ME-09 Salvaging the pharmacy: the priority list, expiry and storage

HEALING after the FALL, research library, ME-09

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

How to read this report

This report ranks what to take from the pharmacies, hospitals, surgeries, veterinary suppliers, farms and homes left after the Fall, and sets out how long each item keeps. It builds on three library reports and does not repeat them.

- **IN-05** covers the antibiotics: their order among themselves, their expiry evidence, dosing cards, fish and veterinary antibiotics, and stewardship (THRIVING library, IN-05). Here they enter the overall ranking as a block, in IN-05's order.
- **FO-11** covers the WHO Essential Medicines List, the Interagency Emergency Health Kit and the village and district shelves with yearly quantities (THRIVING library, FO-11). Here those shelves are extended to a decade and corrected for shelf life.
- **MA-02** covers oxytocin, misoprostol and tranexamic acid in childbirth (THRIVING library, MA-02). Here they appear only as salvage and storage problems.

OR-06 (cold storage without electricity), SY-09 (honest loss) and ME-10 were not in the library. Where they are needed, this report points to them and stops.

Record means a measured result in a source I read. **Folklore** means a common belief, untested or failed. **Inference** means my own reasoning, marked [VERIFY] where it needs checking. Allocation, and whether stock may be taken at all, are GOVERNING's questions, marked [OWNER]. Plant replacements belong to ME-05 (opium poppy, *Papaver somniferum*) and ME-06 (willow, *Salix alba*).

1. Findings

1.1 Medicines that cure and medicines that buy time

The most useful distinction for a salvage list is between medicines that end a problem and medicines that hold one back (inference).

- **Curing medicines** end the problem with one course. Examples are an amoxicillin course for pneumonia, misoprostol after a birth, a magnesium course for eclampsia, artesunate for severe malaria, a six-month TB regimen, tetanus toxoid and rabies vaccine. One course returns a person to a normal life expectancy, so each gram salvaged buys decades of life.
- **Time-buying medicines** work only while stock lasts. Examples are insulin for type 1 diabetes, antiretrovirals, levothyroxine, antiepileptics, antihypertensives and metformin. When the stock ends the disease resumes, so each gram buys days or weeks.

The record shows the size of the gap. Untreated smear-positive TB killed a weighted mean of 70% of patients within ten years (Tiemersma 2011), and a six-month course cures it. Before insulin, a child with type 1 diabetes lived months to about two years after diagnosis (University of Toronto Libraries n.d.). With insulin the same child lives as long as the insulin lasts.

Time-buying medicines are essential to the people who need them, and those people can be identified in the first week. But a decade's plan cannot rest on them, and FO-11 places most under "do without beyond stock" (THRIVING library, FO-11). Scored on the same measures (1.8), the curing medicines rise to the top almost automatically.

1.2 What an expiry date means, and what the long studies show

An expiry date marks the end of the period in which the maker has shown that the product keeps its specified content under stated storage. That content is usually 90% of the label. It is not the date on which the product fails. Two errors follow from misreading it. One treats expiry as a cliff, so usable stock is thrown away. The other treats it as meaningless, so failed stock reaches patients. The evidence supports neither.

The US Shelf-Life Extension Program (SLEP). Lyon and colleagues (2006) reported on 3,005 lots of 122 products held in military stockpiles and tested over about 20 years.

- 88% of lots were extended at least a year past their date, by an average of 66 months.
- Extensions varied widely between lots of the same product.
- The authors concluded that stability "can only be assured by periodic testing" of each lot (abstract read).
- IN-05 adds that 16% of extended lots eventually failed (Aronson 2019, via THRIVING library, IN-05).

These stockpiles had controlled storage, which a salvaged pharmacy will not have had.

The Cantrell cache. Cantrell, Suchard, Wu and Gerona (2012) tested eight medications found unopened in a retail pharmacy, 28 to 40 years past expiry (Pharmacy Times 2012, secondary).

- Eleven of fourteen tested ingredients (79%) stayed at or above 90% of label in every sample. Some summaries say twelve.
- Aspirin and amphetamine failed in all samples. In Fiorinal, 2.28 mg of aspirin was left of 200 mg (Charlton 2025, table).
- Those that held included codeine, hydrocodone, phenobarbital and other barbiturates, caffeine and paracetamol (paracetamol figure [VERIFY], primary not read).

One cache, kept indoors, with no control group, shows what is possible, not what is typical.

Fifty substances and fourteen old ampoules. Zilker, Sörgel and Holzgrabe (2019) found that 44 of 50 drug substances aged 20 to 30 years still met the European Pharmacopoeia (Zilker 2019, thesis summary). They also tested ampoules 53 to 72 years old.

- **Still in specification:** caffeine, etilefrine, synephrine, metamizole, furosemide and sodium salicylate.
- **Degraded:** scopolamine (71%), procaine (70%), epinephrine (about 70%, through oxidation), lobeline (64%), dihydroergotamine (21%) and ATP (15%).
- Salbutamol substance stayed above 98% (Zilker 2019, via Charlton 2025).

Space. After 550 days on the International Space Station, four of nine medications met the US Pharmacopeia up to eight months past expiry (Wotring 2016, via ScienceDaily 2015).

The tropics. Here the picture darkens.

- **Sea shipment (Hogerzeil 1992).** Essential drugs went by sea to Lagos, Mombasa and Bangkok, with pack temperatures from minus 3.5 to 42.4°C. Ergometrine and retinol capsules lost 1.5 to 5.8%, and three of 80 ergometrine ampoules had lost 60%. The penicillins and tetracycline were unaffected (abstract read).

- **Two years in Burkina Faso (Ballereau 1997).** Ampicillin, erythromycin, injectable furosemide, penicillin G, trimethoprim and chloroquine lost more than 10%. The authors advised not holding these drugs more than a year in the tropics (abstract read). Furosemide ampoules thus failed in Burkina Faso but survived more than 50 years in German storage. That contrast tells the whole story of storage in one drug.
- **Rural Zimbabwe (Nazerali and Hogerzeil 1998).** Clinically relevant instability was rare, and poor quality at the start was the bigger risk (secondary summary only).

After the Fall (inference). Dry solid medicines in sealed original packs, kept below about 25°C and dry, will mostly still be usable five years past their dates. Many will be usable at ten years, and some at twenty or more. Heat and humidity shorten all of these figures, and some molecules fail early in any climate. Salvaged stock has an unknown history, so extrapolating from SLEP is optimistic.

1.3 Emergency drugs: epinephrine, naloxone, salbutamol and aspirin

The American Red Cross Scientific Advisory Council found 17 studies of these four drugs past expiry (Charlton 2025, full text read). It is the best single source on them.

