IN-08 Worms, lice, scabies and the skin parasites: cheap treatments

HEALING after the FALL, research library, IN-08

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

How to read this document

This report covers the scabies mite, the head louse, the soil-transmitted worms (hookworm, roundworm, whipworm), pinworm, tapeworms, Strongyloides, the schistosomes and the sand flea. Body lice and typhus belong to the vectors report (THRIVING library, HY-06), latrines and the Rockefeller privy campaign to the sanitation report (THRIVING library, HY-04), and iron to the deficiency report (THRIVING library, HY-08). I build on them and do not repeat them.

Tradition (what a culture says a remedy does), record (what happened when it was used and counted) and inference (what science concludes) are kept apart. Figures I could not verify, and my own arithmetic or inference, are marked [VERIFY]. The main finding is simple: these parasites are beaten less by the drug than by the household. Everyone treated on the same day, bedding heated, the comb used again on day 5, 9 and 13, the latrine used and the feet shod. Treatment fails where one person, one blanket or one session was missed.

Findings by section

1. What these parasites cost a village

They rarely kill directly. They cost sleep, school, work and blood, and open the door to what does kill. Scabies leads to impetigo, and in Fiji impetigo fell by 67% when scabies was cleared with ivermectin (Romani et al. 2015). A hookworm takes about 0.03 to 0.15 mL of blood a day and a heavy infection may hold up to 1,000 worms (Hektoen International 2021). HY-08 gives about 0.1 mL per worm per day (THRIVING library, HY-08). Roundworms can block a child's bowel, Strongyloides can kill a patient given steroids decades after infection, and schistosomes bleed the bladder or scar the liver.

Climate decides which matter. Hookworm needs warm moist soil and bare feet, schistosomes a freshwater snail and people who wade, tungiasis sandy floors and animals in the house. Pinworm, scabies and head lice need only crowding and occur everywhere. A temperate village should expect scabies, lice, pinworm, roundworm and, where meat is eaten undercooked, tapeworm. A tropical one adds hookworm, whipworm, Strongyloides, schistosomiasis and tungiasis.

2. Scabies

2.1 Why treatment fails The mite Sarcoptes scabiei burrows in the skin. An ordinary case carries fewer than 10 to 15 mites, symptoms of a first infestation take 4 to 8 weeks to appear, and mites generally survive only 2 to 3 days off skin (CDC 2024). That delay is the root of failure: by the time one child itches, others carry mites without symptoms. Every source I read says to treat the patient and all close contacts on the same day, itching or not (MSF n.d. b, Gulati and Singh 1978).

2.2 Sulfur ointment **Tradition.** Sulfur in fat is among the oldest scabies remedies. An 1860 encyclopaedia formula gave sulphur two parts, potash one and lard eight (search summary only) [VERIFY]. I could not open the Hesperian text of Where There Is No Doctor to read its recipe.

Record. CDC lists sulfur 5 to 10% in petrolatum as an alternative, considered safe in children including infants under 2 months, though it smells (CDC n.d. a). The usual regimen is a thin layer from neck to soles on 2 to 3 successive days, bathing 24 hours after the last (drugs.com n.d., secondary). A Turkish series of 64 patients given 5 to 10% sulfur on three consecutive days, washed off every 24 hours, found 72% cured after the first course and 92% overall, median 3 days (Altunel 2022). A Thai trial in 100 children aged 6 months to 13 years compared 10% sulfur with 0.3% lindane over seven nights and found cure at 4 weeks of 92% against 94%, with 32 of 100 lost to follow-up (Thai trial, search summary) [VERIFY authors and year]. In India, Gulati and Singh (1978) surveyed 1,727 people house to house and treated 158 with scabies: benzyl benzoate cleared uncomplicated cases faster with less recurrence at six months, sulfur cleared infected cases faster. A Chinese series of 170 patients found complete cure in 54.7%, partial in 31.8% and none in 13.5%, mostly from non-compliance (Zhang et al. 2026).

Inference. Sulfur works, more slowly than permethrin, and the spread from 55% to 92% reflects how faithfully it was applied. Safety in pregnancy rests on long use, not trials: a 2021 review states that no animal studies of sulfur exist (PMC7790223 review 2021). One monograph mentions systemic toxicity in infants at high doses (drugs.com n.d.) [VERIFY: original cases not found]. Grade B for efficacy, C for safety in pregnancy and infancy. Use elemental sulfur (flowers of sulphur, precipitated sulfur), never lime sulfur, a caustic garden fungicide [VERIFY]. By weight, 5 g sulfur in 95 g fat makes 5%, 10 g in 90 g makes 10% (my arithmetic).

2.3 Benzyl benzoate and permethrin MSF uses benzyl benzoate 25% when permethrin is unavailable, diluted by age: under 2 years, 1 part lotion to 3 parts boiled water for 12 hours (6 hours under 6 months), once, with hands wrapped. From 2 to 12 years, 1 to 1 for 24 hours, twice. Over 12, undiluted for 24 hours. Pregnant women, undiluted for 12 hours, once (MSF n.d. b, search summary). This rests on one source [VERIFY a second]. It stings. A 2025 meta-analysis of ten trials found oral ivermectin about as effective, with fewer adverse events (Ivermectin versus benzyl benzoate meta-analysis 2025). Grade A. A village cannot make it.

Permethrin 5% from neck to toes, washed off after 8 to 14 hours, is first line from 2 months of age, with a second application a week later where needed (CDC n.d. a, MSF n.d. a). About 2% is absorbed, and 113 exposed pregnancies showed no excess harm (PMC7790223 review 2021). Cochrane found permethrin and oral ivermectin similar at four weeks (Rosumeck et al. 2018). Grade A. I found no trial of home-made pyrethrum ointment (grade D).

2.4 Oral ivermectin The dose is 200 micrograms per kg, two doses 7 to 14 days apart, with food (CDC n.d. a). MSF gives 200 micrograms per kg once with a second dose a week later, from 3 mg tablets, says to take it on an empty stomach, and forbids it under 15 kg and in pregnancy (MSF n.d. c). The two agree on the dose and differ on food. The drug does not kill eggs, hence the second dose.

