim. The 2004 manual's quicklime and dry ice advice was reversed in 2016. NU-07's brief named the wrong editor of that manual, and NU-06's brief gave the wrong journal for Kumar's 2007 paper. A much-quoted 1980 letter is still cited as proof that pain patients almost never become addicted. It reported on hospital inpatients and showed nothing of the kind (ME-05). This chapter's brief gave three days before burial in the cold, which no report supports, so the clock line carries NU-07's figures. The brief dates Sertürner's work from 1804, and ME-05 from 1803. I supplied the weight bands on the morphine card, read from ME-05's weights.

The turn to the present

The hospital took the dying out of the house, and the knowledge of how dying goes went with them. A family learned the rattle from a nurse's explanation, or never heard it at all. Asked where they wanted to die, between 49 and 100 in every 100 people in the surveys said at home (Higginson 2000). In England a care pathway written to make hospital dying humane was abolished in 2013 after a review titled More Care, Less Pathway (Neuberger 2013). The title said it. Meanwhile the world's morphine stayed near the hospitals.

Who will sit with the dying when there is no ward to send them to? Kerala answered: the neighbours, given training, a nurse to call and a locked supply. The village will need all three. The care itself is the oldest there is. Cool air on the face, a wet cloth at the lips, a dose by the clock and a count of the breaths before it. Then, when the counting stops, a warm hand on a body that is cooling, and the washing.

Now count.

AT THE BENCH

31.1 See: the signs that death is near, and the decision not to send

Never call a person dying before checking the bladder, the bowel, the pain and the drink. Instead: check those four first.

Look twice a day and write what you find.

Late sign	How to find it
No pulse at the wrist	2 fingers on the thumb side, 30 seconds
Breathing moves the jaw	Watch the chin
Breathing stops and starts	Count the pauses in 1 minute
Urine falling away	Less on the cloth each shift
The rattle	A wet sound with each breath

Any one: death is probably 3 days away or less. None: it means nothing.

1. Ask the person, while they can answer, what they want to know, where to be, and who to tell.
2. They cannot answer: the family and the healer decide together.
3. Say it plainly: "The illness will not turn. We will keep them comfortable. Someone will stay."
4. Write the decision on the chart, with who made it and the date.
5. A dying person asks to die: stay, listen, ask what is worst now. Treat that tonight. Tell the healer today. Chapter 30.

Never tell a family that nothing more can be done. Instead: say what will be done, and that nobody will be left alone.

Danger sign: new fever, new confusion, a hard belly or no urine for 12 hours, when death was not expected.

- **Help in time.** Send word now. Keep the mouth care and turns going.
- **Help too late.** Look for the cause: bladder, bowel, infection (24.8, 31.4).
- **No help at all.** Comfort by 31.2. Tell the family what the sign means, and who will stay.

Grades: late signs for death within 3 days B. Asking the person first: no grade in the library.

Rungs. Hands: look, count, ask. Hearth: the chart. Dispensary: the healer's visit. Refuse: deciding for a person who can still answer.

31.2 Do: comfort by the clock

Comfort round.

Every	Do
30 to 120 minutes, awake	Wet the mouth with a clean cloth. Wipe crusts. Fat on the lips
2 hours	Turn to the other side on rolled cloth. Look at spine base, heels, elbows, ears
4 hours	The dose, if one is given (31.3)

Every	Do
Each shift	Feel above the pubic bone for a full bladder
Breathless	Card or fan 15 cm from the face, 5 minutes or more. Window open. Sit up, leaning forward
The rattle	On the side, head slightly down. Stop any fluid by tube or under the skin

1. In the last hours, if turning hurts more than it helps, turn less and pad more.
2. Fluid by tube or under the skin in the last days: no gain (24.5).
3. Tell the family: "This is fluid in the throat. They are too deeply asleep to clear it. It is not drowning."

Never push food or drink into a mouth that cannot swallow. Instead: wet the mouth.

Never put a hot bottle against a dying person's skin. Instead: blankets, a warm room, a hand.

Danger sign: breathlessness that the fan, sitting up and an open window do not ease.

- **Help in time.** Send word. Keep the face cool and the person upright.
- **Help too late.** Opium by 31.3, at half the start dose for the band.
- **No help at all.** Say that nothing is held back. Stay. Keep the air moving across the face.

Grades: fan to the face A. Mouth care C. Oxygen over room air: no gain.

Rungs. Hands: fan, turn, mouth. Hearth: card, cloth, fat, water. Dispensary: the opium of 31.3. Infirmary: shallow suction. Refuse: forcing food or drink.

31.3 Do: opium and morphine, with the breath as the ceiling

Without opium or morphine, the ladder stops at chapter 26.

1. One named person holds the chest, the book and the key. A second checks.

2. Work every dose twice, with two people.
3. One strength only: 1 mg of morphine in 1 ml, by oral syringe. Unknown strength: not used.
4. Weigh every child. No scale: no opium for a child.

Never give opium or morphine to these: a baby under 1 year, the drowsy, the drunk, a head injury, an asthma attack, a child with diarrhoea or dehydration. Instead: comfort by 31.2, and send to the district.

Never measure by drops or a spoon. Instead: an oral syringe marked in ml. Drops vary 1.7 times in size.

Strengths, against the adult start dose.

Bottle	Morphine in 1 ml	Adult 40 kg and over, start, every 4 hours	Use
Morphine solution	1 mg	5 ml	The village strength
Opium tincture	about 10 mg	0.5 ml	District only. Never a child
Paregoric (US)	0.4 mg	12.5 ml	25 times weaker. Never beside tincture

Morphine solution, 1 mg in 1 ml. Start dose by weight.

Weight	Start dose	ml	Every	Ceiling
Under 10 kg, or under 1 year	None	none	none	District only
10 to under 15 kg	1.5 mg	1.5 ml	4 hours	5 mg a dose
15 to under 20 kg	2 mg	2 ml	4 hours	5 mg a dose
20 to under 30 kg	3 mg	3 ml	4 hours	5 mg a dose
30 to under 40 kg	4 mg	4 ml	4 hours	5 mg a dose

Weight	Start dose	ml	Every	Ceiling
40 kg and over	5 mg	5 ml	4 hours	The breath
40 kg and over, frail, over 70 or wasted	2.5 mg	2.5 ml	4 hours	The breath
40 kg and over, little urine or swelling	1 to 2 mg (ME-05) or 2.5 mg (NU-06)	1 to 2 ml or 2.5 ml	6 to 8 hours (ME-05) or 4 hours (NU-06)	The breath

A child's dose rises by half a day at most. The adult start is disputed: WHO 5 mg every 4 hours, MSF 10 mg. NU-06 and ME-05 both start at 5 mg. The owner rules which the book prints. The kidney row stands both ways, unsettled.

5. Count the breaths for a full minute, unseen, before every dose for 48 hours. Then once a shift.
6. Give the dose by the clock, every 4 hours, not when asked.
7. Pain still there 1 hour after a dose: one rescue dose, equal to the regular dose.
8. Each morning, add the last 24 hours of doses, rescues included. Divide by 6. That is the new dose.
9. Start a laxative on day 2: water, fruit, bran, prunes (24.8).
10. Write every dose: date, time, mg, ml, reason, giver, checker.
11. Vivid dreams, visions or sudden jerks: too much. Lower the dose, never raise it.
12. On it 7 days or more and no longer needed: step down, never stop at once.

The breath lines, adult, counted for a full minute. Three actions, not three thresholds.

Breaths a minute	Action	Library
Under 12	Hold the next dose. Count again in 1 hour	NU-06, ME-14, TR-15

Breaths a minute	Action	Library
Under 10, or will not rouse	Wake them. Hold all doses. Wait at the bed. Not rousing: breathe for them, 10 a minute	ME-05, MI-06
Under 8	Naloxone, if any is held	WO-11

Read as three actions, the lines do not conflict (SY-12). Read as rival lines for holding a dose, the library gives 12 (NU-06) and 10 (ME-05), and no report read a primary source for 12 in the dying. The book holds the next dose below 12 and breathes for them below 10, by the owner's ruling of 18 October 2026. The library gives no breath lines for a child. A child who will not rouse gets no dose, and rescue breaths at 20 to 30 a minute.

Danger sign: sleep you cannot wake them from, pinpoint pupils, slow or snoring breaths.

- **Help in time.** Shout, shake, count. Breathe for them: adult 10 a minute, child 20 to 30. Naloxone if held, by its label, in small repeats. Send word.
- **Help too late.** Breathe for them in relays of 1 hour. Hold all doses. Watch 4 hours or more after they wake: naloxone wears off in 20 to 60 minutes.
- **No help at all.** Breathe for them in relays until they rouse. Set the bottle aside. Tell the family what happened. Write it in the book.

Grades: by the clock and by mouth B. Laxative from day 2 B. Rescue breathing in overdose B.

Rungs. Hands: count, wake, breathe for them. Hearth: syringe, book, clock. Garden and still: the poppy is the owner's decision, and this book gives no method (chapter 34). Dispensary: one strength, a chest with 2 keys, a monthly count. Infirmary: issues the one strength, holds the tincture. Hospital: morphine by injection. Refuse: drops, spoons, guessed strengths, poppy drinks.

31.4 Do: the confused or restless dying person

Never give haloperidol or another antipsychotic to a confused dying person. Instead: find the cause.

1. Bladder. Feel above the pubic bone (24.8).

2. Bowel. No stool for 3 days: 24.8.
3. Pain that cannot be said. Watch the face as you move them.
4. Thirst. Wet the mouth.
5. Infection. Fever, cough, burning urine.
6. The room. Too dark, too strange, too full.
7. Withdrawal from drink or tobacco.
8. The opium. Dreams, visions, jerks: lower the dose (31.3).

Then: light by day, dark at night. One known face. Glasses and hearing aid in reach. Water at the lips.

Danger sign: distress with no cause found after all 8 checks.

- **Help in time.** Send word. Keep the room quiet and one known person present.
- **Help too late.** Repeat the 8 checks each shift. Keep the opium at the lowest dose that holds the pain.
- **No help at all.** Someone stays, in low light, with a known voice. Any sleep given on purpose is decided by 2 people and written first.

Grades: correcting the cause A. Antipsychotics in the dying X.

Rungs. Hands: the 8 checks. Hearth: light, quiet, one face. Dispensary: the opium lowered. Infirmary: a nurse at night. Refuse: antipsychotics, restraint, more opium for new confusion.

31.5 Do: cancer at home: the wound, the bowel, the bleed, the child

1. Show the healer a growing lump, a sore that will not heal, unexplained bleeding, or falling weight.
2. Look again at 3 weeks. Growing: send if any send is possible.
3. A white pupil in a child: send at once. It can still be cured.
4. A wound that smells: wash with boiled, cooled water. Honey on clean cloth over it. Change when soaked.
5. A blocked bowel: sips only, the mouth wet, opium for pain. Accept some vomiting.
6. A dying child: weigh, then 31.3. A parent holds the child. What the child is told.

7. A child with leukaemia: no injection into muscle, no aspirin, a soft toothbrush.

Never put black salve or any burning paste on a lump. Instead: clean the wound, honey on cloth, and 31.3 for pain.

Danger sign: a sudden heavy bleed from a wound, the mouth or the bowel.

- **Help in time.** Press on it with folded cloth. Send word.
- **Help too late.** Dark cloths to the wound and under the person. Stay. A sleep placed ready beforehand is the owner's.
- **No help at all.** Dark cloths, so the family does not see red. Hold the hand. Stay to the end.

Grades: honey or silver on the wound A, low. Care of the blocked bowel without a tube B. Charcoal over the dressing D. Black salve and the sold cures X.

Rungs. Hands: the 4 signs. Hearth: honey, boiled water, cloth. Dispensary: opium, salvaged metronidazole for the smell (chapter 32). Infirmary: the lump cut out. Refuse: salves, laetrile, the bicarbonate cure.

31.6 Do: washing and burying the body

Never wash a red-flag death with bare hands. Instead: chapter 15's burial, and no meal.

Check chapter 15's red flags first. Bleeding from any opening. A second fever death in 3 weeks. Death from watery diarrhoea. Swollen glands. Lice with a rash. Pustules. Jaundice. A black painless sore.

An ordinary death:

1. In the first 2 to 4 hours, close the eyes. Tie the jaw with a cloth over the head. Straighten the limbs.
2. Cover cuts on your hands. Wear gloves or oiled cloth.
3. Two healthy adults wash with warm water and soap, by the family's rite. Pad under the hips.
4. Shroud the body. Burn or boil soiled cloth. Wash your hands with soap for 20 seconds.

5. Keep the body in the coolest shaded room, raised off the floor. No loose ice.
6. Bury within 48 hours at most, within 24 in hot weather.

The grave.

Grave	Figure
Length and width	About 2 m by 0.8 m
Depth	1.5 to 1.8 m. 2 m after a feared fever
Earth over the body	1 m at least
Wet-season water within 2.5 m of the surface	Choose higher ground
From a stream or spring	30 m at least
From a drinking well	50 m at least, never uphill. Aim for 250 m for a new cemetery
From a field drain	10 m at least

Where the burial ground goes is chapter 13's, and the owner's.

Never put lime or ash in a grave. Instead: depth, distance from water and a marker.

Never dig a grave alone. Instead: two diggers. Below 1.2 m in loose soil, step or slope the sides.

7. Keep the spoil half a metre back from the edge. Climb out if the walls crack.
8. Fill by hand, mound the top, and mark it.
9. Write the death and the grave's row and number in the book (chapter 36). The mourning is chapter 29's.

Danger sign: a red-flag death.

- **Help in time.** Send word before anyone gathers. Chapter 15's burial.
- **Help too late.** No bare skin touches the body. Wrap it in its bedding. Bury the same day, 2 m deep. No meal. List everyone who came.
- **No help at all.** The same. Watch every mourner for fever from day 2 to day 21.

Grades: keeping an ordinary body 24 to 48 hours C. 1 m of earth over the body C. Safe burial after a fever death B. 250 m from wells D. Six feet as a rule D. Lime or ash X.

Rungs. Hands: close, tie, wash, bury. Hearth: soap, cloth, spade. Dispensary: gloves. Infirmary: chapter 15's burial team. Hospital: cold rooms. Refuse: lime, ash, mass graves, burning against the family's will.

If it goes wrong

1. **A dose too strong or too fast.** Looks like deep sleep, pinpoint pupils, slow snoring breaths after a first dose or a new bottle. Cause: tincture taken for a weaker bottle, drops, a guessed strength, doses stacked too close. Do: the danger sign in 31.3, and set the bottle aside.
2. **A fixable cause called dying.** Looks like new groaning, pulling at sheets, restlessness. Cause: a full bladder or packed bowel, read as pain and given more opium. Do: the 8 checks in 31.4, and lower the opium.
3. **The carer breaks on the third night.** Looks like missed doses, a blank book, shouting. Cause: one person alone. Do: a rota of 2, and the carer sleeps today.

NUMBERS TO CARRY

- 12, 10, 8: hold the dose, wake and wait, naloxone if any. Three actions, not three thresholds.
- 5 mg every 4 hours to start an adult, 2.5 if frail. Breaths counted before every dose for 48 hours.
- 25 times: opium tincture against paregoric.
- A laxative from day 2.
- 15 cm: the card from the face. 30 to 120 minutes: the mouth wetted.
- 5 late signs: probably 3 days or less.
- 48 hours at most before burial, 24 in heat. No lime.
- 1 metre of earth over the body. 30 m from a stream, 50 from a well.

THE LIBRARY

NU-06 Palliative care and the good death: pain, breathlessness, comfort and the ars moriendi. NU-07 Care of the body after death and the public health of burial. CH-06

Cancer without oncology: what can be known, what can be done, and comfort. ME-05 Opium poppy, morphine and pain: dose, dependence and the ethics. ME-14 Poisons, overdoses and the antidotes you can make. WO-11 Local and regional anaesthesia and the old analgesics. MI-06 Withdrawal and addiction when supply ends. SY-10 The harm register. SY-12 What the library could not find. All are on the website. The last breath is warm too.

PART NINE

The Shelf, the Garden and the Village

CHAPTER 32

The Shelf

A year's medicine for 300 people weighs 140 kilograms and fits in a cubic metre. Most tablets outlive their date by years in a cold dry place. A moved decimal kills in an hour. The two keys are the whole of stewardship.

OPENING

Somewhere in the house there is a box of medicine. Fetch it, and set it on the table. Take out one strip of tablets and turn it over. On the edge of the foil, or on the end of the carton, a date is pressed into the metal or printed in small ink. Read it aloud. Then count the tablets left in the strip, and write the number on a scrap of paper with the day beside it.

Most households have never done this. The box is filled from outside and emptied by need, and nobody keeps the score, because there has always been more down the road. The strip in your hand came from a factory you will never see, through a wholesaler, a van and a counter. Every link in that chain counted it. None of them will count it again.

After the Fall there is no more down the road. Every tablet in the village is one of a known number, and the number only goes down. The scrap of paper you have just written on is the first line of a ledger, and a ledger is a memory. It remembers what the shelf cannot: how many there were, who took them, for what, and how many are left for the next child who cannot breathe.

Look at the strip once more. The tablets are small, dry and light. A year of them for a whole village would fit in a trunk. That is the good news of this chapter, and it is real. The hard news is that a tablet is only as safe as the sum done before it is given, and as safe as the hand that holds the key.

Put the box back where you found it, somewhere dry and out of a child's reach. Keep the paper beside it.

THE STORY

The policeman and the bedpan

In the winter of 1940, an Oxford policeman named Albert Alexander had a sore on his face that would not heal. The story that it began with a rose thorn is told everywhere and doubted by the historians. What is certain is what followed. The infection spread through his blood into his lungs and the bone of his arm. He was forty-three, and he was dying in the ordinary way of that time, in a hospital that could do nothing but watch.

On 12 February 1941 he became one of the first people given penicillin. Howard Florey's team in Oxford had grown the mould in whatever would hold broth: ceramic vessels, biscuit tins, bedpans. The brew was weak, about 4 units in each millilitre, and the laboratory reckoned it needed 2,000 litres of culture fluid to treat one person with infected blood. Within a day Alexander was better. After five days he was far better. Then the drug ran out.

The team had seen that most of a dose leaves the body unchanged in the urine. So they collected his urine, carried it back across Oxford, took the penicillin out of it and gave it to him again. It was not enough. He relapsed and died on 15 March 1941. His whole course came to 220,000 units. A historian of surgery called that "today, a small single injection".

Through those weeks the Oxford team kept a ledger. They wrote how many units had been made, how many given, how many recovered from the bottle by the bed. The ledger was their memory of what was left, and it told them the date of a death before it came. They could read the day the last dose would go, and they could not make more in time. Everything else in this chapter follows from that page.

The basement in Stalingrad

The other side of the war gave a different lesson. Zinaida Yermolyeva was a microbiologist in Moscow, and in 1942 she went to Stalingrad, where cholera threatened a city under siege. The treatment of the day in the Soviet Union was phage, a virus that kills bacteria, and it came by train from Moscow. When bombers destroyed the train, she made phage in a basement in the city. The library found no figure for how many people received it.

