SY-05 The twenty interventions that save the most lives per hour of training: a ranked ledger

HEALING after the FALL, research library, SY-05

Researched 10 October 2026 by Claude Opus agent for THRIVING after the FALL, Book Four. Library document, unverified.

How to read this ledger

This is a synthesis. Its ground is the library of 155 accepted reports, read through their summaries and, where the ranking leans on them, in full. A handful of outside sources anchor the method: the Lancet child survival series (Jones et al. 2003), the neonatal series (Darmstadt et al. 2005, Bhutta et al. 2014), the nutrition series (Bhutta et al. 2013), women's groups (Prost et al. 2013) and the costing of the Disease Control Priorities packages (Watkins et al. 2020). SY-08 (the means ledger) and SY-11 (the book's structure) are forthcoming and are not quoted. Library reports are cited as (THRIVING library, ID) at first use and by ID alone thereafter and in tables.

Every number in the ranking tables is my arithmetic on library figures, for a village of 300 that does not exist yet. These figures carry one [VERIFY] mark at each table head rather than in every cell. Three cautions govern everything below.

- **Effects do not add.** Rehydration, soap, water and latrines act on the same diarrhoea deaths. Each row assumes the intervention alone (Section 3.3).
- **The counterfactual is the village as it will be.** Breastfeeding will be near universal after the Fall, so teaching it buys only the margin.
- **Deaths are not the only currency.** Palliation averts none. It is ranked here as the brief asks and argued back into the book on other grounds (Section 5).

Findings by section

1. Method: what "lives per hour" means here

The Disease Control Priorities project ranks interventions by cost per disability-adjusted life year averted, for a health system with clinics, staff and supply chains (Laxminarayan et al. 2006, catalogue record only). Its third edition proposed an essential package of 218 interventions, with a highest-priority subpackage of 115 costing roughly half as much. At 80 per cent coverage the full package would cost US$79 per person a year in low-income countries, and care delivered in health centres takes the largest share (Watkins et al. 2020). None of that money exists after the Fall.

The village's scarce goods are training hours and a few materials it cannot make: amoxicillin, vitamin A capsules, misoprostol, antimalarials, nets. So the ledger asks, for each intervention:

1. **Deaths averted a year** in a village of 300, in a settled state (year 3 onwards, vaccines lost, salvaged stock still present), for a tropical and a temperate village, with a central estimate and a range.

2. **Training hours** in the first year: the healer's share of OR-01's proposed 300-hour course, plus hours spent teaching households, attendants or carers. Refreshers add perhaps a fifth (OR-01) and are left out.
3. **Hours per life saved over ten years**: training hours divided by ten years of deaths averted. Lower is better. This is the ranking figure. Ten years is roughly how long salvaged tablets keep working (ME-09, IN-05).
4. **Materials, evidence grade, harm when done wrong**, and the library report that carries the evidence and protocol.

No source measured "hours to competence" for any village skill (THRIVING library, OR-01). Every hour figure is the length of a course that worked, not the minimum that would.

2. The baseline village: who dies of what

Two villages, one disagreement. FO-01 projects year one, with European fertility, about 3 births a year in a temperate village and about 10 in a tropical one. IN-01 assumes the regime of the 1870s, a crude birth rate of 35 per 1,000 and a crude death rate of 25 to 30, giving about 10 births and 7 to 9 deaths a year in any climate. The two reports describe different moments. Without contraception (THRIVING library, MA-08) temperate fertility will climb from FO-01's figure towards IN-01's. I use 10 births a year for the tropical village and 6 for the temperate one, and say where the result is sensitive to it.

Table 1. Expected deaths a year without the interventions, settled state [VERIFY: my arithmetic on library figures]

Cause	Tropical village (10 births)	Temperate village (6 births)	Basis
Newborn (first 28 days)	0.45 to 0.6	0.2 to 0.3	Neonatal mortality 45 to 62 per 1,000, Gadchiroli baseline (FO-04, IN-01)
Child diarrhoea	0.5 to 0.7	0.15 to 0.25	22 per cent of child deaths (Jones 2003, via IN-01), summer peak in temperate
Child pneumonia	0.5 to 1.75	0.3 to 0.6	Cause share against incidence times case fatality (IN-01, see Section 6)
Child malaria	0.4 to 2.0	0	15 to 24 per cent of children killed before treatment existed (IN-09)
Measles, averaged over epidemic years	0.2 to 0.5	0.1 to 0.2	Cohort build-up, case fatality 2 to 12 per cent under five (IN-12)
Mothers	about 0.09	about 0.05	872 per 100,000 births untreated (FO-01, Kaunitz)
Tuberculosis, adults	0.5 to 0.9	0.5 to 0.8	About 12 per cent of deaths in England 1871 to 1880 (IN-01)
Pneumonia and cold in the old	0.4 to 0.6	0.6 to 1.0	FO-01 judgement, IN-03

Cause	Tropical village (10 births)	Temperate village (6 births)	Basis
Injury, wound sepsis, burns	0.3	0.3	FO-01, WO-14
Lost drugs and lost surgery	0.5 to 2	0.5 to 1.5	FO-01: almost none preventable by a lay healer
Everything else, old age	2 to 3	2 to 3	Remainder
Total	**about 7 to 9**	**about 5 to 7**	Crude death rate 25 to 30 (IN-01)

Three facts fall out of this table before any ranking. First, children under five carry three or four of the tropical village's deaths and one or two of the temperate village's, and most of the preventable ones (IN-01). Second, a mother dies about once in 11 years in the tropical village and once in 20 in the temperate one, (IN-01). Third, the deaths from lost drugs and lost surgery, which dominate year one (FO-01), are almost untouched by anything in this ledger.

Epidemic years. The table describes an ordinary year. A cholera or dysentery outbreak can kill tens in a village in weeks (FO-01, Goma). I add an expected value for epidemics to the oral rehydration and epidemic-control rows: one outbreak in 20 years with about 20 severe cases, half of whom would die untreated and under 1 per cent with full rehydration (IN-11, FO-02). That is about 0.5 deaths a year averted on average in the tropical village and half that in the temperate one. It is the most uncertain number in the ledger, and it is large.