Two restrictions bind. First, weight: an analysis of 1,088 children under 15 kg found 18 mild adverse events in 15 (1.4%) and no serious events (Jittamala et al. 2021), but the authors called for trials, so the village rule stays: under 15 kg, use sulfur or permethrin. Second, Loa loa: in the Central and West African rainforest, ivermectin can cause encephalopathy above 30,000 microfilariae per mL of blood and serious reactions above 8,000 (MSF n.d. c), first recorded after mass treatment in Lékié, Cameroon (Gardon et al. 1997). MSF advises topical treatment if loiasis is possible.

2.5 Treating a whole community In Fiji, three island communities (2,051 people) received standard care, mass permethrin or mass ivermectin. At 12 months scabies prevalence fell from 32.1% to 1.9% with ivermectin (relative reduction 94%), from 41.7% to 15.8% with permethrin (62%) and from 36.6% to 18.8% with standard care (49%) (Romani et al. 2015, secondary). Only three clusters, so the precision is weaker than the headline. A WHO consultation

framework advises mass treatment where prevalence is 10% or more: ivermectin twice, 7 to 14 days apart, permethrin for those excluded, at least 80% coverage, 3 to 5 rounds, stopping below 2% (Engelman et al. 2021). When a third of children itch, case-by-case treatment chases the mite round the village. One coordinated day, repeated a week later, works with sulfur too, but sulfur needs three nights of compliance from every person (inference).

2.6 Crusted scabies Crusted scabies occurs in the old, immunosuppressed, malnourished and disabled and carries up to 4,000 mites per gram of skin (Davis et al. 2013, secondary). Crusts may not itch, and one patient can infest a household. CDC gives ivermectin 200 micrograms per kg on days 1, 2 and 8, or 1, 2, 8, 9 and 15, or 1, 2, 8, 9, 15, 22 and 29 by severity, with permethrin daily or every 2 to 3 days for 1 to 2 weeks and a keratolytic cream (CDC n.d. a). MSF adds that crusts must be softened and removed first (MSF n.d. a). In the Northern Territory, 80 patients with 92 episodes included 23% on dialysis and 11 bacteraemias, and by my count 13 died, mostly of other illness (Hasan et al. 2020) [VERIFY my count].

2.7 The itch that outlasts the mite Itch continues for weeks after cure because the skin reacts to dead mites (CDC 2024). MSF says up to 4 weeks, and not to retreat unless burrows remain (MSF n.d. b). CDC advises retreatment only if itch persists beyond 2 to 4 weeks or new burrows appear (CDC 2024). Repeated scabicide damages skin and prolongs itch. Tell the family before the first treatment.

2.8 Neem and turmeric, and bedding Charles and Charles (1992) treated 814 people with a daily paste of fresh neem leaf (Azadirachta indica) and turmeric (Curcuma longa rhizome), about 4 to 1 by weight, and reported 97% cured in 3 to 15 days, with no control group. Grade D, plausible pharmacology. On the skin it appears safe. By mouth, neem oil is not (section 5.4).

CDC advises washing bedding and clothing used in the three days before treatment above 50°C for 10 minutes, drying hot, or bagging for 72 hours to a week (CDC 2024). HY-06 gives 52°C for 30 minutes as killing all louse stages (THRIVING library, HY-06). At the hearth: boil, sun, or set aside for a week.

3. Head lice

3.1 Schedule and wet combing Nits hatch in 6 to 9 days, nymphs become adults in about 7 days, adults live about 30 days, lay about six eggs a day and die within two days off the head (CDC n.d. b). Spread is head to head. No treatment reliably kills every egg, so it is repeated after hatching and before new lice can lay.

Wet combing: wash, leave conditioner in, untangle, then draw a fine comb (teeth 0.2 to 0.3 mm apart) from scalp to tips section by section, wiping it after each stroke, twice over the head, on days 1, 5, 9 and 13 with a check on day 17. It takes about 10 minutes for short hair and 20 to 30 for long (NHS n.d.).

Two trials disagree. In Wales, 81 children received bug-busting every 3 to 4 days for two weeks or malathion 0.5% twice: cure was 38% (12 of 32) against 78% (31 of 40), and about half the families complied fully (Roberts et al. 2000). In the UK, 133 children received the 1998 Bug Buster kit (four sessions, three days apart) or one application of malathion or permethrin: cure was 57% (32 of 56) against 13% (relative risk 4.4, 95% CI 2.3 to 8.5, number needed to treat 2.26), and the insecticide failures carried kdr resistance mutations (Hill et al. 2005). Combing cures about half to three fifths when done faithfully and needs no supply. Insecticides beat it only where lice are not resistant. Grade A for a modest effect. Salvage fine combs in numbers.

3.2 Heat and shaving In 169 infested children, a purpose-built hot-air device killed nearly 100% of eggs and 80% of lice in about 30 minutes, and an ordinary hair dryer killed 97.9% of eggs but only 55.3% of lice (Goates et al. 2006, secondary). The inventors held a licence. Fire-heated air on a scalp is a burn risk, so heat is for clothes, combs and bedding: wash at 54°C or seal for two weeks (CDC n.d. b). Grade B for laundering, C for hot air on the head.

Lice cannot hold a shaved scalp. No trial exists that I found. The cost is social and falls on girls. It is the fastest certain cure for a boy, a sick patient or a child with lice and impetigo (grade C).

3.3 Salvaged products and neem Dimeticone 4% twice, 7 days apart, cured 69% per protocol against 78% for phenothrin, with irritation in 2% against 9%, and it works physically, so resistance does not matter (Burgess et al. 2005). Oral ivermectin 400 micrograms per kg (double the scabies dose) on days 1 and 8 left 95.2% of 812 people lice-free on day 15, against 85.0% with malathion (Chosidow et al. 2010, secondary). Grade A. A commercial neem seed shampoo killed lice in small groups of children (12, 8 and 60) in studies by one group (Abdel-Ghaffar et al. 2007 and 2012, secondary). Grade C.