A later legend has her making penicillin in that siege, from a mould scraped off the wall of a bomb shelter. The archive tells it otherwise. In 2019 the historian E. V. Sherstneva read the declassified papers. Penicillin entered Yermolyeva's work plan only in early 1943. At a joint session in Moscow on 5 February 1944, with Florey present, Yermolyeva said openly that her laboratory had turned to penicillin after his work was published. Her mould, which she called krustozin, was real, and her team built a line in a little over a year.

It was a great feat, and it was small. Two Moscow plants began making penicillin in late 1944. Their combined output was 500 million units a year, which Sherstneva reckoned enough for 300 to 400 patients. A district of 3,000 people today would need about a fifth of that every year. In 1945 the country imported about 10 billion units and made 120 million at home.

Making a modern drug takes a nation, not a siege, and not a village. A village can make soap, spirit and a good tea, and chapter 33 is about those. It cannot make an antibiotic to a known strength, and broth that has not been purified is never injected. In 1937 an American firm dissolved a good drug in a solvent that was a poison, and 105 people died of the solvent, 34 of them children. What the village has is what was made before, and what it finds.

What the date means

The date on the strip in the Opening is a promise from the maker, not a cliff. The best evidence came from the United States military, which held large stores of drugs for emergencies and did not want to throw them away. Its Shelf Life Extension Program tested lots past their dates over

about twenty years. In 2006 Lyon and colleagues reported on 3,005 lots of 122 products. Of those, 88 in 100 were extended by at least a year, and on average by 66 months. Lots of the same drug behaved differently, and only regular testing showed which were still good. In the end about one lot in six failed.

In 2012 Cantrell and colleagues tested eight products found unopened in a pharmacy, 28 to 40 years past their dates. Of 14 active ingredients, 12 still held at least nine tenths of their strength. Aspirin had almost gone, and an old bottle of aspirin smells of vinegar because it is breaking down. Adrenaline in an ampoule held about four fifths of its strength four years past its date. A dry tablet, sealed, cool and dark, mostly outlives its label by years.

The exceptions matter more than the rule. Oxytocin, the injection that clamps the womb after a birth, often fails before any collapse. In 2016 Torloni and colleagues found that nearly half the samples tested worldwide held too little drug. At four to eight degrees it lost nothing in a year. At twenty-one to twenty-five degrees it lost 3 to 7 in 100 a year, and at thirty degrees 9 to 19. Misoprostol, the tablet that does the same work, keeps well, but tablets from damaged blisters lost nearly half their drug. Unopened insulin keeps about six months at twenty-five degrees and two at thirty-seven, and frost destroys it.

One story made people afraid of old medicine. In 1963 Frimpter and colleagues in New York reported three patients, a woman of fifty-four and two children of thirteen, who had taken old tetracycline that had broken down. Their kidneys leaked sugar, salts and protein, and at first they were thought to be diabetic. All three recovered in about a month. A second report followed in 1964. From those cases grew the belief that expired drugs turn to poison. For nearly everything else the record shows the reverse. Old plain tetracycline is the known exception, and doxycycline, its cousin, is built differently.

For a village the record means three things. Dry tablets in their blisters are worth carrying home whatever their date, and are judged by the eye, the nose and the result. Liquids, eye drops, opened vials and anything that has frozen are not. And cool is worth nearly as much as a fridge for most of the shelf. A cellar two metres down sits near the year's average temperature, ten to thirteen degrees in a temperate valley, and keeps the damp out if the boxes stand clear of the walls. Heat ages a tablet, and water ruins it.

The moved decimal

A full shelf does not make a safe village. Most deaths from medicine in the modern record were not caused by the drug. They were caused by arithmetic. One children's hospital reviewed five years of its reports and found 252 tenfold errors among 6,643, and 22 of them harmed a child. The commonest drug was morphine. The causes were a sum done wrong, a decimal point lost, a zero misread. Written as 15.0 mg, a dose read without its point becomes 150 mg.

The same error lives on old labels. Opium tincture holds 10 mg of morphine in each millilitre. Paregoric, a weaker preparation with an overlapping name, holds 0.4 mg. That is a 25-fold difference. The American regulator received eight reports of the two being confused, and three of the patients died. In one near miss a baby thirteen days old would have been given about 42 mg a day instead of 1.68 mg. Someone, that time, read the order twice.

The measure itself lies. A study in Greece in 2010 found household teaspoons holding anything from 2.5 to 7.3 ml. In Minnesota in 2000, 92 in 100 people measured a dose correctly with an oral syringe, and far fewer with a spoon. And kindness kills as surely as carelessness. In one series of 47 children given paracetamol by carers who meant only to help, at doses from 60 to 420 mg for each kilogram a day, 24 of the 43 whose fate was known died.

The old poisons laws knew the answer before the studies did. In England in 1923 the seller of a scheduled poison wrote each sale in a book and the buyer signed it. Signed orders were kept for two years. One book, one line for every dose, and a second person who reads the sum back. That is the whole of the method, and it costs only paper.

The library draws two more rules from the record. The first is that a village holds one strength of each dangerous drug and no more, so that no bottle can be mistaken for its cousin. Insulin is the sharpest case, because one strength drawn into a syringe marked for another gives two and a half times the dose. The second is that when a person sickens after a dose, the carer assumes an overdose until the sum has been done again. Then the family is told the truth, whatever the sum shows.

The weight of a year

The best yardstick for a village is the kit that agencies fly into disasters. The 2017 emergency kit of the World Health Organization serves 10,000 people for three months and weighs about 1,150 kg. Its basic part, for 1,000 people for three months, weighs 38 kg. Scaled to 300 people for a year, with a share of the supplementary part, it comes to about 140 kg in less than a cubic metre. A second report, counting drugs and not their packing, puts the village shelf under 60 kg, one dry trunk. Either figure goes on one cart in one load.

That kit carries 3,600 amoxicillin tablets for such a village. At 20 to 30 tablets a course, that is 120 to 180 courses. The library's own count of need is 40 to 80 courses a year, if the village spends only on the illnesses that kill. A village of 300 sees about thirteen pneumonias in its children each year. The kit is generous, and generosity tempts.

Antibiotics have a cost paid later. In Gadchiroli in India, village health workers gave amoxicillin to children with pneumonia, and the share who died fell from 13.5 in 100 to 0.8. That is what the drug is for. Given without a sign, it buys nothing and breeds resistance. In one trial of mass azithromycin, the genes of resistance were 7.5 times commoner in the treated villages. Where doctors asked patients to wait two days and return only if worse, antibiotic use fell from 93 to 31 in 100, with no more complications. About a third of antibiotics given are not needed.

The library divides the shelf into three. A household keeps about ten things that are safe in most hands, such as paracetamol, rehydration salts and dressings. The village store holds the rest, three months of it open on the shelf and the remainder sealed. The district holds the injections and the drugs that need a trained hand. Antibiotics, iron and anything that slows the breathing stay out of houses.

Shelves are also lost. In Malawi about 35 in 100 of medicines left the system between the central store and the clinic. And the shelf can kill a child who reaches it. In the United States, child deaths from iron tablets fell from 29 to 1 after iron was sold in single-dose packs. The drug was the same. The pack, the lock and the count made the difference. Keeping costs little: a lock, a thermometer, paper, and an hour set aside each week to count.

The Honest Broker's stocktake

The library is strong on what keeps and weak on how long a salvage window lasts. SY-09 says plainly that nothing measures it, and grades the seven days D. The 140 kg is OR-06's arithmetic on the WHO kit, grade C, and FO-11's 60 kg counts drugs only.

Four errors must not travel. ME-09's salvage table prints a ceiling for dental lidocaine with adrenaline more than twice the book's. WO-11, SY-10 and SY-12 set the lesser of 3 mg/kg and 200 mg, and ME-09 is to be corrected before print, so its figure is not printed here. ME-06's card points every child's paracetamol row to an aspirin method, which chapter 6 named. The paracetamol here comes from IN-02 and SY-10. OR-06 credits FO-11 with a cellar life of two to four years for oxytocin, but that claim is ME-09's, and FO-11 says the opposite. And the brief calls the tetracycline story retracted. IN-05 holds it real for old plain tetracycline, finds no case with doxycycline, and could not confirm the survival books' claim that a citric acid filler caused it.

Oxytocin is printed both ways at 32.3. FO-11 discards oxytocin kept without a fridge. OR-06 and SY-12 keep it, weaker, for salvage. Both rest on one review, and no study tested a cellar at twelve to fifteen degrees. Nor did the library find a shelf life for urine or sugar strips.

The chapters disagree on several ceilings, and 32.7 prints both figures. Amoxicillin only looks like one: 40 mg/kg a dose for child pneumonia in chapter 4, 50 for the young infant in chapters 4 and 11 and for the starved child in chapter 7, 25 for a tooth in chapter 27, each its own indication. Ibuprofen's adult day is 1,200 mg in chapter 26 and 2,400 in chapter 20. The iron poison line is 20 or 60 mg/kg. The adult morphine start is 5 or 10 mg. SY-10 leaves adrenaline off its one-person list, because its harm is delay, where the brief puts it on. SY-10 lets the village healer give lidocaine, where chapter 23 allows only a healer trained at the infirmary. The brief's pool shop and brewery are not on the library's route. Who holds the keys, the library leaves to the village, and so does this chapter.

The turn to the present

Until the Fall, nobody in a village counted medicine. The pharmacist counted, and the wholesaler behind her, and a machine behind him that

ordered more before the shelf was bare. The date on the carton was a rule for throwing away, and good drugs went into the bin by the tonne, while the same drugs were short in places where the bin was a luxury. The fridge hummed in the back room, and nobody asked what would happen when it stopped. The tenfold error was caught by a pharmacist who read the prescription twice, and the parent never knew it had been made.

That hid three things. It hid that the date is mostly a promise and not a cliff. It hid that every dose was checked by a second person, because the second person was invisible. And it hid that a shelf is shared, so that one family's spare course is another family's child.

So what does a village do when the people who counted are gone? It counts for itself. It weighs before it doses, it works every sum twice, and it decides together who holds the key. Now the count.

AT THE BENCH

32.1 See: what is on the shelf, and whether it is good

Inspect every item before it enters the store. Quarantine first. Nothing is used until it is in the stock book.

Look	Means	Do
Blister torn, tablets damp, crumbling or stuck	Damp has entered	Discard. Misoprostol from a torn blister: discard
Vinegar smell in aspirin	Aspirin breaking down	Discard
Adrenaline faintly pink	Weakening	Owner's rule only
Ampoule brown, cloudy or with particles	Spoiled	Discard
Vial frozen once	Insulin, toxoid, oxytocin ruined	Discard
ORS packet brown or caked	Spoiled	Discard

Look	Means	Do
Multi-dose vial punctured over 28 days ago	Contaminated	Discard
Old plain tetracycline, brown or past date	May harm kidneys	Discard
Veterinary label with no strength	Unknown dose	Quarantine. Never use

Past date, dry, sealed, right colour: keep. Write “expired, keep” and the date found.

Grades. Dry tablets past date B. Clear expired adrenaline B. Faintly pink D.

Rung ladder. Hands: eyes, nose, the stock book. Dispensary: a lockable dry store, a thermometer. District: the yearly outside count. Hospital: assay of each lot. Refuse: tasting to test.

32.2 Do: the 7-day route

Run it only if the window is open. Water and latrines start the same day (chapter 13).

Never follow a team that is half a day overdue. Instead, wait, and send word along the planned road.

Never put a veterinary item in the human cabinet. Instead, write VETERINARY in red, with its strength.

Day	Where	Take first
0	The village	Name a team of 4 to 6, a route and a return time
0 to 1	Fridges	Insulin, oxytocin, ergometrine, toxoid, vaccines, antivenom. Cool box, never frozen. Log hours above 25 °C

Day	Where	Take first
1 to 2	Hospital pharmacy, theatres	Amoxicillin, gentamicin, ceftriaxone, ketamine, lidocaine, doxycycline, syringes, needles, misoprostol, artemisinins, magnesium
2 to 3	Pharmacies, wholesalers	Tablets in blisters
3 to 4	Dental surgeries	Lidocaine, needles, instruments
4 to 5	Vets, farms	Marked VETERINARY in red
4 to 6	Seed merchant, hardware. Pool shop, brewery	Seed, copper pipe, pressure cooker, lye, bleach, glycerol, thermometers, scale, paper
5 to 6	Surgeries, care homes, households	Only by agreement
7	The store	Inspect, quarantine, log each lot, strength and expiry

Strength traps. Horse ivermectin paste is 18.7 mg/g, 113 mg a syringe, about 38 human tablets. Veterinary oxytocin may be 20 units/ml, human 10 IU/ml. Ketamine comes as 10, 50 or 100 mg/ml. Lidocaine 2% is 20 mg/ml.

The pharmacy, the hospital, the vet, the farm, the pool shop and the brewery are each a different case. A hospital still treating people keeps its drugs. No drug is worth a death on the road. The council decides who gets scarce stock.

Grades. The 7-day window D.

Rung ladder. Hands: a list, a cool box, a red pen. Dispensary: the stock book. District: shares stock between villages. Refuse: taking from the living sick.

32.3 Do: keep it, by kind, at 12 °C

Store at 0 to 30 °C, below 25 °C if possible. Keep humidity at 65% or less. Set shelves 60 cm from walls. Use the first to expire first. Hold 3 months on the open shelf. Seal the rest as reserve.

Kind	Keeps, sealed, cool, dry	Discard when
Dry tablets in blisters	Years past date	Damp, torn, changed
Carbamazepine, levothyroxine, aspirin	Damp ruins them	Doubtful past date
Misoprostol	Intact aluminium blister only	Blister torn
Oxytocin, no fridge	Both ways: discard (FO-11), or keep, use first, weaker (OR-06, SY-12)	Frozen, cloudy
Ergometrine	Worst keeper	Not cold
Adrenaline	About 80% at 4 years past date, 55 to 77% at 11	Brown, cloudy
Naloxone	Over 90% to 27 years	Cloudy
Diazepam ampoules	Holds, yellowing	Cloudy
Insulin, unopened	6 months at 25 °C, 2 at 37 °C	Frozen once
Mixed amoxicillin suspension	7 days	Day 8
ORS packets	36 months. Mixed, 24 hours	Brown, caked
Malaria tests	Per label, likely longer	Past label, if any doubt
Urine and sugar strips	No figure found	Changed colour
Gloves	Latex 3 years, nitrile 5	Sticky, cracked
Vaccines, toxoid	Chapter 17	Frozen once

Never put tablets in a clay pot cooler. Instead, a sealed jar in the cellar.

Grades. Cellar for tablets B. Clay pot for sealed vials C, for tablets X. Oxytocin without a fridge C, disputed.

Rung ladder. Hearth: a dry box. Garden and still: a cellar. Dispensary: a thermometer. Hospital: a fridge. Refuse: the window sill.

32.4 Do: every dose worked twice

Never give a dose worked once. Instead, two people work it apart.

Never measure by spoon or drop. Instead, an oral syringe.

1. Weigh the person. Check the scale with 7 litres of water: 7 kg.
2. Read the label aloud: name, strength, expiry, colour.
3. Each person works the dose alone, on paper.
4. Compare. Any difference: start again.
5. Write mg and ml. No trailing zero: 15 mg, never 15.0 mg.
6. Read it back, then give it.
7. Write who gave, who checked, and the time.

Work every dose twice, with two people.

Worked for 5 weights. Bands from chapters 4, 6, 22 and 23. Ages are rough.

Weight	Paracetamol 120 mg in 5 ml, every 4 to 6 h, 4 doses a day at most	Amoxicillin 250 mg in 5 ml, every 12 h	Adrenaline 1 mg/ml, thigh, every 5 min, 0.5 ml at most	Lidocaine 1%, whole procedure, lesser of 3 mg/kg and 200 mg	Age, only if no scale
6 kg	90 mg, 3.75 ml	250 mg, 5 ml	0.06 ml	18 mg, 1.8 ml	About 3 months
12 kg	180 mg, 7.5 ml	500 mg, 10 ml	0.1 ml	36 mg, 3.6 ml	About 2 years
17 kg	250 mg, 10 ml	750 mg, 15 ml	0.15 ml	51 mg, 5.1 ml	About 4 years
50 kg	750 mg	Adult, by the chapter	0.5 ml	150 mg, 15 ml	Adult
70 kg	1,000 mg	Adult, by the chapter	0.5 ml	200 mg, 20 ml	Adult

The moved decimal, worked. A child of 12 kg needs 7.5 ml of paracetamol syrup. Written 75 ml, it is 1,800 mg. That is 150 mg/kg, the poisoning line of chapter 6.

Adrenaline 0.1 ml written 1 ml is ten times the dose. Lidocaine 2% given as 1% is twice the dose.

The danger sign: drowsy, vomiting, ringing ears or slow breathing after a dose.

- Help in time: stop. Recheck the sum aloud. Treat as overdose: chapter 22, breath lines in chapter 31.
- Help too late: keep the airway open. Keep the label and the syringe. Watch through the night.
- No help at all: on the side, warm, held, spoken to. Tell the family the truth: what was given, how much, and that it was a mistake.

Grades. Oral syringe B. Weight bands A. Second reader C. Kitchen spoon X.

Rung ladder. Hands: two people. Hearth: an oral syringe. Garden and still: a scale. Dispensary: the dose tables. Refuse: spoons, drops, guesses.

32.5 Do: the antibiotic gate

Never give an antibiotic without a written sign. Instead, write the sign first: fast breathing, a hot spreading wound, fever after a birth.

1. The card decides, not the asking.
2. Full dose, short course. Never half a course to stretch stock.
3. Set aside about a third for children.
4. Under 12 months of amoxicillin left: tell the council.
5. Under 6 months: children with danger signs and adults over 60 only.

Amoxicillin, 300 people, 1 year	Courses
Need, card illnesses only	40 to 80
Kit, 3,600 tablets of 250 mg	120 to 180
Weight of 3,600 tablets	Under 2 kg, my estimate at 0.5 g each

Grades. Amoxicillin by the sign A. Waiting 2 days before a doubtful course B. Mass antibiotics X below the district.

Rung ladder. Hands: the breath count. Dispensary: amoxicillin, the card. District: injections. Refuse: antibiotics on request.

32.6 Prevent: the lock, the keys and the one-person list

Keep one store for the village. No antibiotics, iron or controlled drugs in a house.

Never leave one person alone with the inner cupboard. Instead, 2 keys, 2 people.

One named person holds each drug. A second checks every dose.

Held by	Drugs
Healer	Morphine, diazepam, phenobarbital, haloperidol, quinine, adrenaline
Birth attendant	Magnesium sulfate, misoprostol, oxytocin
Healer trained at the infirmary	Lidocaine (chapter 23). SY-10 allows the village healer
District, 2 people	Ketamine, opium tincture, injected antibiotics
Keeper	Poisons, iron, concentrates, pesticides, veterinary stock

Two forms of the key. The book takes Form 1 for the outer cabinet and Form 2 for the inner cupboard, by the owner's ruling of 18 October 2026.