3. The ranked ledger

3.1 The numbers Table 2. Deaths averted, training hours and the ranking figure [VERIFY: all deaths-averted and hours-per-life figures are my arithmetic on the library's effect sizes and OR-01's hours]

Rank	Intervention	Deaths averted a year, tropical (range)	Temperate (range)	Training hours, first year (healer + others)	Hours per life over 10 years, tropical / temperate
1	Counting breaths, danger signs and amoxicillin for child pneumonia and sepsis, adult pneumonia	0.75 (0.25 to 1.6)	0.45 (0.2 to 0.8)	30 + 30 = 60	8 / 13
2	Oral rehydration, feeding through diarrhoea, zinc where held	0.85 (0.3 to 2.0)	0.36 (0.1 to 1.5)	12 + 60 = 72	8.5 / 20

Rank	Intervention	Deaths averted a year, tropical (range)	Temperate (range)	Training hours, first year (healer + others)	Hours per life over 10 years, tropical / temperate
3	Fever care in malaria: test where possible, full course, sugar, no chilling (tropical)	0.4 (0.1 to 1.0)	not applicable	8 + 30 = 38	9.5 / not applicable
4	Measles care: isolate the case, two doses of vitamin A, feed, eyes, treat the chest	0.18 (0.05 to 0.5)	0.06 (0.02 to 0.2)	6 + 10 = 16	9 / 27
5	Breastfeeding: first hour, nothing else for six months, wet-nursing the orphan	0.15 (0.05 to 0.4)	0.08 (0.02 to 0.2)	4 + 14 = 18	12 / 22
6	Epidemic control: count, isolate fast, safe funerals and burial	0.12 (0 to 1.0)	0.10 (0 to 1.0)	10 + 10 = 20	17 / 20
7	Whole nets, screened houses, closed eaves (tropical)	0.25 (0.1 to 0.4)	not applicable	4 + 30 = 34	14 / not applicable
8	Tuberculosis in the household: separate sleeping, open windows, food for contacts, early recognition	0.12 (0.05 to 0.3)	0.10 (0.05 to 0.25)	8 + 20 = 28	23 / 28
9	Clean first, then boil or steam: one sterile needle and syringe per person per injection	0.04 (0.01 to 0.1)	0.03 (0.01 to 0.1)	10 + 0 = 10	25 / 33

Rank	Intervention	Deaths averted a year, tropical (range)	Temperate (range)	Training hours, first year (healer + others)	Hours per life over 10 years, tropical / temperate
10	Wounds: irrigate with litres, cut out the dead, drain pus, leave dirty wounds open, close at day 4 to 7	0.08 (0.03 to 0.2)	0.08 (0.03 to 0.2)	16 + 6 = 22	27.5 / 27.5
11	Safe water at the house: protected source, chlorine, filter or boil, covered container with a tap	0.25 (0.05 to 0.6)	0.15 (0.03 to 0.4)	8 + 60 = 68	27 / 45
12	Malnutrition: MUAC strap, feeding through illness, slow refeeding, sugar and warmth	0.18 (0.05 to 0.5)	0.05 (0 to 0.15)	8 + 30 = 38	21 / 76
13	Nursing the bedridden: mouth care, turning, feeding, fluids by tube or under the skin	0.08 (0.03 to 0.15)	0.12 (0.05 to 0.25)	12 + 20 = 32	40 / 27
14	Clean birth and cord: washed hands, clean blade and tie, nothing on the cord	0.12 (0.05 to 0.25)	0.05 (0.02 to 0.1)	8 + 29 = 37	31 / 74
15	Hand washing with soap at the key times, with soap the village makes	0.23 (0.08 to 0.5)	0.12 (0.04 to 0.25)	8 + 70 = 78	34 / 65
16	Splinting: padded, loose, the gangrene check, traction for the femur	0.01 (0 to 0.03)	0.01 (0 to 0.03)	6 + 0 = 6	60 / 60

Rank	Intervention	Deaths averted a year, tropical (range)	Temperate (range)	Training hours, first year (healer + others)	Hours per life over 10 years, tropical / temperate
17	Latrines sited and used by most of the village, shoes	0.09 (0.02 to 0.2)	0.03 (0 to 0.08)	4 + 30 = 34	38 / 113
18	Newborn breathing and warmth: dry, rub, bag and mask, skin to skin	0.10 (0.04 to 0.2)	0.04 (0.02 to 0.08)	10 + 28 = 38	38 / 95
19	Warmth for the old in winter, cold-water immersion for heat stroke	0.01 (0 to 0.05)	0.08 (0.02 to 0.5)	4 + 30 = 34	340 / 42.5
20	Breathing for the patient by hand, in relays (drowning, poisoning, paralysing snakebite, botulism, opioid overdose)	0.03 (0.01 to 0.1)	0.02 (0.01 to 0.05)	4 + 20 = 24	80 / 120
Below the line	Postpartum haemorrhage control	0.025 (village), about 0.25 (district)	0.012	6 + 18 = 24	96 / 200
Below the line	Tourniquet, pressure and packing	0.02 (0.005 to 0.05)	0.02	4 + 30 = 34	170 / 170
Below the line	Rabies: wash the bite 15 minutes, confine the dog 10 days	0.005	0.001	1 + 15 = 16	320 / 1,600
Below the line	Lay mental-health care and suicide prevention	0.02	0.03	70 + 0 = 70	350 / 233
Enabler	Antibiotic stewardship	0 directly, roughly doubles the years rank 1 and rank 3 work	same	4	not computable

Rank	Intervention	Deaths averted a year, tropical (range)	Temperate (range)	Training hours, first year (healer + others)	Hours per life over 10 years, tropical / temperate
Comfort	Palliation	0 by definition, every one of the 7 deaths a year	same	8 + family	not applicable

The overall rank is the average of the tropical and temperate ranks, with the two malaria rows ranked on tropical figures alone. The tropical and temperate orders differ, and both are given in Section 3.4.