3.4 Kerosene, petrol and paraffin: mark X In Syria in 2023 parents put kerosene on children's hair, one under a plastic bag for six hours (Enab Baladi 2023). Petrol-soaked hair caught fire from a water-heater pilot light and burned an 18-year-old in Evansville, Indiana, a 5-year-old in South Carolina was critically injured when fumes ignited, and a Massachusetts toddler died when the bag over her mayonnaise-covered hair slipped over her mouth (Snopes n.d., news reports). I found no peer-reviewed series counting these injuries [VERIFY]. After the Fall, fuel and open flame share the room. Grade X. Plastic bags over a child's head: never.

4. Worms

4.1 Hookworm and the Rockefeller campaign Hookworm larvae enter through bare skin from soil fouled by faeces, and adults drink blood in the gut (Hektoen International 2021). The Rockefeller Sanitary Commission was founded in autumn 1909 with one million dollars and worked in eleven southern states (Hektoen International 2021, THRIVING library, HY-04). Its dispensaries examined 692,765 people and treated 382,129 (Hektoen International 2021). Surveys found about 40% infected (THRIVING library, HY-04). Neither I nor HY-04 read Ettling (1981).

The treatment was harsh: Epsom salts the evening before, half the thymol at 6 a.m., half at 8 a.m., Epsom salts at 10 a.m., the patient on the right side, and no alcohol, fat, oil or milk that day because they increased thymol absorption (Public Health Reports 1909 and 1913, secondary). One source gives 45 grains for an adult, about 2.9 g by my conversion. A 1913 study of 243 patients and 464 treatments admitted a few deaths, some after castor oil, some after directions were ignored, and fear of death kept people away.

Three lessons. Dispensary visits are easier to count than latrines, and the Rockefeller men ran dispensaries knowing the privy mattered more (THRIVING library, HY-04). Shoes matter as much as latrines for hookworm: wearing shoes was associated with odds of 0.29 (95% CI 0.18 to 0.47) in one meta-analysis (Strunz et al. 2014) and 0.48 (0.37 to 0.61) in another (Tomczyk et al. 2014), while sanitation lowered the odds of roundworm (0.62) and whipworm (0.61) but not significantly hookworm (0.80, 0.61 to 1.06) (Strunz et al. 2014). And the drugs of 1910 killed people where today's do not.

4.2 The salvaged drugs Pooled single-dose cure rates: roundworm, albendazole 88% and mebendazole 95%. Whipworm, 28% and 36%. Hookworm, albendazole 72%, mebendazole 15%, pyrantel 31% (Keiser and Utzinger 2008). A Lao trial found hookworm cure of only 36.0% with albendazole and 17.6% with mebendazole (Lao trial 2012).

Albendazole. 400 mg once for roundworm, hookworm and pinworm, 200 mg for children over 6 months under 10 kg. For whipworm and Strongyloides, once daily for 3 days. Not under 6 months, not in the first trimester, not in eye cysticercosis. Chew or crush (MSF n.d. d). WHO gives 200 mg at 12 to 23 months and 400 mg above (WHO 2017, secondary). MSF bands by weight, WHO by age: use the lower dose under 10 kg or under 2 years.

Mebendazole. 100 mg twice daily for 3 days for roundworm, whipworm and hookworm (50 mg twice daily under 10 kg), and 100 mg once for pinworm, repeated in 2 to 4 weeks. Not under 6 months or in the first trimester (MSF n.d. e). CDC agrees on pinworm, repeating at two weeks (CDC n.d. c).

Pyrantel. 10 mg per kg once for roundworm (MSF, search summary) or 11 mg per kg, maximum 1 g, for pinworm, repeated at two weeks (CDC n.d. c). The difference is within rounding.

Praziquantel and ivermectin are in 4.5 to 4.7.

4.3 Roundworm and the blocked bowel A ball of roundworms can block a child's bowel. In Kenya, ascariasis was the leading cause of intestinal obstruction in children aged 1 to 10, and 31.2% of those cases needed an operation (Kenya obstruction review 2016). Conservative care (fasting, fluids, hypertonic saline enemas) relieved 84.5% of 103 children in one series, 86% of 22 in an Indian series with nasogastric piperazine, and 84.8% of 33 in another (search summaries). In Pakistan, 5 of 9 children needing urgent surgery died, attributed to late presentation (JPMA series). Colic, vomiting, a swollen belly and no stool or wind in a wormy child mean obstruction until proven otherwise. Guarding or a rigid belly means the bowel is dying. Several clinicians advise deworming only once the bowel opens [VERIFY: not found in sources read].

4.4 Whipworm and pinworm Single doses cure little whipworm (28 to 36%), so the 3-day course is used (MSF n.d. d). Pinworm causes night-time anal itch and broken sleep, and its eggs survive about 2 to 3 weeks indoors (MSD Manual n.d.). CDC gives two doses two weeks apart because drugs kill worms, not eggs, and treats the whole household when infection recurs or several are infected (CDC n.d. c). Morning baths, short nails, hot washing of underclothes and bedding complete it.

4.5 Tapeworms Beef and pork tapeworm come from undercooked meat, fish tapeworm from raw fish, the dwarf tapeworm from dirty hands. Pork tapeworm eggs swallowed by the carrier or a neighbour form brain cysts that cause epilepsy. MSF gives praziquantel 5 to 10 mg per kg once for Taenia and fish tapeworm and 15 to 25 mg per kg for the dwarf tapeworm, from age 4, with no contraindication in pregnancy for taeniasis, and warns that praziquantel and albendazole can provoke seizures in undiagnosed brain cysts and must never be given with eye cysts (MSF n.d. f, MSF n.d. d). Li and colleagues make the same point (Li et al. 2012).

