FO-05 What the physician of 1850 could do, and what killed his patients

HEALING after the FALL, research library, FO-05

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

How to read this document

After the Fall the reader will have roughly the means of a Western physician of about 1850. This document reconstructs what that physician could reliably do and what he did that killed people. He was trained, confident and observant. He watched the fever break after he had bled the patient, and believed what he saw. His failures came from a theory that explained everything, authorities nobody questioned and effects that were visible but meant nothing. The reader after the Fall will face the same three temptations.

Three cautions apply throughout. Nearly all figures come from physicians' own case series or single hospitals, not population data. American heroic depletion lasted longer and went further than practice in Paris or Vienna. And David Wootton's thesis that medicine did more harm than good before 1865 is contested (section 6). Wherever it can, the document keeps apart what the tradition said, what the record shows and what modern science infers.

1. Findings by section

1.1 The physician and his theory, about 1800 to 1850

The physician of 1800 to 1850 worked inside a theory that saw disease as a disturbance of the whole body's balance: too much excitement, too much blood, a fouled gut, a fever to be broken. His tools followed from it. He bled, by lancet from the arm or by leeches and cups. He purged, mostly with calomel (mercurous chloride) and jalap. He vomited the patient with tartar emetic (antimony potassium tartrate) or ipecacuanha. He blistered the skin with cantharides. These were the "heroic" remedies. Their effects were dramatic and visible: the pulse softened after bleeding, the bowel emptied, the mouth salivated under mercury. To patient and doctor alike, a visible effect looked like proof that the drug was working (Rosenberg 1977, read in bibliographic summary only).

Charles Rosenberg argued that the remedies persisted because they did something everyone could see, and because they fitted a shared picture of the body that patients also held. John Harley Warner (1986) traced how American physicians between 1820 and 1885 stopped taking bleeding, alcohol and opium for granted, and began to ask where their knowledge of remedies came from (Warner 1986, read in publisher summary and review only. Fletcher 2002). Neither book has been read in full for this report, and their arguments are given here only at the level their summaries support.

The scale of the practice was enormous. France imported about 42 million leeches for medical use in 1833 (Ackerknecht 1967, cited in Morabia 2004).

1.2 Bloodletting: the death of Washington, Rush in Philadelphia and Louis's count

George Washington, Mount Vernon, 12 to 14 December 1799. Washington fell ill with a sore throat on 12 December and by that night could barely breathe. Dr James Craik diagnosed "cynanche trachealis". Dr Gustavus Richard Brown and Dr Elisha Cullen Dick, a former pupil of Benjamin Rush, joined him. Washington was bled four times, about 5 pints, near half his blood volume (Dunea 2012). Other estimates run from about 2.4 litres to over 2.5 litres [VERIFY]. He also had blisters, gargles and a calomel enema. Dick proposed opening the windpipe and was overruled. Washington died at about 10 pm on 14 December (Dunea 2012). The modern reading is an acute infection of the epiglottis closing the airway, and one surgical reviewer has argued he would have died whatever was done [VERIFY]. The case does not prove that bleeding killed him. It shows the most respected treatment of the day draining a dying man while the one procedure that might have saved him was refused as too bold.

Benjamin Rush, Philadelphia, 1793. Yellow fever killed about 4,000 to 5,000 people in Philadelphia between August and November 1793 (Brooklyn Law School blog, summary only). Rush treated up to 100 patients a day with heavy bleeding and calomel. Osler (1892) quoted Rush's account of taking 111 ounces of blood from one newly arrived Englishman in twelve bleedings over six days, with nearly 150 grains of calomel, jalap and gamboge (the calomel figure is partly illegible in the scanned text [VERIFY]). Rush bled himself and his six-week-old infant (Osler 1892). He claimed that calomel saved nine in ten treated early, a self-reported figure with no comparison [VERIFY]. William Cobbett accused him in Porcupine's Gazette of killing his patients. Rush won a libel verdict of 5,000 dollars on 14 December 1799, the day Washington died (Brooklyn Law School blog). The court settled the libel, not the medicine. No reanalysis of the bills of mortality was found, so Cobbett's charge stands unproven either way.

Pierre Charles Alexandre Louis, Paris, published 1835. Louis grouped 77 previously healthy pneumonia patients by the day of first bleeding. Of 41 bled on days 1 to 4, about 44% died. Of 36 bled on days 5 to 9, about 25% died. The early group held nearly twice as many patients over 50, and Louis concluded only that bleeding did less than believed. Alfredo Morabia's reanalysis found the early-bled did worse ($p = 0.07$) and judged a protective effect "highly unlikely" (Morabia 2004). Louis's gift was the method: count, and compare like with like.

The comparisons that followed. Jean-Baptiste Bouillaud in Paris bled pneumonia "coup sur coup", 10 to 17 bleedings of about six ounces in three or four days, and reported 2 deaths in 55 single-lung cases, a small selected series (Pelletan 1839, summary only). In Vienna, Joseph Dietl published in 1849 his 380 pneumonia cases: 85 bled, 17 died (20.0%). 106 given tartar emetic, 22 died (20.8%). 189 treated by diet and rest alone, 14 died (7.4%) (Obloza and Goddard, summary only). The groups were not randomised and milder cases may have gone to expectant care. Still, the treatment the profession trusted went with nearly three times the mortality of doing nothing. In Edinburgh, John Hughes Bennett treated 129 pneumonias from 1848 to 1865 without bleeding, with food and "restoratives". All 105 uncomplicated cases recovered and 4 of 24 complicated cases died (Bennett 1865, summary only). Bernard Brabin pooled nineteenth-century European hospital series and found case fatality of 19.9% in bled patients against 12.8% in unbled (odds ratio 1.55, 95% confidence interval 1.38 to 1.74). Survivors in one series had lost on average 830 mL of blood, range 114 to 2,272 mL (Brabin 2021, abstract only). Across Paris, Vienna, Edinburgh and the pooled data, bleeding did not help pneumonia and probably killed.

Osler, 1892: the habit survives the evidence. Osler's textbook called pneumonia a self-limited disease running its course "uninfluenced in any way by medicine". In the same section he wrote that "we have certainly bled too little" in recent decades and recommended drawing 20 to 30 ounces from a "full-blooded" man early on. He then reported, without remarking on it, that of twelve hospital patients bled late in the illness only one recovered (Osler 1892, read in the archive text). Hospital pneumonia mortality in his tables was 20% to 40%: 20.4% of 1,012 cases in Montreal, 28.0% of 3,969 in New Orleans. At St Thomas's it rose from 3.7% under age 20 to 65% in the seventh decade (Osler 1892). This is the honest baseline for pneumonia without antibiotics.