3.2 Materials, grades, harms and where the protocol lives Table 3. What each ranked intervention needs and how it kills when done wrong [materials a year are my arithmetic, VERIFY]

Rank	Materials a year, village of 300	Grade	Harm when done wrong	Evidence and protocol
1	About 300 child tablets of amoxicillin 250 mg plus 20 adult courses, about 200 g in all. A watch or bead timer	A for oral amoxicillin, B for the count	Missed danger sign, wrong dose by age not weight, antibiotic for every cough until the stock is gone	IN-03, IN-05, MA-07, FO-07
2	About 135 litres of solution in ordinary years: 0.4 kg salt, 3.4 kg sugar. A marked litre vessel and a fixed scoop per household. Ten times that in a cholera year	A	Too salty solution has killed infants. Withholding food or fluid	HY-03, IN-11, MA-07
3	Rapid tests while they last, artemisinin combinations or quinine 7-day courses, sugar	A with a real drug, D for bark of unknown strength, X for Artemisia tea as cure	Quinine overdose (from about 900 mg in a toddler), low blood sugar, short courses that relapse, every fever called malaria	IN-09, IN-02, PH-04
4	About 60 vitamin A capsules per outbreak, food, clean water for eyes	A (two doses), X for withholding food	Single dose does nothing. Vitamin A above 10,000 IU a day in pregnancy causes birth defects	IN-12, IN-01, MA-10

Rank	Materials a year, village of 300	Grade	Harm when done wrong	Evidence and protocol
5	Nothing. Open cups and a pan for flash-heating donor milk	B (observational, consistent)	Honey, paps, water or undiluted animal milk under six months. Gathering orphans together	MA-06, MA-05, IN-01
6	A register, chlorine for a cholera body, food for the isolated	B	Quarantine without food or consent turns violent and fails. Funeral meals spread cholera	HY-07, IN-13, NU-07, OR-05
7	60 to 90 nets every three years or so, local screening and mud for eaves	A for nets, B for screening	Insecticide misuse, false security in a dengue area	IN-09, HY-06
8	Food for contacts, a window per sleeping room, sputum burned	A for food in contacts, B for the rest	Single-drug salvaged courses breed resistance within months	IN-10, NU-03
9	A 15 psi stovetop pressure cooker or a 20-minute boil, fuel, a stock of needles	B (A for the physics)	Alcohol or flame trusted as sterilising, needle changed but syringe reused	WO-12, WO-15, SY-01
10	At least 1 litre of drinkable water per wound, boiled cloth, sugar or honey for infected wounds	B	Closing a dirty wound, boiling oil, caustics, peroxide in deep wounds	WO-02, WO-03, WO-14
11	Chlorine at 2 mg per litre or a filter. Boiling for all drinking water would need about 0.3 kg of wood a litre, tens of tonnes a year	A in open trials, near null in blinded ones	Recontamination of treated water, Moringa weakening chlorine	HY-02, FO-09
12	Food, oil, sugar, milk, sorted groundnuts, a marked strap	A for community therapeutic care, B for home paste	Fast refeeding stops the heart. Paste without minerals. Aflatoxin	HY-09, MA-07
13	Sheepskin or a soft surface, a tube, isotonic saline	A for mouth care (one trial), B for the rest	Tube fed before position is confirmed. Bed rest as treatment	NU-01, NU-02

Rank	Materials a year, village of 300	Grade	Harm when done wrong	Evidence and protocol
14	Soap, a new or boiled blade, two clean ties, chlorhexidine where held	B, A for chlorhexidine where neonatal mortality is above 30 per 1,000	Dung, ash or oil on the cord. Unwashed internal examinations	MA-05, MA-01, TR-14, WO-14
15	About 70 kg of soap from about 55 kg of fat and potash lye	A	Lye burns and child caustic ingestion where soap is made at home	HY-01, HY-05
16	Padding, slabs, a traction rig	B	Tight bindings: the gangrene that leads every bonesetter complication list	WO-05, SY-01, TR-12
17	Labour, a slab, a lid	A to B, trials mixed	A pit uphill of a well or within 30 m of it	HY-04
18	A towel, a bag and mask, a manikin for weekly drill	B for the package, A for skin-to-skin	Prolonged bagging past about 20 minutes, hypothermia from bathing	MA-05, OR-01
19	Insulation, fuel, a tub or tarpaulin and cold water	A for immersion in heat stroke, B for cold	Hot baths and body-to-body rewarming in hypothermia. Rough handling	HY-11, TR-12
20	A bag-valve mask if salvaged, a written rota	B	Compressions without breaths in drowning. Abdominal thrusts	ME-14, HY-11, WO-13, IN-16

3.3 What the whole package does Summed row by row, the twenty would avert about 4 deaths a year in the tropical village and 2 in the temperate one. That is double counting. Diarrhoea alone shows why: oral rehydration, water, soap and latrines each claim a share of the same 0.5 to 0.7 child diarrhoea deaths. Multiplying the survival fractions rather than adding the effects, I estimate the package averts about 2.5 to 3 of the tropical village's 7 to 9 deaths a year and about 1 to 1.5 of the temperate village's 5 to 7 [VERIFY: my arithmetic]. That is roughly a third of all deaths in the tropics and a fifth in temperate places.

This agrees in shape with the outside models. Jones et al. (2003) found 63 per cent of child deaths preventable at full coverage, about a third by household actions alone. Darmstadt et al. (2005) found that outreach and family and community care at 90 per cent coverage would avert 18 to 37 per cent of newborn deaths, against 41 to 72 per cent with facility care as well. FO-01 reached the same order independently: a lay healer could prevent a third to half of excess child deaths.

The total training cost is about 850 hours in the first year: about 260 healer hours, which fit inside OR-01's 300-hour course, and about 590 hours of household, attendant and carer teaching. A bundled household visit changes that arithmetic (Section 3.5).

3.4 Tropical and temperate orders **Tropical order by hours per life:** amoxicillin, oral rehydration, measles care, malaria fever care, breastfeeding, nets, epidemic control, malnutrition, tuberculosis household, sterilisation, safe water, wounds, clean birth, soap, latrines, newborn breathing, nursing, splinting, rescue breathing, postpartum haemorrhage.

Temperate order: amoxicillin, epidemic control, oral rehydration, breastfeeding, measles care, nursing the bedridden, wounds, tuberculosis household, sterilisation, warmth for the old, safe water, splinting, soap, clean birth, malnutrition, newborn breathing, latrines, rescue breathing, tourniquet, postpartum haemorrhage.

The temperate village pulls the old forward because it is older and has fewer births. Malaria leaves the list. If the temperate village reaches 10 births a year, as IN-01 assumes, the newborn rows rise by two-thirds and move up three to five places.