4.6 Strongyloides Strongyloides can reinfect its host from within, and hyperinfection has been reported more than 50 years after leaving an endemic area (clinical summary). Corticosteroids are the trigger: odds ratio 6.5 (2.1 to 20.0) in one series (Strongyloides series PMC1941746). Hyperinfection mortality is reported at 61 to 85% in case-report reviews, which overestimate it, and 8.1% in one larger series (search summaries). Ivermectin beats albendazole (MSF n.d. d). Anyone who lived in a warm country and is about to receive salvaged steroids should first be given ivermectin 200 micrograms per kg, as some hospitals did for COVID-19 (Ivermectin steroid protocol study n.d., secondary).

4.7 Schistosomiasis Schistosomes enter through skin in snail water. S. haematobium causes blood in the urine of children who swim, S. mansoni and S. japonicum bloody diarrhoea and, over years, liver scarring [VERIFY: clinical description not from a source read]. WHO (2022) recommends annual praziquantel from age 2, including pregnant women after the first trimester, where prevalence is 10% or more. MSF gives 40 mg per kg once, or 20 mg per kg twice 4 hours apart, for S. haematobium and S. mansoni, and 60 mg per kg in divided doses for S. japonicum, from age 4 (MSF n.d. f). WHO and MSF differ on the lower age. A single 40 mg per kg dose cured 22.5% to 83.3% of urinary schistosomiasis (Kramer et al. 2014) and 52% to 92% of S. mansoni (Danso-Appiah et al. n.d.), and it cuts egg output even where it does not cure. Prevention is keeping urine and faeces out of streams and fetching water to wash.

4.8 Tungiasis The sand flea Tunga penetrans burrows around the toenails. Self-extraction with pins risks infection and tetanus (Thielecke et al. 2014, secondary). Low-viscosity dimeticone (NYDA) killed 97% of embedded fleas within 7 days in 47 Kenyan children (Thielecke et al. 2014), over 95% whether whole-foot or targeted (Nordin et al. 2017), and 87% against 64% for 5% sodium carbonate (Suzuki et al. 2024). In Madagascar a twice-daily coconut-oil-based repellent (Zanzarin) cut new infestation to near zero, while shoes helped only those who wore them regularly

(Thielecke et al. 2013). Footwear in general gave odds of 0.42 (Tomczyk et al. 2014). Grade A for dimeticone, B for shoes and floors.

5. Plant anthelmintics with trials

5.1 Papaya seed (Carica papaya, dried seed) **Tradition.** Chewed for worms across West Africa, Asia and Latin America. **Record.** Okeniyi and colleagues gave 60 Nigerian children with stool parasites one 20 mL elixir of air-dried seed in honey, or honey alone. At 7 days 76.7% against 16.7% had clear stools, by parasite 71.4% to 100% against 0% to 15.4%, with no harm seen (Okeniyi et al. 2007). The seed dose is reported as 1 g and as 4 g in the same later paper (Kugo et al. 2018) [VERIFY]. In Kenya, porridge with 10 g of seed per child daily for about two months cut Ascaris egg counts 63.9%, against 78.8% with albendazole 400 mg, with 243 of 326 completing (Kugo et al. 2018). **Inference.** Two small trials point the same way, and do less than one albendazole tablet. Seed extracts caused reversible sterility in male rats and other animals (Lohiya et al. 1994). Use is unstudied in pregnancy. Grade B, small. No dangerous lookalike for the fruit.

5.2 Pumpkin seed (Cucurbita species) with areca nut (Areca catechu) **Tradition.** Pumpkin seed for tapeworm in Europe, the Americas and China, areca in Chinese medicine. **Record.** In Sichuan, pumpkin seed then areca extract made 40 of 45 confirmed cases (88.9%) pass whole worms in a mean of 2 hours, against 9 of 12 (75%) with pumpkin alone and 7 of 11 (63.6%) with areca alone, with nausea and dizziness in 46.3% (Li et al. 2012). A 1956 Chinese series reported about 95% cure for beef tapeworm when seeds came first and areca 2 to 3 hours later, but 67.5% when given together. Its cases used 100 g of chewed kernels or 50 g of oil-free powder, then a decoction of 80 g of areca, then 60 mL of 50% magnesium sulfate (Chinese Medical Journal 1956). **Inference.** Grade B for the combination against tapeworm, C for pumpkin alone. I could not confirm cucurbitin as the active principle [VERIFY]. Habitual areca chewing is carcinogenic (IARC 2003), and arecoline is a cholinergic toxin (Arecoline review 2023), so areca is a drug dose, not in pregnancy (my inference). Use only non-bitter cultivated seeds: bitterness signals cucurbitacins, which cause violent vomiting and diarrhoea [VERIFY].

5.3 Garlic (Allium sativum, bulb) Garlic oil capsules showed no anti-parasite action in Brazilian adults (UFPB 2011). Grade D. A food, not a treatment.

5.4 Neem oil by mouth: X for infants Neem oil is given to infants in South and South-East Asia for colic and worms. Sinniah and Baskaran (1981) described 13 Malaysian children with vomiting, drowsiness, acidosis and a Reye-like illness, a 4-month-old died of cerebral oedema in 1982, and doses from a few drops to 60 mL have caused encephalopathy (LiverTox n.d., Pediatric Oncall n.d., secondary). Grade X by mouth in children. Chinaberry (Melia azedarach) looks similar and has poisonous berries [VERIFY].

6. The old vermifuges: all grade X

Each worked partly, and each killed children at doses close to the working dose. They will be offered by anyone with an old herbal.

Santonin (Artemisia cina, unopened flower heads). King's American Dispensatory gives 1/20 to 2 grains for a child (about 3 to 130 mg) and records that 2 grains reportedly killed a weak 5-year-old and 5 grains killed a child within half an hour by respiratory paralysis (Felter and Lloyd 1898). Signs: yellow or green vision, yellow urine, tremor, convulsions, coma. It acts on roundworm only.

Oil of chenopodium (Dysphania ambrosioides, syn. Chenopodium ambrosioides, fruit oil). The 1918 US Dispensatory gave adults 10 to 15 drops twice daily for two days and children of 6 to 12 one drop per year of age, and cites Levy (1914): twelve poisonings, nine fatal, the smallest fatal dose four drops three times a day for two days in a one-year-old (Remington et al. 1918). It beat thymol for hookworm. Signs come hours later: vomiting, headache,

drowsiness, ringing ears, deafness, coma, convulsions. A Moroccan woman died within six hours in 2024 (Cureus case 2024). The culinary leaf (epazote) is a different exposure from the distilled oil.