1.3 Mercury, antimony and the purge

What the tradition said. Calomel was the universal purgative and "alterative". Physicians gave it until the gums swelled and saliva poured, and took salivation as proof the drug had reached the system. Rush warned against salivating children under six, so older children were salivated (Calomel in Diseases of Children 1853, summary only).

What the record shows. American journals of the 1850s to 1880s carried reports of children whose gums ulcerated and whose cheeks and jaws went gangrenous after calomel (Calomel in Diseases of Children 1853 and related reports, summary only). Some were probably noma, the gangrene of starving children, misattributed. On 4 May 1863 the Union Army's Surgeon General, William Hammond, struck calomel and tartar emetic from the supply table by Circular No. 6, citing profuse salivation and mercurial gangrene. The profession revolted in the "Calomel Rebellion", Hammond was sent away in September 1863 and later court-martialled, and calomel returned to the 1864 table (Calomel and Tartar Emetic 1863, summary only). It is the clearest case in the record of a right decision defeated by professional habit.

The long tail. Calomel teething powders caused "pink disease" (infantile acrodynia) in about one exposed baby in 500. Warkany and Hubbard linked it to mercury in 1948, the powders were withdrawn in Britain in 1953 to 1954, and the disease nearly vanished (Shandley and Austin 2011, summary only).

Antimony. Giovanni Rasori in Genoa from 1801 gave tartar emetic in doses rising to a drachm (about 3.9 g) or more a day (Rasori review, summary only). Dietl's tartar emetic group died at the same rate as his bled group. Antimony potassium tartrate damages heart muscle and has caused fatal arrhythmias in twentieth-century treatment of schistosomiasis [VERIFY]. Grade X.

Purging in general. The 1850 physician purged nearly everyone, including patients with cholera, dysentery and typhoid already losing fluid. No source found counts deaths from purging alone. That it deepened fatal dehydration is a modern inference [VERIFY against FO-02].

1.4 The lying-in hospital: Holmes 1843 and Semmelweis 1847

Oliver Wendell Holmes, Boston, 13 February 1843. Holmes read "The Contagiousness of Puerperal Fever" to the Boston Society for Medical Improvement (Holmes 1843). He collected series showing childbed fever following the attendant, not the season. A Manchester midwife attended 30 women in one month, 16 caught the fever and all died (Roberton, cited by Holmes). Dr Rutter of Philadelphia had about 70 cases in less than a year. Holmes drew rules. A physician should not take part in post-mortems on puerperal fever. If present at one, he should wash, change every article of clothing and wait at least 24 hours before a labour. After one case in his practice he should keep away from labouring women for some weeks. After two close together he should stop obstetric practice for at least a month. Three linked cases were prima facie evidence that he carried the disease (Holmes 1843). These rules need no germ theory, only counting and asking who attended.

Ignaz Semmelweis, Vienna, 1846 to 1849. Medical students, who also dissected corpses, trained in the First Clinic, midwives in the Second. In 1846 the First had 4,010 births and 459 maternal deaths (11.4%), the Second 3,754 births and 105 deaths (2.8%) (Wikipedia, tables from Semmelweis 1861). After his colleague Jakob Kolletschka died of a scalpel wound at an autopsy, Semmelweis blamed "cadaverous particles" on students' hands. From mid-May 1847 he ordered hand-washing in chlorinated lime, chosen because it removed the smell. First Clinic mortality fell from 18.3% in April 1847 to 2.2% in June and 1.2% in July, with two months of no deaths in 1848. At the Szent Rókus Hospital in Pest from 1851 to 1855, 8 of 933 women died of childbed fever (0.85%) (Wikipedia). His book of 1861 was rejected by leading obstetricians, Rudolf Virchow among them. He died in an asylum on 13 August 1865 of an infected wound. Irvine Loudon later judged him "not the hero we had thought", partly because he made his case so badly and so late [VERIFY]. Neither Holmes nor Semmelweis changed general practice in his lifetime.

Population effect. Maternal mortality in England and Wales stayed roughly flat at about 4 to 5 per 1,000 births from

1850 to the mid-1930s, despite anaesthesia, antisepsis and the professionalisation of obstetrics, after parish estimates of about 5 per 1,000 for 1800 to 1850 (Chamberlain 2006). It fell only after Leonard Colebrook introduced Prontosil at Queen Charlotte's Hospital in January 1936 (Chamberlain 2006). Loudon argued that delivery at home by a trained midwife was often safer than hospital delivery by a doctor, who interfered more (Loudon 1992, summary only). In 1935, 1.61 of 3.93 maternal deaths per 1,000 births were from puerperal sepsis [VERIFY].

1.5 Surgery before and after 1846 and 1867

What surgery could do before anaesthesia. The surgeon of 1840 could lance abscesses, reduce dislocations, splint simple fractures, tie bleeding vessels, cut for bladder stone, remove superficial tumours and amputate. He worked fast because the patient was awake. Robert Liston amputated a leg under ether at University College Hospital, London, on 21 December 1846, in about 28 seconds (Liston to Boott, summarised in search results). Speed was the main skill, and it was real.

Anaesthesia, 1846 to 1847. William Morton gave ether at the Massachusetts General Hospital on 16 October 1846, and James Young Simpson introduced chloroform in Edinburgh in November 1847 (Morton and Simpson sources, summary only). The first recorded chloroform death was Hannah Greener, 15, in Newcastle in January 1848, during removal of a toenail (sources give the 18th or the 28th). Chloroform killed about 1 patient in 1,300 to 2,500. St Bartholomew's recorded 33 deaths in 42,978 chloroform anaesthetics from 1875 to 1900, with ether about seven times safer, and a German series of 327,593 anaesthetics recorded 134 deaths (Chloroform tabulations, summary only). Anaesthesia allowed longer operations, and longer operations in dirty hospitals bred more sepsis. Pain relief came first, survival later.

Amputation and the hospital. Joseph-François Malgaigne's Paris figures gave hospital amputation mortality of about 52%, and 62% for the thigh (secondary summary, dated 1832 or 1841 [VERIFY]). Simpson's "Hospitalism" (1869) compared 2,089 amputations in large British hospitals, 41% fatal, with 2,098 in country practice from 374 surgeons, 11% fatal (Simpson 1869, summary only). The country cases were probably milder and the figures were challenged, but the big hospital of 1860 was dangerous in itself.