Epinephrine (adrenaline) oxidises, and the autoinjector studies agree:

- **Simons 2000.** Adult devices 1 to 90 months past expiry delivered a mean 0.238 mg against 0.326 mg in date. Two of 34 were darkly discoloured. The same group later found 0.3 mg devices at 77.1% after 130 months.
- **Rachid 2015.** Patient-stored devices 3 to 36 months past expiry held 84.2 to 101.5%, and all up to 24 months held at least 90%.
- **Cantrell 2017.** Every EpiPen held at least 80%, with 84% left at 50 months.
- **Kassel 2019.** 46 devices up to 168 months past had a median of 97.2%, and all held 90% or more up to 30 months.
- **Weir 2018.** 1 mg prefilled syringes 30 months past expiry were unchanged and sterile.

All were read via Charlton 2025. The working rule (inference): near full strength to about two years past expiry, about four-fifths at four years, half to three-quarters at ten. In anaphylaxis an expired clear device beats none. Set aside pink or brown ones if a clear one exists.

Naloxone. SLEP extended all ten lots it tested by at least five years. Pruyn and colleagues (2019) found ten of eleven samples above 90% at 2 to 27.5 years past expiry, with the eleventh at 89% (via Charlton 2025). Naloxone is one of the most durable items on the list.

Salbutamol. The substance holds for decades, but an inhaler's propellant and valve also age. Kutty and colleagues (2022) found that 80% of nebuliser solution lots kept above 90% past expiry, against only 40% of metered-dose inhaler lots (conference abstract, via Charlton 2025). Nebuliser solution and tablets are the long-term forms of salbutamol, and inhalers are for the first years.

Aspirin breaks down into salicylic acid and acetic acid, which is the vinegar smell of an old bottle. Studies found a lowest content of 76.3% at 45 months (Thomis 1984) and a range of 83.9 to 102.2% (Verstraeten 1987, both via Charlton 2025). In the Cantrell cache it had almost gone. Charlton and colleagues concluded that aspirin can keep its active drug as long as 40 years. That is true of some samples, and the Cantrell figures show it is false for others. Willow (*Salix alba*, ME-06) does not replace aspirin for heart attack.

Across all four drugs Charlton found minimal harmful breakdown products. The fear that expired medicines turn poisonous is folklore, with one recorded exception, tetracycline (1.6).

1.4 Insulin without a refrigerator

Insulin is the drug most often hoarded and most often wasted, because people believe it dies outside a refrigerator. It keeps better than that, but the evidence stops at months.

Kaufmann and colleagues (2021), from MSF and the University of Geneva, cycled insulin between 25 and 37°C for four weeks, as in Dagahaley refugee camp in Kenya. Content, structure and bioactivity matched storage at 2 to 8°C. The paper is in *PLoS ONE*, not *PLoS Biology* as the brief has it (summaries read, full text not read).

The Cochrane review (Richter, Bongaerts and Metzendorf 2023, abstract read in full) gathered 17 studies:

- Unopened human insulin at 28.9 to 37°C for up to four months showed no clinically relevant loss. Two studies found up to 18% loss after one to four weeks at 37°C.
- Opened vials at up to 37°C for up to 12 weeks, and insulin cycled between 25 and 37°C, showed no relevant loss.
- At 25°C, short-acting insulin lost 3.2 to 3.5% in six months and NPH lost 2.0 to 2.3%.
- At 37°C, short-acting insulin lost 8.3 to 8.6% in three months and NPH 4.7 to 5.3%.
- Insulin kept in a clay pot at 25 to 27°C for six weeks lowered glucose in eight volunteers as well as refrigerated insulin did (very low certainty).
- **Conclusion:** unopened short- and intermediate-acting insulin keeps at up to 25°C for six months and up to 37°C for two months.

After the Fall (inference). Extending the 25°C curve, a vial in a cool cellar or clay pot might hold 85 to 90% for two to three years from manufacture. I found no measurement beyond six months, so this is [VERIFY]. Freezing destroys insulin, and so does sustained heat above about 40°C [VERIFY].

The real limits are:

- the number of vials salvaged
- the in-use period of an opened vial, which labels set at 10 to 45 days (Richter 2023)
- the loss of glucose testing when strips run out
- the small number of people involved

Type 1 diabetes has a prevalence of about 9.5 per 10,000 (Mobasseri 2020, misprinted as "9.5%"). That is about three people in 3,000 and probably none in 300. A person using 40 units a day needs about fifteen 1,000-unit vials a year [VERIFY]. So fifty vials keep one person alive for about three years, if they keep their strength. Protocol 7 gives the storage plan, and OR-06 covers cold storage.

1.5 Uterotonics and vaccines

Oxytocin against misoprostol. Both drugs come via MA-02 and FO-11.

- **Oxytocin** (Torloni 2016): a median of 45.6% of samples worldwide failed assay. No loss was found at 4 to 8°C over 12 months. Losses were 3 to 7% a year at 21 to 25°C, and 9 to 19% at 30°C.
- **Misoprostol** keeps only in an intact aluminium blister. It lost 48.2% when the blister was damaged (Hagen 2020).

What follows for salvage (inference):

- Oxytocin found in a refrigerator in week one and moved to a cellar at 12 to 15°C should lose under 5% a year, which makes it usable for two to four years [VERIFY]. FO-11 lists unrefrigerated oxytocin under do without. I disagree for cool cellars in temperate climates, and agree for the tropics.
- Misoprostol keeps in heat or cold, but only while every blister is whole. Use torn strips first.

The trap the brief names is real. Salvagers think of antibiotics and painkillers and walk past the obstetric fridge. That is why oxytocin is on day one of Protocol 1.

Ergometrine keeps worst among the uterotonics. Three of 80 ampoules had lost 60% on a sea voyage (Hogerzeil 1992). Keep it cold and use it first [VERIFY for current products].

Tetanus toxoid (Milstien 2006, full text read) is one of the most heat-stable vaccines. In DTP it showed no significant change at 4 to 8°C for 3 to 7 years, and insignificant loss at 24°C for 6 to 12 months and at 37°C for 2 to 6 months. It is destroyed at 60°C in three to five hours. Freezing is the real enemy, because it breaks the aluminium adjuvant gel. Labelled shelf life is usually three years.

Two doses in pregnancy cut neonatal tetanus deaths by an estimated 94% (Blencowe 2010). Without refrigeration, toxoid should be used within one to two years [VERIFY]. The plan is to give it, not to keep it.