3.5 How sensitive the order is **Household hours.** Rows 2, 11, 15 and 17 carry 60 to 70 household hours each. Taught separately, that is 220 hours. Taught together in one two-hour visit to each of 60 households (rehydration, soap, water, latrine, danger signs, breastfeeding, nets), it is 120 hours. BRAC taught 12 million households rehydration in visits of under an hour (FO-04, OR-09). On the bundled count, soap and water rise into the top ten and the hygiene rows cost under 10 hours per life in the tropics. The book should teach them as one visit.

Drug stock. Ranks 1, 3 and 4 depend on salvaged tablets and capsules. When amoxicillin runs out, rank 1 falls to the breath count, positioning and feeding, which no trial has shown to change pneumonia mortality (IN-03). Rank 1 is then worth perhaps a fifth of its value [VERIFY: inference]. Measles care and malaria care decay the same way as capsules and antimalarials run out (IN-09, PH-04). Stewardship sets how long that takes. IN-05 estimates 40 to 80 courses a year if the village spends only on the syndromes that kill [VERIFY in IN-05].

Epidemic expectation. If cholera never comes, oral rehydration drops to 0.33 deaths a year in the tropics and 0.11 in temperate places, and epidemic control to near zero. Oral rehydration still stays in the top three in the tropics. If it comes twice in 20 years, those rows double and lead the ledger.

Effect sizes. Safe water is the row most at risk. Open trials show 34 to 50 per cent less diarrhoea, blinded trials almost none (relative risk 0.94) (HY-02, IN-01). On blinded figures, row 11 falls below the line.

4. The twenty, one by one

Each note gives what decides the rank and what the rank hides. The report that carries the evidence and the protocol is named in Table 3.

1. Breath count and amoxicillin. Lay case management cut child pneumonia deaths by about 35 per cent and all child deaths by about 21 per cent, and in Gadchiroli case fatality fell from 13.5 to 0.8 per cent (IN-01, IN-05). Oral amoxicillin at home equals injections for chest indrawing without danger signs (MA-07, IN-03). Sulphapyridine cut adult pneumonia deaths from 27 to 8 per cent in 1938 (FO-02), so the same tablets serve the old. One skill and one tablet act on the leading killer at both ends of life. It is also the row most exposed to running out.

2. Oral rehydration. Fluid takes cholera from about 50 per cent to under 1 per cent (IN-11, FO-02), and pooled studies give 69 per cent fewer diarrhoea deaths. The often quoted 93 per cent is a model (IN-01). Up to a quarter of home solutions were dangerously salty two years after teaching (HY-03), so the scoop and the marked litre are part of the intervention. Jones et al. (2003) gave rehydration the largest single share of preventable child deaths, 15 per cent.

3. Fever care in malaria. Malaria killed an estimated 15 to 24 per cent of African children before treatment, and mothers taught to treat with a working drug cut under-five deaths by 40 per cent in one Ethiopian trial (IN-09, FO-04). Quinine cures 85 to 95 per cent over seven days and three-day courses fail. Fewer than half of one series of "severe malaria" cases had parasites (IN-09), so a test, while any remain, is part of the row. The rank holds only while a drug of known strength exists.

4. Measles care. Two doses of vitamin A on consecutive days cut measles deaths sharply and one dose does not (IN-12, IN-01). The rank comes from a 6-hour healer course acting on a disease that will certainly return: a district gathers enough susceptible children for an epidemic within about two years (IN-12).

5. Breastfeeding. Non-breastfed infants under six months die at 14 times the rate of exclusively breastfed ones (IN-01). Starting after 24 hours carried 2.19 times the risk of newborn death (MA-05). A mother's death multiplies her infant's risk about 25-fold, and wet-nursing and flash-heated donor milk are the answer (MA-06). After the Fall most mothers will breastfeed anyway, so the ledger counts only the margin, and still the row ranks fifth.

6. Epidemic control. Isolation works when little spread happens before symptoms, and speed matters more than numbers (HY-07). Touching a cholera body raised the odds of infection 36-fold in Guinea-Bissau (IN-11). Mawah's negotiated, fed quarantine worked and West Point's imposed one failed (IN-13). Its value lies almost wholly in rare years.

7. Nets and screens. Treated nets cut child deaths by 17 per cent, and whole untreated nets still roughly halve infection. Closed eaves and screens halve indoor mosquitoes without insecticide (IN-09, HY-06).

8. Tuberculosis in the household. Untreated smear-positive disease kills 70 per cent in ten years (IN-10). Food for undernourished contacts cut new disease by about 40 per cent (IN-10). These measures slow the disease rather than cure it, which keeps the row in the middle.

9. Sterilisation. Reused needles are the best-documented harm of lay medicine (SY-01). Steam at 121 °C for 20 minutes sterilises, and a stovetop cooker with a 15 psi weight can do it (WO-12). Few deaths are averted directly, but every procedure in this ledger depends on it, and it costs 10 hours.

10. Wounds. Drinkable water irrigates as well as saline, in litres (WO-02). Dirty wounds left open and closed at day 4 to 7 failed in about 5 per cent of 25,000 wartime cases (WO-03). Trueta lost 6 of 1,073 open fractures without antibiotics (WO-05, WO-09).

11. Safe water. Section 3.5 gives the doubt. The material cost is the surprise: boiling all drinking water for 300 people at about 0.3 kg of wood a litre [VERIFY in HY-02] would burn tens of tonnes a year. Chlorine, filters and a covered container with a tap are the realistic means, and boiling is kept for infant feeds and the sick (HY-02).

12. Malnutrition. Undernutrition lies beneath about 45 per cent of child deaths (IN-01), and ten nutrition interventions at 90 per cent coverage were modelled to cut child deaths by 15 per cent (Bhutta et al. 2013, abstract). Community therapeutic care reached 4.1 per cent mortality across 23,511 children (FO-01). The row is worthless without food, which is the village's to give, not the healer's.

13. Nursing the bedridden. Mouth care after meals cut pneumonia from 19 to 11 per cent in nursing-home residents (NU-01). Tube rehydration equals the drip in children (NU-02). The row rises in the temperate village, where the old are more of the deaths.