Male fern (Dryopteris filix-mas, rhizome). In Gatesville, Texas, in 1897 a fasting six-year-old given strong extract by an unlicensed practitioner lay lifeless for hours with pinpoint pupils, and the reporting doctor wrote of numerous deaths from careless use (Jones 1897, search summary). It blinds cattle and is no longer used (RCP London n.d.). Human blindness is reported in older work I could not read [VERIFY]. Many ferns look alike.

Wormwood (Artemisia absinthium, herb and oil). A 31-year-old who drank about 10 mL of the oil had seizures and kidney failure (Weisbord et al. 1997, secondary). The EMA caps thujone at 3 mg a day for at most two weeks, not under 18 (EMA n.d.). Home teas have unknown thujone content. Do not confuse with sweet wormwood, Artemisia annua (THRIVING library, IN-01).

Thymol (from Thymus vulgaris oil), the Rockefeller drug, killed when taken with alcohol, fat or castor oil (section 4.1). History only.

7. The mass-deworming controversy

Taylor-Robinson and colleagues (2015) pooled 45 trials with 67,672 participants plus a trial of a million children. Treating children known to be infected may increase weight (low certainty). Treating whole populations, once or regularly, probably has little or no effect on weight, haemoglobin, cognition, school performance or mortality. Welch and colleagues (2017) agreed from 52 studies with over 1.1 million children.

Against this, Miguel and Kremer (2004) reported that deworming 75 schools in Busia, Kenya, raised attendance (7.5% in a summary) and helped untreated neighbours. Aiken, Davey and colleagues (2015) found errors in the data, including a coding error that stretched spillovers to 6 km instead of 3 km. GiveWell judged the attendance effect survived (GiveWell 2015). Twenty years on, children with 2 to 3 more years of deworming had 14% higher consumption and 13% higher hourly earnings (Hamory et al. 2021). Reinfection is fast: a year after treatment roundworm is back to 94% of its prior prevalence, whipworm 82% and hookworm 57% (Jia et al. 2012).

The worm wars ask whether tablets for every child improve the average child. They do not ask whether treating an infected child works. A pale, thin child passing worms should be treated. WHO advises mass treatment where prevalence is 20% or more, twice a year above 50% (WHO 2017), and it pays only while latrines and shoes stop reinfection. With a small stock, treat the sick first, then pregnant women after the first trimester and small children in heavily infected districts, and spend more effort on latrines, shoes and handwashing.

8. Prevention and the time of year

Handwashing before eating lowered the odds of roundworm (0.38), and after defecation (0.45), treated water lowered the odds of any soil worm (0.46), and soap (0.53) (Strunz et al. 2014). Shoes stop hookworm and sand flea, latrines roundworm and whipworm, latrines and clean water the schistosome. Scabies, lice and pinworm are crowding diseases: separate sleeping mats, weekly hot washing, a household inspection day.

I found no source on the best season for deworming. On the biology, a dose at the end of the wet season in the tropics or of summer in temperate lands clears the year's load [VERIFY: my inference]. Scabies and lice spread in cold months when people crowd and wash less, so hold the inspection day before winter (inference).

Today every drug named here is cheap and on essential lists. After the Fall the village has what it salvaged. MSF stores albendazole below 25°C (MSF n.d. d). What it can make is sulfur ointment, a combing routine, hot water, shoes and latrines, and it can refuse the old poisons.

Evidence grades

Remedy or practice	Grade	Basis (tradition, record, inference)
Sulfur 5 to 10% in fat, 3 nights	B (C for pregnancy, infancy)	Old remedy, 55 to 92% cure in series, slower than permethrin
Benzyl benzoate 25%	A	Equal to ivermectin in meta-analysis, stings
Permethrin 5%	A	First line, pregnancy data reassuring
Oral ivermectin, scabies	A	32.1% to 1.9% prevalence in Fiji, not under 15 kg
Treating all contacts at once	B	Failures traced to untreated contacts
Neem and turmeric paste	D	One uncontrolled series, 97%
Wet combing	A (modest)	38% and 57% cure in two trials
Shaving	C	Untested, certain on biology
Bedding at 50°C or above	B	Kills mites, lice and eggs
Hot air on the scalp	C	98% of eggs, 55% of lice with a hair dryer
Dimeticone, salvaged pediculicides	A	13% to 95%, resistance decides
Kerosene, petrol on hair	X	Burns, fires
Albendazole, mebendazole	A	Roundworm 88 to 95%, hookworm 15 to 72%, whipworm under 40%
Mass deworming of all children	A (little average benefit)	Cochrane null, Kenyan long-term gains
Praziquantel	A	22 to 92% cure, egg output falls
Ivermectin for Strongyloides	A	Better than albendazole
Dimeticone for sand flea	A (small)	87 to 97% of fleas killed
Shoes	B	Hookworm odds 0.29 to 0.48
Latrines	B	Roundworm odds 0.62
Papaya seed	B (small)	76.7% against 16.7% in 60 children
Pumpkin seed with areca	B	89% passed whole tapeworm
Pumpkin seed alone	C	75% of 12
Garlic	D	No effect in one human study
Neem oil by mouth, infants	X	Encephalopathy, deaths
Santonin, chenopodium oil, male fern, wormwood, thymol	X	Child deaths at near-therapeutic doses

Means ledger

Scabies. Hands and knowledge: recognise burrows in finger webs, wrists and genitals, examine the whole household, sun the bedding, refuse to re-treat the first month's itch. Hearth: boil bedding, render fat, and with salvaged sulfur make 5 to 10% ointment and treat everyone the same three nights. Without sulfur the hearth has no proven scabicide. Garden and still: a scale makes the ointment exact, beeswax firms it, neem and turmeric can be grown. Dispensary: salvaged permethrin and benzyl benzoate, a community treatment day, a register, screening the old and sick for crusts. District: ivermectin mass rounds, isolation and multi-dose ivermectin for crusted scabies, care of infected sores. Hospital before the Fall: the same plus microscopy of scrapings and intravenous antibiotics. What changes: the hearth with sulfur cures most ordinary scabies, the dispensary adds speed for those who cannot comply, the district cures crusted scabies and ends epidemics.

