IN-10 Tuberculosis without streptomycin: the sanatorium, the sun and the honest outcomes

HEALING after the FALL, research library, IN-10

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

Findings by section

1. Scope, the three voices, and corrections to the brief

This report asks what untreated tuberculosis does, what rest, air, sun, food and surgery changed before drugs, and what a village must do with the drugs it may hold. "Tradition" is what practitioners said a measure did, "Record" what counted outcomes show, and "Inference" what modern science, or this author, concludes. My own arithmetic is marked [VERIFY].

The brief's leads needed four corrections. Brehmer's Görbersdorf sanatorium opened in 1854 or 1855, and I found no source for 1859 (Wikipedia 2026a, Sokołowsko n.d.). The MRC trial reported deaths at six months, not four: 4 of 55 against 14 of 52, 7 against 27 per cent (Medical Research Council 1948, Higgins 2023). Forlanini's first human pneumothorax is dated only to "the 1880s", so 1882 is unconfirmed (Kolkailah 2018) [VERIFY]. Trudeau's sanitarium is dated to the 1880s, and 1884 is unconfirmed (Historic Saranac Lake n.d.) [VERIFY].

The library's IN-01, HY-08 and HY-09 already cover tuberculosis mortality, cod-liver oil and Belsen, and this report builds on them without repeating their detail.

2. Natural history without drugs

Record. The anchor is Tiemersma's systematic review of pre-chemotherapy cohorts of HIV-negative adults (Tiemersma 2011). For smear-positive pulmonary disease the ten-year case fatality ran from 53 to 86 per cent across cohorts, with a weighted mean of about 70 per cent. For smear-negative but culture-positive disease the estimate is about 20 per cent, and it is indirect. The average time from onset to cure or death was about three years. Deaths came early. In Berg's Swedish cohort of 1928 to 1934, 30.7 per cent of smear-positive patients died in the first year. Five-year survival in smear-positive cohorts ranged from 58 per cent in Hartley's Brompton series of 1905 to 1914, through 42 per cent (Berg), to 27 per cent (Thompson) and 25 per cent (Braeuning). Smear-negative five-year survival was 85 to 92 per cent.

Tiemersma's authors add two warnings that matter for everything that follows. Sanatorium and hospital cohorts "presumably exclude both the mildest and the most severe cases", and the treatments then available, sanatorium care and surgery, "are unlikely to have affected mortality by much" (Tiemersma 2011).

A Bayesian re-analysis of the same cohorts estimated yearly rates (Ragonnet 2021). For smear-positive disease, mortality was 0.389 and natural recovery 0.231 per year, an average duration of 1.57 years. For smear-negative disease

they were 0.025 and 0.130, a duration of 5.35 years, so smear-negative patients may cause as many secondary infections because they stay ill longer. By my arithmetic, about 63 per cent of untreated smear-positive and 16 per cent of smear-negative patients die before recovering, in line with Tiemersma's 70 and 20 [VERIFY].

Children. In the pre-chemotherapy literature, risk after a first infection depends steeply on age (Marais 2004):

Age at infection	Meningitis or disseminated disease	Pulmonary disease	No disease
Under 1 year	10 to 20%	30 to 40%	50%
1 to 2 years	2 to 5%	10 to 20%	75 to 80%
2 to 5 years	0.5%	5%	95%
5 to 10 years	under 0.5%	2%	98%
Over 10 years	under 0.5%	10 to 20%	80 to 90%

The infant in the house of a coughing adult is the person most at risk of the fatal forms, and adolescents again develop adult-type lung disease. I read only the abstract and a secondary reproduction of the table.

Scale. In England in 1871 to 1880, phthisis caused 36.8 per cent of deaths at ages 15 to 44 (THRIVING library, IN-01). At Belsen in 1945, Mollison found tuberculosis in 40 per cent of inmates examined (THRIVING library, HY-09).

Inference. Of ten adults with cough, wasting and a positive smear, about seven will be dead within ten years without drugs, most in the first three. Any remedy must beat the three who would have lived anyway.

3. The sanatorium record

Tradition. George Bodington proposed open air and good food at Sutton Coldfield in 1840 (Wikipedia 2026a). Hermann Brehmer's 1853 thesis claimed first-stage phthisis always curable. He opened his Heilanstalt at Görbersdorf in Silesia in 1854 or 1855, growing it to about 300 beds, on mountain air, exercise and generous food (Wikipedia 2026a, Sokołowsko n.d.). His assistant Peter Dettweiler opened Falkenstein in 1876 and stressed rest instead. Edward Trudeau, himself consumptive, built the Adirondack Cottage Sanitarium at Saranac Lake on the German model (Historic Saranac Lake n.d.). Pendrill Varrier-Jones began a colony at Bourn in 1916 and moved 17 patients to Papworth Hall on 12 February 1918, where patients lived with their families and worked in graded light industry (Royal Papworth n.d.).

Record by stage at admission. No sanatorium had an untreated control group. Outcomes by stage show how much the result depended on whom it admitted.

- Trudeau: of 91 patients staying three to forty-four months, 19 were "apparently cured" and 26 "arrested". Despite a rule to admit only incipient cases, 119 of 163 discharged patients had advanced disease (Historic Saranac Lake n.d.). I found no table by stage.
- Wisconsin state sanatorium: of 109 incipient cases none died and 6.42 per cent failed to improve. Of 47 far-advanced cases 14.89 per cent were arrested and 29.79 per cent died (Wisconsin State Sanatorium n.d.), year not recorded [VERIFY].
- London, patients treated in 1918: by July 1923, 85 per cent of early and 39.9 per cent of moderately advanced cases were alive (Bardswell 1923) [VERIFY].
- Hilleboe pooled American follow-ups: mortality after discharge was about four, sixteen and forty times that of the general population for minimal, moderately advanced and far-advanced disease (Hilleboe 1936), read only in summary.

Papworth's children. E. M. Brieger's 25-year survey found that none of 108 children born in the village developed clinically progressive tuberculosis, although they were infected (Milbank 1946). It is the strongest pre-drug record that a family can live with an infectious adult if hygiene is strict and the family is fed, housed and employed, though from one settlement, read through a review.

What the sanatorium did, by inference. It removed the infectious patient from the crowded home, fed him, rested him, taught him sputum hygiene, and selected patients who would have done better anyway. Anderson and colleagues used American city data from 1900 to 1917 and found that sanatoria and the other measures of the tuberculosis movement explained at most a small part of the fall in mortality. In the working paper a state sanatorium was associated with about a 4 per cent fall (Anderson 2019). Survivor bias ran one way: early cases were admitted, the dying went home, and the results were reported as cure rates.

Grade. Rest and open air as a cure: B for comfort and arrest in early disease, but with no controlled evidence of survival benefit. Segregation of the infectious: B for protecting the household.

4. The Madras trial: home against sanatorium once drugs existed

Record. The Tuberculosis Chemotherapy Centre in Madras opened in 1956 and began a randomised comparison that September. Patients with sputum-positive disease received a year of isoniazid plus PAS either in a sanatorium, with rest, a good diet and nursing, or at home in poor and crowded conditions (Tuberculosis Chemotherapy Centre 1959). I could not read the 1959 report itself. The five-year follow-up of 193 patients found relapse in 7 per cent of the home group against 10 per cent of the sanatorium group. Tuberculosis deaths were 5 against 6 per cent, and 90 against 89 per cent were quiescent at five years (Dawson 1966). Twelve-month cure is quoted in teaching slides as 92 per cent (73 of 81) in the sanatorium and 86 per cent (67 of 82) at home (Grosset 2016) [VERIFY]. A companion paper found that no dietary factor influenced quiescence, although home patients ate less well and were more active (Ramakrishnan 1961). A second companion found that close family contacts of home-treated patients ran no greater risk than contacts of sanatorium patients. Most of their risk came from exposure before diagnosis (Kamat 1966). A 2025 systematic review of respiratory isolation found, on this trial, that sanatorium against home treatment did not change incidence among contacts (Nathavitharana 2025).

Inference, and its limit. With effective drugs, rest, diet and removal from home add nothing measurable to cure or household safety. Madras did not test rest or diet without drugs and must never be quoted as showing them useless when there are no drugs. Its second lesson suits a village: by the time a cough is recognised the household has usually been exposed, so early recognition matters more than late segregation.

5. The sun: Finsen, Rollier and vitamin D

Finsen and lupus vulgaris. Niels Finsen began light treatment in 1895, founded his Copenhagen Institute in 1896 and received the Nobel Prize in 1903. His disease was lupus vulgaris, tuberculosis of the skin. In Berlin in 1902 he reported 804 patients: 412 cured (124 free of recurrence for two to six years), 192 nearly cured, 117 still under treatment and 83 who interrupted. After exclusions, 695 of 737 (94 per cent) responded. Treatment took about two hours a day for weeks under a concentrated arc light, without controls (Gøtzsche 2004). The pitfall is to read this as evidence for sun against lung disease. Light reaches skin, not a cavity in the lung.

Rollier and surgical tuberculosis. Auguste Rollier (1874 to 1954) opened his Institute of Heliotherapy at Leysin in 1903 and came to run 36 clinics with more than 1,000 beds (Wikipedia 2026b, citing Hobday 1997). After the First World War, 1,746 of 2,167 patients were reported to have recovered, a secondhand figure (Wikipedia 2026b). Time reported more than 2,000 cases of bone and joint tuberculosis over twenty years, over 80 per cent discharged cured (Time n.d.). Both probably draw on the same clinic reports. Rollier's 1913 schedule began with the feet only, five minutes at a time, five times at hourly intervals on day one, extending daily up the body (Developments in Heliotherapy n.d.).