	Form 1 (OR-06, SY-10)	Form 2 (OR-08)
Outer cabinet	Keeper	Keeper
Inner cupboard	A second named person	2 households, unrelated to each other or the healer
Spare	Sealed with the council	Council chair opens after 15 minutes
Change	Count and 2 signatures	Yearly. Nobody over 2 years in 5

The rule: Form 1 outside, Form 2 inside. The keeper holds the outer key, with a sealed spare at the council. 2 households, unrelated to each other and to the healer, hold the inner keys, changed yearly. Adrenaline and magnesium sit in a sealed box outside the inner cupboard. 15 minutes is too long for anaphylaxis or

a fit.

Count the inner cupboard weekly, with 2 people. Count the shelf monthly. Once a year, someone who is not the keeper counts it. A gap over 5% goes to the council.

The locked store also prevents suicide. Keep poisons and pesticides central. Ask plainly, and stay: chapter 30.

Grades. Central store of lethal means A. Single-dose packs B.

Rung ladder. Dispensary: 2 keys, the stock book, the poisons book. District: the yearly count. Refuse: a medicine box in every house.

32.7 The register: ceilings across the book

The full register is chapter 36. Where chapters differ, both figures stand.

Drug	Ch.	Ceiling	Held by
Paracetamol	6, 26	15 mg/kg a dose, 4 doses, 60 mg/kg a day. Adult 1 g a dose, 4 g a day	Healer
Ibuprofen	20, 26	Child 30 mg/kg a day. Adult 1,200 mg a day (26) or 2,400 mg (20)	Healer
Amoxicillin	4, 7, 11, 27	By indication: child pneumonia 40 mg/kg a dose (4), young infant of 7 to 59 days 50 (4, 11), the starved child 50 (7), a tooth 25 (27). Child 1,000 mg a dose. Adult 1 g every 8 h	Healer

Drug	Ch.	Ceiling	Held by
Co-trimoxazole	4, 16	Trimethoprim 4 mg/kg every 12 h, 160 mg a dose	Healer
Metronidazole	12, 27	Adult 500 mg a dose. Child 10 mg/kg	Healer
Doxycycline	14, 16	Adult 200 mg a day. Child 4 mg/kg, 100 mg	Healer
Gentamicin, ceftriaxone	10, 16	Gentamicin 5 mg/kg once a day. Ceftriaxone 1 g, child 50 mg/kg	District
Misoprostol	9	600 µg by mouth once. Never 800 µg after 600	Birth attendant
Oxytocin 10 IU/ml	9	10 IU into the thigh, once below the district	Birth attendant
Tranexamic acid	9	1 g, again at 30 min. 2 g in all	District
Magnesium sulfate 50%	10	10 g, then 5 g every 4 h. Hold below 16 breaths or 30 ml urine an hour	Birth attendant
Adrenaline 1 mg/ml	22, 25	0.01 ml/kg, 0.5 ml a dose, every 5 min	Healer
Lidocaine 1%	23, 26	Lesser of 3 mg/kg and 200 mg. 20 ml	Infirmary-trained healer
Ketamine 50 mg/ml	23	1 to 2 mg/kg in a vein over 60 s	District

Drug	Ch.	Ceiling	Held by
Morphine 1 mg/ml	31	Adult start 5 mg (WHO) or 10 mg (MSF). Child 5 mg a dose. None under 1 year	Healer
Opium tincture	31	District only, never a child. 25 times paregoric	District
Diazepam rectal	10, 25	0.5 mg/kg. 10 mg under 12 years, 20 mg after. 2 doses	Healer
Phenobarbital	25, 30	Never over 15 mg/kg in withdrawal	Healer
Haloperidol	30	15 mg a day (MSF English) or 20 (MSF French). Use 15. Old 5 mg	Healer
Quinine	6	10 mg/kg every 8 h, 600 mg a dose. Kills from 1.5 g adult, 900 mg toddler	Healer, locked
Insulin	25	One strength in the village	Healer with patient
Ephedra	25	1.8 g a day (UK) or 3 to 9 g (Chinese practice)	Healer
Iron	7, 8	Child 3 mg/kg once a day. Poison from 20 or 60 mg/kg	Keeper
Vitamin A	6, 8	200,000 IU, then none for 4 to 6 months. Pregnancy 10,000 IU a day	Healer

Drug	Ch.	Ceiling	Held by
Charcoal	22	1 g/kg, 50 g, within 1 h	Healer
Ivermectin	14, 16	200 µg/kg. Never under 15 kg	District
Clove and essential oils	27, 33	Skin only. 5 ml can kill a child	Keeper
Foxglove	34	Never	None

If it goes wrong

1. **The moved decimal.** Looks like: drowsy, vomiting, ringing ears or slow breathing hours after a dose. Cause: mg read as ml, 2% given as 1%, a lost point, a spoon. Do: stop. Work the sum again aloud with a second person. Follow the 32.4 danger sign.
2. **The count does not match.** Looks like: fewer tablets than the stock book, an ampoule gone. Cause: a night dose not written, 2 carers dosing, theft, a person in crisis. Do: count again with 2 people. Ask kindly. A gap over 5% goes to the council. Someone at risk: chapter 30 first.
3. **Spoiled stock.** Looks like: a flooded or frozen cellar, torn blisters, brown ampoules, caked ORS. Cause: damp, frost, heat, a shelf against the wall. Do: quarantine at once. Never mix it with good stock. Write it off in the book. Move the shelf.

NUMBERS TO CARRY

- About 140 kg, under 1 m^3: a year's medicine for 300 (OR-06).
- 7 days: the salvage route, fridges first, nothing used unlogged (SY-09).
- 88 in 100 lots extended, by a mean of 66 months. About 1 in 6 failed in the end (ME-09).
- 0 to 30 °C, below 25 if possible, humidity 65% or less, 60 cm from the wall (OR-06).
- 3 months: the most on the open shelf (OR-06).
- 40 to 80 amoxicillin courses a year for 300 (IN-05).
- 25 times: opium tincture against paregoric (ME-02).

- Tenfold: the commonest fatal dosing slip, a moved decimal (ME-02, SY-10).
- 5%: a gap in the count that goes to the council.

THE LIBRARY

ME-09 Salvaging the pharmacy: the priority list, expiry and storage. OR-06 Stockpile, storage and the dispensary's shelf. OR-08 Health as a commons. IN-05 Antibiotics: salvage, expiry, choice and stewardship. IN-06 Making antibiotics, and why it is harder than it looks. ME-02 Dose and potency. SY-09 The salvage list and the first year. SY-10 The harm register. SY-12 What the library could not find. FO-11 Humanitarian medicine with little. WO-11 Local anaesthesia and the old analgesics. All are on the website. The shelf empties, and the ledger is what the village remembers of it.

CHAPTER 33

The Garden and the Still

A garden of 700 square metres takes a season to plant and a year to yield. An infusion keeps a day, a tincture a year at full strength and two in use. The still gives 25 to 30 litres of pure spirit a year, and about half of it goes into the tincture jars.

OPENING

Take a leaf from a pot of thyme or sage on a windowsill, or the bag from a cup of chamomile left to stand too long. Put it on your tongue and hold it there. Notice what comes first. A warmth, then a bitterness at the back, then a faint numbness along the edge, as if the tongue had been told something and was still deciding whether to believe it. Spit it out, and the taste stays for a minute.

That is the oldest test of a plant there is. Before anyone owned a scale or a glass jar, the mouth decided. Sweet meant food. Sour meant unripe or spoiled. Bitter meant caution, and sometimes medicine. The tongue is still a good guard. It is a poor measure. It says strong, and it cannot say how strong, or whether this leaf is the plant it looks like.

A garden of medicine begins where the tongue stops. It is a set of beds of known plants, one plant to a bed, with its name at both ends, grown so that nobody needs to taste a stranger from the hedgerow. It is a drying rack in a shaded loft, jars in a dark cupboard, and a book that says what

went into each jar and when. Beside it, in a shed with no flame near it, stands a still. It makes the spirit that draws a plant into a bottle and keeps it for a year, and that cleans hands before a birth and skin before a cut.

None of this is grand. A village's garden is the size of a few allotments. The still is a copper pot. The work is picking chamomile heads every few days through the summer and writing labels in the evening. What it gives is a cup that settles a stomach, a salve for cracked hands, a gargle for a sore throat, and children who know which plants are not for the mouth.

It cannot give an antibiotic, insulin, an anaesthetic or a vaccine. Everything that follows keeps that in view.

THE STORY

The garden beside the infirmary

A Frankish ordinance on royal estates, the Capitulare de villis of around 795 to 812, listed the plants every estate was to grow, 73 plants and 16 trees by one count. The plan of the abbey of St Gall, drawn at Reichenau around 819 to 830, puts a small garden beside the infirmary. It has 16 beds, one plant to a bed, each bed named. Two of its plants, rue and pennyroyal, the library now grades as harmful. The rest of the idea has held for twelve centuries: one plant to a bed, a name on it, and the garden next to the sick.

On 29 June 1545 the Venetian Senate founded a garden of single medicinal plants at Padua, under its first prefect, Luigi Squalerno. It was laid out as a circle around a square, quartered by paths on the points of the compass, and it still stands on its first site. Early on it needed a wall, because valuable plants were being stolen.

In 1673 the Society of Apothecaries founded a garden at Chelsea for a plainer purpose. Apprentices were to learn to know plants on sight, and to spot dried material that had been bulked out or swapped. A dried leaf in a merchant's sack does not carry its name. The apprentice who had walked the beds every week knew the living plant, and could tell when the sack was wrong. The first thing that garden produced was knowledge.

The trade needed watching. In 1649 Nicholas Culpeper, apprenticed to an apothecary and by then seeing up to 40 patients a morning in Spitalfields, published an unauthorised English translation of the College of Physicians' pharmacopoeia, so that people outside the College could read what went into their medicines. His English Physician of 1652 gave every herb a ruling planet, and that part has not lasted. He died in 1654, aged 37.

Taste stayed in the method longer than anyone expects. The World Health Organization's manual of 1998 for testing plant material still holds a bitterness test. A panel of tasters works up a row of dilutions until each first notices the bitter, and spits each one out. Quinine is the anchor of the scale at 200,000, and gentian root must reach 10,000. The same manual prints a rule beside the test: it is not run until the identity of the plant is confirmed. Hemlock tastes of nothing much. The tongue can compare two batches of a known plant. It never names an unknown one.

The cup and the jar

The preparations a village makes are old, and they are still called galenicals after Galen, who practised in the second century. The London Pharmacopoeia was published on 7 May 1618, withdrawn for its errors, and reissued corrected on 7 December the same year. The British Pharmacopoeia followed in 1864 and the British Pharmaceutical Codex in 1911. Through three centuries the infusion held at one part of plant to twenty of water. In 1898 Felter and Lloyd's King's American Dispensatory gave the rule for spirit: strong spirit for resins, weaker spirit for the plants that give themselves up to water.

The kitchen spoon was never part of that system. Teaspoons measured in homes have held from 2.5 to 7.3 millilitres, and a drop from a bottle's lip can be anything from a fifteenth to a fortieth of a millilitre. A recipe in spoons is a guess. A recipe in grams, on a scale, is a dose.

Old preparations kill in new ways when the rules behind them are forgotten. In Vancouver in 1985, chopped garlic kept in oil gave 34 people botulism, because oil shuts out the air and the spore needs no air. Vinegar and syrup draw lead out of a glazed pot. A tea brought to the boil is cleaner than it was, and still not sterile. A cup of chamomile drunk the same day is safe. A jug left on a warm sill until the next evening is not.

Heat has its own record. In 1947 Moritz and Henriques measured how long skin takes to burn: ten minutes at forty-nine degrees, one second at seventy. A child's skin burns about four times faster than an adult's. A poultice hot enough to feel like treatment can do its harm before anyone lifts a corner to look.

What the jar forgets

Dried plants keep less well than people hope, and they do not all fail the same way. Bark keeps best. In 2020 Canales and colleagues reanalysed cinchona barks at Kew that John Eliot Howard had labelled with their alkaloid content more than 150 years before, and found much the same quinine he had written down. The bark had kept, and the label had kept the means of checking it. Chapter 6 says what such bark is worth to a fever.

Leaves and flowers fade within a year or two, and aromatic leaves lose their smell first. Tinctures fail more quietly. In 1955 Francis Fish in Glasgow found that tinctures of foxglove leaf lost 20 to 30 parts in 100 of their strength over nine to twelve months, measured on animals, while the chemical test of the day showed them growing slightly stronger. A test that measures the wrong thing will certify a weakened medicine.

Willow shows the same trouble in the living plant. Its salicin runs from 1.5 to 15 parts in 100 of the dried bark, a tenfold range before anyone has cut it. In a trial of 210 people with an attack of low back pain, an extract giving 240 milligrams of salicin a day left 39 in 100 free of pain in the last week, against 6 in 100 on a dummy. That was a measured extract. A cup of bark from the hedge is a guess at it, which is why chapter 26 grades the village decoction lower and never gives it to a child. Meadowsweet carries the same salicylates and the same age line.

The worst failure is the jar that holds the wrong plant. In Taiwan, in a case reported in 2010, nine people drank tea from leaves picked in a national park the day before and taken for comfrey. They were foxglove. All nine vomited, three needed their hearts paced, and all nine lived. An American report of 1977 describes a couple who drank foxglove tea kept in place of comfrey, and the wife died. Once the leaf is cut and dried, no test in a village tells the two apart. Only the label, the voucher and the person who

picked it can.

Gardens grown for a nation

Some communities grew medicine as a crop. By 1827 the Shakers at Watervliet, New York, sold 129 herbs. In March 1941 Britain set up a Vegetable Drugs Committee, and more than 70 county herb committees followed, run by Women's Institutes, Scouts and schoolchildren, with about 250 drying centres by the end of the war. In 1942 the Scouts of Clifton and Mayfield dried 76 pounds of foxglove, and the women of Hathersage dried 50 pounds, mostly nettle. Five of the six plants the committee called essential were poisons sent to factories to be purified, foxglove among them. None was a village medicine, and this book's garden grows none of the five.

In Cuba, Juan Tomás Roig recorded 595 plant species in use in 1945. A ministry resolution of 1992 brought plant medicine into the health service, with a guide of 233 formulations, and by 1998 about 3 million people were using it. Cuba published no national harvest in tonnes. What it published was a choice: it took the common, safe plants that people already knew.

Vietnam's decision of 2002 asked every commune health station to keep at least 40 species, and to treat a fifth of its patients with traditional medicine. One station garden in Làò Cai held nearly 40 species in about 70 square metres, under 2 square metres each. That is a teaching bed and a nursery, not a supply.

The German group anamed trains healers in East and Central Africa to grow a few plants. Its best known is a selected *Artemisia annua* sold as A-3, which Hans-Martin Hirt promoted for malaria. The World Health Organization advised against artemisia plant material for malaria in 2012 and again in 2019, and the 2019 trial offered in its support was retracted. The plant grows in this garden. Chapter 6 says what it may be used for.

The village health project begun at Jamkhed in India in 1970, one of the most cited, had no herb garden that the library could find. Its gains came from trained village women, clean water, food, mothers' care and referral.

The still

Spirit has been in the sickroom for two thousand years and has never made an operation painless. Roswell Park, lecturing in 1896, recalled surgeons who pushed patients to drunkenness and still operated on them writhing, until the ether operation in Boston on 16 October 1846. Between 1969 and 1971 John Dundee's group in Belfast gave ethanol into the vein as an anaesthetic, and the work was given up. The dose that brings sleep lies too close to the dose that stops breathing.

What the still does well is quieter. At 60 to 85 parts in 100, spirit kills bacteria on skin, and 70 to 80 is best. Pure spirit does worse, because it dries before it has worked. In a trial of 849 surgical patients published in 2010, a skin preparation of chlorhexidine in alcohol gave wound infection in 9.5 in 100, against 16.1 in 100 with iodine. Spirit does not kill spores, as chapter 1 says, and it does not belong inside a wound.

The danger of a still is in the mash. Methanol is made before any heat, as the pectin of fruit breaks down. Plums, cherries, apples and pears carry 100 to 1,000 times as much as grain or sugar, and plum brandy sampled in Transylvania averaged nearly 1 part in 100. Distillers have long been taught that the first runnings carry the methanol, and that throwing them away makes the spirit safe. In 2021 Blumenthal and colleagues showed that it is not so. Methanol runs through the whole distillation and gathers towards the end. The only cut that removes much of it is stopping early, and the surer course is to choose the mash.

A still is also a vessel of hot, flammable vapour. In April 2015 a pot still at a distillery in Hardin, Kentucky, built without the right valve to release its pressure, burst, and the apprentice beside it died of his burns in May.

The great poisonings did not come from village stills. At Pärnu in Estonia, in September 2001, spirits cut with industrial methanol killed 68 of 154 people known to be poisoned. A village spirit made from sugar or grain carries its own antidote, because ethanol holds back the body's turning of methanol into its poison.

The Honest Broker's Ledger

The library disagrees with itself on four lines in this chapter, and each is printed both ways.

The garden's size. OR-02 sets a year of teas, washes and salves for 300 people against measured yields, halves the yields for a grower without trial plots, adds paths, a nursery and a fenced plot, and reaches about 700 square metres. PH-01 gives about 70 square metres in four beds, and marks its own figure as inference. The two differ seven to ten times. The Vietnamese station shows what 70 buys: a teaching bed. This chapter plans on 700 and prints 70 beside it.

The wild harvest. ME-04, after FAO, says take no more than 70 parts in 100 of a stand. OR-02 says, for bark and root, take one plant in five a year, and replant. Neither has field data. Where the harvest kills the plant, the stricter line is the safer guess.

Cinchona bark. PH-04 says plan on about 1 part in 100 of quinine, from one assay with a mean of 0.66. IN-09 says 5 for known bark and 3 for unknown. Bark of unknown strength cannot be dosed safely at either figure. Chapter 6 holds it.

Guava leaf and berberine for watery diarrhoea. PH-05, PH-04 and PH-08 grade them B, for fewer stools in adults given oral rehydration as well. IN-11 grades them C or D and says they do not cure. Both readings agree on the line that matters: never a cure, never instead of the salt and sugar drink.

A fifth line is the infusion itself. PH-01 and SY-06 give 2 grams in 150 millilitres, about one part in 75. ME-01 gives the pharmacopoeia's one in 20. The Bench prints both and lets each plant's dose in grams decide.

One error is named and not repeated: the distiller's belief that cutting the first runnings makes a fruit spirit safe. ME-03 grades it X. The Bench still discards the first runnings, for other reasons, and says so. One more is small and old. Peppermint is a sterile hybrid and sets no true seed, which has never stopped a seed catalogue from selling peppermint seed. What comes up is spearmint.

The turn to the present

The pharmacy hid the garden. A cough syrup came in a bottle with a dose on the label, and nobody asked which plant it had been, or whether it had ever been a plant at all. When the shelf empties, the garden comes back, and with it the hope that it will fill the shelf again.

It will not. The library looked for a plant above grade C for dehydration, pneumonia, sepsis in the newborn and after birth, measles, tuberculosis, bleeding after birth, eclampsia, anaphylaxis, type 1 diabetes, epilepsy, meningitis, appendicitis and obstructed labour, and found none. Malaria is the near exception, and only where the bark's strength can be measured. The largest harm a garden does is delay: a guava tea given to a child who needed the salt and sugar drink. The Hesperian handbook of 2024 opens its chapter on home cures with a rule worth keeping: the more remedies a disease has, the less likely any of them works.