14. Clean birth and cord. Any substance on the cord carried an odds ratio of 5.1 for neonatal tetanus (MA-05). Childbed fever is carried by attendants at home as in hospital (MA-04). Chlorhexidine helps only where newborn mortality exceeds 30 per 1,000 (MA-05). Maternal toxoid cut neonatal tetanus deaths by 94 per cent (WO-14), and its loss will be felt as girls born after the Fall become mothers (IN-01).

15. Soap. Hand washing with soap cuts child diarrhoea by about 30 per cent and pneumonia by 16 to 21 per cent, and education without soap did not work (HY-01). So the soap maker belongs in the training count, and lye storage in the lesson: in one Nigerian series 87.5 per cent of child caustic ingestions came from homes making soap (HY-05).

16. Splinting. It averts few deaths and much maiming: one-day courses for 112 Ethiopian bonesetters cut gangrene amputations from 25 to 7 (WO-05, SY-01).

17. Latrines. Sanitation protects the community only when 50 to 75 per cent of households stop open defecation, and hookworm responds more to shoes (HY-04). Low for deaths, higher for worms and typhoid.

18. Newborn breathing and warmth. Helping Babies Breathe halved first-day deaths in Tanzania, mostly by drying and stimulating more babies (MA-05). Skin-to-skin contact cut deaths in small babies by 25 per cent (MA-05). The cost is the drill: hands forget within three months, and three minutes of weekly practice held the gain at Haydom (OR-01).

19. Warmth and cooling. Cold-water immersion cures heat stroke if started at once, and an insulated, fed, shivering person rewarms (HY-11). The row ranks only in temperate villages and climbs sharply in a year when fuel fails.

20. Breathing for the patient. Relays of hand ventilation carry people through paralysing snakebite, botulism and several poisonings given enough hands (ME-14, WO-13). Drowning needs breaths, not compressions alone (HY-11). The events are rare, the teaching short.

5. Below the line, and the rows the metric cannot see

Postpartum haemorrhage (rank 21). It kills about a quarter of the mothers who die, within hours (MA-02). Misoprostol 600 μg by mouth after the birth roughly halves haemorrhage and needs no fridge (MA-02, FO-11). Yet a village sees about one haemorrhage death in 40 years, so per village hour it falls below the line. In the district of 3,000 the same training averts about 0.25 deaths a year and ranks in the top ten. And the arithmetic undercounts, because a dead mother multiplies her infant's risk about 25-fold (MA-06).

Tourniquet and packing (rank 22). A tourniquet applied before shock was associated with about 90 per cent survival against 10 per cent after (WO-01). Improvised windlass tourniquets still fail about a third of the time (WO-01, FO-09). Exsanguination from a limb is rare in a farming village, so per hour of teaching thirty adults it ranks low.

The clock rule. Both rows share what the metric ignores: they are decided in minutes, by whoever is standing there, and nothing later undoes the delay. I propose that the book exempt such skills from the ranking and put them on early cards: pressure and tourniquet, haemorrhage after birth, breathing for the patient, cooling the heat-struck, washing the dog bite for 15 minutes and confining the dog for ten days (IN-15, OR-10). Whether to apply this override is the owner's decision [OWNER].

Lay mental-health care. A person with nine days of training and ten hours of watched practice can deliver a treatment that works (MI-02), and contact after a suicide attempt cut deaths from 2.2 to 0.2 per cent (MI-08). It averts perhaps 0.02 to 0.03 deaths a year in a village, so per hour it ranks last. Measured in suffering it would rank in the top ten. The book should carry it and say plainly why.

Palliation. Every one of the village's seven or eight deaths a year is a palliation case. By-the-clock analgesia, a fan for breathlessness and mouth care for thirst cost almost nothing (NU-06), and FO-08 states the duty: the not-chosen are owed comfort, company and honesty. Outside the metric, inside the book.

Antibiotic stewardship. It saves no life directly and sets how many years ranks 1, 3 and 4 last. Delayed prescribing cuts use by two-thirds safely (IN-05). Four hours that double the life of the stock may be the best-value hours in the course.

Routine vitamin A and iodine. Routine vitamin A cut child mortality by 12 per cent in the Cochrane review but not in the large DEVTA trial (IN-01), and food supplies it after the Fall (ME-09). Iodine prevents cretinism, not deaths, and a district needs only about 165 g a year (HY-08). Both belong in the food chapter.

What no row touches. Insulin-dependent diabetes, advanced HIV, obstructed labour without surgery, drug-resistant tuberculosis (FO-01, CH-01, MA-03, IN-15). The book must say so and point to palliation.

6. Where the library disagrees with itself

1. **Births.** FO-01 (3 births a year, temperate, year one) against IN-01 (about 10 a year at the 1870s rate). Section 2 explains the choice of 6.
2. **Child pneumonia deaths.** IN-01 computes about 1.75 a year from incidence times untreated case fatality, but cause shares from Jones 2003 give about 0.5. The incidence figure uses partly treated control villages and a malnourished population. The ledger uses the midpoint and flags the range.
3. **Water.** IN-01 quotes Wolf 2022 (filtration relative risk 0.50, chlorination 0.66) without the blinding caveat. HY-02 found blinded trials near null (0.94). They are both right about different trials, and the ledger sides with HY-02's caution.
4. **Vitamin A in measles.** IN-01 gives 62 per cent fewer deaths with two doses, IN-12 about 80 per cent under two years. Different subgroups, same direction.
5. **Routine vitamin A.** IN-01 grades it A, contested. ME-09 scores it low because food replaces it. MA-10 found no maternal benefit. The ledger keeps it out of the twenty.
6. **The open femoral fracture.** FO-02 says traction splinting brought mortality from half or more to about 15 per cent. WO-05 says the famous "80 to 15.6 per cent" compares overall wartime mortality with clearing-station mortality in one battle. WO-05 is the more careful reading.
7. **Semmelweis.** HY-01, FO-05 and MA-04 quote different Vienna figures, and MA-04 notes that the unwashed clinic also fell. The direction is secure, the size is not.
8. **Chlorhexidine.** MA-01 says it will not exist at village level, MA-05 and WO-14 recommend it where stocked. Both hold.
9. **How many healers.** FO-11 says one lay healer per village. OR-01 says two, on retention and safety grounds. MI-12 sides with two. The ledger assumes two.