The lung. A 1919 review found heliotherapy of marked service only in surgical tuberculosis. A 1931 British author used only short early-morning exposures for lung cases and reported no haemoptysis in seven years. A 1938 review found that the laboratory could not support the clinicians' claims (Developments in Heliotherapy n.d.). I read these only as fragments in a search summary [VERIFY]. Heliotherapy was abandoned once drugs came (Wikipedia 2026b).

Vitamin D, the modern test. Martineau's London trial gave 2.5 mg (100,000 IU, my conversion [VERIFY]) of vitamin D3 at days 0, 14, 28 and 42 to 146 patients starting standard drugs, 126 analysed. Median time to culture conversion was 36.0 against 43.5 days, hazard ratio 1.39 (0.90 to 2.16), not significant, with an effect only in one receptor genotype (TaqI tt). Serum 25-hydroxyvitamin D rose to 101.4 against 22.8 nmol/L (Martineau 2011). An individual-participant meta-analysis of eight trials and 1,850 patients found no overall effect (hazard ratio 1.06, 0.91 to 1.23), with a large effect in a small multidrug-resistant subgroup (13.44) that needs confirming (Jolliffe 2019). For prevention, 8,851 Mongolian schoolchildren received 14,000 IU weekly for three years. Infection was 3.6 against 3.3 per cent (risk ratio 1.10), and disease 21 against 25 cases (Ganmaa 2020). Deficiency is linked with disease in observational data (adjusted odds ratio 1.48), but illness may cause the deficiency (Aibana 2018).

Inference. Sun cured skin tuberculosis in an uncontrolled series and went with recovery in bone and joint disease among children kept for months at altitude, fed and rested. For the lung it is unproven, and vitamin D does not speed cure. Above about 42 degrees north there is no winter synthesis (THRIVING library, HY-08). Sun is comfort, morale and rickets prevention, not a cure. Grades: lupus vulgaris B, bone and joint C, lung D, vitamin D as adjunct A for no effect.

6. Food

Cod-liver oil. Charles J. B. Williams reported in 1849 on more than 400 private patients given cod-liver oil. Of 234 with detailed notes, 206 showed "marked" improvement, 19 none, and 9 stopped because the oil disagreed with them (Williams 1849). At the Hospital for Consumption at Chelsea (later the Royal Brompton) in about 1848, 542 patients given the oil were compared with 535 controls. Deterioration or death was 19 against 33 per cent, and stabilisation 18 against 6 per cent (Green 2011). Allocation was not random and the source is a later summary. One teaspoon gives about 450 IU of vitamin D and 1,350 micrograms of vitamin A, and infants should get no more than a quarter to half a teaspoon (THRIVING library, HY-08). Whether the benefit came from calories, vitamin A or vitamin D is unknown (Martineau 2012). The oil comes from the liver of the cod, *Gadus morhua*, and after the Fall only from coastal fisheries.

War and famine. In the First World War, tuberculosis deaths in one national series rose from 213 to 273 per 100,000 between 1913 and 1918, a rise of 28 per cent, then fell to 220 by 1920 (Milbank, WW1 tuberculosis paper, n.d.) [VERIFY]. At Lille under occupation the rate rose from 315 to 573 per 100,000 between 1914 and 1918. A German report of 1921 said tuberculosis mortality had returned in 1919 to its level of 1894, undoing forty years of decline (Germany 1921). Denmark, neutral, saw tuberculosis rise while it exported food to Britain, and fall back when exports stopped in 1918 (search summary only, source not recorded) [VERIFY]. In the Second World War, survivors of Japanese camps had a tuberculosis incidence of about 36.6 per 1,000 (Milbank 1957). I could not find Leyton's 1946 paper on prisoners of war.

RATIONS. The modern test is the RATIONS trial in Jharkhand, India (Bhargava 2023a). In 28 tuberculosis units, 2,800 patients received standard drugs plus 1,200 kcal and 52 g of protein a day for six months. Their 10,345 household contacts were randomised by unit to food (750 kcal and 23 g protein a day) or none. About a third of contacts were undernourished and about two-thirds Indigenous. Over about two years, incident tuberculosis was 122 cases (1.27 per 100 person-years) without food against 96 (0.78) with food, an adjusted incidence rate ratio of 0.61 (0.43 to 0.85), and 0.52 for microbiologically confirmed disease. About 30 households, or 111 contacts, needed food to prevent one case. The contact basket was reported as 5 kg of rice and 1.5 kg of pulses per adult per month, seen only in a search summary. My arithmetic shows it matches the stated ration [VERIFY].

In the companion patient cohort (Bhargava 2023b), 82.4 per cent had a body mass index under 18.5 and 17.3 per cent under 14. With drugs and food, 93.7 per cent were treated successfully and 3.9 per cent died of tuberculosis, with a median gain of 4.6 kg. A 5 per cent weight gain by two months went with much lower risk of death (adjusted hazard ratio 0.39). Diabetes (rate ratio 3.30) and poor performance status (5.33) predicted death.

The overshoot. A Cochrane review (35 trials, 8,283 participants) found insufficient evidence that food improves cure or death during drug treatment, though it probably improves weight (Grobler 2017). Madras found diet irrelevant once drugs were given (Ramakrishnan 1961). RATIONS shows that food prevents disease in contacts and goes with survival in patients on drugs. It does not show that food cures active tuberculosis without drugs.

Grade. Food for undernourished contacts: A for prevention, one trial. Food for patients on drugs: A for weight, B for survival. Food without drugs: B that famine raises deaths and refeeding restores pre-war rates, no evidence that it reverses established disease.

7. Collapse therapy

Tradition and record. The idea was to rest the lung by collapsing it so that cavities could close. James Carson collapsed rabbits' lungs in the 1820s, Carlo Forlanini applied artificial pneumothorax to patients in the 1880s, and the methods grew into thoracoplasty (removing ribs so that the chest wall falls in) and plombage (packing inert material against the lung), used from the 1930s to the mid-1950s (Kolkailah 2018). A Glasgow thesis of 1930 found that pneumothorax helped where sanatorium treatment had failed and worked best in intermediate cases. Mortality remained "very heavy" but slightly below ordinary sanatorium care, and pleural adhesions predicted failure (Brown 1930). Tuberculous empyema, pus in the pleural space, was a recognised complication (Smith 1950). John Alexander found in 1925 that postoperative pneumonia was the main cause of death after thoracoplasty. Sputum conversion after thoracoplasty was quoted at 70 to 80 per cent in 1949. The High Carley Sanatorium series of 1933 to 1940 had a 12 per cent postoperative mortality, and 83.5 per cent of 2,000 patients in a British series returned to work (Edwards 1953) [VERIFY]. These figures came to me only through a search summary.

Inference. Collapse therapy worked for selected patients with one-sided cavitary disease, in sanatoria with X-ray, a manometer, sterile needles and a thoracic surgeon. Thoracoplasty killed about one patient in ten, and empyema took a steady toll. It has no place below a district infirmary with a surgeon and radiography, and this report gives no technique. Grade: B for selected hospital patients, X for a village.

8. Drugs: the trial, the regimen, the partial stock

The trial. The Medical Research Council's 1948 trial was the first properly randomised trial with concealed allocation (Crofton 2005). Young adults with acute progressive bilateral disease received bed rest alone or bed rest plus streptomycin 2 g a day. At six months 4 of 55 on streptomycin had died against 14 of 52 controls, and "considerable improvement" on X-ray was seen in 28 of 55 against 4 of 52 (Medical Research Council 1948, Higgins 2023). The same dataset shows the price: by six months 34 of the 55 treated patients had highly resistant organisms, 62 per cent by my count [VERIFY], and 8 more moderately resistant ones. By five years mortality was 58 against 67 per cent in one secondary account [VERIFY]. Adding PAS greatly reduced resistance (Crofton 2005). In Madras, isoniazid resistance in patients given isoniazid alone emerged in two stages, the first very early, and that early stage decided the outcome (Selkon 1964). Leeming-Latham (2015) tells how Britain learned to combine drugs.

The modern regimen. For drug-susceptible lung disease the standard is two months of isoniazid (H), rifampicin (R), pyrazinamide (Z) and ethambutol (E), followed by four months of isoniazid and rifampicin: 2HRZE/4HR. Given daily, this is 56 doses in the intensive phase and 126 in the continuation phase. Directly observed therapy, in which someone watches each dose swallowed, is the standard of care (CDC n.d.). WHO's 2022 update allows a four-month regimen, 2HRZ(E)/2HR, for children aged 3 months to 16 years with non-severe disease, based on the

SHINE trial. Infants under three months and children with severe acute malnutrition still get six months (WHO 2022).

Doses, from two sources. The UK product information for the fixed-dose combinations and WHO's 2010 adult table agree on these targets in mg per kg per day (Voractiv SmPC n.d., WHO 2010):

Drug	Adult target	Range
Isoniazid	5	4 to 6
Rifampicin	10	8 to 12
Pyrazinamide	25	20 to 30
Ethambutol	15	15 to 20
Streptomycin (if used)	15	12 to 18

They differ on ethambutol: WHO's 2006 table gave 20 (15 to 25) mg/kg (WHO 2010). For children, the European Medicines Agency and WHO give isoniazid 10, rifampicin 15, pyrazinamide 35 and ethambutol 20 mg/kg (EMA n.d.) [VERIFY ranges]. The UK product information does not advise ethambutol under eight years, because vision cannot be tested, whereas WHO uses it in young children.