What, then, is the garden for? It is a school, where children learn the young foxglove from the plantain before either is in a mouth. In Austria, 113 of 163 recorded swallowings of autumn crocus were by children. It is a supply of comfort: the cup for the colicky stomach, the gargle, the salve, the warm compress. And it is a guard against poisoning by error, because a village that grows its known plants in labelled beds does not go looking in the hedgerow.

The tongue was the first test and is still the last check on a jar. Bitter tells you a plant is strong. Only the scale tells you how strong, and only the label tells you what it is.

Now the spade.

AT THE BENCH

33.1 See: the garden and its beds

Never plant the plants of chapter 34 here. Never grow foxglove. Instead: the fenced plot for 4 outside plants. Poppy, cannabis and coca: chapter 34 and the owner.

- Site: full sun, at least 50 m from a road, not on a dump or smithy's ground.
- Plan 700 m^2 for 300. PH-01's 70 m^2 is a teaching bed.
- Berlin-Brandenburg beds, m^2: chamomile 200, thyme 85, calendula 60, sage 50, peppermint 28, fennel 20, marshmallow 20, lemon balm 15, nursery 30, fenced plot 20. Add a third for paths.

- Hedge: elder, dog rose, willow, yarrow, plantain.
- One species per bed. A label at each end. A pressed voucher of each in the book.
- Fenced plot, fence 1.2 m: comfrey, wormwood, alder buckthorn, horse chestnut. Outside use only.
- Ephedra: restricted, one trained person. The library gives no plan to grow it. Dose: chapter 25.
- Short of chamomile: keep it for infants and the sick. Adults take mint or balm.
- Other climates' beds and their 10 plants: on the website.
- March: sow chamomile and calendula, divide mint. April: sow balm and marshmallow, set thyme and sage cuttings.
- May to July: pick chamomile every 3 to 5 days. June to September: calendula every 5 days.
- June and August: cut mint and balm. July: thyme in flower. August: sow chamomile again. October: lift second-year marshmallow.
- Keep 2 seasons of seed in 2 places. Each spring, test 20 seeds on a wet cloth. Leave chamomile seed uncovered.
- Peppermint from cuttings only. Replant every 3 years.
- Labour: 300 to 350 hours a year, one keeper a day a week.

Plant	Lookalike that harms
Chamomile	Scentless mayweed
Fennel	Hemlock, fool's parsley
Plantain, comfrey	Young foxglove
Garlic, wild garlic	Autumn crocus
Calendula	*Tagetes*
Mint	Pennyroyal

Rungs. Hands: the lookalikes. Hearth: the household's 10. Garden and still: the beds, the fenced plot. Dispensary: the voucher book. Refuse: foxglove, any plant of chapter 34.

33.2 Do: gather, dry, store, label

Never use a plant you cannot name. Never keep an unlabelled jar. Instead: 3 confirmations on the whole living plant (chapter 3). Condemn the jar.

- Gather in dry weather, after the dew.
- Confirm on the whole living plant before cutting. Press a voucher.
- Wild stands: take at most 70% (ME-04). Bark and root: 1 plant in 5 a year, and replant (OR-02).
- Bark from one side only. Never ring a tree.
- Reach the rack within 1 hour.
- Dry at 35 to 45 °C, aromatic leaves at 30 to 35 °C.
- Dry until the stem snaps. Seal a handful in a jar overnight. Mist means dry longer.
- Store whole in glass, nearly full, dark, at or below 20 °C. Grind on the day.
- Label: plant, part, place, date, gatherer, batch. Narrow-margin plants in a jar of another shape.
- Before the first dose, read the label aloud with a second person.
- Every 3 months: smell, mist, beetles of 2 to 3 mm. Lost smell fails first.
- Keeps: aromatic leaf 6 to 12 months. Other leaf and flower 2 years. Root 1 to 2. Bark 3 and more. Powder up to 3 months. Narrow-margin plants 1 season.

Rungs. Hands: 3 confirmations. Hearth: jars, labels. Garden and still: the solar dryer. Dispensary: the batch register (chapter 36). Refuse: an unlabelled jar.

33.3 Do: the 6 preparations

Never give a child a dose from an adult's jar. Instead: weigh the child. Make the child's own cup from 33.5.

Preparation	Make	Keeps	Grade
Infusion (leaf, flower)	2 g in 150 ml boiling water, covered, 10 min (PH-01, SY-06). Or 5 g in 100 ml, 10 to 15 min (ME-01). The plant's dose in grams decides	12 h warm, 24 h cool	B

Preparation	Make	Keeps	Grade
Decoction (bark, root, seed)	5 g in 120 ml. Simmer covered: bark and seed 10 min, hard root 20 to 30 min. Strain hot. Make up to 100 ml	24 h, 2 days cool	B
Cold soak (marshmallow)	0.5 to 3 g in 150 ml cold water, 30 min	Same day	C
Tincture	1 part dried plant to 5 parts 40% spirit. Resins 60 to 70%. 14 days, 12 to 21. Press. Make up the volume, or write it on the label	1 year full, 2 usable	B method, C keeping
Syrup	1,000 g sugar made to 1,500 g with water or infusion. Bottle hot	Plain: months. With a plant: a few months	A
Salve	1 part beeswax to 4 parts oil. Soft 1 to 5, hot weather 1 to 3. Dried plant only, 40 to 60 °C, 2 to 4 h, never over 70 °C. Strain. Pour off water	6 to 18 months	B
Poultice, compress	Under 44 °C. Test on the inside of the wrist	Make fresh	D for good, B for harm

- Weigh in grams. A level 5 ml teaspoon holds a different weight of each herb.

- Glass or enamel. Vinegar and syrup in glass only.
- Newborn or weak patient: boil fully, use within 1 hour.
- Never keep fresh herb or garlic in oil. Throw out cloudy or bubbling oil untasted.
- No tincture under 6 years, none at all under 1. Use syrup or infusion.
- No honey by mouth under 12 months.
- Mustard or garlic over oiled cloth, off at 15 min. No heat on the sleeping, numb or paralysed.
- Keep a spirit-free version for those recovering from drink.

Rungs. Hands: the scale. Hearth: infusion, decoction, syrup, compress. Garden and still: tincture, salve. Dispensary: the register. Refuse: spoons, metal pots for acid.

33.4 Do: the still and its spirit

Never distil fruit in the medical still. Never trust a cut of the first runnings to remove methanol. Instead: sugar or grain only. Stop the run early.

- Build: FEASTING. Copper, no lead solder, no radiator. Never seal it. No flame within 3 m.
- For 300: 25 to 30 l pure spirit a year, 65 to 75 l at 40%. Tinctures 15 l, skin and hands 10, lamp 2 to 3.
- Feed: 55 to 60 kg sugar or 80 to 90 kg grain a year.
- Discard the first 50 ml per 20 l of wash, for its other poisons. Stop the run early. Never rerun the tails.
- Strength: weigh a marked bottle of water, then of spirit. Divide. 0.79 pure, 0.835 about 86%, 0.92 about 57%, 0.935 about 49%.
- A hydrometer reads true in spirit and syrup, false in a tincture.
- Dilute: water into spirit, cool, measure again, label. 500 ml of 40% takes about 210 ml of 95%.
- Denature outside grades with a tenth of their volume of bitter decoction or wormwood.
- Lock the drinkable grade: 2 keys in 2 households, the inner cupboard's form (chapter 32). Expect the register to be falsified once.
- Spirit to drink: chapter 30.

Use	Strength	Grade
Tincture	40%, resins 60 to 70%	C for the rule
Hand rub	Chapter 1's recipe, or 80%. 3 ml, rub 20 to 30 s	A for 60 to 85%
Skin before a cut	Soap and water, then 70 to 80% on cloth, outward. Dry fully	A
Instruments	Boil first. Spirit does not kill spores	A for no spores
Wound	On intact skin round it only. Water inside it	
Anaesthetic	Never	X

Danger sign: methanol. 12 to 24 hours after drinking, rarely 48: blurred or snowy sight, belly pain, fast deep breathing. 10 ml can blind, 30 ml kill.

Antidote: 40% sugar or grain spirit from the locked store, never a denatured grade. Load slowly. Then hourly, at least 3 days. Aim: drunk but rousable.

Weight	Load, 40% spirit	Then each hour, non-drinker	Then each hour, regular drinker
45 to under 55 kg	100 ml	12 ml	25 ml
55 to under 65 kg	120 ml	15 ml	30 ml
65 to under 75 kg	140 ml	17 ml	35 ml
75 kg and over	160 ml	20 ml	40 ml

Ceiling: the table. Hold a dose if breathing slows or the person cannot be roused. Under 45 kg: the library found no figure. Send. Give sugar by mouth. Lie the person on the side.

- **Help in time.** Start the antidote. Send to the infirmary with the bottle and the hour.
- **Help too late.** Sight gone, breathing fast and deep, fits. Keep the antidote going. Carry. The district decides.
- **No help at all.** Antidote hourly for 3 days. Someone stays. Sight may not return. Tell the family: the poison was made in the mash, not added by a hand. Every bottle of that batch is destroyed today.

Rungs. Hands: the signs. Garden and still: sugar and grain spirit. Dispensary: the 2-key store, the antidote. Infirmary: days of antidote. Refuse: fruit mash, spirit as anaesthetic.

33.5 Do: the 10 plants and their doses

Work every dose twice, with two people.

Never give a plant of the fenced plot by mouth. Never an essential oil by mouth or near an infant's face. Instead: comfrey 10% on intact skin, adults, 10 days. Oils: none.

Weigh the patient. Use the age only if there is no scale. "No figure" means the library found no figure: ask the healer.

Plant, part, preparation	Use, grade	40 kg and over (12 years)	16 to under 40 kg (4 to 12 years)	Under 16 kg	Ceiling
Matricaria chamomilla, chamomile flower, infusion	Gut cramp, mouth, wash: C	1.5 to 4 g in 150 ml, 3 to 4 times a day. Wash 3 to 10 g in 100 ml	No figure	No figure	4 cups a day
Mentha x *piperita*, peppermint leaf	Indigestion: B	1.5 to 3 g a cup, 3 times a day	No figure	No figure	9 g a day
Foeniculum vulgare, fennel fruit, crushed	Colic, wind: C	1.5 g in 250 ml, 3 times a day	1 g, 3 times a day	Never	3 cups a day
Melissa officinalis, lemon balm leaf	Restlessness, gut: C	1.5 to 4.5 g in 150 ml, 1 to 3 times a day	Never	Never	3 cups a day

Plant, part, preparation	Use, grade	40 kg and over (12 years)	16 to under 40 kg (4 to 12 years)	Under 16 kg	Ceiling
Thymus vulgaris, thyme herb	Wet cough: C alone, B mixed	1 to 2 g in 150 ml, 3 to 4 times a day	Never	Never	4 cups a day
Salvia officinalis, sage leaf	Throat: C	Gargle 2.5 g in 100 ml. Tea 1 to 2 g, 3 times a day	Never	Never	Tea 3 cups a day, 2 weeks
Plantago lanceolata, plantain leaf	Throat: C. Wounds: D	1.4 to 2 g in 150 to 250 ml, 2 to 3 times a day	No figure	No figure	3 cups a day
Rosa canina, rose hip	Vitamin C: B	5 to 10 g a day. Strain the hairs	No figure	No figure	10 g a day
Allium sativum, garlic	Blood pressure: B	Powder 900 to 1,380 mg a day	As food	As food	1,380 mg a day
Calendula officinalis, calendula flower, on skin	Small wounds: C	Dressing 1 to 2 g in 150 ml. Salve 2 to 10%	From 6 years only	Never	Skin only
Althaea officinalis, marshmallow root, cold soak	Throat, cough: C	0.5 to 3 g in 150 ml a cup. Interval: no figure	No figure	No figure	15 g a day. 1 hour from other medicines

Plant, part, preparation	Use, grade	40 kg and over (12 years)	16 to under 40 kg (4 to 12 years)	Under 16 kg	Ceiling
Salix species, willow bark, decoction	Back pain: B. Fever: D	4 g in 200 ml, boil 15 min, stand 15 min, 3 times a day	Never	Never	3 cups a day, 4 weeks. Never under 18 years, whatever the weight

- Willow age: none under 12 (ME-02), none under 18 (IN-02, ME-06, WO-11). Follow the stricter. None in late pregnancy. Chapter 26.
- *Filipendula ulmaria*, meadowsweet: C. 1.5 to 6 g a cup, at most 18 g a day, 4 weeks. Never under 18.
- Artemisia leaf for malaria: X. Chapter 6.
- 5 ml of eucalyptus, clove or tea tree oil can kill a child.

Rungs. Hands: the weight. Hearth: the 10. Dispensary: ephedra, cinchona. Hospital: what no plant treats. Refuse: foxglove, oils by mouth.

33.6 Prevent: test what you made

Never test an unknown plant on a person. Instead: identity first, by chapter 3. Test only known plants.

- Look and smell each batch beside its kept sample. Condemn mould, insects, sourness, rancid smell, no label.
- Taste only a harmless preparation, a trace on the lip. Never a narrow-margin plant.
- Bitter plants: 6 adults taste new against kept batch, same day, spitting out. Write the ratio on the label (ME-13).
- Syrup: weigh as for spirit. Below 1.33 it ferments.
- Tincture: a hydrometer misleads. Distil a sample first.
- Seal 10 g of each passed batch. Store it apart from the dispensing shelf.

- Register each batch: mark, plant, part, place, date, maker, test, verdict (chapter 36).
- A new batch of a known safe plant: try it on 1 healthy adult, not the only trained person. A second person present. A written stop rule.
- Children: nothing from the garden goes in a mouth unless an adult hands it over.

Danger sign: a child has eaten an unknown plant, or drunk from a jar. Keep the plant or jar. Note the time. Never make the child vomit. Watch at least 6 hours. About 10 ml of 40% tincture can poison a 10 kg child. Charcoal: chapter 22.

- **Help in time.** Drowsy: on the side. Carry child, plant and jar to the dispensary.
- **Help too late.** Fits, slow breathing, a slow or racing pulse. Side, warmth, clear mouth. On to the infirmary.
- **No help at all.** On the side, warm, someone stays and watches the breathing all night. Tell the family what was swallowed, and that the next hours decide. Every jar goes out of reach today.

Rungs. Hands: look, smell, label. Hearth: the kept sample. Dispensary: the panel, the register. Refuse: tasting to identify.

If it goes wrong

- **The sour jug.** Fizz, a sour smell, then diarrhoea. Cause: an infusion kept warm past 12 hours. Do: pour it away. Make it fresh daily. Rehydrate by chapter 13.
- **The wrong leaf.** Vomiting, diarrhoea, dizziness, a slow or uneven pulse after a comfrey or plantain tea. Cause: young foxglove picked with it, or an unlabelled jar. Do: stop that jar, keep it, count the pulse, send. Check the voucher.
- **The bubbling oil.** Herb oil gone cloudy or bubbling. Later, drooping lids, double sight, a hard swallow. Cause: fresh plant or garlic kept in oil, botulism. Do: throw the oil out untasted. Send at once.

NUMBERS TO CARRY

- 700 m² for 300 people, against PH-01's 70 (OR-02, PH-01).
- 2 g in 150 ml, 10 min, poured away at 12 h, against 1 in 20 (SY-06, ME-01).
- 1 in 5 in 40% spirit, 14 days, 1 year full, 2 usable (ME-01, ME-04).
- 25 to 30 l of pure spirit a year for 300 people (ME-03).
- 10 ml of methanol can blind, 30 ml can kill (ME-03).
- 5 ml of an essential oil can kill a child (SY-06, ME-11).
- 35 to 45 °C to dry, 30 to 35 °C for aromatic leaves (ME-04).
- 0.3 g of alcohol per kg can poison a child (ME-01).

THE LIBRARY

OR-02 The medicinal garden: what to grow for a village of 300 in each climate. SY-06 The pharmacopoeia: the fifty plants and twenty minerals the book should carry. ME-01 The dispensary's grammar: infusion, decoction, tincture, syrup, oxymel, salve, poultice, suppository. ME-03 Ethanol for the dispensary. ME-04 Harvest, drying and storage. ME-11 Fats, waxes and oils. ME-13 Testing what you made. PH-01 Temperate Europe: the forty plants that matter. SY-12 What the library could not find. TR-06 European folk and wise-woman medicine. All are on the website.

CHAPTER 34

The Poison Garden

The autumn crocus may wait most of a day before the first vomit and kill on the third. Water hemlock brings fits within ninety minutes. The death cap sickens, seems to let go, and kills days later, when the liver fails. A young foxglove leaf feels like comfrey to a hand in a hurry, which is the whole argument.

OPENING

SOMEWHERE near you, probably within a short walk, a yew is growing. It stands in churchyards and parks and is clipped into hedges along front gardens. Its needles are flat, dark above and paler beneath, set in two rows along the twig. In autumn it carries red berries with a small opening at one end, where a dark seed sits inside the flesh. If one is near, go and look at it. Pick nothing. Notice how ordinary it is, how many people pass it every day, and that its red is the red a child reaches for.

Most gardens hold something like it. Foxgloves seed themselves along walls. Lily of the valley spreads in the shade under shrubs. Monkshood stands blue at the back of a border. Nobody planted them to harm anyone. They are there because they are beautiful, and because for a long time nobody needed to know what they were.

That changes when the shops close. A village that eats from its hedgerows will meet these plants in the basket. A village that makes its

own medicines will meet them on the shelf, because several of them are medicines as well, at a dose close to the dose that kills. The temptation is not malice. It is usefulness. The leaf that once steadied a failing heart looks like the leaf that soothes a sprain. The plant that eased gout for centuries comes up in spring beside wild garlic, leaf for leaf.

A garden gate with a latch is the oldest answer to that kind of temptation. It is not a wall. It keeps out the child, the goat and the stranger in a hurry, and it opens for the one who knows why it is there. Put your hand on a latch today, any latch, and feel how little it takes to lift it. That is the measure of the thing. A lock does not make a poison safe. It turns the moment of opening from an accident into a decision.

This chapter is about what grows behind that gate, why some of it was once given as medicine, and why most of it should not be given now. It is also about remedies that were poisons all along, given by learned people with every confidence. The village has to learn to tell a plant from its double, a medicine from its poison, and a promise from a cure.

THE STORY

Mount Vernon

On 13 December 1799 George Washington spent hours riding his farms in cold rain, snow and hail, and sat down to dinner in damp clothes. At about two the next morning he woke unable to breathe properly. By six he had a high fever and a raw throat. What followed was written down hour by hour, and it reads now like a list of poisons.

At half past seven his overseer, George Rawlins, opened a vein and took twelve to fourteen ounces of blood, and Washington asked for more. At nine Dr James Craik laid a blister of cantharides, the dried blister beetle, on his throat. A second bleeding of eighteen ounces followed at half past nine and a third at eleven. At noon came an enema and a gargle that nearly choked him. In the afternoon Craik ordered a fourth bleeding of thirty two ounces. Dr Elisha Cullen Dick argued against it and asked instead to open the windpipe below the swelling. He was overruled. At four Dr Gustavus Richard Brown proposed calomel and tartar emetic, mercury

to purge and antimony to make him vomit. At eight blisters went on his feet, arms and legs. Washington died at about twenty past ten that night.