7. The book's order, as the ledger implies it

SY-11 (forthcoming) will decide the structure. What the ledger implies, as a proposal:

1. **The clean hand and the count.** Hand washing, sterilisation, examination by hand, danger signs, the register. (ranks 9 and 15, OR-01, OR-05).
2. **Clock-rule cards.** Pressure and tourniquet, haemorrhage after birth, breathing for the patient, cooling, washing the bite [OWNER].
3. **The child who may die.** Breath count and amoxicillin, rehydration, fever and malaria, measles, malnutrition (ranks 1 to 4, 12).
4. **Birth and the newborn.** Breastfeeding, clean birth and cord, breathing and warmth, haemorrhage (ranks 5, 14, 18, 21).
5. **The village's defences.** The household visit (water, soap, latrine, nets), epidemic control, tuberculosis in the house (ranks 6, 7, 8, 11, 15, 17).
6. **Injury.** Wounds, splints, the tourniquet in full (ranks 10, 16, 22).
7. **The long illness and the end.** Nursing, warmth for the old, mind, palliation (ranks 13, 19, below the line).
8. **The shelf and its rules.** Stewardship, the salvage list, expiry (enabler, ME-09, IN-05).
9. **To the website or district manual.** Surgery, chronic disease, the full materia medica, veterinary detail: long in the library, short in lives per village hour.

Evidence grades

Intervention	Tradition says	Record shows	Modern inference	Grade
Amoxicillin for counted fast breathing	Chest remedies everywhere, none tested (IN-03)	Gadchiroli 13.5 to 0.8 per cent	Pooled 35 per cent fewer pneumonia deaths	A
Oral rehydration	Rice water, salted soups, coconut water	Bongaon 1971, 3.6 per cent with mostly oral fluid	69 per cent fewer diarrhoea deaths	A
Malaria treatment, full course	Cinchona bark, Artemisia	Italy's state quinine, 1901	Drug A, bark D, tea X	A / D / X
Two-dose vitamin A in measles	Liver, red palm oil	Trials by dose	Two doses work, one does not	A
Exclusive and early breastfeeding	Near universal, with prelacteals and discarded colostrum in many	Cholera infantum in the hand-fed (Lynde 1882)	14-fold risk when not breastfed	B
Fast, fed, negotiated isolation	Ragusa, Eyam	Mawah against West Point	Fraser's rule	B
Nets and screens	Smoke, untreated nets	Trials	17 per cent fewer child deaths	A
Household measures against tuberculosis	Sanatorium, sun	No survival benefit from the sanatorium	Food for contacts 40 per cent fewer cases	A / B
Steam sterilisation, one needle each	Fire, alcohol	Rivalta, needle-borne hepatitis	Physics of 121 °C	B
Irrigation and delayed closure	Paré against boiling oil	25,000 wounds, 5 per cent failure	Trials on irrigation fluid	B
Safe water	Boiling, sari cloth	Matlab 48 per cent less cholera	Blinded trials near null	A / B
MUAC and slow refeeding	Gruel and broth	Ten steps, 30 to 50 per cent to under 5	Community care 4.1 per cent	A
Mouth care, turning	Nightingale	Scutari confounded	One trial, 19 to 11 per cent	A / B
Clean birth, nothing on the cord	Dung, ash, ghee in many places	Neonatal tetanus series	Odds ratio 5.1 for substances	B
Soap	Ash, clay	Semmelweis	29 trials, 30 per cent less diarrhoea	A
Loose splints	Bonesetters' tight bindings	Gangrene series	One-day courses, 25 to 7	B
Latrines	Night soil traditions	Mixed trials	Community threshold 50 to 75 per cent	A / B
Dry, stimulate, skin to skin	Warming, rubbing	Helping Babies Breathe before and after	Skin-to-skin trial, 25 per cent	B / A
Misoprostol after birth	Raw ergot, herbs (X)	Trials	Halves haemorrhage	A

Means ledger: hands, hearth, garden and still, village dispensary, district infirmary, hospital reference

What each rung adds to the twenty (SY-08, forthcoming, holds the full ledger).

Rung	What becomes possible	What it changes in outcome
Hands and knowledge alone	Breath count, danger signs, breastfeeding support, pressure and packing, rescue breathing, positioning, isolation decisions, the clock-rule cards	Breastfeeding, epidemic control and the counts. About a fifth of the package's effect [VERIFY: inference]
The hearth	Rehydration solution, boiled water, soap and water washing, boiled cloth, clean birth kit, skin-to-skin, sugar for low blood sugar, warmth, cold-water immersion, honey or sugar dressings	Most diarrhoea deaths, a share of newborn deaths. The largest single step up
Garden and still	Soap made in quantity, 70 to 80 per cent ethanol for hands and skin, pressure-cooker sterilisation, a scale, latrines, screened houses	Makes the hygiene rows sustainable and the procedures safe
Village dispensary	Salvaged amoxicillin, zinc, vitamin A capsules, misoprostol, antimalarials, nets, rapid tests, a bag and mask, a register	Ranks 1, 3 and 4 and haemorrhage. Roughly doubles the deaths averted while stock lasts
District infirmary	Gentamicin and ceftriaxone for sick newborns, magnesium, surgery for wounds and the abdomen, tuberculosis courses, a supervisor for lay counsellors	Moves haemorrhage, sepsis and wound surgery from the village's below-the-line to the district's top ten
Hospital before the Fall	Transfusion, caesarean, oxygen, intensive care, vaccines	Facility care carried 82 per cent of the modelled newborn and maternal benefit (Bhutta et al. 2014). That is what is lost

Harm test

The harms that matter most are those that turn a top-ranked intervention into a killer. Table 3 lists one per row. Six deserve a fixed rule.

- **Salt.** Too salty solution has killed infants (HY-03). Fixed scoop, marked litre, a taste check at each visit, and the rule that too dilute is safe.
- **Dose by age.** Stunted children are overdosed by age tables (FO-06). Weigh, and use an oral syringe (OR-09).
- **Spending the stock.** Antibiotics for every cough leave nothing for the pneumonia that kills (IN-05, SY-03).
- **Locked poisons.** Quinine kills from about 900 mg in a toddler (IN-09) and iron above 60 mg per kg poisons children (ME-08).
- **Refeeding and the tube.** Fast feeding of the starved stops the heart (HY-09). A tube is checked by aspirate at pH 5.5 or below, never by listening (NU-02).
- **Coercive isolation.** Quarantine without food or consent turns violent and fails (IN-13, HY-07).