Weight bands for the four-drug tablet (isoniazid 75, rifampicin 150, pyrazinamide 400, ethambutol 275 mg): 2 tablets for 30 to 39 kg, 3 for 40 to 54 kg, 4 for 55 to 70 kg and 5 over 70 kg, with the two-drug tablet (75/150) in the same numbers for continuation (Voractiv SmPC n.d.). A WHO table with the same bands appeared in a search summary (WHO 2010) [VERIFY].

Stock arithmetic [VERIFY, mine]. A 50 kg adult needs 3 × 56 = 168 four-drug tablets and 3 × 126 = 378 two-drug tablets. A village with 500 four-drug tablets and nothing else can complete no one's treatment.

Organ harms. - **Isoniazid and the liver.** Hepatitis rises with age: 3, 12 and 23 per 1,000 at ages 20 to 34, 35 to 49 and 50 to 64 among 13,838 people surveyed, with 174 cases and 8 deaths (Kopanoff 1978). The UK product information gives up to 3 per cent over 50 (Voractiv SmPC n.d.). Neuropathy is prevented by pyridoxine 25 to 50 mg a day, 100 mg if it appears (CDC n.d.), a single source [VERIFY]. - **Rifampicin and pyrazinamide** also injure the liver. Stop isoniazid for jaundice or enzymes over three times the upper limit, and the others over five times (Voractiv SmPC n.d.). Without a laboratory, watch for jaundice, dark urine, vomiting and abdominal pain (CDC n.d.). - **Rifampicin interactions.** It turns urine, tears and sweat orange-red. Its enzyme induction peaks in about a week and lasts about two weeks after stopping, weakening hormonal contraceptives, warfarin and many antiretrovirals (Voractiv SmPC n.d., CDC n.d.). It must never be given alone, nor "to help" a cough or a wound (Protocol P4). - **Ethambutol and the eye.** Optic neuropathy affected a pooled 1.54 per cent of patients, more with kidney impairment (odds ratio 3.73), and only 52.4 per cent recovered (Alessa 2026). Acuity and red-green colour vision must be checked (Voractiv SmPC n.d.). - **Streptomycin and the ear.** A Korean series reported deafness in 15.2 per cent (Korean ototoxicity series 1977). Balance damage and congenital deafness after use in pregnancy are recognised. A cumulative dose over 100 g was quoted as raising risk in a search summary of a WHO document I did not open [VERIFY]. - **Pregnancy and breastfeeding.** The UK product information advises vitamin K when rifampicin is given in the last weeks of pregnancy and does not recommend breastfeeding on the combination (Voractiv SmPC n.d.). WHO practice treats pregnant and breastfeeding women with the standard regimen [VERIFY].

DOTS and partial stocks. DOTS, the WHO strategy of the 1990s, joined direct observation to smear diagnosis, a secure drug supply and a register. Its logic is what matters after the Fall: every dose watched, every patient recorded, every course completed. The product information states that the combinations are not for interrupted treatment (Voractiv SmPC n.d.). The MRC streptomycin arm and Selkon's isoniazid patients show what one drug alone does: resistance within weeks to months, and the drug lost for that patient and everyone he infects. Isoniazid alone as prevention gave a relative risk of resistance of 1.45 (0.85 to 2.47), which neither proves nor excludes harm (Balcells

2006). Prevention is given to people without active disease, which is why it is far less risky than one drug for a patient with cavities.

Grade. 2HRZE/4HR with direct observation: A. Monotherapy for active disease: X.

9. BCG

Record. Colditz's meta-analysis found BCG protected by about 51 per cent in trials and 50 per cent in case-control studies, with 71 per cent protection against death from tuberculosis and 64 per cent against meningitis (Colditz 1994). Rodrigues found 86 per cent protection against meningeal and miliary tuberculosis in trials and 75 per cent in case-control studies (Rodrigues 1993). Mangtani's review of 18 trials found a relative risk of pulmonary tuberculosis of 0.41 after infant vaccination, 0.26 in carefully tuberculin-tested children, but 0.81 to 0.88 in older people, and 0.1 for meningeal or miliary disease in infants (Mangtani 2014). BCG also cuts infection by about 19 per cent and progression by about 58 per cent (Roy 2014). The brief's figures stand, with infant protection against the fatal forms probably higher.

Inference. BCG matters most for infants, where the Marais table shows the greatest danger. It cannot be made locally, and salvaged stock is a live vaccine that needs cold storage and expires. Grade A.

10. Stopping spread in the household

Record. Richard Riley's Baltimore experiment, reported in 1959, piped air from a six-bed tuberculosis ward to about 150 to 160 guinea pigs for 24 months. Seventy-one were infected. Of 22 infections matched to patients, 19 came from just two. Untreated patients with heavily positive sputum were the infectious ones (Riley 1959). Escombe measured 70 naturally ventilated hospital rooms in Lima. With windows and doors open they reached a median 28 air changes an hour, and about 40 in pre-1950 buildings with high ceilings and large windows, against 12 recommended for high-risk rooms. Modelled risk of infection for someone sharing a room with an infectious patient was 97 per cent with windows closed, 39 per cent with mechanical ventilation, 33 per cent with modern natural ventilation and 11 per cent in old-style rooms (Escombe 2007). Changes costing under US$75 cut modelled risk by 72 per cent (Escombe 2019). Surgical masks worn by patients on a South African ward cut infection in guinea pigs from 69 of 90 to 36 of 90, a 56 per cent (33 to 70.5) reduction (Dharmadhikari 2012). Madras and Papworth show that a family can live safely alongside a patient who is treated or strictly hygienic (Kamat 1966, Milbank 1946).

Sputum. Dettweiler introduced the blue glass pocket spittoon in 1889 (University of Melbourne n.d.). A 1916 article set out sanatorium disposal of sputum, including disinfectant in the cups (Institutional Treatment of Consumption 1916). A museum record calls incineration the safest disposal [VERIFY]. I found no current WHO household guidance on sputum. IN-01 uses a covered pot whose contents are burned (THRIVING library, IN-01).

Inference. Find the cougher early, because most household infection happens before diagnosis. Keep him in the best-ventilated room, alone at night, window open. Have him cover his cough and spit into a covered pot that is burned. Keep infants away and feed the contacts. Grades: ventilation A (modelled, with experimental support), masks on patients B, separating infants B, sputum disposal C.

11. The Ziehl-Neelsen smear

Record. A positive smear needs about 5,000 to 10,000 bacilli per ml of sputum. The first specimen finds about 69 per cent of the patients who will be found, and the second about another 20 per cent, so at least two, and by older rules three, specimens are examined (NTI India n.d.). Smear-negative disease, which still kills about one in five untreated, is missed by definition (Tiemersma 2011). Children rarely produce sputum [VERIFY].

Inference. A district with an oil-immersion microscope, stains and one trained reader can pick out the most infectious patients, telling it whom to isolate first and whom to give scarce drugs. The staining method belongs in a

laboratory manual. Grade B.

12. Traditional claims

- **Stevens' Cure (Umckaloabo).** A British patent remedy of the early 1900s sold as a tuberculosis cure. Analysis of surviving samples confirmed the root of *Pelargonium sidoides*, distinguished from the lookalike *Pelargonium reniforme*. Stevens's account is the first record of use for tuberculosis, and Sechehaye's claims for about 800 patients are unverified. The modern product is licensed only for acute bronchitis (Brendler 2023). Grade D.
- **Koumiss.** Fermented mare's milk was sold as a cure at steppe resorts such as Samara from the mid-nineteenth century, promoted by Postnikov and described by Isabel Hapgood in 1893. The evidence is promotional and confounded by diet, rest and air (Imperiia Project n.d., Koumiss and its use in medicine n.d.). Grade D as a remedy, though as food it supplies calories and protein.
- **Garlic (*Allium sativum*, bulb).** Extracts kill mycobacteria in the laboratory and reduce burden in mice. I found no clinical trial. Wild garlic (*Allium ursinum*, leaf) is confused with autumn crocus (*Colchicum autumnale*), whose colchicine caused severe poisoning in a 2026 case (Kovács-Ábrahám 2026). Grade D.
- **East African and other plant lists.** A systematic review found 195 East African species used for tuberculosis symptoms. Only 36 (18.5 per cent) had been screened, 31 showing laboratory activity (Obakiro 2020). An Ethiopian review, seen only in a search summary, found 98 species, 78 with no experimental evidence [VERIFY]. Grade D.
- **Cod-liver oil** is the one traditional remedy with a counted comparison, and is covered in section 6. Grade B for symptoms and weight.

Inference. No plant has been shown to cure tuberculosis in patients. Safe, correctly identified remedies may soothe cough or appetite, but none should delay recognition or isolation.

13. HIV

Record. During treatment, 18.8 per cent of HIV-positive against 3.5 per cent of HIV-negative patients died, 9.2 against 3.0 per cent from tuberculosis (Straetemans 2011). In a Malawian HIV cohort 20 per cent died during treatment (THRIVING library, IN-01). I found no cohort of HIV-positive patients left untreated for tuberculosis, so no number can be given. Rifampicin lowers the levels of many antiretrovirals (CDC n.d.).