Head lice. Hands: weekly inspection, shaving. Hearth: oil or soapy water as conditioner, a fine comb, hot water. Garden: neem wash (C), a carver making combs. Dispensary: dimeticone, permethrin, malathion. District: oral

ivermectin for resistant lice over 15 kg. The rungs change little: comb and razor are nearly as good as anything the hospital had.

Worms. Hands: handwashing, shoes, latrine use, keeping out of snail water, cooking meat through. Hearth: boiled water, soap, oral rehydration and enema for obstruction. Garden: papaya seed for roundworm, pumpkin seed with weighed areca for tapeworm. Dispensary: albendazole, mebendazole, pyrantel, a microscope for stool eggs, a register. District: praziquantel, ivermectin, mass rounds by prevalence, iron, drips. Hospital: surgery for obstruction, endoscopy for bleeding varices, scans for brain cysts. What changes: tablets cure what the garden only reduces, and only the hospital opens a blocked bowel.

Sand flea. Hands: daily foot checks, swept or sealed floors, shoes, animals out. Hearth: boiled needle, soap. Dispensary: dimeticone, tetanus vaccine if salvaged. District: antibiotics for infected feet.

Harm test

Sulfur. Irritant dermatitis if applied too long or too strong, smell, stained cloth. Infant toxicity at high doses reported (drugs.com n.d.) [VERIFY]. Errors: lime sulfur instead of elemental sulfur, nightly use for weeks against post-scabies itch. Use 5% in infants and pregnancy (my inference). Raw, weeping skin: stop, wash off, apply plain fat.

Benzyl benzoate. Burning, worse on broken skin, eye injury, infants sucking treated hands (MSF n.d. b). Dilute for children. Screaming infant or red eyes: wash off at once.

Permethrin. Mild burning. Not under 2 months without strong reason (CDC n.d. a).

Ivermectin. Not under 15 kg or 90 cm, not in pregnancy, caution in Loa loa areas (MSF n.d. c). Historical harm: the Lékié encephalopathies (Gardon et al. 1997). Veterinary pastes and injectables are concentrated for horses and cattle, and a child dosed from them can be poisoned [VERIFY]. Overdose signs I did not read in a source [VERIFY].

Albendazole, mebendazole. Not under 6 months or in the first trimester. Seizures with undiagnosed brain cysts (MSF n.d. d). A fit after a dose: lie the patient on the side, do not repeat. Iron tablets given with them are a leading poisoning of small children (THRIVING library, HY-08): lock them away.

Praziquantel. Drowsiness, headache, nausea, seizures with brain cysts, never with eye cysts (MSF n.d. f).

Papaya seed. No harm in 60 children (Okeniyi et al. 2007). Animal male infertility (Lohiya et al. 1994). Use for days, not as a tonic. Not in pregnancy.

Pumpkin with areca. Nausea and dizziness in 46% (Li et al. 2012). Areca is a cholinergic poison and carcinogen. The magnesium sulfate purge dehydrates: give fluids. Not in pregnancy or small children (my inference).

Neem. Safe on skin. By mouth in infants, encephalopathy and death. Chinaberry confusion [VERIFY].

Kerosene, petrol. Burns, fire, aspiration pneumonia if swallowed.

Old vermifuges. Section 6. Signs: yellow vision, vomiting, ringing ears, drowsiness, convulsions, coma. Stop, lie on the side, keep the airway open, nothing by mouth if drowsy. No village antidote exists.

Sand flea extraction. Infection, tetanus. Boil the needle, remove the whole flea, cover the wound.

Red flags

1. **Crusted scabies:** thick grey crusts on hands, feet or scalp of an old, sick or wasted person, little itch. Needs repeated ivermectin. Without it, soak and lift crusts, apply sulfur daily, isolate bedding, treat everyone who touches the patient, and watch for fever, which signals blood infection.
2. **Scabies with fever, spreading redness, or puffy face and dark urine:** infection has reached blood or kidneys. Antibiotics if any exist, rest, fluids, less salt for the swollen.

3. **Bowel obstruction in a wormy child:** colic, vomiting bile or worms, swollen belly, no stool. Nothing by mouth, fluids, enema, watch. Guarding, a rigid belly or fever means only surgery can save the child. Keep warm, relieve pain, stay.
4. **Severe anaemia:** white inner eyelids, breathless at rest, swollen feet. Deworm, iron, food. Without transfusion such a child may die of heart failure or a minor infection.
5. **Strongyloides hyperinfection:** fever, belly pain, cough and spreading rash in someone on steroids, then confusion. Stop steroids if safely possible, give daily ivermectin. Most die without a hospital.
6. **Seizure after a worm tablet:** suggests brain cysts. Do not repeat. Protect the patient.
7. **Vomiting blood in an adult from schistosome country:** bleeding varices. Rest, cool fluids, comfort.
8. **Drowsiness after any vermifuge, neem oil or kerosene:** poisoning. Airway, side position, nothing by mouth.

Honest comfort: most people with worms, lice and scabies get well. Those who do not are usually the late, the wasted and the frail. For them cool water and fat ease the itch, and the healer can keep them clean, fed and accompanied.

The case against

Against the herbal. Every old vermifuge on the X list worked partly and killed children, and every one is sold today as natural. The plant remedies with trials have tiny trials: papaya seed rests on 60 children and three schools, neem and turmeric on one uncontrolled series. A village treating these as equal to albendazole will leave children anaemic (Science Feedback n.d.).