Who must never receive what. Honey under 12 months (MA-06). Aspirin under 16 (IN-02). Vitamin A megadoses in pregnancy (MA-10). Ivermectin under 15 kg or in pregnancy (IN-08).

The harm of the list itself. A healer who has mastered the top twenty may stop looking beyond them. The danger signs (FO-07) are the guard. The record shows what confident, unmeasured practice cost: bleeding in pneumonia, 19.9 against 12.8 per cent dead (FO-05, TR-13), and arm-to-arm vaccination at Rivalta, which infected 44 to 46 of 63 children (HY-10).

Red flags

These signs mean death or disability without what the village cannot give. Move the patient to the district while they can be moved, keep giving what the village has, and if moving is impossible, give comfort and say honestly what is happening.

- A child with a danger sign (cannot drink, vomits everything, convulsions, lethargy) not better 48 hours into amoxicillin, or any child with grunting, cyanosis or head nodding (MA-07, IN-03).
- Severe dehydration in someone who cannot drink and in whom a tube cannot be passed (HY-03, NU-02).
- Fever with coma or repeated fits in a malarious place (IN-09).
- Bleeding after birth that continues despite misoprostol, massage and compression (MA-02).
- Labour without progress despite good contractions (MA-03).
- A newborn with any of the seven signs (MA-05).
- A wound with pain out of proportion, spreading redness and a rising pulse (WO-02, WO-14).
- Cough over two weeks with weight loss, or any child in a tuberculosis household who stops thriving (IN-10).
- Falling urine, no radial pulse, jaw breathing and the rattle: death within about three days (FO-07, NU-06). Here the task becomes palliation.

Red flags for the ledger itself. Deaths at one a month for three months, the humanitarian emergency line (FO-01). Amoxicillin stock below six months' need. Rehydration solutions found too salty at a visit. A healer working alone (MI-12). Any of these means the district must be told.

The case against, with named critics

The models assume a system. Jones et al. (2003), Darmstadt et al. (2005) and Bhutta et al. (2014) all modelled interventions delivered by health systems. In Bhutta's model 82 per cent of the benefit came from facility care, which the Fall removes (Bhutta et al. 2014, abstract). FO-04 found that every lay mortality benefit depended on a drug supply, a referral point, supervision or pay, often all four. A village ledger built on effect sizes measured inside systems will overstate what a village can do alone.

Lives-saved figures are modelled, twice. Many library effect sizes are already models (the 93 per cent for rehydration, IN-01), and this ledger models again on top. The ranking is a structured guess, fit to sort, not to promise.

Training hours are not measured. OR-01 found no consistent effect of course length, and MI-02 found two days and three weeks of training gave similar effects.

The metric is biased against rare catastrophes and against suffering. Per-village-hour ranking pushes down everything rare (haemorrhage, tourniquets, rabies) and everything that relieves rather than saves (mental health, palliation, splinting for function). The clock rule corrects part of the first bias. Nothing in a deaths ledger corrects the second.

The leading critics. Thomas McKeown argued that population mortality fell before medicine could act, through food and living conditions, and Simon Szreter answered that sanitation and organisation mattered more than McKeown allowed (SY-03). Both readings support the hygiene rows over the clinical ones in the long run, which this per-hour ledger may underrate. Ivan Illich's charge of clinical iatrogenesis (SY-03) applies with full force to rank 1:

amoxicillin spent freely breeds resistance (Keenan 2018, via IN-01). David Werner, author of Where There Is No Doctor, held that the general edition of his own book lost usefulness and that a manual must be adapted, taught and checked locally (OR-09). SY-01 sets the floor of the argument: against the realistic counterfactual of no care, a disciplined lay manual should do more good than harm.

The village's starting state decides the order. A village with good wells reorders the hygiene rows. A village with HIV adds cotrimoxazole near the top (IN-15). A village with no salvaged antibiotics loses rank 1's lead. The ledger is a method to be rerun, not a verdict (Protocol 1).

10-line summary

1. In a village of 300, about 7 to 9 people die a year in the tropics and 5 to 7 in temperate places once vaccines and supply are gone, three or four of them children.
2. The breath count with salvaged amoxicillin and oral rehydration lead the ledger at about 8 to 20 training hours per life saved.
3. Measles care with two doses of vitamin A, breastfeeding support and epidemic control are nearly as efficient because they cost so few hours.
4. Malaria fever care and nets lead in the tropics and vanish in temperate places, where nursing and warmth for the old rise.
5. Together the twenty avert roughly a third of deaths in the tropical village and a fifth in the temperate one, not the sum of their rows.
6. Four of the top five depend on salvaged stock, so stewardship, which saves no one directly, decides how long the ledger holds.
7. Haemorrhage after birth and the tourniquet fall just below the line per village hour and rise into the top ten at district scale.
8. Taught in one bundled household visit, water, soap, latrines and nets cost a third of the hours they cost taught apart.
9. Palliation and lay mental-health care avert few deaths and belong in the book on other grounds, stated plainly.
10. Every figure here is a model on models, and the village's own register is the only way to correct it.

Open questions

- What is the true untreated case fatality of child pneumonia in a malnourished population with no partly treated controls (IN-01)?
- How long do salvaged amoxicillin, vitamin A capsules and antimalarials actually last in village storage, and so how many years do ranks 1, 3 and 4 hold (IN-05, ME-09)?
- How often will cholera, dysentery or a haemorrhagic fever reach a village of 300? The epidemic expectation drives two rows and has no measured base.
- What is the least training that keeps each top-five skill at a safe standard (OR-01)?
- Does the bundled household visit retain each lesson as well as single-topic teaching? BRAC's seven-point limit (OR-09) suggests a ceiling.
- How should suffering be counted against deaths in the book's order [OWNER]?

Sources to read in full

1. THRIVING library, IN-01: the mortality map and the village arithmetic this ledger extends.
2. THRIVING library, FO-01: year-one projections for both villages.
3. THRIVING library, OR-01: the 300-hour course and the decay of skills.
4. THRIVING library, HY-03: rehydration, the recipe and its errors.
5. THRIVING library, MA-02: the full set of tools against haemorrhage.