Inference. Every number in this report is likely worse with untreated HIV. If antiretrovirals run out after the Fall, tuberculosis will kill faster and more often, and the book should say so without pretending to precision [VERIFY].

14. Today and after the Fall

Measure	Today	After the Fall
Diagnosis	Molecular tests, culture, X-ray	Symptoms, weight, smear at the district
Drugs	Full regimens, resistance testing	Salvaged stock, uncertain potency, no testing
BCG	At birth in high-burden countries	Only from salvaged, cold-stored stock
Food	Programme rations in some countries	The village's own grain and pulses
Isolation	Brief, until treatment takes effect	Long, as untreated infectiousness lasts years

Measure	Today	After the Fall
Ventilation	Engineering	Windows, high ceilings, outdoor sleeping
Surgery	Rare, for resistant disease	Not feasible below a district with a surgeon and X-ray

Evidence grades

Measure	Tradition says	Record shows	Science infers	Grade
Sanatorium rest and air	Cures early disease	Good outcomes in early cases, poor in late, no controls	Mostly selection, plus segregation and food	B (arrest in early cases), no survival proof
Segregation of the infectious	Protects family	Papworth children, Riley ward	Cuts transmission	B
Home against sanatorium, with drugs	Sanatorium needed	Equal cure and contact risk (Madras)	Drugs do the work	A
Heliotherapy, skin (lupus vulgaris)	Cures	94% response, uncontrolled	Plausible, local UV effect	B
Heliotherapy, bone and joint	Cures	About 80% “cured”, clinic-reported	Rest, food and time confound	C
Heliotherapy, lung	Helps	Contemporary scepticism	Unproven	D
Vitamin D added to drugs	Speeds cure	Trials and meta-analysis null	No benefit	A (no effect)
Vitamin D to prevent	Protects	Mongolian trial null	No benefit in children	A (no effect)
Cod-liver oil	Restores	19 against 33% deterioration (1840s)	Calories and vitamins	B
Food for contacts	Strengthens	RATIONS, about 40% less disease	Undernutrition drives progression	A
Food for patients on drugs	Cures	Weight gain, less death in a cohort	Helps survival	A (weight), B (survival)
Food without drugs as a cure	Cures	Famine raises deaths, peace lowers them	Prevents, does not reverse	B for prevention, none for cure
Artificial pneumothorax, thoracoplasty	Rests the lung	Conversion 70 to 80%, 12% operative death	Works for selected patients with X-ray and surgeon	B (hospital), X (village)
2HRZE/4HR, observed	(modern)	Cure rates above 90% where taken	Standard	A
Monotherapy for active disease	Better than nothing	Resistance in most within months	Harmful	X
BCG in infancy	Protects	50% lung, 64 to 90% meningitis and miliary	Protects infants from fatal forms	A

Measure	Tradition says	Record shows	Science infers	Grade
Ventilation	Fresh air heals	11% against 97% modelled risk	Removes droplet nuclei	A (modelled)
Mask on the patient	(modern)	56% less infection in guinea pigs	Works as an adjunct	B
Smear microscopy	(modern)	Finds the most infectious	Misses smear-negatives	B
Pelargonium sidoides	Cures TB	Patent claims, unverified	Not shown	D
Koumiss	Cures	Resort reports	Food value only	D
Garlic	Cures	Laboratory and mouse data	Not shown in patients	D

Means ledger

Care without drugs (rest, air, food, sputum hygiene)

Rung	What can be done	What it changes
Hands and knowledge	Recognise cough over two weeks with weight loss. Separate sleeping. Cough into cloth. Open windows. Keep infants away	Fewer household infections. No change to the patient's own odds
Hearth	Covered sputum pot, burned daily. Boiled cups. Extra food: grain and pulses. Weekly weighing on a borrowed scale	Food may slow wasting. Sputum burned stops floor and dust contamination [VERIFY]
Garden and still	Pulses and oil crops for protein and calories. Cod-liver oil if coastal. Cloth masks. A sleeping porch	Ration close to the RATIONS patient ration becomes possible
Village dispensary (300)	Register of coughers. Ration for patients and contacts. Outdoor sleeping shelter. A trained lay healer visiting weekly	Contacts' incidence probably falls by about 40% if they were undernourished (RATIONS)
District infirmary (3,000)	Smear diagnosis. A small isolation ward with cross-ventilation. Food store	Isolation targeted at smear-positives. The infectious leave crowded homes
Pre-Fall hospital	Drugs make isolation short and food an adjunct	Cure above 90%

Drugs

Rung	What can be done	What it changes
Hands and knowledge	Nothing safe without a full course in hand	None

Rung	What can be done	What it changes
Hearth	Nothing. Never give household drug remnants singly	Avoids resistance
Garden and still	Nothing	None
Village dispensary (300)	Hold salvaged stock centrally. Count it. Give only full courses with every dose watched. Weigh for dose. Watch for jaundice and vision change	A full course cures more than 90% of drug-susceptible cases [VERIFY for degraded stock]
District infirmary (3,000)	Smear at start, two months and end. Pooling of stock across villages. Colour-vision checks for ethambutol	Confirms cure. Detects failure early
Pre-Fall hospital	Molecular resistance testing, liver tests, second-line drugs	Resistant disease treatable

Collapse therapy

Rung	What can be done	What it changes
Hands to garden and still	Nothing	None
Village dispensary	Nothing	None
District infirmary	Not without X-ray and a trained thoracic surgeon	If attempted, roughly one death in ten from surgery, plus empyema
Pre-Fall hospital	Rarely, for resistant disease	Selected patients

Diagnosis by smear

Rung	What can be done	What it changes
Hands to dispensary	Recognition by symptoms and weight only	Finds most adults with long cough, misses many children
District infirmary	Ziehl-Neelsen smear with oil-immersion microscope	Finds the most infectious, about 89% after two specimens
Pre-Fall hospital	Culture, molecular tests, X-ray	Finds smear-negative and resistant disease

BCG

Rung	What can be done	What it changes
Hands to dispensary	Nothing unless salvaged, cold-kept vaccine and a trained vaccinator exist	Without it, infants of infectious adults bear the meningitis and miliary risk
District infirmary	Vaccinate newborns from stock while it lasts	Cuts infant meningitis and miliary disease by about 75 to 90%

Rung	What can be done	What it changes
Pre-Fall hospital	Routine at birth in high-burden countries	Same

Sun and vitamin D

Rung	What can be done	What it changes
Hands and hearth	Graded sun on limbs for comfort, morale and rickets prevention	Nothing proven for lung disease
Garden to district	Sun porches. Cod-liver oil in winter above 42°N	Vitamin D status, not cure
Pre-Fall hospital	Not used for tuberculosis	None

Harm test

Measure	How it harms	Who must never	Signs it is going wrong	What to do	Historical harm
Strict bed rest	Weakness, clots, despair over months	(none absolute)	Swollen calf, breathlessness	Graded walking as fever settles [VERIFY]	Patients kept bedbound for years in sanatoria
Open-air sleeping in cold	Chilling, pneumonia in the frail	The very old and infants without warm covers	Shivering, blue lips	Warm covers, shelter from wind	Not quantified
Sun exposure	Burns, heat, possibly bleeding in lung disease	Patients with fever or recent haemoptysis [VERIFY]	Redness, headache, fever	Shorter, earlier exposures	1938 review found claims unsupported
Cod-liver oil	Vitamin A excess, especially in infants and pregnancy	Infants beyond a quarter to half teaspoon	Headache, vomiting, bulging fontanelle [VERIFY]	Stop	See HY-08
Refeeding	Refeeding syndrome in the severely wasted (BMI under 14) [VERIFY]	(caution, not exclusion)	Swelling, confusion, heart failure in the first week	Start slowly	17% of RATIONS patients had BMI under 14
Collapse therapy	Empyema, operative death, air embolism [VERIFY]	Everyone below a district with X-ray and surgeon	Fever, chest pain, breathlessness after the procedure	(hospital care)	12% operative mortality at High Carley

Measure	How it harms	Who must never	Signs it is going wrong	What to do	Historical harm
Isoniazid	Hepatitis, neuropathy	Those with active liver disease or heavy drinking [VERIFY]	Jaundice, dark urine, vomiting, tingling feet	Stop all drugs and seek the district	8 deaths among 13,838 (Kopanoff)
Rifampicin	Hepatitis, failed contraception, interactions	Never alone for tuberculosis	Jaundice, bleeding on warfarin, pregnancy	Stop, seek the district	(not quantified here)
Pyrazinamide	Hepatitis, gout	(caution in liver disease) [VERIFY]	Jaundice, painful joints	Stop, seek the district	(not quantified here)
Ethambutol	Optic neuropathy	Children who cannot report vision (UK label)	Blurred vision, red-green confusion	Stop ethambutol at once	1.54% affected, half do not recover
Streptomycin	Deafness, vertigo, kidney injury, fetal deafness	Pregnancy	Ringing ears, unsteady gait	Stop	15.2% deafness in a Korean series
Monotherapy	Resistance, then loss of the drug for patient and contacts	Any patient with active disease	Improvement then relapse	Do not do it	62% highly resistant at six months, MRC 1948
Herbal remedies	Misidentification, delay	Pregnancy, infants (default)	(varies)	Stop	Colchicum mistaken for wild garlic