Rabies vaccine. Lyophilised human diploid cell vaccine keeps 3 to 5 years at 2 to 8°C, 18 months at 20 to 25°C and four weeks at 37°C, and it tolerates freezing (Milstien 2006). HY-10 covers the intradermal schedule that shares a vial (THRIVING library, HY-10).

Vaccine vial monitors. A VVM30 label changes after 30 days at 37°C or 193 days at 25°C, and it does not show freezing (DCVMN 2014, secondary). Reconstituted vaccine is discarded at the end of the session (Milstien 2006).

1.6 The exceptions: what does not keep

These items break the rule that most medicines outlast their date. IN-05 covers the antibiotic cases, and they are extended here to the rest of the pharmacy.

- **Liquids and suspensions.** Once mixed or opened they keep days to weeks: 7 days without cold and 14 with, for antibiotic suspensions (THRIVING library, IN-05). They are heavy and poor value (THRIVING library, FO-11).
- **Eye drops.** 28 days after opening, and 24 hours for preservative-free units (THRIVING library, IN-05).
- **Reconstituted powders.** The dry powder keeps for years, and once mixed it keeps hours to days. Take the powder.
- **Multi-dose vials.** Discard 28 days after first puncture unless the maker says otherwise (NJ Department of Health 2009). Reuse of a single-patient vial spread hepatitis C at a Los Angeles pain clinic (Alarcón 2024). The danger is contamination, not loss of potency, and it applies equally to a 100 mL veterinary oxytocin vial and an insulin vial (Protocol 6).
- **Tetracycline.** Degraded tetracycline caused a reversible kidney injury, Fanconi syndrome (THRIVING library, IN-05). Hesperian still warns that "old" tetracycline can be poisonous (Hesperian 2025). This is the one place where the folk fear has a record behind it. Doxycycline is not known to share it.
- **Glyceryl trinitrate tablets** are volatile. The old advice was to discard them six months after opening. Later work found them stable to expiry in moderate conditions, but weakening within two to six months when warm and humid. Keep them in their glass bottle (Therapeutic Research Center 2005, secondary).
- **Carbamazepine** keeps its chemistry and loses its ability to dissolve. Al-Zein, Riad and Abd-Elbary (1999) stored three brands at 40°C and 75% humidity. Tablets of one brand taken out of their strips released only 7% of their drug in 60 minutes. There was no chemical change, so an assay would have passed tablets that could not work (abstract read). Gulcebi and colleagues (2025) add valproate, phenytoin and lorazepam to the antiepileptics at risk from heat and humidity (abstract read). Keep carbamazepine in its strips.
- **Phenobarbital** is the opposite case. It held for 28 to 40 years in the Cantrell cache, which makes it the antiepileptic for a decade.
- **Levothyroxine** is among the products most often recalled for low potency, and it is sensitive to moisture (Okezue 2023, abstract read). Expect it to fade early.

- **Diazepam ampoules.** After about ten years in Mediterranean heat, content and pH stayed within specification. A breakdown product passed its limit at about two years, tracking the yellowing of the solution, but caused no harm in rats at about 2,200 times the permitted level (Itin 2021, abstract read).
- **Magnesium sulfate** is an inorganic salt in water. Mixed with lidocaine it stayed stable for six months at 25 and 40°C (Houlihan 2016, abstract read). I found no study of ampoules years past expiry, but little can go wrong except the glass and the seal [VERIFY].
- **ORS** may be used while it is a white, loose powder. Brown or caked ORS is discarded (MSF 2008).
- **Creams and suppositories** that have melted are unusable, because the drug is no longer evenly spread (MSF 2008).
- **IV fluids.** Fifteen 1-litre saline bags kept in overwrap for 199 days, cold, warm and hot, showed no change in pH or sodium and stayed sterile (Harpine 2015, secondary summary). A supplier gives 18 to 24 months in overwrap (CIA Medical n.d., vendor). A punctured bag keeps 24 hours at room temperature (WashU 2023). Water passes slowly through plastic, so reject slack or shrunken bags [VERIFY].
- **Gloves.** Latex keeps about three years and nitrile a nominal five (Ansell, via Safety+Health n.d.). Light, ozone from motors and heat damage latex, and hot-stored chlorinated latex has caught fire (AORN 2005, secondary). Discard gloves with white lines or tears.
- **Sutures.** In 225 knots with packs a mean 10.5 years past date, overall strength did not differ, but expired chromic catgut and polydioxanone were weaker (Muffly 2011, abstract read). Hong Kong judged expired polyester sutures in unopened packs low-risk (Hong Kong Government 2014).
- **Needles, syringes and catheters.** Sterile single-use items carry a sterility date [VERIFY usual length]. Glass syringes and steel needles can be sterilised indefinitely (FO-11, OR-06).

1.7 Potency at 5, 10 and 20 years

The table assumes sealed, dark, dry storage below about 25°C. In the tropics, move each class one column to the right. Cells beyond the measured range are inference.

Class	5 years past expiry	10 years	20 years	Basis
Stable tablets in blister (penicillins, barbiturates, codeine, paracetamol)	Most lots 90% or more	Many still pass, some fail	Some pass, unpredictably	Lyon 2006, Cantrell 2012
Moisture-sensitive solids (carbamazepine, levothyroxine, clavulanate, ORS, aspirin)	Doubtful	Expect failure	Discard	al-Zein 1999, Okezue 2023, MSF 2008
Stable ampoules (lidocaine, furosemide, magnesium)	Near full	Likely usable [VERIFY]	Some pass at 50 years	Zilker 2019
Oxidisable ampoules and autoinjectors (epinephrine, procaine)	About 80%	55 to 75%	Doubtful	Charlton 2025, Zilker 2019

Class	5 years past expiry	10 years	20 years	Basis
Diazepam ampoules	In specification, yellowing	In specification	Unknown	Itin 2021
Naloxone	Over 90%	Over 90%	Over 90% to 27 years	Pruyn 2019
Salbutamol inhaler	Under half of lots pass	Doubtful	Use solution or tablets	Kutty 2022
Insulin, below 25°C	No data	No data	No data	Richter 2023 stops at 6 months
Oxytocin, cellar	Probably below 85%	Discard	Discard	Torloni 2016, via MA-02
Misoprostol, intact blister	Probably usable [VERIFY]	Doubtful	Discard	Hagen 2020, via MA-02
Tetanus toxoid, not frozen	Discard	Discard	Discard	Milstien 2006
Latex gloves	Many perished	Perished	Perished	Ansell
Synthetic sutures, sealed	Usable	Usable except chromic and polydioxanone	Unknown	Muffly 2011

1.8 The ranking

Method (inference). Each item is scored from 1 to 5 on four measures:

- **L**: lives saved per gram carried
- **B**: breadth, meaning how many conditions and people it serves
- **R**: irreplaceability. 5 means nothing made after the Fall replaces it, and 1 means a household recipe does.
- **S**: shelf life. 5 means a decade or more sealed and cool, and 1 means months without refrigeration.