Compound fractures, where bone breaks the skin, killed 40% to 80% of patients treated without amputation in retrospective accounts, the femur worst (Syme's amputation history, summary only). In Confederate records to 1 February 1864, primary thigh amputations killed 38% (132 of 345) and secondary ones 73% (Confederate States Medical and Surgical Journal 1864, summary only). An early amputation of a smashed limb killed fewer than a late one.

Lister, Glasgow, 1867 to 1870. Lister reported amputation mortality of 16 of 35 (about 45%) before carbolic antisepsis and 6 of 40 (15%) after, and admitted the numbers were too small (Tröhler 2014). Ulrich Tröhler shows that Lister chose his comparison years, omitted 1865 when the infirmary-wide rate was only 9%, and never ran a concurrent comparison. Lawson Tait lost 3 of 100 ovariotomies without Listerism and found results improved as carbolic was diluted, plain water best. George Callender favoured simple cleanliness (Tröhler 2014). Lister was right about the cause and partly wrong about the cure.

Caesarean section. Before about 1880 the caesarean killed most mothers, 60% to 80% in British accounts. Porro's operation had about 56% mortality by 1884, and Sänger's uterine suture saved 18 of 25 women in 1886 (Hektoen 2024, summary only). In 1850 it was a last resort to save the child of a dying mother.

1.6 What he could reliably do

The 1850 physician was not helpless. Holmes himself, in the address of 30 May 1860 in which he said that most of the materia medica could be sunk in the sea, kept back "opium, which the Creator himself seems to prescribe", "a few specifics", wine, which he called a food, and anaesthetic vapours. His note on the specifics named cinchona, mercury for syphilis, arsenic, colchicum, iodine, sulphur for scabies, iron and the antiscorbutic regimen (Holmes 1860, read in full text). That list is a fair inventory of what worked. Each item is taken in turn.

Scurvy. James Lind on HMS Salisbury in May 1747 gave six pairs of scorbutic sailors six different supplements. The pair given oranges and lemons recovered fastest (Lind 1753, via summaries). Gilbert Blane persuaded the Admiralty to issue lemon juice to the fleet in 1795 (sources give 1795 to 1799). Scurvy admissions to Haslar naval hospital fell from 1,457 in 1780 to 2 in 1806 to 1810 (Lloyd 1963, summary only). In the Sorby experiment of 1944 to 1946, 10 mg of ascorbic acid a day prevented scurvy in volunteers, while men on none developed it and two had dangerous heart problems (MRC 1948, via Hujoel 2021). Hujoel's reanalysis suggests about 95 mg a day for full wound strength. Grade A.

Smallpox vaccination. In the London smallpox hospitals of 1871 to 1872, about 10% of 11,174 vaccinated patients died against about 45% of 3,634 unvaccinated. At Homerton from 1871 to 1878 it was 3.3% with good scars against 45.8% unvaccinated (Efficacy of Vaccination, summary only). The unvaccinated were poorer, so the gap overstates the effect, but every series agrees. Arm-to-arm transfer carried other diseases: at Rivalta in 1861, 46 of 63 children vaccinated from one infected chain contracted syphilis (Buonaguro 2015, summary only, which gives 44). Britain banned arm-to-arm vaccination in 1898 (Buonaguro 2015). Smallpox is eradicated, so the lesson after the Fall is how a good procedure transmits a bad disease.

Quinine and cinchona bark. François Maillot at Bône in Algeria, where 1,500 of 5,000 French soldiers died in 1833, gave up bleeding for large doses of quinine, and mortality fell (Quotidien du Médecin, summary only, [VERIFY] the size of the fall). William Balfour Baikie took the Pleiad up the Niger in 1854 with quinine wine twice daily and returned after 118 days without a death. The 1841 Niger expedition, without it, lost 42 of 150 Europeans or 55 of 159 by another count (BSHM, summary only). Doses ranged from 1.5 to 2 grains in Boston to 15 to 30 grains (about 1 to 2 g) in the American South (journal reports, summary only). Grade B for malaria.

Digitalis. William Withering's "Account of the Foxglove" (1785) reported 163 patients, mostly with dropsy, now read as heart failure. He found the dried leaf about five times stronger than the fresh and wrote partly against overuse (James Lind Library, summary only). Grade B for heart failure with a fast irregular pulse, with a narrow margin.

Ipecacuanha. Edward Docker in Mauritius in 1858 reported that large doses for dysentery cut mortality from 18% to 2% (Indian Journal of History of Science 2017, the only source found [VERIFY]). Its alkaloid emetine kills the amoeba of amoebic dysentery but was abandoned for toxicity. Grade C to D for village use.

Opium. Opium relieved pain, cough, diarrhoea and the terror of dying, and nothing else in 1850 did. It also killed infants. Godfrey's Cordial was given to quiet babies whose mothers worked. In 1854 Thomas Bull estimated that three-quarters of opium deaths were in children under five, and Coventry bought about ten gallons of the cordial a week (Godfrey's Cordial sources, summary only). The Pharmacy Act 1868 exempted patent medicines, and many drugged infants died of starvation rather than overdose. Grade B for adult pain and diarrhoea, X for quieting infants.

Expectant and nursing care. Osler (1892) wrote that typhoid "is not a disease to be treated by medicines", and that nursing and diet were the essentials. He cited Hare's Brisbane figures: expectant care 1,838 cases at 14.8% mortality, incomplete cold baths 171 at 12.3%, strict Brand baths 797 at 7%. Osler called the bath at 70°F (21°C) for 15 to 20 minutes "barbarous" and preferred lukewarm baths. Modern evidence is weaker: tepid sponging lowers temperature a little and causes shivering, and NICE does not recommend it for children (Meremikwu and Oyo-Ita, summary only). Better nursing, not cold water, may have done the work.

Fractures, dislocations, abscesses, teeth. A 2023 meta-analysis of 9 studies and 987 patients found sedation-free reduction of an anterior shoulder dislocation succeeded in about 80% of cases, with external-rotation series reporting about 88% to 91% (Shoulder reduction review 2023, abstract only). No outcome series was found for abscess drainage, bone-setting or tooth extraction in this period [VERIFY in TR-13].