He lost more than 80 ounces of blood, about 2.4 litres, in some twelve hours, about two fifths of all he had. Most modern readers think his throat was closed by an infection of the epiglottis, the flap above the windpipe. One physician argued in 1999 that the bleeding probably did not kill a man of his size. Whether it killed him or only hurried him, the day shows the shape of the danger. Every substance given that day was a poison: the beetle, which can harm the kidneys through raw skin, the mercury, the antimony, and the lancet. Each was given because it did something that could be seen. The pulse softened, the bowel emptied, the skin rose in blisters. The one bold act that might have opened his airway was the one refused as too rash.

The three physicians were not careless men. They sat with him all day and did what every book they owned told them. Six years earlier, in Philadelphia, the most admired physician in America had done the same on a larger scale. In the yellow fever of 1793, which killed about 4,000 to 5,000 of the city's 50,000 people, Benjamin Rush stayed when others fled, saw up to a hundred patients a day, and gave calomel and jalap with heavy and repeated bleeding. He bled himself and his own infant. William Cobbett called him Doctor Sangrado, after the bleeding physician in Gil Blas, and accused him of killing his patients. Rush sued for libel, and the jury gave him 5,000 dollars on 14 December 1799, the day Washington died. The court settled the libel. Nobody counted the dead by treatment, so the medicine itself was never tried.

The leaf that is two plants

Foxglove is the plant this chapter turns on, because it is the one poison in the garden that is also, beyond doubt, a medicine. William Withering, a physician and botanist, found it inside a Shropshire family's receipt for dropsy, and in 1785 he published 163 cases of his own, failures included. He learned that the dried leaf was about five times as strong as the fresh, and that the plant had to be given in small amounts and stopped at the first sickness, the first slowing of the pulse or the first loosening of the bowels. He wrote partly to warn against its careless use.

Two centuries of study confirmed him and narrowed him. The leaf's drug steadies some failing hearts. In the largest trial, published in 1997 with about 6,800 people, digoxin did not lengthen life, though it kept about a quarter fewer of them out of hospital. The dose that helps is about half the dose that harms. One of the leaf's drugs, digitoxin, takes about a week on average to leave the body, so a mistake made on Monday is still poisoning on Sunday. Before the Fall a hospital held an antidote. After it, no village will.

The same leaf is the poison. In the year before it flowers, foxglove grows as a low rosette of soft leaves that look like comfrey, and comfrey is a plant people have long made into tea. In August 1977, in Washington State, an elderly couple drank a comfrey tea made from foxglove. The husband found the foxglove in the refrigerator after the sickness began. His wife was dead when the ambulance came. In Taiwan in 2010 nine people made the same mistake, and three were poisoned in the heart. A woman of 55 there collapsed with her heart quivering instead of beating just before the antidote reached her. The leaf is most poisonous as the plant comes into flower, and a few leaves can kill. Untreated, serious foxglove poisoning kills 20 to 30 people in every 100.

So the plant is a remedy, a poison and a question for the garden. The library answers the question two ways. SY-10, the register of harms, puts foxglove on its never list: never as medicine, at any rung, and this book follows it. ME-07 argues the other way. It holds that foxglove is the only narrow margin plant a trained village healer can use, and only under strict rules: one bed, one named healer, a logbook of every dose and pulse, and a locked chest for the dried leaf. This is the temptation in its plainest form, and ME-07's answer is a locked gate rather than a wall. OR-03 replies that Britain's wartime foxglove harvest worked only because factories measured the strength of every batch, and a village cannot. PH-10 says never gather it for any purpose. The choice is a village rule, not a fact, and it belongs to the owner. Until the owner decides, the village learns to know the plant and gives none of it.

The hedgerow's double

Most poisonings by plants are mistakes in the basket, not in the dose. Between 2002 and 2023 the poison centre at Marseille took 2,197 calls about a plant or fungus eaten in place of another. One of those people died, a man who took monkshood for an edible mountain plant, and he had a hospital behind him. Without one, the same mistakes would kill more.

The commonest spring mistake in Europe is the autumn crocus taken for wild garlic. Both put up broad leaves in damp woods in April and May. The crocus is a medicine too. The Ebers papyrus of Egypt lists it for pain and swelling, a secret gout water sold from 1783 turned out to be colchicum, and Alfred Garrod set out its use in gout in 1859. Its poison survives cooking, and many of the Slovenian cases had eaten the leaves boiled. In that series of 32 people, sickness began between two and 24 hours after the meal, and those whose sickness came late did better. A man of 76 died on the third day. Eight of the nine most severe cases were over 65. In Austria there were 174 recorded swallowings. Of these, 163 were accidents, 113 were by children under 15, and two people died.

The carrot family holds the worst of the hedgerow. Poison hemlock looks like wild carrot, parsley and fennel. It paralyses from the feet upwards while the mind stays clear, and a person who is breathed for until it wears off can live. In Italy two people who took it for fennel survived. Water hemlock and hemlock water dropwort are worse, because their roots look like parsnip and celery and no field mark on the root is reliable. Hemlock water dropwort smells of celery, which is the trap. On 5 October 1992, in Maine, two brothers dug a root they took for wild ginseng. The younger died three hours after three bites. In May 2017 two men died at Santarém in Portugal after eating hemlock water dropwort. In the American record for water hemlock from 1900 to 1975, about 30 in 100 of those poisoned died.

Monkshood root has been grated as horseradish. In 1857 a Dublin journal recorded three deaths in Scotland from that mistake, two of them clergymen. Yew has no antidote. Its red flesh tempts children, and its seed is poison. The death cap looks like a field mushroom or a young puffball, makes its eater sick some twelve hours later, seems to let go, and then destroys the liver over days. In California in December 2016 four-

teen people were poisoned and three needed new livers. The deadly nightshade's single black berry is sweet and looks like a cherry, though children poisoned by the nightshades mostly live with good care.

Every one of these mistakes has the same shape. A plant that feeds or heals has a double that kills, and the double grows in the same place in the same season. Folk tests do not separate them. A silver spoon tells nothing about a mushroom, and cooking does not cure a crocus. What separates them is a trained eye, the whole living plant, three separate checks, and one species to a basket.

Remedies made of metal

The heroic physicians gave mercury and antimony as medicines, and the poisons outlived them. Calomel, the mercury salt offered to Washington, stayed a household purge for another century. On 4 May 1863 the Union Army's Surgeon General, William Hammond, struck calomel and tartar emetic off the army's supply table because of the salivation and the rotting gums and cheeks that followed them. The profession revolted. Hammond was sent away within months and dismissed in August 1864, and calomel went back on the table. Calomel teething powders gave pink disease, with raw pink hands and feet, to about one exposed baby in 500, until the powders were withdrawn in Britain in 1953 and 1954.

The metals live on in traditions still practised today, and they deserve to be named with care. In Mexican and Mexican American households a stomach complaint called empacho has long been treated by massage and by bright powders called azarcon and greta, which are 70 to more than 90 parts in 100 lead. In 1982 a child of three given azarcon for diarrhoea died with fits. In California in 1991 and 1992 forty children were found with lead in their blood, most of them from these powders, and families denied using them until someone said the names aloud.

Rasa shastra, the branch of Ayurveda that prepares metals and minerals as medicine, is a living practice with its own account of purification. In 2004 Robert Saper and colleagues bought every Ayurvedic product they could find in shops near Boston and found that 14 of 70, one in five, held lead, mercury or arsenic above safe limits at the makers' own doses. Half of those said children could take them. Buying online in 2008, they found

much the same. Practitioners answered that proper preparation makes the metals harmless. Saper replied that long use is not proof of safety. The traditional tests of a well made bhasma, the ash of a metal, were passed by products that poisoned people. In California in 1998, about a third of 260 Chinese patent medicines held undeclared drugs or metals, among them cinnabar, a mercury ore. SY-10 names kohl, the eye cosmetic, in the same row, and the library gives no measurement for it.

The village cannot test any of this. No colour, smell, taste, heat or water test tells a powder with lead from one without. Every case above was found with instruments the village will not have. It can ask the names, refuse what it cannot name plant by plant, find the source, and bury what it finds.

The Honest Broker's Label

Two reports in the library say that both of the 1977 couple died. PH-01 says so and then, in the same paragraph, says the husband found the foxglove after the sickness began and his wife was dead when the ambulance came. SY-02 repeated the error from a summary. ME-07 says the wife died, and so does chapter 3. This chapter follows ME-07 and does not repeat the error. No report read the 1977 notice itself.

Foxglove is printed both ways. The default is SY-10's never, at every rung. ME-07's case for one locked bed and one named healer is printed at the Bench, for the owner to decide. The leaf's dose is not printed in this draft. If the owner opens the bed, the dose goes into chapter 32's table, worked twice by two people.

Washington's loss is printed as TR-13 gives it, more than 80 ounces. SY-03 gives 80 to 124 ounces, and chapter 3 printed both. FO-05 puts the first sore throat a day earlier, on 12 December. ME-14 and PH-10 give slightly different onset times for foxglove and the nightshades, and the Bench prints both.

Three old errors are named so that they are not repeated. Cooking makes none of these plants safe, because their poisons survive heat. A silver spoon and the peeling of a cap tell nothing about a mushroom. The fingerprint and floating tests of a bhasma tell nothing about its lead.

The library is thin in three places. It holds no record of daffodil bulbs taken for onions, so this draft prints no plate for them. It gives kohl a name and no measurement. It gives false hellebore a clock and a likely recovery, and no count of cases. One more gap is deliberate. Some reports print the amount of each plant that kills. This chapter leaves those amounts out. A warning needs the plant, the clock and the signs, and the number serves nobody well.

The turn to the present

Until the Fall the poison garden looked after itself. Seed catalogues sold foxglove and monkshood for the border, and a poison centre answered the telephone when a child ate a berry. Medicines came in sealed packs with the dose printed on the side, and nobody needed to know that the heart drug had once been a leaf. The plants stay. The telephone and the antidote do not.

The village will be tempted twice. The first temptation is the hedgerow, food for the taking with its doubles growing in it. The second is the old medicine cupboard, the remedies that did something you could see. Both come back when the shelf empties, and both come back looking like kindness.

What is a lock for, in a village where everyone knows everyone? Partly for children, who learn by tasting. In Austria about two in every three crocus swallowings were by children. Near houses where children play, ME-07 says, deadly nightshade, thorn apple, monkshood, oleander and autumn crocus are dug out, not fenced. Partly for the stranger in a hurry, who picks the wrong leaf for the pot. And partly for the person in a dark hour. Putting the means of death out of reach during a crisis saves lives, because many such crises last minutes, and a lock box kept in the house does not work, since the person who lives there opens it. The poison plot belongs to that rule. Its keys are kept apart from any one house, and anyone worried about a neighbour asks plainly and stays, as chapter 30 sets out. If you are reading this in such an hour yourself, tell someone today.

The locked gate is not a judgment on the plants. They are what they always were, beautiful and old and sometimes useful. It is a judgment on us: that we are tired, hurried and hopeful, and that a gate which must

be unlocked gives us one moment to remember what grows behind it. Withering kept that moment with a counted pulse. Dick asked for it at Mount Vernon and was refused. The village keeps it with two keys, a book and two people.

Now the gate.

AT THE BENCH

34.1 See: the ten lookalike plates

Never eat a wild plant on one check. Never dig a wild root of the carrot family. Instead, check the whole living plant 3 separate ways. Grow carrot, parsnip and fennel.

1. Put 1 species in a basket.
2. Check each leaf, not the bunch. Smell 1 leaf at a time with clean hands.
3. Never send children to gather alone.
4. Keep a sample of every wild meal for 72 hours.

Plate	Poison	Taken for	The tell	First sign	The record
1	Autumn crocus	Wild garlic	Wild garlic: each leaf on its own stalk, matt beneath, smells of garlic. Crocus: leaves from a sheath, no stalk, glossy, no smell	2 to 24 h	2 dead of 174 in Austria
2	Lily of the valley	Wild garlic	2 leaves from a shared sheath, no garlic smell	1 to 6 h	Death rare
3	Poison hemlock	Wild carrot, parsley, fennel	Stem hairless, hollow, purple-blotched, mousy smell. Wild carrot: stem bristly, solid, green	30 min to 2 h	Lives if breathed for

Plate	Poison	Taken for	The tell	First sign	The record
4	Water hemlock, hemlock water dropwort	Parsnip, celery root	No reliable tell on the root. Dropwort smells of celery	15 to 90 min	About 30 in 100 dead, water hemlock, 1900 to 1975
5	Foxglove rosette	Comfrey, borage	Foxglove soft and velvety, a raised net of veins. Comfrey and borage bristly, scratch, smell of cucumber. Draw the leaf across the back of the hand	1 to 8 h (ME-14), 2 to 8 h (PH-10)	20 to 30 in 100 dead untreated
6	Monkshood root	Horseradish	No reliable tell on the root. Dig only roots you planted	10 min to 2 h. Lips tingle first	1 of 6 dead at Marseille
7	Yew	Pine, spruce, tea leaf	Flat dark needles in 2 rows. Red cup around a dark seed	1 to 24 h	No antidote

Plate	Poison	Taken for	The tell	First sign	The record
8	Deadly nightshade berry	Bilberry, cherry	1 large glossy black berry in a green 5-pointed star, on a waist-high plant. Bilberry: a shrub under 50 cm	30 min to 2 h (PH-10), 1 to 4 h (ME-14)	Children mostly live with care
9	Death cap	Field mushroom, puffball	Dig the base whole. A white sack at the base, white gills, a ring	6 to 24 h, then a false calm	10 to 27 in 100 dead
10	False hellebore	Yellow gentian, wild garlic	Leaf deeply pleated, clasping the stem, no garlic smell. Hellebore leaves alternate, gentian opposite	15 min to 2 h	Slow pulse, recovery usual

Grades. Lookalike plates D: no study measures their error rate. 3 confirmations C. Silver, peeling, cooking X.

Rungs. Hands: the plates, 3 checks, 1 species to a basket. Hearth: the sample

kept. Garden and still: the safe cousins grown. Dispensary: the plates on the wall, a pressed specimen of each. Infirmary: a trained identifier. Hospital: a poison centre. Refuse: wild carrot-family roots, any mushroom not known to 3 people.

34.2 See: the person poisoned by a plant

Never make anyone vomit. Never give salt water. Instead, lay them on their side. Then 22.5.

1. Write the time it was eaten. Write each sign with its time.
2. Find everyone who ate it.
3. Keep the plant, the food and the vomit, labelled, for 72 hours.
4. Count breaths and pulse for 1 full minute. Write both.
5. Charcoal only by 22.5. 1 g/kg, 50 g at most, within 1 hour, only if they can drink it themselves.

What fails	Signs	Likely plants	Do
Breathing	Weakness rising from the legs, mind clear	Poison hemlock	Breathe for them: adult 10 a minute, child 20 to 30. New breather every hour
The brain	Fits within 15 to 90 minutes	Water hemlock, dropwort	On the side. Nothing in the mouth. Chapter 21
The heart	Vomiting, slow or uneven pulse, yellow or blurred sight. Monkshood: tingling lips	Foxglove, lily of the valley, yew, monkshood, oleander, false hellebore	Flat, still, warm. Pulse every 15 minutes. Never walk them
Heat and mind	Hot, dry, red, wide pupils, wild talk for 24 to 48 hours	Deadly nightshade, thorn apple	Shade, cool water on skin, quiet. Someone stays

What fails	Signs	Likely plants	Do
Gut, then liver	Vomiting and watery stools hours later, then a false calm	Death cap, autumn crocus	ORS through the calm. Watch 7 days after crocus

The danger sign: breathing fails, fits do not stop, or the pulse turns slow and uneven with fainting.

- Help in time: breathe for them, keep them flat, carry them to the district. Hemlock paralysis passes if breathing is kept up.
- Help too late: keep breathing for them in relays while the heart beats. Tell the family it may fail.
- No help at all: on the side, warm, held, spoken to. Tell the family the plant did this, not their hands or their cooking.

Grades. Breathing by hand B. Charcoal within 1 hour B for what it holds, D for lives saved. Salt water X. Folk antidotes X.

Rungs. Hands: side, breaths, clock, sample. Hearth: ORS, shade. Garden and still: nothing. Dispensary: charcoal, scale, register. Infirmary: fluids by vein. Hospital: antidotes, dialysis, new livers. Refuse: vomiting, salt, walking a slow pulse.

34.3 Do: foxglove and the locked bed

Never use foxglove as medicine, at any rung. Never grow it in the open garden. Instead, teach the rosette. Dig it out where children play.

This is the default (SY-10). The case below is ME-07's. It is printed for the owner to decide.

ME-07's locked bed, only if the owner allows it:

1. Keep 1 bed only, fenced and locked. Name 1 healer.
2. Dry the leaf. Keep it in a locked chest. Label and date each batch.
3. Keep a logbook. Write every dose, every pulse, every death and near miss.
4. Before each dose, count the pulse for 1 full minute. Ask about nausea, sight and urine.

5. Stop at the first nausea, slowing pulse or loose bowels.
6. Never give it to children, or with a pulse under 60, vomiting or dehydration.
7. Work every dose twice, with two people.
8. The dose is not printed here. It goes in chapter 32's table only if the owner opens the bed.

OR-03 objects that no village can measure the leaf's strength. Assay at the district first.

Grades. Leaf titrated by pulse B (ME-07). Pure glycoside A, not made after the Fall. Leaf at a fixed dose X. Foxglove tea X.

Rungs. Hands: know the plant, count the pulse. Hearth: nothing. Garden and still: no bed by default, 1 locked bed. Dispensary: the logbook, the chest. Infirmary: assay, salvaged digoxin. Hospital: digoxin, blood levels, antidote. Refuse: tea, fixed doses, a second bed.

34.4 Prevent: the metals and the heroic cures

Never give a metal, mineral, ash or gem remedy by mouth. Never bleed, blister or make anyone vomit as a cure. Never purge in diarrhoea, fever, under 5 or over 70. Instead, nurse: warmth, fluids, food, rest.

1. Ask every family what has been given. Say the names aloud: calomel, blue pill, tartar emetic, azarcon, greta, bhasma, ras, sindoor, kajjali, cinnabar.
2. Refuse any salvaged remedy that cannot be named plant by plant.
3. Take every refused remedy to the locked store.
4. Bury calomel, tartar emetic and cantharides 50 m from any well, 1 m deep.
5. A dull, pale child with belly pain: ask about powders, pills, eye cosmetics and glazed pots.
6. Find the source and remove it. Check the brothers and sisters.
7. Send a child with fits or drowsiness to the district.

The village cannot test for lead, mercury or arsenic. No colour, smell, taste or heat test works.

Grades. Every metal remedy X at every rung. Bleeding X. Emetics X. Purging in fever or diarrhoea X. Cantharides X.

Rungs. Hands: the names, the refusal. Hearth: food, warmth, fluids. Garden and still: nothing. Dispensary: the locked store, the burial record. Infirmary: a

blood lead test if one survives. Hospital: blood tests, chelation. Refuse: all of it, under any name.