The score is 2L + B + 2R + S, out of 30. L and R are doubled because the brief asks first which items "save the most lives per gram and cannot be made later". A difference of two points is noise, and IN-05 decides the order among antibiotics.

The lives-per-gram arithmetic behind the scores (inference from the cited trials):

- **Amoxicillin.** About 40 g per child's life saved (THRIVING library, IN-05).
- **Misoprostol.** 600 μg per birth, and one haemorrhage prevented per 18 or so women (THRIVING library, FO-11). One gram is about 1,650 doses.
- **Tranexamic acid.** CRASH-2 cut death from 16.0 to 14.5% with 2 g per patient (CRASH-2 2010). That is about 134 g per life. A 2026 review gives a relative risk of death of 0.73 when TXA is given within 90 minutes, and more clotting at 4 g (Lier 2026).
- **Magnesium sulfate.** About 91 women with pre-eclampsia are treated per eclampsia prevented (Magpie 2002). At 14 to 40 g per course [VERIFY], that is one to four kilograms per case. In eclampsia, magnesium cut maternal death against diazepam (relative risk 0.59) and recurrence (0.43) (Duley 2010). Its score rests on irreplaceability and shelf life.
- **Artesunate.** Deaths in African children with severe malaria fell from 10.9 to 8.5% against quinine (Dondorp 2010). Against no treatment the gain is far larger.
- **TB regimen.** Hundreds of grams per course [VERIFY], but it cures a disease that kills 70% within ten years (Tiemersma 2011).

- **Vitamin A.** Child mortality fell 12% (Imdad 2022). But food after the Fall supplies vitamin A, so it scores low on R.
- **ORS.** It prevents an estimated 93% of diarrhoea deaths (Munos 2010), the best lives-per-gram figure here. But salt, sugar and clean water replace the sachet (HY-03), so it scores 1 on R.
- **Chlorhexidine on the cord.** In the community it cut neonatal mortality (relative risk 0.81) and halved omphalitis (Sinha 2015).

The top 30

Rank	Item	L	B	R	S	Score	Note
1	Amoxicillin, dispersible	5	5	5	4	29	Child pneumonia (IN-05)
2	Gentamicin	5	4	5	4	28	Neonatal and adult sepsis
3	Ceftriaxone powder	5	4	5	4	28	Meningitis, sepsis. Powder keeps
4	Ketamine	4	4	5	4	26	Makes surgery possible (WO-10)
5	Lidocaine, plain, and dental cartridges	3	5	5	5	26	Every wound repair
6	Doxycycline	4	5	5	3	26	FDA refused its extension (IN-05)
7	Syringes and needles, sterile, plus glass and steel	4	5	4	5	26	Every injectable depends on them
8	Misoprostol, intact blister	5	3	5	2	25	Bleeding after birth, miscarriage
9	Artesunate and combination tablets	5	2	5	3	25	Where malaria is or returns
10	Magnesium sulfate 50%	4	1	5	5	24	Eclampsia. Heavy, stable

Rank	Item	L	B	R	S	Score	Note
11	Tetanus toxoid	5	2	5	2	24	Use, do not keep
12	Metronidazole	3	4	5	4	24	Pelvic, abdominal sepsis (IN-05)
13	Co-trimoxazole	3	4	5	4	24	Urinary, HIV prophylaxis (IN-05)
14	Prednisolone, dexametha-sone	3	4	5	4	24	Asthma, croup, adrenal crisis [VERIFY stability]
15	Oxytocin	5	2	5	1	23	Forgotten in the fridge
16	Epinephrine	4	3	5	2	23	Anaphylaxis, resuscita-tion
17	Tranexamic acid	3	3	5	4	23	Trauma, birth bleeding (MA-02)
18	Phenobarbital	3	2	5	5	23	The decade antiepilep-tic
19	Atropine	3	2	5	5	23	Organophosphate poisoning on farms
20	Rabies vaccine	5	1	5	2	23	Where rabies is present (HY-10)
21	Diazepam	3	3	5	3	22	Fits, tetanus spasms
22	Albendazole	2	4	5	4	22	Worms, anaemia
23	First-line TB drugs	4	1	5	3	22	Curing [VERIFY stability]
24	Zinc 20 mg	3	2	4	5	21	Child diarrhoea

Rank	Item	L	B	R	S	Score	Note
25	Chlorhexidine gel and solution	3	4	3	5	21	Cord care, skin preparation
26	Furosemide	2	2	5	4	20	Pulmonary oedema
27	Salbutamol, all forms	3	2	5	2	20	Inhalers fade first
28	Naloxone	2	1	5	5	20	Opioid overdose
29	Ivermectin, human tablets	2	3	5	4	20	Scabies, strongy-loides (IN-08)
30	Carbamazepine, in strips	3	2	5	2	20	Second to phenobar-bital

The rest of the antibiotic sweep scores 21 to 23: benzathine penicillin, ciprofloxacin, azithromycin, cloxacillin or cefalexin, and veterinary procaine penicillin. These are taken in the same sweep, in IN-05's order.

Below the line (19 or less, taken when found but not worth a separate trip):

- **19:** gloves (perish), morphine (few lives, much suffering relieved, ME-05), praziquantel (regional).
- **18:** ORS sachets (the recipe replaces them, but they are light), IV fluids (heavy, nasogastric ORS replaces most uses), povidone-iodine, antiretrovirals.
- **17:** sutures and catheters [VERIFY replacements], paracetamol and ibuprofen, iron and folate.
- **16:** insulin (life for a few, but time-buying and short-lived), amlodipine, 50% glucose.
- **15 and below:** vitamin A, metformin, levothyroxine.

Where I disagree with the library.

- **Oxytocin.** FO-11 puts unrefrigerated oxytocin under do without. I would keep it in a cellar for two to four years first (1.5).
- **Diazepam.** FO-11 marks it light-sensitive, which is true, but its content keeps about ten years in heat (Itin 2021).
- **Plant analgesics.** FO-11's village table says these are "graded in ME-09". They are not. They belong to ME-05 and ME-06.
- **Ceftriaxone and doxycycline.** IN-05 ranks doxycycline above ceftriaxone. My score reverses them on shelf life. The difference is within noise, and I defer to IN-05 on clinical order.