1.7 Cholera, homeopathy and the lesson of doing less

In London in 1854 the London Homoeopathic Hospital reported that about 16.4% of its cholera patients died, against 51.9% of patients treated in London's other hospitals. The Medical Council of the General Board of Health left the homeopathic returns out of its 1855 report (Dean 2016, read in summary). Homeopathic remedies are diluted past the point where any molecule remains. Grade X as a drug. Patients may simply have been less sick, or better nursed, but the most likely lesson is that heroic treatment, bleeding and purging in cholera, was actively killing patients that rest, warmth and drink would have spared. A sugar pill beat the faculty because the faculty was doing harm.

The one cholera remedy of the era that worked was ignored. Thomas Latta in Leith in 1832 injected salt water into the veins of dying cholera patients and reported revivals in the Lancet on 2 June 1832. Accounts differ on numbers, from 5 patients to 8 survivors of 16 (Wikipedia. British Online Archives, read in summary). Latta died in 1833 and the method lapsed for decades. The 1850 physician thus had the right idea, replacing lost fluid, and abandoned it, while keeping the wrong one, removing more.

1.8 Therapeutic nihilism and the turn

The turn away from heroic medicine came from several places at once. Louis's pupils carried the numerical method to Boston. Jacob Bigelow told the Massachusetts Medical Society on 27 May 1835 that some diseases are "self-limited", running a fixed course that treatment cannot shorten. He said the physician should be "the minister and servant of nature", relieving pain, promoting sleep, guarding diet and telling the truth about prognosis, and warned that "a charm is popularly attached" to bold practice (Bigelow 1835, read in full summary). Holmes in 1860 proposed that every medicine, being a noxious agent, "should always be presumed to be hurtful" until shown otherwise (Holmes 1860, read in full text). That sentence is the most useful thing in this report.

In Vienna, Dietl's trial and the diagnostic school of Joseph Škoda earned the label "therapeutic nihilism". Škoda was not a nihilist in practice. He used digitalis and aspirated pleural and pericardial fluid, and with Franz Schuh made the first known pericardial aspiration in 1840 (Hektoen 2021, summary). The label meant that the Viennese diagnosed carefully and then refused to give drugs they could not show worked. Osler in 1892 is the end point: a textbook that treats most diseases by nursing, diet and a few specifics (Osler 1892). A 2009 comparative study called him a "medicinal nihilist" rather than a therapeutic one, because he trusted nursing and general measures while distrusting drugs (summary).

The Harvard physiologist Lawrence Henderson is said to have remarked that some time between 1900 and 1912, a random patient seeing a random physician first had a better than even chance of benefiting. No primary source for the remark has been found, and the dates given vary (Bynum 2011, read in summary). It should be quoted only as attributed.

1.9 The physician of 1900 and of 1935

By 1900 the physician had anaesthesia, antisepsis and asepsis, the germ theory, diphtheria antitoxin and a few laboratory tests. Émile Roux at the Hôpital des Enfants-Malades in Paris in 1894 reported diphtheria mortality of 24% among 448 children given antitoxin, against 51% among 3,971 children in 1890 to 1893 and 60% among 520 children at the Trousseau Hospital, which did not use it. Johannes Fibiger in Copenhagen in 1896 to 1897 gave serum on alternate days and confirmed the benefit in a controlled comparison of 484 patients (James Lind Library, summaries). Salvarsan for syphilis came in 1910 and insulin in January 1922 (Science History Institute. James Lind Library. Ohio State Origins, summaries). Yet maternal mortality was no better in 1934 than in 1867, pneumonia still killed one hospital patient in four or five, and surgery's gains were mainly in what could be attempted. The real break was 1935 to 1936, when Gerhard Domagk published on Prontosil (February 1935) and Colebrook began using it in puerperal fever at Queen Charlotte's in January 1936 (Shaikh 2017. Chamberlain 2006). The physician of 1935 had the same

hands and much the same drugs as the physician of 1900 until the sulfonamides arrived. After the Fall the reader is not a physician of 1935, because the 1935 physician's advantages were all manufactured: antitoxin, serum, salvarsan, insulin, sulfonamides, sterile instruments and electric light.

1.10 The warning: theory, authority and the visible effect

The history teaches three tests that the reader after the Fall must apply to every remedy, including the ones in this book.

1. **A confident theory is not evidence.** Bleeding followed directly from a theory of plethora and inflammation. The theory was coherent, ancient and wrong. Semmelweis's chlorine worked although his "cadaverous particle" theory was incomplete. Results matter, not explanations.
2. **A trusted authority is not evidence.** Rush, Bouillaud and later Osler were the most admired physicians of their countries. Hammond, who was right about calomel, was removed. Semmelweis, who was right about hands, died in an asylum. Virchow, the greatest pathologist of his age, rejected him.
3. **A visible effect is not evidence.** Bleeding softened the pulse and cooled the skin. Calomel salivated. Tartar emetic made the patient sweat and vomit. Each effect was real and each was taken as a cure. The patient who recovered after a self-limited disease was counted as a success of the treatment.

Against all three, the record offers one tool that works at every rung of the ladder: count outcomes in comparable groups, as Louis, Dietl and Holmes did, and presume the remedy harmful until the count says otherwise.

1.11 What the Fall will reinstate, and what must not return

What the Fall will reinstate, because there is no alternative. Opium for pain and the dying. Bark or quinine where malaria exists and supplies remain. Splinting, traction and reduction of fractures and dislocations. Lancing of abscesses. Tooth extraction. Early amputation of a destroyed limb. Delivery by a skilled attendant at home. Diet against scurvy. Expectant nursing of pneumonia, typhoid and the fevers. Ether, if it can be made or found, with all its danger. A physician who works mostly by watching, feeding, cleaning and comforting.

What must not return. Bloodletting for fever, pneumonia or any "inflammation". Mercury in any form taken by mouth. Antimony. Routine purging and vomiting. Opiates to quiet children. Cold-bath regimes forced on unwilling patients. Arm-to-arm or person-to-person transfer of lymph, blood or pus. Moving from a corpse, an abscess or a fever case to a birth without washing and waiting. The big crowded sick-house. And above all, the habit of trusting a remedy because it does something visible.