Red flags

1. **Coughing blood in volume.** Massive haemoptysis is usually defined as 600 ml in 24 hours. The airways hold only about 150 to 200 ml, so death comes from drowning in blood, not from blood loss. Untreated mortality is quoted at 50 to 100 per cent (Clinical haemoptysis review n.d.). The village can only lie the patient on the bleeding side so that the good lung stays clear, keep him calm, and measure the blood. Honest comfort: stay with him, use dark cloths so the blood is less frightening, and give sedation if the district has it [VERIFY].
2. **A child with fever, headache, vomiting, drowsiness or a stiff neck after contact with a coughing adult** may have tuberculous meningitis (signs from general knowledge [VERIFY]). Before streptomycin it was "invariably fatal", 97 per cent of deaths coming within 30 days of onset (Levinson, via Glasgow thesis n.d.). With intrathecal streptomycin in 1948, 64 per cent of 105 patients still died by six months (Medical Research Council 1948 meningitis, secondary). Without drugs, only nursing. With a full stock, this child is treated first.
3. **Breathlessness at rest, a sudden one-sided chest pain or a swelling, discharging gland or spine** means disease beyond the lung (pleural, spinal, lymph node). Treat comfort and position and seek the district [VERIFY].
4. **Weight loss continuing despite food,** or BMI under 14. In the RATIONS cohort, failure to gain 5 per cent by two months marked those who died. Poor performance status (bedbound) raised the risk of death about

fivefold (Bhargava 2023b).
5. **Jaundice, dark urine, vomiting or blurred vision on drugs.** Stop all drugs and seek the district.
6. **Diabetes** raised the risk of death about threefold in RATIONS patients.
7. **Known or suspected HIV without antiretrovirals.** Expect death in about one in five even with tuberculosis drugs (Straetemans 2011).

Honest comfort. Without drugs, about seven of ten smear-positive adults die, over years rather than days. The household can make those years warmer, better fed, less lonely and safer for the children. Tell the patient the odds truthfully, including that three in ten recover. Ease night cough with warm drinks, honey for those over a year old, and propping up [VERIFY]. Keep the patient in family life, outdoors, away from the infants.

The case against

Against the sanatorium. Tiemersma and colleagues judge that sanatorium care and surgery "are unlikely to have affected mortality by much" (Tiemersma 2011). Anderson, Charles, Las Heras Olivares and Rees found the American tuberculosis movement's measures explained at most a small part of the decline (Anderson 2019). Fox and the Madras investigators showed that, with drugs, the sanatorium adds nothing (Dawson 1966). Reported cure rates measured admission policy, and long stays cut the poor off from earnings and family.

Against the nutrition story. Thomas McKeown credited rising living standards, especially food, with the nineteenth-century fall in tuberculosis. Simon Szreter argued that public health intervention mattered more, noting that the London fall began only in 1867 without a matching rise in real wages (Szreter 1988). Fairchild and Oppenheimer describe McKeown's thesis being used against targeted public health measures, and call that nihilism (Fairchild 1998). Leonard Wilson also wrote on the causes of the decline, but I read only his title [VERIFY] (Wilson 1990). The Cochrane review found insufficient evidence that food improves cure (Grobler 2017). RATIONS is one trial in one Indian state, with patients on drugs.

Against the sun. The 1919 and 1938 reviewers found little to support heliotherapy for lung disease. The vitamin D trials are null for treatment and for prevention (Jolliffe 2019, Ganmaa 2020). The mountain cure's romance rests on patients who were rich, well fed and selected.

Against drugs after the Fall. A salvaged stock of unknown potency, given without diagnosis, observation or follow-up, can do more harm than good. It breeds resistant strains that then spread through a population with no other drugs. The counter-argument, from Balcells, is that isoniazid preventive therapy has not been proven to cause resistance (Balcells 2006). That evidence concerns people without active disease.

Against the hospital romance. Even with drugs, about one in five HIV-positive patients died during treatment (Straetemans 2011), and 3.9 per cent died in RATIONS. Much of modern success lies in finding cases early and watching doses, which a disciplined village can also do.

10-line summary

1. Untreated smear-positive tuberculosis kills about 70 per cent of adults within ten years, most within three. Smear-negative disease kills about 20 per cent.
2. Infants infected in the first year have a 10 to 20 per cent risk of meningitis or disseminated disease.
3. No sanatorium proved a survival benefit. Its good results came largely from admitting early cases, and its real gifts were segregation, food and hygiene.
4. With drugs, home treatment equalled the sanatorium in cure and in contact safety (Madras).
5. Sun cured skin tuberculosis and is linked with recovery in bone disease. For lung disease it is unproven, and vitamin D trials are null.
6. Food for undernourished household contacts cut new tuberculosis by about 40 per cent (RATIONS). Food does not cure active disease without drugs.

7. Collapse therapy belongs only in a hospital with X-ray and a surgeon.
8. The cure is six months of four then two drugs, every dose watched. One drug alone breeds resistance within months.
9. BCG protects infants against the fatal forms by about three-quarters or more.
10. Open windows, separate sleeping, covered coughs, burned sputum and early recognition protect the household.

Open questions

- What did rest, apart from food and segregation, add to survival before drugs? No controlled data exist.
- How long do salvaged tuberculosis drugs keep potency in village storage? Not researched here.
- What is the natural history of tuberculosis with untreated HIV? Not found.
- Does food without drugs change the course of established disease? No study isolates it.
- Is RATIONS generalisable beyond Jharkhand, and to adequately fed contacts?
- Did vitamin D help the multidrug-resistant subgroup in the Jolliffe meta-analysis, or was this chance?
- What were Trudeau's results by stage, and what did Bynum (2012) and the other book-length histories named in the brief conclude about the sanatorium? I did not read them.
- The best village rule for allocating a stock too small for everyone: first come, youngest, most infectious, or most likely to be cured?

Sources to read in full

1. Tiemersma 2011, natural history.
2. Medical Research Council 1948, with the 1950 PAS combination report.
3. Tuberculosis Chemotherapy Centre 1959, with Dawson 1966 and Kamat 1966.
4. Bhargava 2023a and 2023b, RATIONS.
5. Marais 2004, childhood tuberculosis before chemotherapy.
6. Escombe 2007, natural ventilation.
7. Riley 1959, the Baltimore ward.
8. Hilleboe 1936, mortality after sanatorium discharge.
9. Bynum 2012, *Spitting Blood* (Oxford University Press), not read here.
10. WHO 2022, Module 4, drug-susceptible treatment.

At the bedside after the Fall

Household. Recognise a cough of over two weeks with weight loss, night sweats or blood. Move the patient to the airiest room, alone at night, window open, with cloth for coughing and a covered pot whose contents are burned daily. Keep infants out. Feed him and the household, weigh him weekly, and tell the village healer. **Needs:** a separate sleeping space, cloth, a pot with a lid, fire, a scale. **First failure to expect:** the family sleeps together in winter because it is warm, and the baby is infected.

Village of 300. Keep a register of everyone with a long cough, visit and weigh them weekly, and ration patients and undernourished contacts close to RATIONS amounts. Build a sleeping porch. Hold drug stock centrally and give only full, watched courses (Protocol P4). Teach mothers the meningitis signs. **Needs:** a lay healer, a register, a scale, a grain and pulse store, a lockable box for drugs. **Plants:** pulses (*Cajanus cajan*, *Lens culinaris*, *Phaseolus vulgaris*), grain and oil crops for calories and protein. No medicinal plant is recommended for cure. **First failure to expect:** a well-meaning healer gives the last strip of rifampicin to a coughing patient "to help", or a patient feels better at six weeks and stops.

District of 3,000. Run smear microscopy, two specimens per suspect, to choose whom to isolate and treat. Keep a cross-ventilated isolation room. Pool village drug stocks and decide centrally who receives full courses. Check

vision on ethambutol, vaccinate newborns while BCG lasts, and record outcomes: cured, died, defaulted. **Needs:** a microscope with oil immersion, stains, slides, a trained reader, a ten-bed ward with cross-ventilation, records. **First failure to expect:** the microscope is fine but the stains run out, or the reader leaves, and diagnosis falls back to guesswork.

Protocols

P1. Recognising tuberculosis

- ☐ Cough for more than 2 weeks in anyone over 10 years old.
- ☐ Plus any of: weight loss, night sweats, fever in the evenings, blood in sputum, chest pain.
- ☐ In a child under 5: failure to thrive, fever for more than 2 weeks, or a household contact with a long cough [VERIFY].
- ☐ Weigh and record the weight. Repeat every week on the same scale.
- ☐ Ask who sleeps in the same room, and list children under 5.
- ☐ Send two sputum samples to the district if it has a microscope (P8).
- ☐ Start P2 and P3 at once, without waiting for the smear.