1.9 Where stock is found, and the concentration traps

Source	What it holds	Notes
Hospital fridges	Insulin, oxytocin, vaccines, rabies vaccine, antivenom (WO-13)	Day one. Every hour of heat counts

Source	What it holds	Notes
Hospital pharmacy, theatres	Ketamine, lidocaine, gentamicin, ceftriaxone, magnesium, TXA, epinephrine, atropine, diazepam, morphine, naloxone, IV fluids, consumables	The largest store, and the first place others go. Controlled drugs are locked (MSF 2008)
Pharmacies, wholesalers	Tablets in quantity, inhalers, autoinjectors, ORS, zinc, chronic drugs	Wholesale depots may hold weeks of regional supply [VERIFY]
GP surgeries	Vaccine fridges, emergency bags	Small but well chosen [VERIFY contents]
Dental surgeries	Lidocaine, articaine and prilocaine cartridges, epinephrine, reusable steel cartridge syringes, oxygen, nitrous oxide, sutures, autoclaves	Sealed glass cartridges keep well
Veterinary practices, farm suppliers	Procaine penicillin, oxytetracycline, oxytocin, ivermectin, ketamine, lidocaine, atropine, bulk syringes and needles, long gloves, sutures, catheters	The traps below
Farms	Calving kits, oxytocin, ivermectin pour-on and drench, organophosphate dips	Where there are dips, atropine is needed
Care homes, schools, households	Chronic drugs, inhalers, autoinjectors, insulin pens, leftovers	Usually belong to a living person [OWNER]

Concentration traps. These are the errors that kill. Read the strength per millilitre or per gram on every label.

- **Ivermectin.**
  - Horse paste is 1.87%, or 18.7 mg per gram. One 6.08 g syringe holds 113 mg, enough to dose a 1,250 lb horse at 200 μg/kg (Durvet n.d.).
  - Cattle injection is 1%, or 10 mg/mL, given at 1 mL per 50 kg under the skin (Valley Vet n.d.).
  - The human tablet is 3 mg, so one horse syringe holds as much as about 38 tablets (inference).
  - In 2021, US poison-centre calls about ivermectin ran three to five times the baseline, with most Mississippi calls involving livestock products. Toxicity brings vomiting, confusion, ataxia, low blood pressure, seizures and coma (CDC 2021). A Texas man ate a whole syringe of horse paste (AVMA 2021).
  - Pour-on, drench and the injection's solvents are not for human use [VERIFY excipients].
- **Ketamine.**
  - Human vials come in 10, 50 and 100 mg/mL. The 100 mg/mL strength must be diluted with an equal volume before intravenous use (Par Pharmaceutical 2026).
  - Veterinary vials are commonly 100 mg/mL [VERIFY, search summary only].
  - The trap is a tenfold error between strengths.
- **Oxytocin.**
  - Veterinary vials are 20 USP units/mL in 100 mL multi-dose vials, preserved with chlorobutanol. That is twice the human 10 IU/mL ampoule.
  - The US label says store at room temperature (Bimeda n.d.). A Canadian label says 2 to 8°C (Vetoquinol n.d.).

  - After first puncture the multi-dose rules apply (Protocol 6).
- **Lidocaine.**
  - Dental 2% is 20 mg/mL, in cartridges of 1.7 to 2.2 mL, often with epinephrine [VERIFY volume by country]. Articaine 4% cartridges look the same [VERIFY].
  - Count milligrams, not cartridges. With epinephrine, two labels give a maximum of 7 mg/kg and not over 500 mg (Drugs.com n.d., Medicine.com n.d.). Plain lidocaine allows less [VERIFY].
- **Procaine penicillin.** Veterinary vials are 300,000 IU/mL (THRIVING library, IN-05).
- **Feed premixes and water-soluble powders.** Not for humans. The dose cannot be known.

1.10 A decade's need for 300 and 3,000

Protocol 2 gives the decade quantities. Most are ten times FO-11's yearly figure. Gentamicin, co-trimoxazole, furosemide, ivermectin, atropine and TB courses are my own estimates. Births set misoprostol (three tablets per birth, four per bleed), oxytocin, chlorhexidine and magnesium (about 2% of births, about eight ampoules each). Every figure is inference [VERIFY]. The assumptions are:

- about 30 births a year per 1,000 people, so 9 in 300 and 90 in 3,000
- children under five are 15% of the population
- type 1 diabetes at 9.5 per 10,000 (Mobasseri 2020), about 3 people in 3,000
- active epilepsy at 6.38 per 1,000 (Fiest 2017), about 2 people in 300 and 19 in 3,000
- the district figure covers all 3,000 people, including the village shelves

Three conclusions follow (inference).

The stable decade is small enough to keep. The district's decade of stable tablets weighs a few hundred kilograms and fits one dry room. Amoxicillin dominates the bulk, and stewardship can halve it (THRIVING library, IN-05).

Most of the decade's value lies in four groups:

- the antibiotics
- the stable ampoules (lidocaine, magnesium, naloxone, atropine)
- phenobarbital, at about 140,000 tablets of 60 mg for 19 patients at 120 mg a day [VERIFY dose]
- glass syringes and steel needles

The perishables cannot be stocked for a decade. Oxytocin, misoprostol, vaccines, insulin, inhalers and latex gloves are used in the first years. After that the community's health rests on the curing drugs and on what it can make (FO-11, OR-06).

1.11 The ethics of salvage and allocation [OWNER]

These are GOVERNING's questions and the owner's decision. They are named here, not answered.

- **Whose stock is it?** A pharmacy's shelves, a hospital's fridge and a neighbour's insulin pens are different cases.
- **What the ranking leaves out.** Lives per gram is one measure among several. Morphine, paracetamol and ibuprofen rank low on lives but high on suffering relieved. Insulin, antiretrovirals and antiepileptics rank low because they buy time, yet they are life itself for the people who take them. The book should say so wherever it uses the ranking.
- **Who receives a scarce course,** for example one rabies course and two bitten children. Honest loss is SY-09's subject.
- **Controlled drugs.** Morphine and ketamine draw theft and violence. MSF keeps narcotics locked, with a register (MSF 2008). Who holds the key is a governance question.
- **Buildings others will need,** such as a hospital that may reopen.

1.12 Folklore, record and inference

Belief	Status	Evidence
Medicines are worthless after expiry	Folklore, false	88% of SLEP lots extended (Lyon 2006)
Medicines last forever	Folklore, false	Aspirin, epinephrine, insulin, oxytocin, vaccines, carbamazepine fail
Expired medicines turn poisonous	Folklore, mostly false	True for degraded tetracycline (Hesperian 2025)
Insulin dies outside the fridge	Folklore, false over months	Richter 2023
Veterinary drugs are the same drugs	Half true	Same molecule, different strength, form and excipients
A prepper list is a plan	Folklore	Rarely cites evidence. This report's quantities are also inference

Evidence grades

A means trials or systematic reviews. **B** means controlled laboratory or good observational evidence. **C** means case series, labels or expert consensus. **D** means belief alone. **X** means shown false or harmful.