34.5 Prevent: the never list

Never cross a line below, at any rung. Instead, bring the case to the register (chapter 36) and the owner.

Never	Why	Chapter	Row
Foxglove, monkshood, autumn crocus, yew, oleander or thorn apple as medicine	Margin too narrow, no antidote	3, 22, 34	H43, H44, H26
A wild root of the carrot family	No tell on the root, death in hours	22, 34	H9
Children gathering alone	113 of 163 accidental Austrian crocus cases were children	33, 34	H9
Vomiting by any means, salt water	Salt kills, vomit is breathed in	22	H17
A metal, mineral, ash or gem by mouth	Lead, mercury, arsenic, untestable	3, 34	H30
Bleeding for any illness	19.9 against 12.8 in 100 dead in pneumonia	3, 34	H51
Comfrey by mouth, birthwort	Liver and kidney damage, cancer	3, 33	H32
Poison plants where children play	Berries and bulbs get tasted	33, 34	H9, H26

Never	Why	Chapter	Row
Grain unchecked for thorn apple seed	Over 200 ill in Uganda, 2019	34	H16
A lock box in the house as the answer	Opened by the person who lives there	30, 32	H10

34.6 Prevent: the locked plot, the children and the register

Never keep the only key in one house. Never fence a poison plant where children play. Instead, 2 keys in 2 households, the inner cupboard's form (chapter 32). Dig the plant out.

1. Decide what grows locked. Default: nothing from the never list. Poppy: chapter 31. Foxglove: 34.3.
2. Fence the plot apart from the open beds and from chapter 33's fenced plot. Fit a lock.
3. Hold 2 keys in 2 households, unrelated to each other and to the healer, changed yearly (chapter 32). Open only with both keepers present.
4. Write every opening: date, both names, what was taken, its weight, for whom.
5. Count the beds against the register each month (chapter 36).
6. Each spring, walk the village edges with the children. Show each plate's plant in the ground.
7. Dig out nightshade, thorn apple, monkshood, oleander and autumn crocus near houses.
8. Someone seeks the key without reason, or seems in despair: ask plainly and stay. Chapter 30.

Grades. Central store with keepers D. Household lock box X.

Rungs. Hands: teaching the children. Hearth: nothing poisonous by the door. Garden and still: the locked plot, if any. Dispensary: the register, 2 keys. Infirmary: the monthly count. Hospital: nothing more. Refuse: a lock box in the house, a key on a nail.

If it goes wrong

- **The spring soup.** Vomiting and watery stools hours after a wild garlic meal. Cause: crocus or lily of the valley leaves in the bunch. Do: keep the pot and the leaves. Find everyone who ate. Give ORS. Watch 7 days. Send the old first.
- **The open plot.** A bed found disturbed, or a key not returned. Cause: one keeper, or a key left in the lock. Do: count the beds. Find who entered and why. Ask plainly. Change the lock. Write it down.
- **The salvaged tin.** A dull, pale child with belly pain, given a cure from an old tin. Cause: a metal remedy. Do: stop it. Take the tin to the store. Check the siblings. Send if there are fits.

NUMBERS TO CARRY

- 72 hours: keep the specimen and the vomit (PH-10, ME-14).
- 1 g/kg of charcoal, 50 g at most, within 1 hour, only if they can drink it themselves (ME-14, SY-10).
- 15 to 90 minutes: fits after water hemlock root (PH-10).
- 2 to 24 hours: autumn crocus before the first vomit. Watch 7 days (PH-10).
- 6 to 24 hours: death cap before the first vomit, then a false calm (PH-10).
- 20 to 30 in 100: untreated serious foxglove poisoning that kills (ME-07).
- 10 a minute for an adult, 20 to 30 for a child: breathing for the paralysed (ME-14).
- 2,197 confusions and 1 death at Marseille, with a hospital (PH-10).
- 1 in 5: Ayurvedic products bought near Boston with lead, mercury or arsenic (TR-02).

THE LIBRARY

TR-13 Humours, bloodletting, purging and the therapies that killed. FO-05 What the physician of 1850 could do, and what killed his patients. ME-07 The heart and the poison garden: digitalis, atropine, ergot, ephedra, strychnine, colchicine. ME-14 Poisons, overdoses and the antidotes you can make. PH-10 The deadly lookalikes. SY-10 The harm register. SY-12 What the library could not find. TR-02 Ayurveda. TR-03 Chinese medicine. TR-09 Mesoamerican, Andean and Amazonian healing. PH-01 Temperate Europe: the forty plants that matter. All are on the website.

CHAPTER 35

The Healer, the Infirmary and the Commons

Three hundred hours makes a healer. Three months without practice unmakes a skill. A village of 300 needs one healer and a second who can take the key. A district of 3,000 needs ten beds and the knife.

OPENING

Tie your shoe without looking. Your fingers do it in two seconds, and you could not say in words how. Now try a knot you were shown once and never used again: the one from a summer on a boat, the sling from a first-aid evening, a stitch your grandmother showed you. Most of us find the shape gone. The hands kept the knot they tie every morning and let the other one slip.

You can check this on yourself in a minute. What is done often stays. What is done once fades, and faster than we expect. The facts sit in the head and last. The order of the hands, which comes first and how hard, leaks away in weeks.

A village with no hospital must keep its skills somewhere. It cannot keep them in a building, and it cannot keep them in a book alone. It keeps them in people, and people forget, fall ill, move away and die. So the village does for its healer what it does for its hearth fire. It feeds the fire every day, whether anyone is cold or not. Someone watches it at night. It is never let

out, because a fire that goes out has to be carried back from a neighbour, and the neighbour may be far away.

Think of who, within a short walk of where you sit, could stop a wound bleeding, breathe for a baby that will not breathe, or tell a fever that will pass from one that will kill. Perhaps you know one name. Perhaps none. Each of those people is a fire that someone keeps fed. Most are fed by a school, a wage, a licence and a supply of drugs, all so far away that no one near you thinks about the fuel.

This chapter is about the fuel. It is about how a village chooses the person who will carry its skills, how many hours it takes to make them, and how often they must practise so the skill does not leak. It is about feeding them without making them rich on the village's fear. It is about the second person, the one who can take the key when the first cannot. And it is about the larger fire the villages share: ten beds, a midwife who is always awake, and a knife that only a few hands may hold.

A healer is the village's shared memory of what to do. Everyone feeds it, because everyone will need it.

THE STORY

The doctors who went barefoot

In June 1965 Mao Zedong attacked Chinese medicine for serving the cities and forgetting the countryside. The charge had numbers behind it. In 1964 the state spent more on 8.3 million city people than on 500 million peasants. Teams of city doctors went out to train villagers, and a newspaper article of 1968 spread the name the trainees kept. They were the barefoot doctors.

Each village chose its own. They farmed half the day and healed the other half. The course lasted months, not years: one to four months in one account, three to six in another, a year in a few places. They learned to vaccinate, to look after wells and latrines, to space births, to catch babies, to give a short list of drugs, and something of needles and herbs. Their manual, put into English in 1974, ran to more than 900 pages, and over

400 of them were about plants. By the 1970s more than a million had been trained.

The village fed them. A barefoot doctor earned work points from the brigade, the same unit a farmer earned in the field, at about half a regular doctor's pay. A household paid 1 yuan a year into the cooperative medical scheme, a visit cost 5 fen, and medicines were free. At its height the scheme reached about 9 villages in 10. Between 1962 and 1982 infant deaths fell from about 200 to 34 in every 1,000 born. Schooling and the great campaigns against disease carried much of that fall, and no one can say how much was the barefoot doctors' own. What they did was carry the campaigns to every door.

Then, early in the 1980s, the land went back to the households. The brigade had no common harvest left from which to pay work points. From 1981 a barefoot doctor who passed an examination became a village doctor, and by 1985, 643,022 had passed, about half of those still working. The scheme shrank to a small fraction of the villages it had served. Without a keep, the village doctor lived on what he sold. Years later, of 20,125 prescriptions from village clinics in the west of the country, 23 in 100 included an injection. The healer the village had fed had become a shop.

One finding from those years matters more than the rest. In 1987 a team surveyed three counties. Where the scheme survived, it paid its way. Where it died, it had not run out of money. It died when local officials came to believe that no one above them wanted it any more. Where it died, infant deaths and infections rose and fewer children were vaccinated, even as incomes rose. A fire does not go out only for want of wood. It goes out when the people around it stop believing it is theirs to tend.

The cowshed at Jamkhed

In 1970 two doctors, Rajanikant and Mabelle Arole, began work in a leased cowshed at Jamkhed in Maharashtra. They made one choice that set them apart. They did not pick the health workers. Each village did.

The villages chose women, most of whom could not read, many of low caste. The senior workers had on average 1.6 years of school. They came to the project's centre for training one day a week, and they kept coming for the rest of their working lives. The senior workers had served on average

28.9 years, and about 2 in 3 of all the workers stayed more than twenty years.

They checked women before and after birth, caught babies at home, taught others to do it safely, and sent the women in trouble to the project's own hospital. On the project's own count, infant deaths fell from 176 in every 1,000 in 1971 to 18 in 2016. There was no comparison village for most of those years, and roads and electricity came at the same time. A later comparison, from 1994 to 2007, found deaths of babies after their first month 30 in 100 lower than in villages nearby. Rajanikant Arole reckoned that lasting change takes ten to fifteen years.

Two things stood behind each worker. One was the weekly day, which never ended. The other was the hospital, which by 2011 had 50 beds for more than half a million people. About 4 problems in 5 were settled in the village. The fifth had somewhere to go.

The aides in the snow

In most of Alaska's small villages the nearest doctor is hundreds of air miles away. Since 1968 Alaska has trained village people as community health aides. About 500 work in 178 communities, and in most of them the aide is the only healer there is.

An aide is hired first and trained while working: 16 weeks of classes in four sessions, spread over two to three years. After the first session the aide sees 20 patients in the village. After the second come 200 hours and about 60 patients. After each of the last two come 200 hours more. A thick manual sits on the clinic desk, and a doctor answers the telephone. Every two years the aide must earn 48 credits or stop.

The weak point was keeping them. In 1988 the programme lost about a third of its aides, over 151 posts. New money raised the pay and the losses fell, but by 1999 one aide in 5 still left each year. Each loss costs years, because the new aide serves while learning. When aides in 15 villages were asked what kept them, they named five things: a co-worker, training on time, a fully staffed clinic, the support of the village and the support of their own family. The first was a second person.

What the aides fight, beyond the weather, is the leak in the hands that the Opening showed. People taught resuscitation hold it a short while

and then lose it. Across 34 studies of 35,421 people, the skill fell within 3 months and then levelled off. Knowledge holds better than the hands. Of 835 birth attendants, 99 in 100 passed a practical test after training and 81 in 100 about seven months later, while their written knowledge stayed at 99.

At Haydom, a hospital in rural Tanzania, Mduma and colleagues tried the cheapest answer, and published it in 2015. They kept a newborn mannequin on the labour ward. Every week two staff practised together on it for 3 minutes. Once a month they had 40 minutes of retraining. In the year before there were 4,814 births, and in the year after 4,894. Deaths in the first day of life fell from 11.1 to 7.2 in every 1,000. There was no comparison ward. But the finding agrees with everything else: practise little, often, in pairs, beside the work.

Three pence in the pound

In Tredegar, a town in South Wales, the workers built their own health service. From 1890 members of the Workmen's Medical Aid Society paid three pence in every pound of their wages, 1.25 in 100, taken at source. It bought doctors, medicine and appliances. In 1911 the members chose their lead doctor by ballot, 2,584 votes to 1,804. By 1933 the society cared for 95 in 100 of the town, with five doctors, two dentists, dispensers and a nurse.

A contract of 1901 holds the rule that matters most here. The society paid its medical officer a salary of £900 and required him to hand back every sum he received as medical officer, less a commission. His income no longer rose with the number of bottles he gave. It is the oldest written rule the library found that cuts the healer's living loose from the amount of his work. In 1948 Aneurin Bevan took the Tredegar model to the whole country as the National Health Service, and the society withered once the state did its work.

In the United States the lodges did much the same for about $2 a year, about a day's wage, with doctors chosen by the members. The county medical societies fought it, expelled the contract doctors and shut them out of hospitals, and by the end of the 1930s lodge practice was gone. The lodges had their own fault. They turned away 10 to 20 in 100 of those who applied, on grounds of health, and some left childbirth out of the

contract. A village cannot turn away its sick or its births.

Nor can it run on goodwill alone. In the slums of Dhaka, women volunteers who had joined expecting some income were almost twice as likely to stay. In two trials of counselling by lay helpers, every paid helper stayed while 35 in 100 of the unpaid ones left. Standing in the village is a wage too, and a real one, but it is paid only while the village goes on approving.

The arithmetic for a village is plain. Three hundred people make about 60 households. A healer whose household lives like the others needs one sixtieth of the village's food and fuel, about 1.7 in 100 of each household's keep. That is close to Tredegar's three pence in the pound.

Ten beds for three thousand

The small hospital has an old pedigree. In 1859 a surgeon, Albert Napper, opened a cottage hospital in the English village of Cranleigh, and about 294 were founded between 1855 and 1898. Each was a few beds in a house, with local doctors and local money. China's commune hospitals had 8 to 15 staff and about 1 bed for every 1,000 people.

In a year a district of 3,000 brings its infirmary between 90 and 120 births and about 30 major operations, of which about 5 are hernias and about 1 is strangulated. The caesareans are reckoned two ways. Counting only the women who would die without one gives 1 to 2 a year. A floor of 5 in every 100 births gives about 6. Then come 100 to 150 people sick enough for a bed. At about 5 days each they fill about 2 beds a night, and on most nights 7 or 8 of the 10 beds stand empty. The beds are for the bad week, when an epidemic arrives, or when the obstructed labour comes in on the same night as the man who fell from the roof.

Ten beds need 11 to 13 people: two who can operate, two midwives, 4 or 5 ward keepers, a keeper of the steriliser and 2 or 3 more. That is about 24,000 hours of work a year, or 20 hours from each of about 1,200 adults in the district. The house needs 250 to 1,000 litres of water a day and 13 to 22 tonnes of wood a year. Chapter 23 tells how Mozambique trained the técnicos who did the operating there, and draws the line of what the district may cut.

The record names six things that kill a small hospital: the loss of whoever pays, the pull of a bigger centre, the loss of its one trained person, war, infection on the ward and fees at the door. None of the six is about the walls.

The Honest Broker's ledger

Nine reports carry this chapter, with help from SY-01, SY-10 and SY-12, and they bear weight unevenly.

OR-01 is careful, and it says plainly that its 300 hours is its own synthesis, not a tested course. No one has trained a healer on exactly this plan. Its programme lengths, its decay figures and the Haydom study can be trusted as reported, and its case minimums between blocks are its own. OR-07 is careful on volumes and staff. Its hours, water and fuel are its own arithmetic and are marked. OR-08 read Tredegar only through archive summaries and an encyclopaedia, so the 1901 contract and the 1911 ballot must be checked. It could not find how Jamkhed's workers were paid, and the familiar line that they were paid in grain and respect has no source in the library. FO-04 says more than a million barefoot doctors were trained, and OR-01 says about 1.4 million served, so the Preface's "a million" carries. The common claim that only a third passed the 1985 examination is not supported. About half of those in post passed. The scheme's fall to about 5 in 100 appears in one abstract without a year, so the Story says only "a small fraction". Tredegar's 1890 comes from the Preface and Alaska's 1968 from the plan of this book. Neither was found in a report. MI-02's finding that training length does not predict effect is drawn from an absence, and MI-02 says so. FO-10's trial of the warm consultation is grade A for felt symptoms only. TR-01's chances for a graded remedy are its own synthesis.

Two figures are disputed and printed both ways. At Maputo, Pereira and colleagues reported in 1996 on 2,071 caesareans. MA-03 says técnicos did 958 of them. WO-08 gives 978 by técnicos against 1,113 by doctors. SY-12 notes that 958 and 1,113 make 2,071, while 978 and 1,113 make 2,091, which favours MA-03. Neither report read the paper, so neither figure is settled here. The district's caesareans are 1 to 2 a year for absolute causes (OR-07), against about 6 from FO-11's floor of 5 in 100 births. OR-07's

own estimate from Nordberg is about 7, and the register carries 1 to 7.

The library carries two forms of the cupboard key. OR-08 puts the inner cupboard under two keys held by two households, neither of them the healer's. SY-10 gives one keeper, a deputy and a sealed spare with the council. Chapter 32 takes SY-10's form for the outer cabinet and OR-08's for the inner cupboard, by the owner's ruling of 18 October 2026. SY-10's table also lists lidocaine under the village healer. The book's rule, set at 23.2, is that only a healer trained at the infirmary gives it, and that rule stands here. No known error has been recorded against these reports. SY-04's consultation with living traditions has not been done. I supplied the mapping of the book's chapters onto the four blocks and the quarterly drill rota, and both are marked for the owner.

The turn to the present

The hospital let us forget the fuel. Behind every doctor we met stood a school, a wage, a licence, a supplier and an inspector, and none of them asked more of us than a tax. We never had to choose a healer, feed one, test one or train a second. Who in your street would notice if the person who knew what to do had stopped practising?

The hospital also hid how much of healing is the healer. In a Boston trial of 2008, 262 people with an irritable bowel were split three ways. One group waited. One had sham needles from a curt practitioner, and one had the same needles after 45 minutes with a warm one who listened. At three weeks 28 in 100 who only waited felt relief, 44 with the curt ritual and 62 with the warm one. Time, attention and honest hope are part of the medicine for what is felt. They never replace the drained abscess or the splint. A village that keeps its healer keeps both.

There is a serious case against this chapter, and chapter 3 promised it an answer. Lay healers spread infection with needles, give drugs nobody needs, splint limbs into gangrene and bind snakebitten legs. Short training raises confidence faster than skill, and print alone barely changes what people do. A manual lends the confident amateur authority, and authority delays the journey to real care. Tested against the record, the case holds in part. It holds for injection, which this book does not teach below the district. It holds for naming diseases, where manuals go wrong most of-

ten. It holds for drugs given without need, which training does not cure, and for print alone, which is why the healer here has a trainer, a register and a district to send to. As a general claim it fails. In no trial the library found did trained lay healers make things worse, and in several they cut deaths sharply. And the case assumes a doctor down the road. After the Fall the choice is between a trained lay healer and nobody.

Nor is the village empty of healers when it starts. Most places have a bonesetter, a woman who has caught babies for years, someone who knows the plants, and someone people go to when the mind is troubled. Some of what they know is shared freely. Some is kept within a family or a rite, and some of that secrecy grew under laws that once punished it, like New Zealand's Tohunga Suppression Act, in force from 1907 to 1962. The village works beside them. It keeps what helps, stops what harms, and never asks for what is closed.

So: the choosing.

AT THE BENCH

35.1 See: who the village needs

Never leave one healer alone. Instead: train 2 at once and name a reserve (OR-01, MI-12).