2. Evidence grades

Practice	Grade	What the tradition said	What the record showed	What modern science infers
Bloodletting in pneumonia and fevers	X	Relieves plethora and inflammation	Louis 44% against 25%, Dietl 20% against 7.4%, Brabin 19.9% against 12.8%, Osler 1 of 12 survived	Removes oxygen-carrying capacity and iron from a sick patient. No benefit
Calomel and mercury by mouth	X	Purges, alters, salivates the system	Mercurial gangrene, Hammond's ban 1863, pink disease to 1954	Mercury is a poison with no therapeutic place here

Practice	Grade	What the tradition said	What the record showed	What modern science infers
Tartar emetic	X	Breaks fever, sedates	Dietl 20.8% mortality, equal to bleeding	Cardiotoxic antimony
Routine purging	X	Clears morbid matter	Not separately counted	Worsens dehydration [VERIFY in FO-02]
Hand cleansing and waiting before births	B	Not part of the tradition until Holmes	First Clinic 18.3% to about 1% to 2%. Pest 0.85%	Removes streptococci and other organisms carried on hands
Expectant care and nursing in pneumonia and typhoid	B	Nature heals self-limited disease	Dietl 7.4%, Bennett 4 of 129, Brand and Hare 7% against 14.8%	Supportive care lets the immune response finish. Cooling regimes doubtful in modern trials
Citrus and fresh food against scurvy	A	Antiscorbutic regimen	Lind 1747, Haslar 1,457 to 2	Vitamin C, 10 mg a day prevents frank scurvy
Smallpox vaccination	B	Prevents smallpox	About 10% against 45% case fatality in London 1871 to 1872	Effective. Disease eradicated 1980
Arm-to-arm transfer of vaccine lymph	X	Convenient chain of vaccination	Rivalta 1861, 46 of 63 infected with syphilis	Transfers blood-borne infection
Quinine or cinchona bark for malaria	B	Specific for intermittent fever	Maillot, Baikie 1854	Effective antimalarial, causes cinchonism and haemolysis
Digitalis for dropsy	B	Diuretic for dropsy	Withering 163 cases	Effective in some heart failure, narrow margin
Ipecacuanha for dysentery	C to D	Specific for flux	Docker 18% to 2% (one secondary source)	Emetine kills amoebae but is toxic
Opium for pain, cough, diarrhoea, dying	B	Holmes's first exception	Universal clinical use	Effective opioid, respiratory depression, addiction
Opiate syrups for infants	X	Quiets the child	Infant deaths and starvation, three-quarters of opium deaths in under-fives (Bull 1854 estimate)	Infants are highly sensitive to opioids

Practice	Grade	What the tradition said	What the record showed	What modern science infers
Shoulder and joint reduction	A	Manual art	Practised successfully for centuries	About 80% success without sedation in a 2023 meta-analysis
Early amputation of a destroyed limb	B	Save life, lose limb	Primary 38% against secondary 73% mortality in Confederate thigh amputations	Removes dead tissue before sepsis
Ether anaesthesia	B	Abolishes pain	Fewer deaths than chloroform, about seven-fold at St Bartholomew's	Safer volatile agent, flammable
Chloroform anaesthesia by lay hands	X	Gentler than ether	1 death in about 1,300 to 2,500	Causes sudden cardiac arrest
Lister's carbolic antisepsis	B	Kills germs in wounds	45% to 15% amputation mortality (selected)	Cleanliness itself does much of the work, carbolic is caustic
Caesarean section before 1880	X except as last resort for the child	Saves child	60% to 80% maternal death	Needs asepsis and uterine suture
Intravenous saline for cholera	B historically weak	Replaces lost fluid	Latta 1832, small series	Correct principle, needs sterile fluid and equipment
Homeopathic remedies	X	Like cures like	16.4% against 51.9% in 1854, explained by avoided harm	No pharmacological action

3. Means ledger

The ledger asks what each rung of means adds. The general finding is that the first rungs carry most of the benefit of 1850 practice, because most of that benefit was cleanliness, food, nursing and manual skill. Higher rungs add the few true specifics, safer anaesthesia and the ability to keep records and compare.

Practice	Hands and knowledge	Hearth	Garden and still	Village dispensary	District infirmary	Hospital before the Fall
Not bleeding, not purging	The whole benefit lies in refusing	Same	Same	Same	Same	Same

Practice	Hands and knowledge	Hearth	Garden and still	Village dispensary	District infirmary	Hospital before the Fall
Hand cleansing before birth	Rules on corpses, pus and waiting	Soap, boiled water, clean cloth	Home-made soap, ethanol, lime	Chlorine solution made to strength, register of births	Separate rooms for fever and birth	Gloves, antibiotics
Nursing of fever and pneumonia	Position, watching, honesty	Fluids, food, warmth, sponging for comfort	Willow or other febrifuge [see other chapters]	Thermometer, records, a lay nurse	Ten beds, night watch, oxygen if any	Antibiotics, oxygen, ventilation
Scurvy prevention	Knowing which foods	Fresh greens, potatoes, sprouted grain	Citrus or rosehip stores, kitchen garden	Stock list and winter plan	Same	Vitamin C tablets
Pain relief	Splint, rest, presence	Warmth, alcohol in small amounts	Opium poppy, tincture by weight	Measured tincture, register of doses	Morphine if salvaged	Full range of analgesia
Fracture and dislocation	Reduction techniques, traction	Splints from wood and cloth	Plaster, padding	Trained hands, simple traction frames	Sterile room for open fractures	Imaging, internal fixation
Abscess drainage	Recognising fluctuance	Clean knife boiled, hot compresses	Ethanol for skin	Instruments, dressings	Sterile room	Antibiotics, ultrasound
Amputation	None safely	None	None	Emergency only, for a dead limb	Ether, ligatures, sterile room	Full surgery and prosthetics
Malaria treatment	Recognising pattern	Nets, drainage	Cinchona bark if grown (tropical highlands only)	Quinine if salvaged, dose by weight	Microscope for blood films	Artemisinin combinations
Records and comparison	Memory	A notebook	A notebook	Register of treatments and outcomes	Comparisons between treatments, a monthly count	Trials, audits

What each rung changes, in short. Hands and knowledge alone already remove the heroic remedies, which in pneumonia moved mortality from about 20% to about 7% to 12% in the historical series. The hearth adds clean water, soap and fluids, which carry the Semmelweis and Holmes benefit to childbirth. The garden and still add opium, ethanol and perhaps a stock of antiscorbutic food. The village dispensary adds the register, which is the Louis method and the

most important single tool against repeating 1850's errors. The district infirmary adds a clean room and safer anaesthesia, which make amputation and drainage survivable more often. The hospital before the Fall adds antibiotics, which the record shows were the decisive break in maternal and pneumonia mortality.