P2. Care plan without drugs

- ☐ Ration for the patient: about 1,200 kcal and 52 g of protein a day on top of usual food, for at least 6 months (Bhargava 2023a, 2023b, one trial in two papers) [VERIFY second independent source].
- ☐ Ration for each undernourished adult contact: about 750 kcal and 23 g of protein a day, for example 5 kg of rice and 1.5 kg of pulses per month (RATIONS contact basket) [VERIFY].
- ☐ Weigh weekly. Target a 5 per cent gain by 2 months. A 50 kg patient should reach 52.5 kg [VERIFY, my arithmetic].
- ☐ In a severely wasted patient (BMI under 14), increase food over the first week rather than all at once [VERIFY].
- ☐ Cod-liver oil if available: 1 teaspoon a day for an adult in winter. No more than a quarter to half a teaspoon for an infant (THRIVING library, HY-08) [VERIFY second source].
- ☐ Rest while feverish. Walk gently once the evening fever has gone for a week [VERIFY].
- ☐ Days outdoors in shade or early sun, warmly covered. Limbs first, minutes at a time, as Rollier did for bone disease, never to the point of burning [VERIFY for lung disease].
- ☐ Sleep alone, window open, warm covers.
- ☐ No plant remedy as a cure. Safe cough comforts only: warm drinks, honey for those over 1 year [VERIFY].
- ☐ Record weight, fever and blood in sputum weekly.

P3. Household protection

- ☐ Patient sleeps alone in the best-ventilated room. Window and door open when possible, cross-draught if possible.
- ☐ Patient covers every cough with cloth, or wears a cloth or surgical mask when others are near.
- ☐ Sputum goes into a covered pot. Burn the contents in the fire each day. Boil or burn the cloths [VERIFY].
- ☐ No infant or child under 5 in the patient's room. No shared bed with any child.
- ☐ Time together outdoors rather than indoors.
- ☐ Feed undernourished contacts (P2).
- ☐ Watch every contact for cough, weight loss or, in a child, the signs in P7.
- ☐ Continue for as long as the cough lasts. Without drugs this may be years.

P4. Rules for a partial drug stock

- ☐ All stock is held by the dispensary or district, never in households.

- ☐ Count it. Write down each drug, strength, number of tablets and expiry date.
- ☐ Work out how many full courses it allows. An adult of 40 to 54 kg needs 168 four-drug tablets and 378 two-drug tablets for 2HRZE/4HR (my arithmetic) [VERIFY].
- ☐ Never treat active tuberculosis with one drug. Never rifampicin alone. Never isoniazid alone.
- ☐ Never add a single new drug to a regimen that is failing [VERIFY].
- ☐ Never start a course you cannot finish. Treat fewer people completely rather than many partly [VERIFY, inference].
- ☐ Dose by weight band: 2, 3, 4 or 5 tablets for 30 to 39, 40 to 54, 55 to 70 and over 70 kg (Voractiv SmPC n.d., WHO 2010).
- ☐ Children aged 3 months to 16 with non-severe disease may receive 4 months (2HRZ(E)/2HR) rather than 6 (WHO 2022). Use children's doses.
- ☐ Give daily, watched by a named person, recorded on a card: date, tablets, initials. 56 doses then 126 doses.
- ☐ A missed dose is made up at the end, not doubled [VERIFY].
- ☐ Pyridoxine 25 to 50 mg daily with isoniazid if available (CDC n.d.).
- ☐ Warn rifampicin users: orange urine, failed contraceptive pills, weakened other medicines.
- ☐ Priority, if the district must choose [VERIFY, inference]: children with meningitis or miliary disease, then smear-positive adults with dependent children in the house, then others.
- ☐ Smear at 2 months and at the end if the district can.

P5. Watching for drug harm

- ☐ Every week ask: yellow eyes or skin, dark urine, vomiting, pain under the right ribs. If yes, stop all drugs and go to the district.
- ☐ Every month on ethambutol: test each eye separately on a fixed letter chart at a fixed distance, and ask about colour. Any fall: stop ethambutol.
- ☐ Ask about burning or tingling feet. Give pyridoxine 100 mg daily if present (CDC n.d.).
- ☐ Ask about rash, joint pain, ringing ears or unsteadiness (streptomycin).
- ☐ Extra care over 50 years old, in heavy drinkers and in late pregnancy.

P6. Coughing blood

- ☐ Measure it: use a marked cup. Note the time.
- ☐ Less than a cupful in a day: rest, keep calm, continue P2 and P3, tell the healer.
- ☐ A cupful or more at once, or more than 600 ml in 24 hours, is life-threatening.
- ☐ Lie the patient on the side that is bleeding (the side where he feels the gurgle), head slightly down if tolerated [VERIFY head position].
- ☐ Keep the mouth clear. Let him cough blood out. Do not give food.
- ☐ Send for the district. Tranexamic acid and transfusion exist only there, and are adjuncts only.
- ☐ If he is dying, stay with him, hold his hand, use dark cloths, speak calmly.

P7. Suspected meningitis in a child

- ☐ Signs: fever with headache, vomiting, irritability or drowsiness, stiff neck, a fit, or a bulging soft spot in an infant [VERIFY signs].
- ☐ Especially in a child under 5 living with a coughing adult.
- ☐ Send to the district at once. This is the first claim on any drug stock.
- ☐ Without drugs: nurse in a quiet, dim room. Fluids by mouth or spoon if the child can swallow. Turn every 2 hours [VERIFY]. Expect death within weeks, and tell the family honestly.

P8. Collecting sputum for a smear

- ☐ Give the patient a clean, labelled, lidded pot.
- ☐ First sample on the spot, second the next morning on waking [VERIFY timing].
- ☐ Ask for a deep cough from the chest, not saliva. Collect outdoors, away from others.
- ☐ Close the lid tightly. Carry to the district within a day or two [VERIFY].
- ☐ Two samples find about 89 per cent of smear-positive patients (NTI India n.d.).
- ☐ A negative smear does not mean no tuberculosis. Continue P2 and P3 if the symptoms are there.

P9. BCG

- ☐ Only from stock that has been kept cold and is in date.
- ☐ Give to newborns and infants, by a trained vaccinator following the leaflet [VERIFY dose and route].
- ☐ Do not give to infants known to have HIV [VERIFY].
- ☐ Record each vaccination with date and batch.
- ☐ Expect protection of roughly three-quarters or more against meningitis and miliary disease, about half against lung disease.

Numbers to carry

1. **70 and 20.** Untreated ten-year death rate in smear-positive and smear-negative adults (Tiemersma 2011).
2. **Three years.** Average duration of untreated disease, with most deaths early.
3. **10 to 20 per cent.** Risk of meningitis or disseminated disease in an infant infected in the first year (Marais 2004).
4. **Two weeks.** A cough this long is tuberculosis until proved otherwise.
5. **40 per cent.** Fall in new tuberculosis among undernourished contacts given food (RATIONS).
6. **5 per cent in 2 months.** The weight gain that marks a patient likely to survive.
7. **2HRZE/4HR, 182 doses, every one watched.** Never one drug alone.
8. **600 ml.** Blood in 24 hours that marks massive haemoptysis. Lie on the bleeding side.
9. **11 against 97 per cent.** Modelled infection risk with open windows in an old high-ceilinged room against closed windows (Escombe 2007).
10. **One in three.** Of untreated smear-positive adults, about this many recover on their own. Tell patients the truth.

References

1. Aibana O, Huang C, Aboud S, and others. 2018. Vitamin D status and risk of incident tuberculosis disease: a systematic review and individual participant data meta-analysis. Preprint, bioRxiv/medRxiv. https://doi.org/10.1101/481739 (abstract read, year of posting [VERIFY]).
2. Alessa AA, Awan AZ, Almutairi AB, and others. 2026. Neuro-ophthalmic complications of tuberculosis and its treatment: a systematic review and meta-analysis. Frontiers in Ophthalmology. https://doi.org/10.3389/fopht.2026.1818640 (abstract read).
3. Anderson DM, Charles KK, Las Heras Olivares C, Rees DI. 2019. Was the first public health campaign successful? The tuberculosis movement and its effect on mortality. American Economic Journal: Applied Economics 11(2):143-175. https://www.nber.org/papers/w23219 (abstract and secondary summaries read).
4. Balcells ME, Thomas SL, Godfrey-Faussett P, Grant AD. 2006. Isoniazid preventive therapy and risk for resistant tuberculosis. Emerging Infectious Diseases 12(5). https://doi.org/10.3201/eid1205.050681 (secondary summary read).
5. Bardswell N, as reported in a London Medical Officer of Health report. 1923. After-histories of patients treated in 1918. Wellcome Library, London's Pulse. https://wellcomelibrary.org/moh/report/b18252709/86

(search summary only, attribution of figures to this page [VERIFY]).