Against the hospital. Paul Garner, David Taylor-Robinson and colleagues at the Cochrane Infectious Diseases Group showed that the favourite public health tablet, given to whole schools, has little measurable average effect (Taylor-Robinson et al. 2015). Alexander Aiken and Calum Davey found errors in the flagship trial (GiveWell 2015). Resistance has made permethrin and malathion fail against lice, and the comb beat the bottles (Hill et al. 2005). One albendazole dose cures a third to three quarters of hookworm (Keiser and Utzinger 2008), and reinfection undoes most of it within a year (Jia et al. 2012).

Against this report. Edward Miguel, Michael Kremer and colleagues argue that the Cochrane view misses long-term and spillover effects, and their 20-year follow-up found earnings gains (Hamory et al. 2021). If they are right, mass deworming in a heavily infected district is among the best uses of a scarce stock. The truth probably depends on worm burden.

10-line summary

1. Scabies, lice and pinworm fail when a contact, a blanket or a second session is missed: treat the household together and repeat on schedule.
2. Sulfur 5 to 10% in fat for three nights cures most ordinary scabies and is the hearth's only proven scabicide.
3. Ivermectin 200 µg/kg twice, a week apart, cut Fijian scabies from 32.1% to 1.9%, but not under 15 kg, in pregnancy or near Loa loa.
4. Itch lasts up to four weeks after cure: do not re-treat it.
5. Wet combing on days 1, 5, 9 and 13 cures about half of head lice with no supply, shaving cures all, kerosene burns children.
6. Albendazole 400 mg once clears about 88% of roundworm, at best 72% of hookworm, under a third of whipworm.
7. Within a year roundworm returns to 94% of its prior level: shoes and latrines are the lasting cure.
8. Papaya seed and pumpkin seed with areca have small positive trials, garlic none.
9. Santonin, chenopodium oil, male fern, wormwood and thymol killed children: grade X.
10. Mass deworming has little average short-term effect, but treating an infected child works.

Open questions

- Is sulfur safe in the first trimester and in newborns? No trial found.
- What seed dose did Okeniyi use, and does papaya seed act on hookworm?
- What is the lowest effective areca dose with pumpkin seed?
- Should ivermectin be used under 15 kg in an epidemic with no permethrin?
- Do deworming earnings gains hold outside western Kenya?
- Which season is best for deworming? No direct study found.
- How fine must a home-made comb of horn, bone or wood be?

Sources to read in full

1. Taylor-Robinson et al. 2015, Cochrane CD000371.
2. Hamory et al. 2021, PNAS, and Miguel and Kremer 2004.
3. Romani et al. 2015, NEJM.
4. Hill et al. 2005, BMJ, with Roberts et al. 2000, Lancet.
5. MSF Clinical Guidelines and Essential Drugs: scabies, ivermectin, albendazole, mebendazole, praziquantel.
6. Ettling 1981, The Germ of Laziness, Harvard University Press (not read by me or HY-04).
7. Keiser and Utzinger 2008, JAMA.
8. Okeniyi et al. 2007, Kugo et al. 2018, Li et al. 2012.
9. Strunz et al. 2014, PLoS Medicine.
10. Remington et al. 1918, US Dispensatory, and Levy 1914, JAMA, on chenopodium deaths.

At the bedside after the Fall

Household. Needs: a fine comb, a razor, a pot to boil bedding, soap, rendered fat, salvaged sulfur if possible, shoes, a latrine. Skills: recognising burrows, nits and pinworm, and the schedules (three sulfur nights, combing days 1, 5, 9, 13, pinworm doses two weeks apart). Records: who was treated, which day. First failure: one member who did not itch and was not treated, or skipped a night.

Village of 300. Needs: a lay healer with this book, sulfur and fat and a scale, a register, combs to lend, salvaged albendazole and ivermectin kept cool and counted, papaya and pumpkin plants, a latrine per household, shoes per child, the X list posted at the dispensary. A scabies and lice day before winter, every household together. Deworm children who are pale, thin or passing worms, and pregnant women after the first trimester where worms are common. First failure: the tablets spent on mass rounds and gone when a heavily infected child arrives, or a herbalist selling wormseed oil.

District of 3,000. Needs: a nurse or trained healer with a microscope for stool eggs and skin scrapings, praziquantel where there are snails or tapeworm, ivermectin for crusted scabies and Strongyloides, a bed where an obstructed child can be given fluids and watched, and someone to judge mass rounds against thresholds (worms 20%, scabies and schistosomiasis 10%), with a yearly survey. First failure: rounds counted as success while privies go unbuilt and reinfection returns within the year, as in the Rockefeller campaign.

Protocols

Protocol 1. Sulfur ointment for scabies (household)

By weight, from the 5 to 10% range (CDC n.d. a, Altunel 2022). Tolerance plus or minus 1 percentage point. - [ ] Weigh 10 g elemental sulfur and 90 g soft fat (petrolatum or lard) for 10%. For infants and pregnant women, 5 g in 95 g. Never lime sulfur. - [ ] Warm the fat until soft, not hot, stir in the sulfur until no streaks remain, cool. 100 g treats about two adults for three nights [VERIFY: my estimate]. - [ ] Choose an evening when every household member can be treated, itching or not. - [ ] Bathe and dry each person. Rub a thin layer from neck to soles, between

fingers and toes, under nails, navel, armpits, groin, buttocks. In infants include scalp and face, avoiding eyes and mouth [VERIFY]. - [ ] Leave 24 hours, reapply after handwashing. Repeat on the second and third evenings. Bathe 24 hours after the third. - [ ] On day 1, wash bedding, towels and clothes used in the last three days above 50°C for at least 10 minutes and dry in sun, or bag unwashables for at least 3 days, better 7. - [ ] Tell the family the itch lasts up to 4 weeks. Re-treat only for new burrows after 2 to 4 weeks. - [ ] Raw, weeping skin: stop and wash off.

Protocol 2. Ivermectin for scabies (dispensary)

- ☐ Weigh. Do not give under 15 kg or 90 cm, in pregnancy, or to anyone from the Central or West African rainforest with eye-worm history unless Loa loa has been checked.
- ☐ Give by MSF bands with 3 mg tablets: 15 to under 25 kg, 1 tablet. 25 to under 45 kg, 2. 45 to under 65 kg, 3. 65 kg or more, 4 (MSF n.d. c).
- ☐ Repeat the same dose 7 to 14 days later.
- ☐ Same day, treat household members under 15 kg and pregnant women with sulfur or permethrin.
- ☐ Wash bedding as in Protocol 1.
- ☐ Never dose from veterinary products unless two people have calculated and checked the concentration.