4. Harm test

Bloodletting. It kills by removing blood a sick patient needs. Signs: faintness, a fast thin pulse, pallor, confusion, air hunger. Stop, lay flat, give fluids by mouth. Nobody is bled for fever, pneumonia or "inflammation". Cases: Washington 1799, Rush's patients 1793, Louis's early-bled group.

Mercury and antimony. They poison gut, kidneys, nerves and heart. Signs: salivation, loose teeth, ulcerated gums, tremor, painful pink hands and feet in babies (mercury), violent vomiting, collapse and an irregular pulse (antimony). Nobody receives them. Salvaged calomel, "blue pill" or tartar emetic is locked away for disposal. Cases: the Union Army before May 1863, mercurial gangrene in children, pink disease until 1954.

Purging and vomiting. They kill by dehydration, fastest in infants, the old and the already sick. Signs: dry mouth, sunken eyes, little dark urine, a weak fast pulse. Stop and rehydrate (FO-01, FO-02).

Dirty hands at a birth. They kill by childbed fever in the days after delivery. Signs: fever, rigors, a tender womb, foul discharge, a rising pulse. The error is going from a corpse, a wound, an abscess or a fever case to a birth without washing, changing and waiting. Cases: Vienna's First Clinic, Holmes's series.

Opium. It kills by stopping breathing, at far lower doses in infants and the old, and drugged babies starve. Strength of home tinctures varies: historical equivalents ranged from 13 to 30 drops per grain, and modern standard tincture holds 10 mg of morphine per mL (Epocrates, summary only). Signs: pinpoint pupils, slow shallow breathing, blue lips, unrousable sleep. Wake, keep the airway open, breathe for the patient if needed. Never for infants [VERIFY doses in the pain chapter].

Quinine. Cinchona species (C. officinalis, C. pubescens and others), bark. Harms: cinchonism (ringing ears, deafness, nausea, blurred sight) and blackwater fever, a sudden destruction of red cells with black urine, linked to irregular quinine use (Blackwater fever sources, summary only). Black urine means stop. Bark alkaloid content varies between trees [VERIFY], so bark cannot be dosed without assay.

Digitalis. Digitalis purpurea, dried leaf. Harms: slow pulse, vomiting, yellow-green vision, fatal heart rhythms. Narrow margin, and the dried leaf is about five times the fresh (Withering). Not dispensed without the cardiac chapter's rules.

Ipecacuanha. Carapichea ipecacuanha, root. Harms: vomiting, and with prolonged emetine use, heart muscle damage.

Anaesthesia. Chloroform kills suddenly at induction, even in the young and healthy, as Hannah Greener's death showed. Ether is safer but flammable, and the unconscious may vomit and choke. No anaesthetic in a village without trained hands for an operation that can wait.

Surgery and amputation. They kill by bleeding, shock and wound sepsis. Late amputation killed about twice as many as early. Crowding raised amputation mortality from about 11% to 41% in Simpson's survey.

Transfer between people. Lymph, blood or pus moved from one person to another can carry syphilis, hepatitis or HIV. Rivalta is the warning.

Cold baths. Forced cold immersion causes shivering, distress and collapse in the frail. Lukewarm sponging for comfort is the most that should be done.

5. Red flags

These are the signs, in the conditions this document covers, that mean a patient will die or be disabled without what the village cannot give.

1. **After childbirth:** fever with rigors, a tender womb and a rising pulse above about 120, especially if the woman becomes confused or her skin mottles. In 1850 and in 1935 alike this was puerperal sepsis, which killed until 1936. Without antibiotics, nothing reliable can be done.
2. **Pneumonia in someone over 60, or with a pulse above about 120, breathing above about 30 a minute, blue lips or confusion.** Osler's tables show mortality of 47% to 65% in the fifth to seventh decades in hospital without antibiotics. Nursing helps. Bleeding never helps.
3. **An open fracture of the thigh,** or any limb that has gone cold, black, foul or crackling under the skin. Historical mortality without amputation was up to 80%.
4. **A woman in obstructed labour for more than a day, or bleeding heavily after birth.** The 1850 caesarean killed 60% to 80% of mothers. The child may be lost to save the mother [see the obstetric chapters].
5. **Black urine in a patient on quinine.** Blackwater fever.
6. **A patient who stops passing urine, or is too weak to drink, in cholera or dysentery.**
7. **Any sign that a "remedy" is working by visible violence:** salivation, purging, vomiting, blistering. The violence is the harm.

What to do anyway. Stop every harmful treatment. Keep the patient warm, clean and dry. Give fluids by mouth or by spoon as long as the patient can swallow. Relieve pain and breathlessness with opium in measured doses if it is available, accepting that comfort near death may shorten life slightly. Tell the truth gently to the patient and family, as Bigelow advised in 1835. Record what happened, so the next case is judged on a count and not on a memory. Honest comfort means saying that this illness can be fatal, that everything that helps is being done, and that the patient will not be left alone.

6. The case against

Against this report's reading of the heroic era. Wootton's Bad Medicine (2006) argues that before Lister in 1865 medicine did more harm than good. Steven Shapin in the London Review of Books (30 November 2006) answered that the book judges the past by the present, and that a "history of error" needs a theory of progress that Wootton does not supply (Shapin 2006, excerpts only). Jeffrey Brosco argued that Wootton gives no credit to bone-setting, abscess drainage and wound care, which plainly helped (Brosco, Bulletin of the History of Medicine, excerpt only). The Nature review called his blanket condemnation of historians unsupported (Nature 2006, summary). This report agrees with the critics on one point. The 1850 physician did real good with his hands, his opium and his specifics. The harm was concentrated in internal medicine, where theory drove action.

Against the numbers. Every series here is a physician's or a hospital's, with selection, loose diagnosis and interested authors. Louis's comparison was confounded by age and his own p value was 0.07. Dietl may have sent milder cases to expectant care. Lister chose his years. Simpson's country figures were challenged. The homeopathic hospital's patients may have been less sick. Semmelweis's figures come here through a secondary source. None of this rescues bleeding, because the direction of every series agrees, but no single figure should be carried as exact.

Against Rosenberg's and Warner's framing. Some historians of medicine hold that judging nineteenth-century remedies by modern efficacy misses what they meant to patients, and that the heroic remedies had real social and psychological value. That may be true. It does not help a patient bled to death.

Against the romance of the herbal. The 1850 physician's plant drugs, foxglove, opium, bark and ipecacuanha, were all powerful poisons with narrow margins. Digitalis and opium killed when doses were guessed. Old does not mean safe.