Claim	Grade	Basis
Sealed dry tablets keep years past expiry in controlled storage	B	Lyon 2006, Cantrell 2012
The same in tropical field storage	C	Ballereau 1997 shows exceptions
Epinephrine at 90% or more for about two years past expiry	B	Charlton 2025
Naloxone above 90% for decades	B	Pruyn 2019
Unopened insulin keeps six months at 25°C	B, low certainty	Richter 2023
Clay pot storage for insulin	C	Richter 2023
Toxoid tolerates heat, not freezing	B	Milstien 2006
Carbamazepine fails dissolution in humidity	B	al-Zein 1999
Ranking by lives per gram	D	Own inference
Veterinary products given as human doses unconverted	X	CDC 2021
Expiry as a cliff, or as meaningless	X	Section 1.2

Means ledger

The rungs follow FO-11: household, village (300 people, lay healer), district (3,000 people, nurse-level healer, ten beds).

Rung	Can salvage and keep	Needs	Cannot do
Household	Its own chronic drugs, ORS, painkillers, an autoinjector	A dry tin, a cool corner, a dated list	Injectables, cold chain, controlled drugs
Village	The FO-11 village shelf, misoprostol, zinc, chlorhexidine, phenobarbital for its few patients	A dry trunk with desiccant, a thermometer, a stock card, one literate keeper	Ketamine, magnesium infusion, vaccines beyond weeks
District	The top 30, a cool cellar, a locked cabinet, a clay-pot or spring-house cold store (OR-06)	Two trained people, a steriliser, registers, reference books (Hesperian, MSF)	Potency testing

No rung can assay a drug after the Fall. Every judgement rests on the drug's class, its pack, its storage history and its appearance (inference).

Harm test

- **A failed drug** gives false reassurance and costs time. Guard: use the class table (1.7) and Protocol 4, and change course if a fever or fit does not respond.
- **The fresh-stock overdose (inference).** A patient stabilised on weakened insulin, carbamazepine or levothyroxine, then switched to a fresh lot, gets a sudden higher dose. With insulin this means hypoglycaemia. Guard: start lower on a new lot and watch.
- **Veterinary concentration errors**, such as ivermectin toxicity and tenfold ketamine errors. Guard: Protocol 5.
- **Contaminated multi-dose vials** spread hepatitis C, HIV and bacteria. Guard: Protocol 6.
- **Degraded tetracycline** causes Fanconi syndrome. Guard: discard brown or sticky tetracycline, and prefer doxycycline.
- **Uterotonics at the wrong time.** Given before birth they can rupture the uterus [VERIFY, see MA-02]. Guard: the birth attendant holds them.
- **Salvage by habit.** Painkillers and syrups fill the store while the obstetric fridge is missed. Guard: Protocol 1 starts at the fridges.
- **Insulin hoarded without a plan,** cooking in a loft. Guard: Protocol 7.
- **Theft and violence over controlled drugs.** Guard: governance [OWNER].

Red flags

Quarantine in the store:

- Epinephrine that is pink or brown
- Insulin that is clumped, frosted or frozen, or short-acting insulin that is cloudy
- Brown or sticky tetracycline
- Aspirin that smells of vinegar
- Caked or brown ORS
- Melted creams
- Toxoid that is frozen or fails the shake test
- Torn misoprostol blisters

- Ampoules that are cracked or cloudy
- Multi-dose vials with no opening date
- Unlabelled tablets
- IV bags that are slack or have lost their overwrap
- Gloves with white lines
- Anything marked "not for human use", pour-on, drench or premix
- Any abnormal colour, stain, odour, solubility or crumbling (MSF 2008)

Stop and seek help in the patient:

- After veterinary ivermectin: confusion, unsteadiness, seizures or low blood pressure (CDC 2021)
- After local anaesthetic: numb lips, ringing ears, twitching or fits [VERIFY]
- After salvaged insulin: sweating and confusion, or thirst and drowsiness if the insulin is too weak
- After an antiepileptic from a new lot: drowsiness, or fits returning
- Any fever or fit that does not respond as expected. Suspect the drug.

The case against

Past stability is no promise of future stability. Aronson and colleagues showed that 16% of extended SLEP lots eventually failed (via THRIVING library, IN-05). Lyon and colleagues (2006) wrote that only lot-by-lot testing can assure stability, and no one will test after the Fall. The tables here rest on averages, and any one bottle may be the exception.

The Cantrell cache is a ceiling, not an average. It was one find of eight products, mostly barbiturates and opioids that are on no essential list now. The authors are reported as not recommending that patients use expired drugs (AARP 2012, secondary) [VERIFY].

The regulator's view. The FDA does not endorse use past expiry outside its programmes, and it refused an extension for doxycycline (via THRIVING library, IN-05). Readers may meet this book before the Fall, while pharmacies still work.

Starting quality matters more than decay. Nazerali and Hogerzeil (1998) found poor initial quality a bigger risk than instability. Torloni found 45.6% of in-date oxytocin failing (via MA-02). Salvaged stock may include falsified products, and no ranking protects against a fake.

Keep few medicines. MSF (2008) and Hesperian (2025) both argue for a short list held well. Thirty molecules kept dry beat 300 that cannot be stored or tracked.

The utilitarian objection. A palliative-care or disability-rights critic would say that ranking by lives per gram abandons the dying and the chronically ill [OWNER].

The hospital romance. Hospitals hold days to weeks of stock, their fridges fail within hours, and others arrive first [VERIFY]. The first week may yield far less than these tables assume, and my quantities scale a kit designed for three months of humanitarian work.

10-line summary

1. Curing drugs outrank time-buying drugs on lives per gram: antibiotics, uterotonics, magnesium, artesunate, TB drugs and toxoids ahead of insulin, ART, antiepileptics and thyroid.
2. The top ten are amoxicillin, gentamicin, ceftriaxone, ketamine, lidocaine, doxycycline, syringes and needles, misoprostol, artemisinins where malaria is, and magnesium sulfate.
3. Expiry is neither a cliff nor meaningless: 88% of SLEP lots were extended, by a mean of 66 months, but lots vary and 16% eventually failed.