6. Bhargava A, Bhargava M, Meher A, and others. 2023a. Nutritional supplementation to prevent tuberculosis incidence in household contacts of patients with pulmonary tuberculosis in India (RATIONS): a field-based, open-label, cluster-randomised, controlled trial. The Lancet. https://doi.org/10.1016/S0140-6736(23)01231-X (abstract read).
7. Bhargava A, Bhargava M, Meher A, and others. 2023b. Nutritional support for adult patients with microbiologically confirmed pulmonary tuberculosis: outcomes in a programmatic cohort nested within the RATIONS trial in Jharkhand, India. The Lancet Global Health. https://doi.org/10.1016/S2214-109X(23)00324-8 (abstract read).
8. Brendler T, Stander MA, van Wyk BE. 2023. Stevens' Cure (Umckaloabo): the vindication of a patent medicine. Frontiers in Pharmacology. https://pmc.ncbi.nlm.nih.gov/articles/PMC10791834/ (abstract and search summary read).
9. Brown (initials not recorded). 1930. On the results of treatment of pulmonary tuberculosis by artificial pneumothorax. MD thesis, University of Glasgow. https://theses.gla.ac.uk/79862 (catalogue abstract read).
10. Bynum H. 2012. Spitting Blood: The History of Tuberculosis. Oxford University Press. Not read. Existence and scope confirmed through reviews, for example Danny Yee's review at https://dannyreviews.com/h/Spitting_Blood.html (search summary only).
11. CDC (Centers for Disease Control and Prevention). n.d. Treatment for TB disease. Web page, accessed October 2026. https://www.cdc.gov/tb/hcp/treatment/tuberculosis-disease.html (read).
12. Clinical haemoptysis review. n.d. Evaluation and management of clinically significant hemoptysis: a clinical practice review. AME Medical Journal. https://amj.amegroups.org/article/view/8694/html (search summary only).
13. Colditz GA, Brewer TF, Berkey CS, and others. 1994. Efficacy of BCG vaccine in the prevention of tuberculosis: meta-analysis of the published literature. JAMA. https://doi.org/10.1001/jama.1994.03510330076038 (abstract read).
14. Crofton J. 2005. The MRC randomized trial of streptomycin and its legacy: a view from the clinical front line. James Lind Library. https://www.jameslindlibrary.org/articles/the-mrc-randomized-trial-of-streptomycin-and-its-legacy-a-view-from-the-clinical-front-line/ (read, year [VERIFY]).
15. Dawson JJ, Devadatta S, Fox W, and others. 1966. A 5-year study of patients with pulmonary tuberculosis in a concurrent comparison of home and sanatorium treatment for one year with isoniazid plus PAS. Bulletin of the World Health Organization. https://pmc.ncbi.nlm.nih.gov/articles/PMC2475991/ (abstract read).
16. Developments in Heliotherapy. n.d. Journal article, details not recorded, with quotations from 1913 to 1938 heliotherapy writing. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5243483/ (search summary only, which did not separate the quoted sources [VERIFY]).
17. Dharmadhikari AS, Mphahlele M, Stoltz A, and others. 2012. Surgical face masks worn by patients with multidrug-resistant tuberculosis: impact on infectivity of air on a hospital ward. American Journal of Respiratory and Critical Care Medicine. https://doi.org/10.1164/rccm.201107-1190OC (abstract via search summary).
18. Edwards FR and colleagues. 1953. Follow-up of the High Carley Sanatorium thoracoplasty series, with Edwards's 1949 review of sputum conversion. Possibly Thorax 8(2):114. https://thorax.bmj.com/content/thoraxjnl/8/2/114.full.pdf (search summary only, attribution to this URL unconfirmed [VERIFY]).
19. EMA (European Medicines Agency). n.d. European Medicines Agency concludes review of dose recommendations for anti-tuberculosis medicines used in children. https://www.ema.europa.eu/en/news/european-medicines-agency-concludes-review-dose-recommendations-anti-tuberculosis-medicines-used-children (search summary only).
20. Escombe AR, Oeser CC, Gilman RH, and others. 2007. Natural ventilation for the prevention of airborne contagion. PLoS Medicine 4(2):e68. https://doi.org/10.1371/journal.pmed.0040068 (abstract and search

summary read).
21. Escombe AR, Ticona E, Chávez-Pérez V, Espinoza M, Moore DAJ. 2019. Improving natural ventilation in hospital waiting and consulting rooms to reduce nosocomial tuberculosis transmission risk in a low resource setting. BMC Infectious Diseases. https://doi.org/10.1186/s12879-019-3717-9 (abstract read).
22. Fairchild AL, Oppenheimer GM. 1998. Public health nihilism vs pragmatism: history, politics, and the control of tuberculosis. American Journal of Public Health 88(7):1105-1117. https://doi.org/10.2105/ajph.88.7.1105 (search summary only).
23. Ganmaa D, Uyanga B, Zhou X, and others. 2020. Vitamin D supplements for prevention of tuberculosis infection and disease. New England Journal of Medicine. https://doi.org/10.1056/NEJMoa1915176 (abstract read).
24. Germany 1921. The effects of the starvation blockade on public health. German History in Documents and Images. https://germanhistorydocs.org/en/wilhelmine-germany-and-the-first-world-war-1890-1918/the-effects-of-the-starvation-blockade-on-public-health-1921.pdf (search summary only).
25. Glasgow thesis n.d. Factors influencing the prognosis in tuberculous meningitis treated with streptomycin. University of Glasgow thesis, citing Levinson and colleagues. https://theses.gla.ac.uk/79262 (search summary only).
26. Green M. 2011. Cod liver oil and tuberculosis. BMJ 343:d7505. https://doi.org/10.1136/bmj.d7505 (read through a TB Online summary at https://tbonline.groundup.org.za/posts/print/cod-liver-oil-helped-combat-tb-past-century/index.html).
27. Grobler L, Durao S, Van der Merwe SM, Wessels J, Naude CE. 2017. Nutritional supplements for people being treated for active tuberculosis: a technical summary. South African Medical Journal. https://doi.org/10.7196/SAMJ.2017.v108i1.12839 (abstract read, summarising the 2016 Cochrane review).
28. Grosset J. 2016. Teaching slides, Maryland Department of Health tuberculosis annual update, quoting Fox on the Madras results. https://health.maryland.gov/phpa/OIDPCS/CTBCP/CTBCPDocuments/2016%20Annual%20Update (search summary only).
29. Gøtzsche PC. 2004. Niels Finsen's treatment for lupus vulgaris. James Lind Library, republished in Journal of the Royal Society of Medicine 2011. https://www.jameslindlibrary.org/articles/niels-finsens-treatment-for-lupus-vulgaris/ (read).
30. Higgins P. 2023. strep_tb: RCT of streptomycin therapy for tuberculosis, a reconstruction of the MRC 1948 dataset in the medicaldata R package. https://rdrr.io/cran/medicaldata/man/strep_tb.html and https://raw.githubusercontent.com/higgi13425/medicaldata/master/data-raw/strep_tb.csv (dataset tabulated by me, year of package version [VERIFY]).
31. Hilleboe HE. 1936. Comparative mortality of patients discharged from tuberculosis sanatoria. Milbank Memorial Fund Quarterly 15(4). https://milbank.org/wp-content/uploads/mq/volume-15/issue-04/15-4-Comparative-Mortality-of-Patients-Discharged-from-Tuberculosis-Sanatoria-by-H.-E.-Hilleboe.pdf (scanned PDF unreadable, search summary only, year [VERIFY]).
32. Historic Saranac Lake. n.d. Trudeau Sanatorium and Adirondack Cottage Sanitarium pages. Historic Saranac Lake wiki. https://localwiki.org/hsl/Trudeau_Sanatorium (search summary only).
33. Imperiia Project. n.d. Beyond Baedeker: the pursuit of health. Harvard University. https://scalar.fas.harvard.edu/imperiia/beyond-baedeker-the-pursuit-of-health (search summary only).
34. Institutional Treatment of Consumption. 1916. The institutional treatment of consumption: V. The disposal of sputum. Journal article, author not recorded. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5227393/ (search summary only).
35. Jolliffe DA, Ganmaa D, Wejse C, and others. 2019. Adjunctive vitamin D in tuberculosis treatment: meta-analysis of individual participant data. European Respiratory Journal. https://doi.org/10.1183/13993003.02003-2018 (abstract read).
36. Kamat SR, Dawson JJ, Devadatta S, and others. 1966. A controlled study of the influence of segregation of tuberculous patients for one year on the attack rate of tuberculosis in a 5-