Against the romance of the hospital. The big hospital of 1860 killed by crowding: 41% against 11% for amputations, 11.4% against 2.8% for births in Vienna, and the Scutari Barrack Hospital in the Crimean winter of 1854 to 1855, where 1,151 men were buried in February 1855 alone and the hut hospital at Renkioi had less than a tenth of Scutari's death rate (Scutari burial roll and comparisons, read in summary). Hugh Small argues that Florence Nightingale herself did not at first see that sanitation was killing her patients, while Lynn McDonald calls such criticisms preposterous (HNN and reviews, read in summary). Modern does not mean replaceable, but a crowded sick-house without asepsis is worse than nursing at home.

Against the book's own rule. Presuming every remedy harmful could lead a village to withhold things that work, such as opium for pain or quinine for malaria. The answer is the register. Presumption of harm is the starting point, and counted results move it.

7. Ten-line summary of robust findings

1. Bloodletting in pneumonia was associated with higher mortality in every comparison found: Louis 1835, Dietl 1849, Bennett 1865, Brabin's pooled 19.9% against 12.8%.
2. Diet, rest and nursing alone gave pneumonia mortality of about 7% in Dietl's series against about 20% with bleeding or antimony.
3. Mercury and antimony poisoned patients for more than a century, and calomel teething powders were only withdrawn in 1953 to 1954.
4. Hand-washing with chlorinated lime cut Vienna's First Clinic maternal mortality from 18.3% in April 1847 to about 1% to 2% within months.
5. Holmes in 1843 derived working rules against childbed fever from case counts alone, without germ theory.
6. Maternal mortality in England and Wales stayed near 4 to 5 per 1,000 from 1850 until sulfonamides arrived in 1936.
7. Large hospitals before asepsis killed surgical patients at several times the rate of country practice (41% against 11% for amputations in Simpson's survey).
8. The 1850 physician's real assets were opium, quinine, citrus against scurvy, vaccination, digitalis used with care, manual reduction and splinting, and expectant nursing.
9. The profession abandoned heroic remedies slowly and against its leaders, through counting (Louis, Dietl, Bigelow, Holmes), not through a new theory.
10. A confident theory, a trusted authority and a visible effect each misled good physicians, and only counted outcomes in comparable groups corrected them.

8. Contested and open questions

- How many deaths did heroic therapy cause in total? No population estimate exists, and case series cannot supply one.
- Did Rush's methods raise Philadelphia's death rate in 1793? Cobbett said so, and no reanalysis of the bills of mortality was found.
- Was Washington's death caused or only hastened by his treatment?
- How much of Semmelweis's and Lister's success was due to their specific agents (chlorine, carbolic) and how much to general cleanliness and less crowding? Tait's dilution results suggest much of it was cleanliness.
- Did the cold-bath treatment of typhoid lower mortality, or did the better-nursed patients in those wards survive for other reasons?
- What were the true outcomes of 1850 abscess drainage, tooth extraction and bone-setting? No series was found.
- Docker's ipecacuanha figures and Maillot's quinine figures need their primary sources.
- Did Osler's 1892 recommendation to bleed survive into later editions, and in what form?

- When, if ever, did the "random patient" first benefit on balance from a physician? Henderson's remark is unsourced.

9. Sources to read in full

1. Osler (1892), the chapters on pneumonia and typhoid: what nursing could do and what a great physician still believed.
2. Holmes (1843), the model for deriving rules from counted cases.
3. Holmes (1860), "Currents and Counter-Currents", for the presumption of harm.
4. Bigelow (1835), on self-limited diseases.
5. Morabia (2004), on Louis and bloodletting.
6. Semmelweis (1861), The Etiology, Concept and Prophylaxis of Childbed Fever, in K. Codell Carter's translation [not read for this report].
7. Tröhler (2014), on the Lister statistics.
8. Loudon (1992), Death in Childbirth [not read in full].
9. Rosenberg (1977) and Warner (1986) [neither read in full].
10. Wootton (2006), Bad Medicine, read alongside Shapin's review.

At the bedside after the Fall

The household. The minimum viable version is a set of refusals and a few habits. Do not bleed, purge, vomit or blister anyone. Do not give mercury, antimony or opium to children. Keep the sick warm, clean and drinking. Wash hands with soap and water before touching a wound or a birth, and never go from a corpse, a boil or a fever case to a birth without washing, changing and waiting a day. Eat fresh greens or potatoes through the winter. To start, the household needs soap, a clean pot for boiling water, clean cloth, a notebook and this chapter. The first failure to expect is a family member demanding that "something be done" for a fever, and someone reaching for a violent remedy because it looks like action.

The village of 300. The minimum is one trained lay healer and one birth attendant who follow the Holmes rules, a register of every birth, illness, treatment and outcome, and a small dispensary. Its stock: opium tincture of known strength with a measured dropper or graduated spoon, any salvaged quinine and digitalis under lock, soap, chlorine solution or the means to make it, clean cloth and splints. Plants: Papaver somniferum for pain (latex of the unripe capsule), a winter supply of vitamin C foods, and no foxglove in the dispensary unless the cardiac chapter's rules are met. Skills: reduction of dislocations, splinting, abscess drainage, measuring and recording. The first failure to expect is the register lapsing within months. Without it the village will remember the cures and forget the deaths, exactly as the physicians of 1850 did.

The district of 3,000. The minimum is a ten-bed infirmary with separate rooms for fevers, wounds and births, never mixed, and a nurse or doctor who reviews the registers of the villages each month. It needs a clean room for drainage and emergency amputation, ether if it can be made or salvaged, ligatures, boiled instruments, a microscope for malaria films where malaria exists, and the habit of comparing treatments in groups. The first failure to expect is crowding. When an epidemic or a battle fills the beds, the infirmary will become Scutari or the Vienna First Clinic, killing patients who would have lived at home. Plan to send people home or to separate huts before that happens.

Protocols

Protocol 1. The rule of presumed harm (every remedy, every rung)

1. Before giving any remedy, write down what it is, the dose, the patient's age and weight, the illness, and the date.
2. Ask: is this illness self-limited? Colds, most fevers, measles, chickenpox and most pneumonias in young adults end by themselves. If yes, nurse and do not dose, unless the dose relieves suffering.