Protocol 3. Crusted scabies (district)

- ☐ Isolate bedding and clothes. Carers wear gloves and long sleeves.
- ☐ Soak crusts in warm soapy water and lift them gently, with salicylic acid ointment if available.
- ☐ Ivermectin 200 µg/kg on days 1, 2 and 8. Add days 9 and 15 for moderate and 22 and 29 for severe disease (CDC n.d. a).
- ☐ Permethrin 5% or sulfur 10% to the whole body daily or every 2 to 3 days for 1 to 2 weeks.
- ☐ Treat every contact on days 1 and 8. Fever or collapse: suspect blood infection.

Protocol 4. Head lice (household)

- ☐ Check the whole household on one day with wet hair and a fine comb.
- ☐ For each person with live lice: wash, apply conditioner (or a little oil in water), untangle, comb scalp to tips section by section, wiping after each stroke, twice over. 10 minutes short hair, 20 to 30 long.
- ☐ Repeat on days 5, 9 and 13, check on day 17. Adults found at any session: three more sessions 4 days apart.
- ☐ Wash hats, pillowcases, combs and towels at 54°C or more, or seal two weeks.
- ☐ Consider shaving a sick child or one with impetigo.
- ☐ Never kerosene, petrol, paraffin, farm insecticides or plastic bags over the head.

Protocol 5. Deworming a sick child (dispensary)

- ☐ Treat if worms are seen, inner eyelids are pale, the child is thin or pot-bellied, has chronic diarrhoea or night-time anal itch.
- ☐ Under 6 months: no albendazole or mebendazole.
- ☐ Albendazole 400 mg once, 200 mg if under 10 kg or aged 12 to 23 months. Crush or chew.
- ☐ Whipworm (bloody, mucous stool): albendazole daily for 3 days. Strongyloides: ivermectin 200 µg/kg if over 15 kg.
- ☐ Pinworm: treat the household, repeat in 2 weeks, morning baths, short nails, hot washing.
- ☐ Not in the first trimester. After it, a single dose is acceptable (WHO 2017, MSF n.d. d).
- ☐ If anaemic, give iron after deworming (THRIVING library, HY-08) and lock it away.
- ☐ Record child, date, drug, dose. Teach shoes, latrine, handwashing.

Protocol 6. Papaya seed when no drug is left (roundworm)

Grade B, small trials. - [ ] Take seeds from ripe fruit, rinse, dry in shade until hard. - [ ] Grind. Give a child 4 g [VERIFY: 1 g in some reports] in 20 mL honey, once. No honey under 12 months [VERIFY]. - [ ] Watch stool for 7 days. Not in pregnancy. Not daily for weeks.

Protocol 7. Pumpkin seed with areca for tapeworm (adult)

Grade B. Not in pregnancy or children. Prefer praziquantel if available, except in a pork-tapeworm carrier with seizures. - [ ] Fast from the evening before. - [ ] Morning: chew 100 g shelled kernels of non-bitter cultivated pumpkin. Discard any bitter batch. - [ ] Two to three hours later: decoction of 80 g areca nut [VERIFY: from four case reports]. - [ ] Half an hour later: 30 g magnesium sulfate (60 mL of 50%) in water, then plenty to drink. - [ ] Pass stool into a bowl of warm water to see the whole worm with its head. Do not pull. - [ ] Expect nausea in nearly half. No head seen: check stool for segments at 3 months.

Protocol 8. Schistosomiasis (district)

- ☐ Praziquantel 40 mg/kg once with food, or 20 mg/kg twice 4 hours apart. From age 4 (MSF) or 2 (WHO).
- ☐ Pregnant women after the first trimester.
- ☐ Mass treatment yearly where 10% or more are infected. Keep urine and faeces out of fresh water.

Protocol 9. Sand flea (household)

- ☐ Inspect feet daily, especially round the toenails.
- ☐ With dimeticone, apply to the lesion and leave it.
- ☐ Without it, wash the foot, boil a needle 5 minutes, open the skin, lift out the whole flea unburst, wash and cover.
- ☐ Sweep floors, keep animals out, wear closed shoes. Red, hot foot or fever: infection.

Protocol 10. Suspected roundworm obstruction (village)

- ☐ Nothing by mouth except sips of oral rehydration solution if not vomiting. Fluids by vein if anyone can.
- ☐ Warm salt-water enema. The series used hypertonic saline but I found no strength [VERIFY]. Do not improvise strong brine.
- ☐ Keep warm, relieve pain, check the belly hourly.
- ☐ Guarding, rigidity, fever or rectal blood: surgery is needed. Send if possible, comfort if not.
- ☐ Deworm only after stool and wind return [VERIFY].

Numbers to carry

1. **Ivermectin 200 µg/kg, twice, 7 to 14 days apart, never under 15 kg.** Loa loa encephalopathy above 30,000 microfilariae per mL.
2. **Sulfur 5 to 10% in fat, three nights, whole household the same night.**
3. **Itch lasts up to 4 weeks after cure.**
4. **Comb on days 1, 5, 9 and 13, check day 17.** Nits hatch in 6 to 9 days.
5. **50°C for 10 minutes kills mites and lice in cloth.** Mites die in 2 to 3 days off skin.
6. **Albendazole 400 mg once, 200 mg under 10 kg or under 2 years, never under 6 months or in the first trimester.**
7. **Pinworm: two doses two weeks apart, whole household.**
8. **Praziquantel 40 mg/kg for schistosomes, 5 to 10 mg/kg for tapeworm.**
9. **Shoes cut hookworm odds to 0.29 to 0.48. Roundworm returns to 94% within a year.**

10. **Four drops of chenopodium oil three times a day for two days killed a one-year-old.**

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