Rung	Who	For how many	Training
Hands	Every adult	The household	A few hours from the healer
Hearth	The household carer	The household	Retaught at each visit
Garden and still	The named preparer	The village	Chapter 33
Dispensary	1 healer and 1 second	300	300 hours each, 35.2

Rung	Who	For how many	Training
Infirmary	11 to 13 staff, 10 beds	3,000	Operators 3 years and 1 as intern. Midwives. Ward keepers months (OR-07)
Hospital	As before the Fall		
Refuse	One healer alone, untrained or unpaid		

The library's ratios: 1 lay healer per 300 to 1,500 people (FO-04). 1 to 2 health workers per 1,000 in camps (FO-11).

Where the village stops and the district begins (23.1, 23.2):

1. The village never cuts into a belly, chest, skull or eye.
2. The village injects 2 things only. Magnesium into muscle, by the birth attendant (10.5). Adrenaline into the thigh, for anaphylaxis (22.2).
3. Lidocaine, general anaesthesia and every operation in 23.1 belong to the district, with 2 trained people.
4. The infirmary healer is the lowest rung taught to inject anything else. That training is.

Choosing (OR-01):

1. The open assembly chooses. 2 healers and a reserve. At least 1 woman.
2. Tell them the work: about 2 hours a day, and nights.
3. Ask each one: how would you refuse a neighbour who demands medicine?
4. Set the keep before the choosing (35.4).

Danger sign: the village has 1 trained healer, or none.

- **Help in time.** The second goes to the next district block. The district trainer visits monthly meanwhile.
- **Help too late.** The healer works alone only on Block 1 and 2 skills. Births and wounds go to the district.
- **No help at all.** The healer teaches a second from this book, 1 block at a time, with stations (35.2).

35.2 Do: the 300 hours

Never teach injection, surgery past wound care, the microscope, unlisted drugs or naming diseases in the 300 hours. Instead: the healer refers (OR-01).

Block	Hours	Taught (hours)	Chapters
1. The clean hand and the danger sign	72	Role and refusal 6, hygiene 8, sterilising 10, examination 16, danger signs 12, records 6, first aid 10, stations 4	1, 2, 3, 13, 18, 20, 36
2. The killers of children	72	Diarrhoea 12, pneumonia 12, fever and malaria 8, malnutrition 8, newborn 8, medicines 12, home visits 8, stations 4	4, 5, 6, 7, 11, 32
3. Birth and wounds	72	Normal birth 16, resuscitation 10, bleeding after birth 6, pregnancy and spacing 10, wounds 16, fractures 6, stations 8	8, 9, 10, 11, 12, 18, 19

Block	Hours	Taught (hours)	Chapters
4. Adults, epidemics and the village	72	Adult fever and TB 8, epidemics 10, eyes, skin, teeth and pain 8, mind and grief 8, chronic illness 4, plants and refusal 6, teaching 6, referral and records 4, simulations 14, review 4	14 to 17, 21, 22, 24 to 31, 33, 34
Certification	12	Oral and picture test 2, 10 skill stations 6, observed cases 4	All

The hours are OR-01's. The chapter column is mine.

1. 8 hours a day, 6 days a week. A block is 9 teaching days.
2. Between blocks, 4 to 8 weeks of practice at home. Log 20, 40 and 60 cases.
3. At least 170 hours with the hands. Classes of 12 to 15.
4. Pass: every critical step, and at least 80% overall.
5. Then 6 months on probation, at least 100 cases, under the district.
6. The lay counsellor's hours (29) count toward the 300. A healer who has done that course skips Block 4's 8 hours on mind and grief. Its 15 watched hours count as logged practice.

Who teaches when there is no teacher:

1. First, anyone who nursed, doctored or served as a medic before the Fall.
2. Next, the district trainer. The 4 blocks run once a year for all 10 villages.
3. With no one: 2 learners teach each other from this book, in block order. Each practises on the other and scores the other on the station sheet.
4. One trial found village leaders, taught by trainers new to the place, ran good counselling groups (MI-02).

5. Every hour ends with hands, not words.

Rungs. Hands: none. Hearth: a few hours from the healer. Garden and still: the course in 33. Dispensary: the 300 hours. Infirmary: the trainer, the examiner, the advanced courses. Hospital: as before the Fall. Refuse: a healer with no course.

35.3 Do: keep the skill

Never let a hand skill go 3 months unpractised. Instead: keep the rota (OR-01).

When	What	How long	If missed or failed
Daily	Kit check	3 minutes	Restock that day
Weekly	Paired drill	3 to 10 minutes	Never more than 2 weeks apart
Monthly	Practice day	1 day	Never more than 6 weeks apart
Quarterly	Stations on 5 core skills	Half a day	Skill suspended. Retest within 2 weeks
Yearly	Refresher	10 to 15 days	Practice limited until done
Every 2 years	Recertification		Not renewed: stop practising

The weekly drill follows the quarter:

1. Months 1 to 3: bleeding. Press 10 minutes on a timer, band, write the time (18.2, 18.3).
2. Months 4 to 6: the newborn's breath. Dry, rub, position, puff (11.2).
3. Months 7 to 9: bleeding after birth (9) and the child's breath count (4).
4. Months 10 to 12: bleeding (18) and the newborn's breath (11) again, with the danger signs (1).

Haydom used 3 minutes a week and 40 minutes a month (OR-01). Write every drill in the register (36).

Rungs. Hands and hearth: retaught at each visit. Dispensary: the rota. Infirmary: quarterly stations, recertification. Hospital: as before the Fall. Refuse: a lapsed skill used alone.

35.4 Do: the keep and the key

Never let the healer sell what the healer prescribes. Instead: the village keeps the healer (OR-08).

Set the keep each harvest (OR-08):

1. List the healer household's year: grain, food, fuel, clothes, field work lost. Price it in grain.
2. Add the second's share, half the healer's.
3. Divide by households. With 60 households, about 1.7% each.
4. Pay in food, fuel or labour, after harvest, at midwinter and at sowing.
5. No patient pays at the door. Care is never refused for arrears.
6. A rise of more than 10% goes to the assembly.
7. The village's own rule on the keep:.

The key:

1. The keeper holds the outer key. 2 households, unrelated to each other and to the healer, hold the inner keys, changed yearly (chapter 32).
2. The second knows where every key is, reads the register and opens the outer cupboard.
3. The healer never chairs the council that reads the counts (OR-08).

When the healer dies, leaves or is suspended:

1. That day the second takes the outer cupboard and the case book.
2. The key holders count the inner cupboard with the second, aloud.
3. Send word to the district within 7 days.
4. The assembly names a new second at its next meeting. Training starts at the next block.
5. Meanwhile the second works only in the blocks passed. All else goes to the district.

After a death or complaint (OR-08):

1. Write it down within 1 day.
2. Send for a healer from another village within 7 days.
3. The review meets within 14 days. It hears the healer, the family and the record.
4. Suspend before review only for harm still going on: a reused needle, theft from the cupboard.
5. Appeal to the district within 30 days.

The healer's own health (29). The healer has a healer: the second, and the healer of the next village. Rest days go on the rota.

Rungs. Hands: work on the healer's field. Hearth: food and fuel on fixed days. Garden and still: a share of the garden's work. Dispensary: the levy, set each harvest. Infirmary: a district fund, staff on a wage. Hospital: tax or insurance. Refuse: a fee per dose (OR-08).

35.5 Do: the infirmary

Never a fee at the door. Instead: a standing levy on the district in food, fuel or labour (OR-07).

Never one needle or blade on 2 people. Instead: new, or steamed at 121 °C, for each person (SY-10).

A year for 3,000 people	Number
Births	90 to 120 (OR-07)
Caesareans	1 to 2 for absolute causes (OR-07), against about 6 at a 5% floor (FO-11)
Major operations	About 30 (OR-07)
Hernias	About 5, about 1 strangulated
Other admissions	100 to 150, about 2 beds a night
Beds	10
Staff	11 to 13

1. Staff: 2 operators, 2 midwives, 4 to 5 ward keepers, 1 steriliser keeper, 2 to 3 others.
2. Each trained person trains the next.
3. What it attempts and refuses: 23.1, word for word.
4. Women from far villages wait at the infirmary from 37 weeks.

5. Carrying: 4 bearers and a runner sent ahead.
6. Donor panel of 30 to 50 (23).
7. Audit every month. Review every death within 7 days.
8. Cost: about 24,000 hours of work a year. Who pays and how:.

Danger sign: a woman in obstructed labour, and no operator.

- **Help in time.** Carry her to the nearest operator. Runner ahead. Care on the way as 10.1.
- **Help too late.** Do what 10.1 allows. Keep her drinking and her bladder empty.
- **No help at all.** Stay with her. Ease her pain as 31 says. Tell the family plainly.

Rungs. Hands and hearth: carry, keep warm, send word. Dispensary: refer on 23's lines. Infirmary: the table above. Hospital: all that 23.1 refuses. Refuse: what 23.1 refuses.

35.6 Prevent: working with the living traditions

Never ask for what a tradition keeps closed. Instead: name the tradition and the holder, and write down only what they choose to share (SY-04).

Tradition	Kept	Stopped	Never asked for
Bonesetter (19)	Setting and pulling, the patient's trust	Tight splints	Rites and lineage knowledge
Midwife (8)	Company, warmth, the home birth that goes well	Anything on the cord but chlorhexidine. Pressing on the belly. Anything to hurry labour (SY-10)	The same
Herbalist (33)	Remedies graded C or better, credited by name	Aristolochia and the never list (34)	The same

Tradition	Kept	Stopped	Never asked for
Healer of the mind (29)	Rites of comfort and repair (FO-10)	A rite in place of treatment for a disease that kills. Prone holds, chains	The same

1. Ask first.
2. Name the tradition and the person.
3. Respect a restriction. Write that it exists, not what it is.
4. Test a new remedy: 2 sources, the exclusions, 10 uses logged at days 1, 3 and 7 (SY-04).
5. Give back: credit and care to the holders.
6. Keep the trail in the register (36).

Grades are printed per preparation in 33. Grade C helps about 1 time in 3, grade D about 1 in 10 (TR-01).

Rungs. Hands and hearth: ask before taking. Garden and still: the vouchered bed (33). Dispensary: the test log. Infirmary: comparison by lot (TR-01). Hospital: as before the Fall. Refuse: secret remedies and cures for sale.

If it goes wrong

1. **The second drifts away.** Looks like one healer doing everything, a blank case book. Cause: no keep and no fixed days for the second. Do: give fixed days, pay the half keep, name a reserve.
2. **The healer becomes a shop.** Looks like more injections and remedies with no more illness, a relative selling. Cause: the keep is too small or late. Do: the council meets within 7 days. Raise the keep, stop the sales.
3. **The skill leaks.** Looks like a failed station, a fumbled newborn. Cause: drills skipped. Do: suspend the skill, retest within 2 weeks, fix the drill day.

NUMBERS TO CARRY

- 300 hours: 4 blocks of 72 and 12 to certify (OR-01).
- 3 months: a hand skill fades without practice (OR-01).
- 3 minutes a week, 40 a month: the Haydom drill (OR-01).
- 1 healer and 1 second for 300 people (OR-01, FO-04).
- About 1.7%: each of 60 households' share of the healer's keep (OR-08).
- 1.25%: Tredegar's three pence in the pound (OR-08).
- 90 to 120 births, 1 to 7 caesareans, about 30 major operations, 10 beds: 3,000 people in a year (OR-07, FO-11).
- 11 to 13 staff for 10 beds (OR-07).

THE LIBRARY

OR-01 The village health worker's curriculum: what to teach in 300 hours. OR-07 The district infirmary: ten beds, a sterile room, a lab bench and a midwife. OR-08 Health as a commons: paying the healer, deciding the rules and the capture of care. FO-04 The lay healer in the record. FO-10 The meaning response. FO-11 Humanitarian medicine with little. MI-02 Lay-delivered mental health care. TR-01 How often is the old remedy right? SY-04 The romance of the indigenous and the ethics of taking. Also SY-01, SY-10, SY-12 and MI-12. All are on the website. A village keeps its healer as it keeps its fire: fed every day, watched at night, and never let out.

CHAPTER 36

The Register and the Correction of This Book

An hour a week keeps the register. A death is reviewed within the week. Twice the usual count plus two is the watch. The book is corrected once a year, by the village, in ink.

OPENING

Open this book at the Bench of any chapter and run a finger down the page. Before long it stops at a word in square brackets: VERIFY. On some pages it stops five or six times. The mark sits beside a count of breaths, a number of minutes, a share of the sick who lived. It is not a printer's slip. It is the book telling you which of its lines have not yet been checked against their sources.

Most printed pages admit nothing. The type is even, the margins are clean, and a reader takes clean type for settled fact. A handwritten page is more honest. It shows where the writer crossed out, paused, came back a week later and wrote above the line. This book was printed, but it asks to be read like a handwritten page.

There is a second mark, rarer: OWNER. It stands where the book has made a choice that is not a fact, such as whether a strap is taught for a bleeding limb, or how long a person may be held down on the floor. In

the end these are the village's choices, and the book says so instead of hiding them. Neither mark is a weakness. Each is the book being plain about what it knows and what it does not.

A book that cannot learn is finished on the day it is printed, and a little more wrong each year after. Drugs age on the shelf. A disease moves north. A figure copied from a summary turns out to belong to the wrong paper. A child dies who should have lived, and nobody can say which page failed. This book is built to learn. Its memory is the register the village keeps, an hour every week. Its growth is the correction the village writes into it, once a year, in ink.

The marks in square brackets are where that growth begins.

THE STORY

The searchers of the dead

In London from about 1592, when someone died, two women came to look at the body. They were the searchers of the dead, poor and elderly, paid a small fee for each corpse, and they named what had killed it. Their word went to the parish clerk. The clerks' counts went into the weekly Bill of Mortality, printed and sold in the street. The Bill for 19 to 26 September 1665 counted 7,165 plague deaths in 126 parishes.

The Bills were wrong. The clerks did not count Quakers, Anabaptists, Jews or the poorest. The official plague toll for the year was about 68,600, against a later estimate of 100,000. John Graunt worked through twenty years of Bills for his book of 1662. He suspected that a searcher could be swayed by a cup of ale and a small fee. He still found the Bills worth reading. A count that misses a third of the dead still shows the week the dying rose.

The rules for keeping such a book are older. An injunction of 5 September 1538 ordered every parish in England and Wales to write down each baptism, marriage and burial. The book lived in a chest with two locks. The priest held one key and the churchwardens the other. Many parishes ignored the order, fearing a new tax. In 1597 and 1598 the books had to go onto parchment, and a copy had to go each year to the bishop. Two

keys, so that no one person could alter the book. A copy kept elsewhere, so that one fire could not end it. The village register in this chapter keeps both rules, nearly five centuries on.

A register can do more than count. In August 1854, at William Farr's suggestion, London's death returns gained one column: the water company that served the dead person's house. Chapter 13 tells what that column found.

Pholela counts itself

At Pholela, in rural Natal in South Africa, Sidney and Emily Kark began in 1940 with a map. Their health assistants were local people. They mapped the homes around the health centre and counted who lived in them: 887 people in 130 homes, the area's first census. The count was taken again every year, house by house. Between 1942 and 1950 deaths fell from 38.3 to 13.6 in every 1,000 people a year. Deaths of infants fell from 275 to 100 in every 1,000 born. Food, gardens, water and care changed together, and there was no comparison village, so the register cannot say which of them did it. It can say that the village knew its own dying, and that the dying fell.

A village register has a weakness a city's does not. Its numbers are small. A rule written for a district of 30,000, such as "alarm when the cases double", fires constantly in 300. OR-05 worked the arithmetic for a village with one case a week on average and no outbreak at all. The doubling rule raised a false alarm in about one week in five, some 11 times a year. In Sierra Leone in 2015, 7,416 village monitors reported illness to their districts. Their reports came one to three days ahead of the clinics. But 94 alerts in every 100 were false, and they missed 7 cases in 10. False alarms have a price. People stop coming to the meeting.

So the village register uses two levels. A watch costs only a visit. It comes at twice the usual weekly count plus 2. An alarm calls the meeting. It comes at twice the usual plus 3, or at a watch two weeks running. This is OR-05's own arithmetic, untested in any real season, and a small outbreak can slip beneath it. That is why some things skip the arithmetic. One case of an alert sign is an alert, and two deaths alike within two weeks is an alarm (chapter 15).

The other weakness is silence. In 1665 families hid their dead, because a plague death shut the house. A quiet week in a season that is never quiet is a register that has stopped hearing.

The deaths need a rule of their own. In the largest test of the family interview after a death, 24 physicians read 12,542 accounts whose hospital cause was known. Beyond chance, they matched the hospital for about 3 adults in 10. A family's account is wrong more often than right about the cause. It still holds the story: when the illness began, what was done, how long the carrying took. So the village writes the story in the family's words, and never a verdict. A cause written down can become an accusation. A story can be read again in a year by someone who knows more.

Registers have also been turned on the people in them. In the occupied Netherlands, with its thorough population register, up to 75 in 100 of 140,000 Jews died, against about 40 in 100 in Belgium. So counts go out, and names stay in.

The book at Ajoya

In the Sierra Madre of western Mexico, David Werner, a biologist without medical training, made notes and pencil sketches for villagers who read with difficulty. A village project, Piaxtla, grew from a centre at Ajoya in Sinaloa. It served more than 100 villages, some of them two days away by mule. Its start is dated anywhere from 1963 to 1966. The notes became Donde no hay doctor. Some sources date it to 1970, as a mimeographed Spanish version, and others to 1973. The English edition, Where There Is No Doctor, followed in October 1977.

The front of the book thanks four of the project's health workers by name: Martín Reyes, Miguel Angel Manjárrez, Miguel Angel Alvarez and Roberto Fajardo. What their testing changed is not recorded in anything the library read. What is recorded is Werner's judgement of his own English edition. In becoming general enough for the whole world, he wrote, it lost much of the flavour and usefulness the Spanish original had for its villages. He asked readers to adapt it, and left blanks in its drug pages for local names and prices.

The book went on changing, and it changed in a way a village can copy. Its page numbers stayed fixed across revisions, so that a teacher's note say-

ing "see page 63" still pointed to the right page. Advice came out and advice went in. Drinks made from cereal were added for the child with diarrhoea. Milk for stomach ulcers was withdrawn. A copy passed from hand to hand, and in one house an old healer who could not read had her eight-year-old granddaughter read it aloud while she studied the pictures.

The idea is older than Werner. William Buchan's Domestic Medicine, first printed in 1769, ran to 19 editions and about 80,000 copies. In the twelfth edition, of 1791, Buchan explained that his later corrections went into notes, partly to prevent fatal mistakes. A manual of this kind is never finished. It learns from the people who use it, or it slowly stops being true.

Forty-four corrections

For thirty years after 1977, no one outside the publisher checked Werner's book line by line. Early reviewers from WHO, UNICEF and the Christian Medical Commission had called it unrealistic and dangerous, and nobody answered them with a count. Babu and Eisenberg did. Three physicians read the Prevention chapter of the 2007 edition and one read First Aid, 43 pages in all. The authors wrote it up in 2010.

The prevention advice held. It was correct in 96 sections in 100 of the Prevention chapter, and in every section of First Aid. The treatment advice had aged. Only 62 in 100 treatment sections in the Prevention chapter were current, and 88 in First Aid. The auditors listed what had gone wrong: tetracycline for amoebic dysentery, piperazine for worms, the claim that fever rules out amoebic dysentery, penicillin alone for infected wounds, a sling worn for 30 days after a dislocation. Children's doses were set by age, where about 28 in 100 children under five are stunted. Of the traditional remedies they checked, only honey on burns was supported.