3. Ask: does this remedy work by doing something violent (vomiting, purging, sweating, salivating, bleeding, blistering)? If yes, do not give it.
4. Ask: what is the evidence grade in this book? Give grade A and B remedies. Give C remedies only for symptom relief and with a record. Do not give D or X.
5. After the illness ends, write down the outcome: recovered, recovered with harm, died, and the date.
6. Each month, count outcomes by remedy. If a remedy's group does no better than the untreated group, stop using it.
7. Tolerance: a count of fewer than 20 patients per group tells you little. Keep counting.

Protocol 2. Clean hands at a birth (the Holmes and Semmelweis rules)

1. For 24 hours before attending a birth, do not touch a corpse, a pus-filled wound or a person with fever after childbirth. If you must, then do steps 2 to 4 and still wait 24 hours if any other attendant can go.
2. Remove rings. Cut nails short.
3. Wash hands and forearms to the elbow with soap and clean water for at least one minute, scrubbing under nails.
4. If chlorine is available, then rinse hands in 0.05% chlorine solution, the strength MSF uses for hand-washing in cholera centres (MSF guideline). From household bleach of 5% strength, this is about 10 mL of bleach in 1 litre of clean water [VERIFY: this is arithmetic, check the bleach label, and make fresh daily]. Do not use stronger solution on skin.
5. Wear clean clothes or a clean apron kept only for births.
6. Make as few internal examinations as possible. Each one is a chance to carry infection.
7. If a woman you delivered develops fever, rigors and a tender womb in the days after birth, then stop attending other births for at least some weeks, as Holmes advised, and hand them to another attendant.
8. If two such cases occur close together under the same attendant, that attendant stops all birth work for at least one month and every cloth, apron and instrument is boiled or replaced.
9. If three cases follow one attendant, treat it as proof that the attendant is carrying the disease.
10. Record every birth and every fever in the register.

Protocol 3. Nursing pneumonia and fever without heroic remedies

1. Do not bleed, purge, vomit or blister. Do not give antimony or mercury in any form.
2. Put the patient in a warm, aired room, propped up if breathless.
3. Give fluids often: small cups every hour while awake, aiming for pale urine. Adults usually need at least 2 litres a day in fever [VERIFY in FO-02 and the fever chapter].
4. Give food as tolerated: broth, porridge, milk, eggs. Bennett treated pneumonia with food and Osler with diet and nursing.
5. If the patient is very hot and distressed, then sponge with lukewarm water, limb by limb, for comfort. Stop if shivering starts. Do not force cold baths.
6. Relieve chest pain with warmth. If opium tincture of known strength is available, then follow the dosing table in the pain chapter, and never give it to infants.
7. Count breathing and pulse morning and evening and record them. Rising breathing above about 30 a minute, a pulse above about 120, blue lips or confusion are red flags.
8. Expect the crisis between the 5th and 10th days in lobar pneumonia, as Osler described (sometimes as early as the 3rd and as late as the 12th).
9. Record the outcome.

Protocol 4. Anterior shoulder dislocation by external rotation (no sedation)

1. Confirm the injury: the shoulder looks square, the patient holds the arm out from the body and cannot touch the opposite shoulder. Check feeling over the outer upper arm and the pulse at the wrist, and record both.
2. Seat or lay the patient comfortably. Explain each step. Relaxation is the key.
3. Hold the elbow bent at 90 degrees, tucked against the patient's side.
4. Very slowly rotate the forearm outwards, like opening a door, taking 5 to 10 minutes. Stop each time the patient feels pain, wait for the muscles to relax, then continue.
5. The shoulder often slips back with a clunk before the forearm points straight out to the side. If it does not, gently raise the arm forward and upward while keeping it rotated.
6. After reduction, check feeling and the pulse again and record them. Bind the arm to the chest in a sling for about 1 to 3 weeks [VERIFY duration in TR-13].
7. Tolerance: if two careful attempts fail, do not force it. Seek the district infirmary. Reported success is about 80% to 91% without sedation (2023 meta-analysis and series).
8. Never use force against strong muscle spasm in an old person, where bones break easily.

Protocol 5. Scurvy prevention for the household and village

1. Every person needs vitamin C every day. 10 mg a day prevents frank scurvy (Sorby experiment). Aim higher, around 45 to 95 mg, for wound healing and safety margin (WHO figure and Hujoel reanalysis).
2. Sources after the Fall: fresh green leaves, cabbage and other brassicas, potatoes, rose hips, berries, citrus where it grows, sprouted grain or pulses [VERIFY content per portion in the nutrition book].
3. Long cooking destroys vitamin C. Eat some fresh or lightly cooked food every day.
4. In late winter, check gums. Bleeding, swollen gums, easy bruising, reopening of old scars and leg pains are early signs.
5. If signs appear, give fresh vitamin C food daily at once. Improvement in days, as in Lind's citrus pair, confirms the diagnosis.

Protocol 6. Remedies to forbid and remove from any stock

1. Search salvaged medicine stores for these and set them aside under lock for safe disposal: calomel (mercurous chloride), mercury pills or "blue mass", any mercury compound for internal use, tartar emetic (antimony potassium tartrate), chloroform for anaesthesia, and any opiate syrup sold for babies or teething.
2. Do not dispense home-made foxglove preparations without the cardiac chapter's training.
3. Do not bleed anyone, by lancet, leech or cupping, for any illness.
4. Do not transfer lymph, blood or pus from one person to another.
5. Record what was removed and why.

Numbers to carry

1. **About 7% against 20%:** pneumonia deaths with diet and rest against bleeding or antimony (Dietl, Vienna 1849).
2. **18.3% to 1% to 2%:** childbed fever deaths in Vienna's First Clinic before and after hand-washing in 1847.
3. **24 hours:** the minimum wait, after washing and changing clothes, between a corpse or septic case and a birth (Holmes 1843).
4. **4 to 5 per 1,000:** maternal deaths per birth in England from 1850 to 1935, the baseline a village without antibiotics should expect.
5. **20% to 40%:** hospital pneumonia mortality without antibiotics, rising to about 50% to 65% over age 50 (Osler 1892).

6. **41% against 11%:** amputation deaths in large hospitals against country practice before asepsis (Simpson 1869). Crowding kills.
7. **10 mg:** daily vitamin C that prevents scurvy.
8. **1 in 12:** Osler's late-bled pneumonia patients who survived. A visible effect is not a cure.
9. **0.05%:** chlorine strength for hand-washing, about 10 mL of 5% bleach per litre [VERIFY against the bleach label].

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