6. Jones et al. 2003, Lancet: the original ranking of child survival interventions.
7. Bhutta et al. 2014, Lancet: why facility care carries most of the modelled benefit.
8. Watkins et al. 2020, Lancet Global Health: what the Disease Control Priorities packages cost and assume.
9. THRIVING library, FO-04: what lay health workers achieved, and on what they depended.

At the bedside after the Fall

The household. The minimum is one person in each house who can make rehydration solution with a fixed scoop, count a child's breaths for a full minute, put a newborn to the breast within the hour, wash hands with soap at the key times, press hard on bleeding, and keep drinking water covered. To start: soap, salt, sugar, a litre vessel, a clean cloth and one two-hour visit from the healer. The first failure to expect is the too-salty solution two years after teaching.

The village of 300. The minimum is two healers trained in OR-01's 300 hours, in the order of Section 7, and a birth attendant drilled weekly on a manikin. To start: amoxicillin and vitamin A counted on day one and locked, a pressure cooker, a register, a household visit to all 60 homes in the first season, and a supply of nets in the tropics. The first failure to expect is the stock spent on coughs and fevers that would have passed, so that the first real pneumonia finds the shelf empty.

The district of 3,000. The minimum is a nurse or midwife, misoprostol and magnesium, a sterile room, injectable antibiotics for newborns and a supervisor for the lay counsellors and healers. Haemorrhage, newborn sepsis and wound surgery move up here. To start: a district register pooling the villages' counts (OR-05) and a twice-yearly review of this ledger against real deaths. The first failure to expect is that the infirmary attempts too much and refuses too little (OR-07).

Protocols

Protocol 1. Rerunning the ledger for your own village (yearly)

- ☐ Count the people, the births in the last year and the children under five.
- ☐ From the register, list every death in the last three years by age and the cause the healer believes.
- ☐ For each of the twenty rows, multiply the local deaths from that cause by the effect in Table 2's source report. Use the lower end if you are unsure.
- ☐ Write down the hours the row would take to teach (Table 2).
- ☐ Divide hours by ten years of deaths averted. Sort.
- ☐ Mark any row whose drug stock will last under two years.
- ☐ Read the new order to the assembly. Keep the old order beside it. Change teaching only if a row moves five or more places.

Protocol 2. The two-hour household visit (once a year per house, with a check a month later)

- ☐ Wash hands with soap in front of the household. Show where the soap and water will stand, in sight of the latrine and the hearth.
- ☐ Make one litre of rehydration solution together: 1 litre of clean water, half a level 5 mL teaspoon of salt, 6 level teaspoons of sugar (HY-03, MA-07). Taste it. It should taste no saltier than tears. Leave the scoop and mark the vessel.
- ☐ Teach: give 75 mL per kg over 4 hours for some dehydration, keep feeding, call the healer for blood in the stool or a child who cannot drink (IN-11, HY-03).
- ☐ Count a calm child's breaths for one full minute together. Write 50 for under one year and 40 for one to five years on the wall (MA-07).
- ☐ Name the four danger signs: cannot drink, vomits everything, fits, very sleepy.
- ☐ Show the covered water container with a tap, and how never to dip into it (HY-02).

- ☐ With any pregnant woman: breast within the first hour, nothing else by mouth for six months, nothing on the cord (MA-05, MA-06).
- ☐ In the tropics: check every net for holes and hang it (IN-09).
- ☐ Return in a month. Have the household make the solution unaided. Correct and record.

Protocol 3. Ordering the healer's first year

- ☐ Weeks 1 to 2: the clean hand, sterilising, examination, danger signs, the register (OR-01 block 1).
- ☐ Weeks 3 to 4: rehydration, the breath count and amoxicillin by weight, fever and malaria, measles, malnutrition (block 2).
- ☐ Before any birth is attended alone: clean birth, newborn breathing, haemorrhage, drilled on a manikin for 3 minutes every week thereafter (OR-01, MA-05).
- ☐ Clock-rule cards taught to every adult, 1 hour each, in the first season [OWNER].
- ☐ Wounds, splints, nursing, palliation, mind: block 4, after logged practice.
- ☐ Stewardship rule from the first day: no antibiotic for a cold, a cough without fast breathing, or diarrhoea without blood (IN-05).

Protocol 4. The stock check that protects ranks 1, 3 and 4 (monthly, two people)

- ☐ Count amoxicillin, vitamin A, antimalarials and misoprostol. Two people sign.
- ☐ Divide the count by last year's use. Write the months remaining.
- ☐ Below 12 months: report to the district. Below 6 months: amoxicillin for children with danger signs or chest indrawing, and adults over 60 with counted fast breathing, only [OWNER].
- ☐ Check storage below 25 °C, dry, dark, blisters intact (ME-09, OR-06).

Numbers to carry

1. **7 to 9 deaths a year** in a village of 300 without care, three or four of them children (IN-01).
2. **50 and 40.** Breaths a minute that mean pneumonia under one year and from one to five years (MA-07).
3. **1 litre, half a teaspoon, six teaspoons.** Water, salt, sugar. Too dilute is safe, too salty kills (HY-03).
4. **13.5 to 0.8 per cent.** Child pneumonia deaths without and with amoxicillin in lay hands (IN-01).
5. **Two days, two doses.** Vitamin A in measles, on consecutive days. One dose does not work (IN-12).
6. **Within the hour.** First breastfeed. A baby not breastfed in its first six months dies at 14 times the rate (IN-01, MA-05).
7. **600 µg.** Misoprostol by mouth after the birth (MA-02).
8. **90 against 10.** Survival with a tourniquet applied before shock against after (WO-01).
9. **115 mm.** MUAC below which a child is severely malnourished (MA-07).
10. **One a month.** Deaths at this rate in a village of 300 mean an emergency (FO-01).

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3. Darmstadt GL, Bhutta ZA, Cousens S, Adam T, Walker N, de Bernis L. Evidence-based, cost-effective interventions: how many newborn babies can we save? Lancet 2005, 365:977 to 988. Abstract read only, via repository record and search summary. https://repository.ias.ac.in/103767
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