The publisher acted. The 2009 reprint adopted 44 corrections, fully or in part. The auditors called the book a useful stop-gap and proposed a field trial of whether it saves lives. The library found none, then or since.

The audit left two lessons, and this book is built on both. Words on prevention and watching last, while drugs and doses date first. So the drug pages here are loose and dated, to be replaced when the shelf changes (chapter 32). And corrections are never finished. ME-14 found

that a newer Hesperian manual still advises a finger in the throat and salt water for a poisoned person. Chapter 22 names it so that it can be refused.

What a picture says

Werner and Bower's Helping Health Workers Learn, from 1982, holds the record of what village readers made of drawings. Shading confused them. Readers asked why a baby's neck was black. A large drawing of a malaria mosquito was not recognised as a mosquito at all. In one village in the Philippines an umbrella meant nothing. Tablets drawn small were taken for bullets. Many of the drawings were made by a health worker who had taught himself to draw. He copied square by square on a grid, once on an old X-ray plate cleaned with lye.

Later studies say the same with numbers. In South Africa, 2 of 23 pictograms imported from the United States reached the standard of 85 readers in 100 understanding them. Of 23 drawn locally, 12 did. A later team tested a picture meant to say "fever". In its first form 17.5 readers in 100 understood it, and 85.6 after it was redrawn with them. A feverish person had been read as someone being prayed for, and a lightning bolt as arthritis or tuberculosis. In Kaduna, a picture for "take 1 capsule every 6 hours" was understood by 16.5 in 100. Pictures are not a universal language.

Words fail the same way. A study in 2010 checked Spanish labels from pharmacies in the Bronx, many translated by computer. The English "once", meaning one time, reads in Spanish as eleven. A man took 11 tablets of each of two medicines for blood pressure.

This book carries pictures, and none has yet been shown to a reader. Each picture mark is a drawing to be tested on twenty people of the village before it is trusted (36.4). Some will fail. Someone local redraws them, and they are tested again.

The Honest Broker's Errata

Every chapter of this book has weighed its sources. Here the scale turns on the book itself.

The library behind it is about 160 reports and 1.7 million words. It carries 4,961 marks saying a figure is unchecked, and about 4,600 notes say-

ing a source was read only as an abstract, a summary or another writer's account. SY-12 warns that one kind of tool wrote it all, and that a tool reviewing its own work is generous to it. When this series' earlier book was checked, confident figures from its library were often wrong by factors of 2 to 10. And no outcome study exists for any lay manual. FO-06 found no trial showing that Werner's book, or any book like it, changes how many people die. This book rests on how manuals are designed and read (OR-09), not on proof that they save lives.

The chapters found errors as they were written, and each was named and not repeated. They are listed here as corrections already made, so that the method can be seen.

- ME-06's dose card for children sent its paracetamol rows to the aspirin method. SY-12 calls it the most dangerous single error in the library. Chapter 6 takes its table from IN-02's own paracetamol method.
- OR-06 credited a cellar figure for oxytocin to FO-11, which holds no such figure. It is ME-09's. Chapter 9 cites each figure to its own report.
- WO-05's question on the Red Cross penicillin course was filed under the report on dislocations, which holds no penicillin. Chapter 19 sends it back, still open.
- ME-09 prints a theatre's ceiling for lidocaine. SY-12 marks it for correction. Chapter 23 uses the Red Cross field ceiling, and a reader who meets ME-09's figure should strike it out.
- PH-01 and SY-02 say a Washington State couple died in 1977 of foxglove taken for comfrey. ME-07 says the wife died. Chapter 3 prints ME-07.

The book also caught itself. Chapters 2 and 24 found a syrup row in 06.2 whose millilitres and milligrams did not agree. Chapter 24 found that the Preface gave Scutari's fall in deaths to the nurses, where NU-01 shows it followed the Sanitary Commission. Both were corrected at the first edit, on 18 October 2026, and both stand as the first two lines of the correction page, as the pattern for the rest. Smaller slips were named where they fell, in chapters 13, 15, 25, 30 and 31.

An error is a line its own source does not support. A dispute is two sources that disagree, each with a reason. The book prints a dispute both ways until someone reads the primary sources (36.5).

The library knew where it was thin, and asked for a second round of 13 reports, about 130,000 words. R2-01 comes first and alone. It settles the disputed lines, and SY-12 asks that a person rather than a tool read it where possible. Then come blood and anti-D (R2-02), meningitis (R2-03), psychosis after birth and the antipsychotic stock (R2-04), the adult cholera drink (R2-05), how long salvaged drugs last (R2-06), hours to competence (R2-07), the odds without treatment (R2-08), how often epidemics reach a village (R2-09), the bleeding and burst belly (R2-10), who heals the healer (R2-11), breathing by hand and for how long (R2-12), and the missing regions (R2-13). Some answers no round can give, because nobody has measured them: how long toxoid keeps its strength, whether the kava drink harms the liver, how long a village can bear a quarantine.

And a village of 300 will meet things this book does not cover at all. Giving blood, and anti-D for the Rhesus-negative mother. Meningitis as a chapter of its own. Psychosis after birth. The belly that needs a surgeon. The healer's own care. Violence in the home and between partners. Sexual violence beyond the chapters on trauma. Learning disability. Child abuse, which two reports touch, cerebral palsy, which one touches, and sickle cell disease. The failing kidney. The plants and climates of Central Asia, the arid zone and the cold continental interior. A silence in a book is easily read as nothing to be done. It is a page not yet written.

The turn to the present

Before the Fall, the corrections of medicine reached the bedside without anyone at the bedside making them. A trial appeared in a journal. A committee changed a guideline. A pharmacist's screen flagged the old dose, and a new leaflet went into the box. The registers that proved the old dose wrong were kept far away, by people paid to keep them.

After the Fall the journals stop. The committees do not meet. The leaflet in the last box is the last leaflet. Every correction this book will ever receive must now come from the people who use it. Who else is left to notice that a page is wrong?

The searchers of London were poor women open to a cup of ale, and their Bills still showed the plague's rise. The village's register will be kept by its own healer, an hour every Sunday, in a book with two locks. It will be wrong at times. It will be wrong where the village can see it and mend it.

Here is the hour.

AT THE BENCH

36.1 See: the five registers

Never let one person hold both keys.

The village keeps 5 books. They take about 1 hour a week, plus a morning a month to measure children's arms. They fill about 300 pages a year.

Book	What goes in	Who writes	When
1. Daybook	1 line per visit: date, house, age, code, what was done. The visit page (02.8) is its long form	The healer	At the visit
2. Births and deaths	Every birth. Every death, with the family's story in their words	Healer or birth attendant	Within 1 day
3. Watch list	Every pregnancy, thin child and long illness, with the next visit due	The healer	30 minutes a month
4. Labour sheets	1 sheet per labour (chapter 8)	Birth attendant	During the labour

Book	What goes in	Who writes	When
5. Ledger and poisons book	Every drug in and out (chapter 32). Every batch made (chapter 33). Every key turned	Keeper and a 2nd person	At the time

The epidemic page (chapter 15) opens from the daybook when an alarm sounds.

Daybook codes: D watery stool. B bloody stool. F fever without cough or stool. C cough with fast breathing. L cough over 2 weeks. R fever with rash. J yellow eyes. X anything on the alert list. O other.

1. Write at the time. If late, write "late" and the hour.
2. Use carbon ink or pencil. Never erase.
3. Strike a wrong line once, so it can still be read. Write the right line beside it, with date and initials.
4. In an empty week write "no visits". A blank is not a zero.
5. Keep the books in a dry chest with 2 locks. 2 people hold the keys.
6. Keep the chest dry and off the floor. Paper moulds above about 65 in 100 humidity.
7. Copy every book once a year after harvest. Keep the copy in another house.
8. Counts go out. Names stay in.
9. Never add a column for faith, origin or debt. Strike any column that led to no care in a year.
10. Anyone may read their own lines and ask for a correction beside them.

Rungs. Hands: the spoken count. Hearth: paper, pencil, a dry chest. Dispensary: the 5 books. Infirmary: the master copy and yearly sums. Hospital: a laboratory. Refuse a register kept for anyone who gives no care.

36.2 Do: the Sunday count

1. Each Sunday, count the week's codes. Allow 15 minutes.
2. The first 8 weeks set the usual count. After a year, use the same month last year.

3. Watch: twice the usual weekly count plus 2. Visit each house with a case within 2 days.
4. Alarm: twice the usual plus 3, or a watch 2 weeks running. Call the meeting. Open the epidemic page. Send word to the district. The table is at 15.1.
5. 1 case of an alert sign is an alert, whatever the count. The list is at 15.1. Tell the healer the same day. Tell the district within 1 day.
6. 2 deaths alike within 2 weeks is an alarm at once. So are 3 ill alike from 1 house, water source or gathering.
7. Deaths in a month: OR-05 sets watch at 2 and alarm at 3. Chapter 15 also prints 3 and 4. Both are untested.
8. Close every watch and alarm in writing within 2 weeks: what was found, what was done.
9. Read the counts aloud at the meeting, without names.

Danger sign: silence. A week with no entries in a season that always has them. A house gone from the daybook. A death heard of only at the burial. Visit that day.

- **Help in time.** Word reaches the district within 1 day and help comes. Hand over the epidemic page.
- **Help too late.** Help comes after the peak. Hand over the page anyway. It warns the next village.
- **No help at all.** The village acts alone: water, carers apart, food at the door (chapter 15). Keep counting. The count shows when it is over.

Rungs. Hands: the count and the visit. Dispensary: the epidemic page and a messenger. Infirmary: sums across villages. Refuse a doubling rule borrowed from a district.

36.3 Do: the death review within the week

No entry is ever punished. A punished register goes silent.

1. Write every death in the births and deaths book within 1 day.
2. Review it within 7 days. The healer, the 2nd healer and 1 elder sit for up to 1 hour.
3. Ask 4 questions. When was the illness first seen? What was done, and when? What was missing: a skill, a drug, a carrier, a page? What will we do differently?

4. Review first every death of a mother, a newborn or a child under 5.
5. Visit the family 2 to 4 weeks after the death. Ask them to tell the story. Allow 30 to 45 minutes.
6. Write the story in their words. Never write a cause that accuses. Write "probable", or the family's words.
7. Write 1 lesson in 1 line. If the lesson is about this book, copy it onto the correction page (36.5).
8. Read the lesson aloud at the next meeting, without names.

Rungs. Hands: the questions. Dispensary: the review. Infirmary: its own reviews within 7 days (chapter 35). Refuse any review that names a culprit.

36.4 Do: test a picture, replace a page

1. Find at least 20 readers from the village. Include the least schooled and at least 5 over 50.
2. Cover the words. Show the picture alone. Ask: "What does this picture tell you to do?"
3. Score each answer: correct, partly, wrong or opposite.
4. Pass an ordinary picture at 67 in 100 correct. Pass a danger sign, a dose or a "do not" at 85 in 100.
5. Fail any picture that 1 reader takes for its opposite, whatever the score.
6. Redraw a failed picture with local faces, clothes and objects. Test it on new readers.
7. Write the result, the date and the testers in the register.
8. Drug pages are loose, numbered and dated (chapter 32).
9. When a new page arrives, 2 people read every number aloud against the master.
10. Take the old page out and burn it. Never keep 2 versions.
11. Copy only from the master. Copy drawings on a grid. Date each copy.
12. Drill monthly: name a sign, find its page in under 1 minute.

Rungs. Hands: showing and asking. Infirmary: the master copy. Refuse a picture no reader has seen.

36.5 Prevent: correct this book

The marks:

- VERIFY in square brackets: the line is not yet checked against its source. Confirm it before you trust a life to it.
- OWNER in square brackets: the line is a choice, not a fact. The village may choose otherwise.
- a warning mark in the verification file: a life depends on the line.

1. Ask the district for the verification file. It lists each checked claim by chapter, with its source and status: open, confirmed, amended or dropped.
2. A figure the register contradicts is wrong until shown otherwise. The register must show it in counts, over a season, with every case written. 1 case is a question, not a correction.
3. Write each error on the back correction page: date, page, line, what the register showed, new line, 2 names.
4. Never change a dose in the village alone. Send it to the district's editorial group of 2 or 3. They work it twice, with 2 people, and issue a dated slip.
5. Once a year after harvest, the village meets with the register and the correction page. It reads every page flagged that year and corrects the book in ink.
6. Send the year's corrections to the district. Copy the district's slips into every copy.
7. When the slips outnumber the pages, write the second edition. Keep the page numbers. Date the title page.

The first two lines on the correction page were found before print and are already corrected. They stand there as the pattern for the rest. The Preface once credited the fall in deaths at Scutari to the nurses alone, and now names the drains (see NU-01). A syrup row in 06.2 once printed 250 mg against a measure that holds 240, and now prints both.

The disputed lines. These are the reader's own verification list. Doses stay on their chapter's page.

C	Line	Where	Printed	What settles it
1	Foxglove as medicine	3, 34	Never. ME-07's case printed	The village's choice

C	Line	Where	Printed	What settles it
2	Garden size	33	700 m², with 70 beside	A year of the village's own yields
3	Wild harvest	33	70 in 100 of a stand, and 1 plant in 5 for bark and root	Counts of the stand over years
4	Oxytocin past its date	9	Discard, and 2 to 3 years cool at falling strength	R2-06
5	Breath lines for opium	30, 31	12, 10 and 8 as 3 actions. The hold line is 12, ruled by the owner on 18 October 2026	R2-01
6	Breath line for magnesium	10	Hold below 16, emergency below 12	R2-01
7	Ephedra ceiling	25	The British lay ceiling, Chinese practice beside it	R2-01
8	Lidocaine ceiling	23, 26	The Red Cross field ceiling. ME-09's struck	R2-01

C	Line	Where	Printed	What settles it
9	Salt in the household drink	5, 15	The half spoon, WHO's wording beside it	R2-01, R2-05
10	The tourniquet	18	Taught. Never for snakebite	The village's choice
11	Restraint	30	Floor rule, never face down. Time limit open	The village's choice
12	Técnicos' caesareans, Maputo	10, 23, 35	958 and 978	Pereira's 1996 paper
13	Caesareans for 3,000 a year	23, 35	1 to 2, and about 6	The district's register
14	Killing dogs against rabies	14, 22	Fails as control, WO-13's mark beside	The record OR-10 read
15	Depth of an anthrax pit	14	2 m, and 2 feet of cover	The FAO manual of 1994
16	Washington State, 1977	3	The wife died	Settled (ME-07)
17	Quinine in bark	6, 33	About 1 in 100, and 5 or 3. Unknown bark is never dosed	R2-01
18	Guava and berberine	5, 33	B for fewer stools, and C or D. Never a cure	Primary trials, read in full

C	Line	Where	Printed	What settles it
19	Kava	30	The null trial preferred. Water drink D or C	Liver tests in drinkers
20	Meningitis alert	15	In 300, 1 case is the alert	R2-03
21	Deaths in heat stroke	20	10 in 100, and 5	The cooling guideline's sources
22	Urine on magnesium	10	30 ml an hour, 25 beside	R2-01
23	Age for aspirin and willow	26	16 and 18, with 12 beside	R2-01
24	Boiling instruments	1, 18, 20, 23, 27	20 minutes from a full boil, 10 beside. Linen and utensils 10 (1, 13, 24)	R2-01
	Poison in a thorn apple seed	22	2 figures, neither a dose	R2-01
	Feeding a starved adult	7	The low start, and the fourfold higher	R2-01

Each chapter's Honest Broker section names its other lines printed both ways.

The gaps are named in this chapter's Honest Broker section. For each one you meet, write in the register what you did. That is where its chapter starts.

To be decided by the village. The book's default stands until the village decides.

Decision	The book's default	Where
Foxglove	Never as medicine	3, 34
The tourniquet	Taught	18
How long a hold may last	Floor rule, never face down	30
The opium breath ladder	12, 10 and 8 as 3 actions	31
Injection below the district	Magnesium by the birth attendant, adrenaline for anaphylaxis	10, 22
Who gives lidocaine	A healer trained at the infirmary	23
Adrenaline in the household	Kept in the dispensary, both printed	25
Poppy and ephedra beds	As chapter 34 sets	34
Garden size and wild harvest	700 m², the stricter harvest	33
Age column on dose tables	Only "if no scale"	Throughout
Who holds the keys	Form 1 for the outer cabinet, Form 2 for the inner cupboard, as chapter 32 sets	32
Traditions asked before printing	Not yet asked	3
Who reads the register, and its copy	2 keys, 1 copy away, names in	36.1
Who may change the book	The district's editorial group	36.5
Pictures tested before print	20 readers each	36.4

If it goes wrong

The register goes silent. It looks like empty weeks, a house missing from the daybook, a death heard of at the burial. The cause is a keeper who is ill or overworked, or fear that an entry brings punishment. Let the 2nd healer keep it. Write "no visits" when there are none. Visit the silent house. Take away any

punishment tied to an entry.

The register is captured. It looks like someone asking for names who gives no care. Or a new column for faith, origin or debt. Or the book used to share out food. The cause is a register kept for a reader other than the sick. Strike the column at the meeting. Counts go out, names stay in. GOVERNING after the FALL holds the rules on who may demand the book.

A correction spreads an error. It looks like 2 copies giving 2 numbers, or a line changed after one bad night. The cause is a copy made from a copy, or 1 case read as proof. Go back to the master. 2 people read every number aloud. Change a dose only through the district (36.5).

NUMBERS TO CARRY

- 1 hour a week: the 5 books (OR-05).
- About 300 pages a year (OR-05).
- Twice the usual plus 2 is the watch. Twice the usual plus 3 is the alarm (OR-05).
- 1 case of an alert sign. 2 deaths alike in 2 weeks (15.1).
- 7 days: every death reviewed.
- 20 readers a picture. 67 in 100 to pass, 85 for a danger sign, dose or "do not" (OR-09).
- 62 against 96 in 100: treatment current, prevention correct, in the audited manual (FO-06).
- 44 corrections in one reprint (FO-06).
- Once a year, by the village, in ink.

THE LIBRARY

OR-05 Records, surveillance and noticing the outbreak: the village register. OR-09 Teaching the book: readability, pictures and the design of a manual for people who read little. FO-06 The manuals that worked: Where There Is No Doctor, the Ship Captain's Medical Guide, military and mission manuals. SY-12 What the library could not find: gaps, contradictions and the second round. SY-11 The book's structure: parts, chapters, protocols and the website. Also SY-10 and SY-07, and the Honest Broker section of every chapter. All are on the website, with the verification file and the corrections log.

That is the whole book. It was made from what could still be reached, for a place its makers will never stand in. You stand there. Everything in it that holds was first seen by someone at a bedside, counted, written down, and then put right by the next person who looked. It reaches you in that state, unfinished. After this page come the wall card and the clock cards. They are the book's last pages, and they are meant to be torn out, copied and pinned up where the sick are seen. Keep the rest on the shelf beside the register, and read the two side by side each year. A book that learns is kept by the people who use it. Keep it.