4. In the Cantrell cache, 11 of 14 ingredients held at 28 to 40 years. Aspirin had almost gone.
5. Epinephrine keeps 90% or more for about two years past expiry, then fades. Naloxone holds for decades.
6. Unopened insulin keeps six months at 25°C and two months at 37°C. Beyond that there are no data.
7. Oxytocin needs cool storage, misoprostol an intact blister, and toxoid must never freeze. None keeps a decade.
8. Carbamazepine can pass an assay and still not dissolve. Phenobarbital is the decade antiepileptic.
9. Veterinary ivermectin, ketamine and oxytocin come at different strengths. Read mg per mL, and check in pairs.
10. Start at the fridges on day one, store dry, dark and below 25°C, and leave allocation to GOVERNING [OWNER].

Open questions

- Insulin beyond six months at room temperature, or in a 12 to 15°C cellar.
- Stability past expiry for magnesium, TXA, ketamine, morphine, prednisolone, artemisinins, TB combinations, ART, albendazole, praziquantel, zinc and 50% glucose. None found for most.
- Oxytocin over several years at cellar temperature.
- Water loss from IV bags over years.
- The primary Cantrell 2012 paper, and its paracetamol figure.
- Excipients in veterinary ivermectin injection and pour-on.
- How much stock a regional wholesaler holds.
- Nitrous oxide cylinders in dental surgeries, and whether premixed gas separates in cold [VERIFY].
- Whether glucose test strips can be salvaged and kept.
- OR-06, SY-09 and ME-10, not yet in the library.

Sources to read in full

Charlton 2025 (open access), Lyon 2006, Cantrell 2012, Richter 2023, Kaufmann 2021 (open access), Milstien 2006, the storekeeping chapters of MSF 2008, Ballereau 1997, Itin 2021, and Hesperian 2025 (“The Medicine Kit” and the Green Pages).

At the bedside after the Fall

Household. Keep the family’s medicines in a tight tin with silica gel, in the coolest dry corner, away from stove, fuel and windows, with name, strength and date on the lid. Use the oldest first, and keep insulin in a clay pot (Protocol 7). It needs a tin and a list. The first failure: medicines cooked in a car, loft or windowsill by the first summer.

Village (300). The FO-11 shelf, plus phenobarbital for its two or so patients, misoprostol and chlorhexidine for about nine births a year, and zinc. The keeper logs temperature morning and evening (MSF 2008) and sends injectables and controlled drugs to the district. It needs a dry trunk, a thermometer, a stock card and one reader of labels. The first failure: misoprostol torn in a damp bag.

District (3,000). The top 30, the antibiotic sweep and the cold store. It runs Protocol 1, keeps registers of controlled drugs and opened vials, and checks veterinary stock in pairs. It uses vaccines, oxytocin, insulin, inhalers and latex gloves in the first two years, and saves phenobarbital, naloxone, lidocaine, magnesium, glass and steel for later. It allocates under GOVERNING [OWNER]. It needs a cellar, a lock, two trained people, a steriliser and reference books. The first failures: the fridges in week one, then multi-dose vials spreading infection.

Protocols

Protocol 1. The first-week salvage route

The order follows what fails first, not what is wanted most (inference). The route assumes GOVERNING has decided what may be taken [OWNER].

Day	Where	Take first	Tolerance
0 to 1	Hospital, clinic and pharmacy fridges	Insulin, oxytocin, ergometrine, toxoid, rabies vaccine, other vaccines, antivenom	Every hour above 25°C counts. Cool box or wet-cloth wrap, out of sun. Never freeze
1 to 2	Hospital pharmacy, theatres, emergency department	Ketamine, lidocaine, gentamicin, ceftriaxone, magnesium, TXA, epinephrine, atropine, diazepam, naloxone, morphine with its register, IV fluids, consumables, steriliser	Boxed, out of light
2 to 3	Pharmacies, wholesalers	Antibiotic sweep (IN-05), misoprostol, phenobarbital, carbamazepine, prednisolone, salbutamol, ORS, zinc, albendazole, ivermectin tablets, chlorhexidine, TB drugs	Original packs only. Leave syrups
3 to 4	Dental surgeries	Cartridges, epinephrine, steel syringes, sutures, gloves, autoclave, oxygen	Sort cartridges by drug, strength and vasoconstrictor
4 to 5	Veterinary practices, farm suppliers, farms	Procaine penicillin, oxytocin, ivermectin, ketamine, lidocaine, atropine, bulk syringes and needles, sutures, catheters	Mark every box "VETERINARY" in red. Store apart
5 to 6	GP surgeries, care homes, schools, households by agreement	Emergency bags, autoinjectors, inhalers, insulin pens	Household stock belongs to its owner [OWNER]
7	The store	Inspect (Protocol 4), quarantine, log, store (Protocol 3)	Nothing is used until it is logged

Protocol 2. The one-page priority list

Take in this order. The quantities are decade totals (inference, [VERIFY]). Where a decade cannot be kept, take what the shelf life allows. "FO-11 × 10" means ten times FO-11's yearly figure.

No.	Item	300	3,000	Keeps sealed, cool, dry
1	Amoxicillin 250 mg	36,000	360,000	Years
2	Gentamicin 80 mg	500	10,000	Years [VERIFY]
3	Ceftriaxone 1 g	0 to 200	8,000 to 10,000	Years as powder

No.	Item	300	3,000	Keeps sealed, cool, dry
4	Ketamine vial	0	300	Years [VERIFY]
5	Lidocaine plain vial	20	500, plus cartridges	Decades likely
6	Doxycycline 100 mg	3,000	30,000	Uncertain
7	Sterile syringe and needle sets	500	30,000, or 40 glass and 500 steel	Glass and steel indefinite
8	Misoprostol 200 μg	400	4,000	To about year 5 [VERIFY]
9	Artemisinins	By burden	By burden	Years [VERIFY]
10	Magnesium sulfate 5 g	16	300	Decades likely
11	Tetanus toxoid	All found	All found	1 to 2 years without cold
12	Metronidazole	2,000	20,000	Years
13	Co-trimoxazole	2,000	20,000	Years
14	Prednisolone 5 mg	1,000	10,000	Years [VERIFY]
15	Oxytocin 10 IU	90	1,200	2 to 4 years in a cellar [VERIFY]
16	Epinephrine 1 mg	20	500	Full to 2 years, then fading
17	Tranexamic acid 500 mg	20	800	Years [VERIFY]
18	Phenobarbital 60 mg	15,000	140,000	Decades
19	Atropine 1 mg	20	500	Years [VERIFY]
20	Rabies vaccine	0	20 courses	18 months at 20 to 25°C
21	Diazepam 10 mg	20	2,000	About 10 years, yellowing
22	Albendazole 400 mg	2,400	24,000	Years [VERIFY]
23	TB first-line	0	40 courses	Uncertain
24	Zinc 20 mg	12,000	120,000	Years if dry
25	Chlorhexidine cord gel	90 tubes	900 tubes	Years
26	Furosemide 40 mg	2,000	20,000, plus 200 ampoules	Tablets years
27	Salbutamol inhaler	75	750, plus solution	Inhalers 1 to 3 years
28	Naloxone 0.4 mg	5	100	Decades
29	Ivermectin 3 mg	1,000	10,000	Years [VERIFY]
30	Carbamazepine 200 mg	2,200	22,000	Years if in strips
Below the line	Insulin 1,000-unit vial	0 to 15	About 45 a year	No data past 6 months