year period in close family contacts in South India. Bulletin of the World Health Organization. https://pmc.ncbi.nlm.nih.gov/articles/PMC2475993/ (abstract read).
37. Kolkailah AA, Fugar S, Rey-Mendoza J, Campagnoli T, Fakhran S. 2018. Revisiting the evolution of tuberculosis therapy: historical reflections in the modern era. Oxford Medical Case Reports. https://pmc.ncbi.nlm.nih.gov/articles/PMC6086088/ (read in full).
38. Kopanoff DE, Snider DE, Caras GJ. 1978. Isoniazid-related hepatitis: a US Public Health Service cooperative surveillance study. American Review of Respiratory Disease. https://doi.org/10.1164/arrd.1978.117.6.991 (abstract and drug label summary read, tables not read).
39. Korean ototoxicity series. 1977. Clinical observation of streptomycin ototoxicity. Authors not recorded. https://koreascience.or.kr/article/CFKO197711921995375.page (search summary only).
40. Koumiss and its use in medicine. n.d. Historical journal article, author not recorded. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9809671/ (search summary only).
41. Kovács-Ábrahám Z, Aczél T, Lakner B, Ónodi M, Csontos C, Németh M. 2026. Successful management of accidental colchicine intoxication after ingestion of Colchicum autumnale: a case report. Toxics. https://doi.org/10.3390/toxics14040309 (abstract read).
42. Leeming-Latham C. 2015. Unravelling the 'tangled web': chemotherapy for tuberculosis in Britain, 1940-70. Medical History. https://doi.org/10.1017/mdh.2015.19 (abstract read).
43. Mangtani P, Abubakar I, Ariti C, and others. 2014. Protection by BCG vaccine against tuberculosis: a systematic review of randomized controlled trials. Clinical Infectious Diseases. https://doi.org/10.1093/cid/cit790 (abstract read).
44. Marais BJ, Gie RP, Schaaf HS, and others. 2004. The natural history of childhood intra-thoracic tuberculosis: a critical review of literature from the pre-chemotherapy era. International Journal of Tuberculosis and Lung Disease. https://pubmed.ncbi.nlm.nih.gov/15141729/ (abstract and a secondary reproduction of the table read).
45. Martineau AR, Timms PM, Bothamley GH, and others. 2011. High-dose vitamin D3 during intensive-phase antimicrobial treatment of pulmonary tuberculosis: a double-blind randomised controlled trial. The Lancet. https://doi.org/10.1016/S0140-6736(10)61889-2 (abstract read).
46. Martineau AR. 2012. Old wine in new bottles: vitamin D in the treatment and prevention of tuberculosis. Proceedings of the Nutrition Society. https://doi.org/10.1017/S0029665111003326 (abstract read).
47. Medical Research Council 1948 meningitis. 1948. Streptomycin treatment of tuberculous meningitis. The Lancet. https://www.jameslindlibrary.org/illustrating/records/streptomycin-treatment-of-tuberculous-meningitis (bibliographic record only, 64% figure from a later review via search summary [VERIFY]).
48. Medical Research Council. 1948. Streptomycin treatment of pulmonary tuberculosis. BMJ 2:769-782. https://www.jameslindlibrary.org/medical-research-council-1948/ (James Lind Library record read, results from the reconstructed dataset, five-year figure from a secondary source).
49. Milbank 1946. Annotations, including a review of Brieger's 25-year survey of the Papworth Village Settlement. Milbank Memorial Fund Quarterly 24(2). https://www.milbank.org/wp-content/uploads/mq/volume-24/issue-02/24-2-Annotations.pdf (search summary only, year [VERIFY]).
50. Milbank 1957. Two Veterans Administration medical monographs (review). Milbank Memorial Fund Quarterly 35(1). https://www.milbank.org/wp-content/uploads/mq/volume-35/issue-01/35-1-Two-Veterans-Administration-Medical-Monographs.pdf (search summary only, year [VERIFY]).
51. Milbank, WW1 tuberculosis paper. n.d. Milbank Memorial Fund Quarterly paper reporting tuberculosis mortality in the First World War, probably The relation of protein scarcity and modification of blood protein to tuberculosis among undernourished subjects, 28(2). https://www.milbank.org/wp-content/uploads/mq/volume-28/issue-02/28-2-The-Relation-of-Protein-Scarcity-and-Modification-of-Blood-Protein-to-Tuberculosis-Among-Undernourished-Subjects.pdf (search summary only, attribution [VERIFY]).
52. Nathavitharana RR, Pearl A, Biewer A, and others. 2025. Effects of respiratory isolation for tu-

berculosis to reduce community-based transmission: a systematic review. Clinical Infectious Diseases. https://doi.org/10.1093/cid/ciae496 (abstract read).
53. NTI India (National Tuberculosis Institute, Bangalore). n.d. Frequently asked questions on sputum microscopy. https://ntiindia.kar.nic.in/faq.htm (search summary only).
54. Obakiro SB, Kiprop A, Kowino I, and others. 2020. Ethnobotany, ethnopharmacology, and phytochemistry of traditional medicinal plants used in the management of symptoms of tuberculosis in East Africa: a systematic review. Tropical Medicine and Health. https://doi.org/10.1186/s41182-020-00256-1 (abstract read).
55. Ragonnet R, Flegg JA, Brilleman SL, and others. 2021. Revisiting the natural history of pulmonary tuberculosis: a Bayesian estimation of natural recovery and mortality rates. Clinical Infectious Diseases. https://doi.org/10.1093/cid/ciaa602 (abstract read).
56. Ramakrishnan CV, Rajendran K, Jacob PG, Fox W, Radhakrishna S. 1961. The role of diet in the treatment of pulmonary tuberculosis: an evaluation in a controlled chemotherapy study in home and sanatorium patients in South India. Bulletin of the World Health Organization. https://pmc.ncbi.nlm.nih.gov/articles/PMC2555577/ (abstract read).
57. Riley RL, Mills CC, Nyka W, and others. 1959. Report of a 24-month study of airborne contagion from a six-bed tuberculosis ward at the Baltimore Veterans Administration Hospital. Primary paper not read. Secondary account: Johns Hopkins Hub 2020. https://hub.jhu.edu/2020/07/22/richard-riley-airborne-virus/ (search summary of secondary accounts only).
58. Rodrigues LC, Diwan VK, Wheeler JG. 1993. Protective effect of BCG against tuberculous meningitis and miliary tuberculosis: a meta-analysis. International Journal of Epidemiology. https://doi.org/10.1093/ije/22.6.1154 (abstract read).
59. Roy A, Eisenhut M, Harris RJ, and others. 2014. Effect of BCG vaccination against Mycobacterium tuberculosis infection in children: systematic review and meta-analysis. BMJ. https://doi.org/10.1136/bmj.g4643 (abstract read).
60. Royal Papworth. n.d. Our history. Royal Papworth Hospital NHS Foundation Trust. https://royalpapworth.nhs.uk/our-hospital/about-us/our-history (search summary only).
61. Selkon JB, Devadatta S, Kulkarni KG, and others. 1964. The emergence of isoniazid-resistant cultures in patients with pulmonary tuberculosis during treatment with isoniazid alone or isoniazid plus PAS. Bulletin of the World Health Organization. https://pmc.ncbi.nlm.nih.gov/articles/PMC2555166/ (search summary of the abstract).
62. Smith (initials not recorded). 1950. Tuberculous empyema in artificial pneumothorax. Thesis, University of Glasgow. https://theses.gla.ac.uk/id/eprint/79829 (catalogue record only).
63. Sokołowsko. n.d. Dr Brehmer's Sanatorium: a brief overview. https://sokolowsko.org/en/informacje-praktyczne/historia-sokolowska/ (search summary only).
64. Straetemans M, Glaziou P, Bierrenbach AL, Sismanidis C, van der Werf MJ. 2011. Assessing tuberculosis case fatality ratio: a meta-analysis. PLoS One 6(6):e20755. https://doi.org/10.1371/journal.pone.0020755 (abstract read).
65. Szreter S. 1988. Article in Social History of Medicine 1(1) challenging the McKeown thesis on the role of public health in Britain's mortality decline. Not read. Secondary summary: AcaWiki, Mortality in England in the eighteenth and nineteenth centuries: a reply to Sumit Guha. https://acawiki.org/Mortality_in_England_in_the_Eighteenth_and_Nineteenth_Centuries:_A_Reply_to_Sumit_Guha (search summary only).
66. Tiemersma EW, van der Werf MJ, Borgdorff MW, Williams BG, Nagelkerke NJD. 2011. Natural history of tuberculosis: duration and fatality of untreated pulmonary tuberculosis in HIV negative patients: a systematic review. PLoS One 6(4):e17601. https://pmc.ncbi.nlm.nih.gov/articles/PMC3070694/ (read in full).
67. Time. n.d. Medicine: Heliotherapy. Time magazine. https://content.time.com/time/magazine/article/0,9171,716302,00.htm (search summary only, date not shown).
68. Tuberculosis Chemotherapy Centre, Madras. 1959. A concurrent comparison of home and sanatorium

treatment of pulmonary tuberculosis in South India. Bulletin of the World Health Organization 21:51-144. https://eprints.nirt.res.in/14/ (not read, cited for the design only).

69. University of Melbourne. n.d. Dr Dettweiler's sputum bottle. Medical History Museum collection record. https://collections.mdhs.unimelb.edu.au/objects/1525/dr-dettweiler-sputum-bottle (search summary only, with other museum records).
70. Voractiv SmPC. n.d. Summary of product characteristics, Voractiv (rifampicin, isoniazid, pyrazinamide, ethambutol) and Rimactazid. Electronic Medicines Compendium. https://www.medicines.org.uk/emc/product/10609/smpc (read).
71. WHO 2010. Treatment of tuberculosis guidelines, fourth edition, adult dose table, as reproduced in a PMC table comparing the 2006 and 2010 doses. https://pmc.ncbi.nlm.nih.gov/articles/PMC4958858/table/t2 (secondary reproduction only).
72. WHO 2022. WHO consolidated guidelines on tuberculosis. Module 4: treatment. Drug-susceptible tuberculosis treatment. ISBN 978-92-4-004812-6. World Health Organization. https://www.who.int/publications/i/item/9789240048126 (search summary only, URL constructed from the ISBN [VERIFY]).
73. Wikipedia 2026a. Hermann Brehmer. https://en.wikipedia.org/wiki/Hermann_Brehmer (search summary read).
74. Wikipedia 2026b. Auguste Rollier. https://en.wikipedia.org/wiki/Auguste_Rollier (read, citing Hobday 1997, Vázquez and Hanslmeier 2006 and Alpert 2010).
75. Williams CJB. 1849. On the use and administration of cod-liver oil in pulmonary consumption. Medical Examiner (Philadelphia). https://pmc.ncbi.nlm.nih.gov/articles/PMC10283871/ (search summary only).
76. Wilson LG. 1990. The historical decline of tuberculosis in Europe and America: its causes and significance. Journal of the History of Medicine and Allied Sciences 45(3):366. https://doi.org/10.1093/jhmas/45.3.366 (title only).
77. Wisconsin State Sanatorium. n.d. Superintendent's report. University of Wisconsin Digital Collections. https://search.library.wisc.edu/digital/AMCI3DPDR5XRAD8R/text/AR3CB4JWG2LLX28C (search summary only, attribution and year [VERIFY]).