Protocol 3. The storage card

General rules (MSF 2008, unless marked otherwise):

- Keep between 0 and 30°C, even at midnight. Aim below 25°C (inference from Richter 2023 and Lyon 2006).
- Log maximum and minimum temperature twice a day.
- Keep humidity at 65% or less. Never remove silica gel.
- Shelves stand 60 cm from walls, and nothing goes on the floor.
- No direct light. Use opaque packaging, especially for injectables.
- Insulate the roof, shade the walls, and ventilate high and low. A fan lowers temperature by only about two degrees.
- Never store medicines with fuel, chlorine or food. A tent is not a store.
- Lock narcotics away, with a register.
- Cold items go at 2 to 8°C, never in the fridge door. Cold storage without electricity is OR-06's subject.

By class:

Class	Keep	Use first or discard
Tablets	Original blister, or sealed tin with desiccant	Moisture-sensitive drugs first
Ampoules	Boxed, dark	Epinephrine, ergometrine first
Powder vials, multi-dose vials	Dry, dark, opening date written	Mixed: hours to days. Opened: 28 days
Insulin, oxytocin, vaccines	Cold, cellar or clay pot. Never freeze insulin or toxoid	Use, do not keep
Misoprostol	Intact blister, dry	Torn strips first
Creams, suppositories, IV fluids	Cool, IV fluids in overwrap	Melted, slack or punctured: discard
Gloves, sutures	Dark, sealed, away from motors	Latex 3 years, nitrile 5. Chromic and polydioxanone first

Protocol 4. Inspection and quarantine

1. **Read the label:** name, strength per unit or per millilitre, form, lot and expiry. Do not mistake the manufacture date for the expiry date (MSF 2008).
2. **Check the pack:** blister intact, ampoule uncracked, cap sealed, overwrap present.
3. **Check the appearance** against the Red flags list. Note that yellowed diazepam has aged but may still be potent (Itin 2021).
4. **Freezing check for toxoid.** Compare the suspect vial with one known to have been frozen (the WHO shake test). If the suspect vial's sediment settles as fast, discard it [VERIFY details, Milstien 2006].
5. **Record where it was found.** Stock from a hot loft or vehicle goes to use first.
6. **Quarantine** doubtful items on a marked shelf until two people decide.
7. **Log** every item. Nothing is issued unlogged.

Protocol 5. Veterinary and dental product check

1. Store veterinary stock apart, and mark it.
2. Before use, two people read the label aloud: drug, strength per millilitre or gram, route, and any "not for human use".
3. Both write the milligrams and compare them with the human dose card (IN-05, IN-08). Never count in syringes or cartridges.
4. Never inject pour-on, drench, premix, powder or paste. Most are not for humans in any form.
5. Horse paste holds about 113 mg of ivermectin per syringe, and a human tablet holds 3 mg. If paste is the only source, a trained person decides with IN-08 open.

6. Dilute ketamine 100 mg/mL before intravenous use (Par Pharmaceutical 2026), and mark the strength on every syringe.
7. Veterinary oxytocin is 20 units/mL, twice the human strength. Apply Protocol 6.
8. Dental lidocaine 2% is 20 mg/mL. With epinephrine the maximum is 7 mg/kg and not over 500 mg (Drugs.com n.d., Medicine.com n.d.). Separate articaine and prilocaine by strength [VERIFY].

Protocol 6. Multi-dose vials

1. Write the date and time of first puncture on the vial.
2. Use a new sterile needle and syringe for every entry, even for the same patient.
3. Wipe the stopper with alcohol and let it dry first [VERIFY].
4. Discard 28 days after first puncture unless the label says otherwise, or at once if contamination is suspected (NJ Department of Health 2009).
5. Use single-dose vials once only (Alarcón 2024).
6. Steam-sterilise reused needles between patients (OR-06). Boiling disinfects but does not sterilise (THRIVING library, FO-11).

Protocol 7. Insulin storage plan

1. **Count:** list every person who needs insulin, and every vial by type and expiry. Allocation is GOVERNING's decision [OWNER].
2. **Store unopened vials** in the coolest place: a cellar, a spring house, or a clay pot with damp sand kept shaded (Richter 2023, and OR-06).
3. **Target below 25°C**, which keeps vials six months with under 4% loss. Spells up to 37°C are tolerated for up to two months with under 9% loss (Richter 2023).
4. **Never freeze it**, and never leave it in sun, a vehicle or a loft. Discard if heated above about 40°C [VERIFY].
5. **In use:** one vial per person, dated on opening, used within 28 days or the label period, whichever is shorter. Labels give 10 to 45 days (Richter 2023).
6. **Inspect before each use.** Clear insulin must be clear, and NPH must re-mix evenly.
7. **On a new lot,** watch for low blood sugar.
8. **Record the run-out date** at the current dose. Honest loss is SY-09's subject.

Numbers to carry

- Epinephrine: about 80% at 4 years past expiry, 55 to 77% at 11 years.
- Salbutamol: 40% of inhaler lots pass, 80% of nebuliser solution lots.
- Insulin opened: 10 to 45 days.
- Oxytocin: 3 to 7% loss a year at 21 to 25°C, 9 to 19% at 30°C.
- Rabies vaccine: 18 months at 20 to 25°C.
- Store at 0 to 30°C, humidity 65% or less, shelves 60 cm from walls.
- Multi-dose vial: 28 days after opening.
- Ivermectin horse paste: 18.7 mg/g. Human tablet: 3 mg.
- Oxytocin: veterinary 20 units/mL, human 10 IU/mL.
- Ketamine: 10, 50 or 100 mg/mL. Dilute 100 mg/mL for intravenous use.
- Lidocaine 2% is 20 mg/mL. With epinephrine: 7 mg/kg, maximum 500 mg.
- Per 3,000 people: about 3 with type 1 diabetes, 19 with epilepsy, 90 births a year.
- Untreated TB: 70% dead in ten years.

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