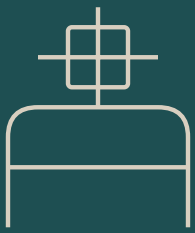
Industries of India

The Hospital

Source Companion



Ketineni Ramarao

The Hospital: Source Companion

The reading behind Shelter, Science, System

Ketineni Ramarao

How to use this companion

Every superscript reference number in The Hospital resolves here. Numbers 1-26 are historical sources (H), 27-39 are contemporary and statistical sources (C), and 40-48 are strain and society sources (S); each entry also keeps its letter code for cross-checking. Each entry says what was read, which claims in the book it supports, with the final chapter numbering, the limitations a careful reader should keep in mind, and the source itself. Historical dates and statistics are quoted with the source's own year, because an estimate is only as good as its vintage: a 2019 death toll is a 2019 death toll, not a current one. Where a figure rests on modelling or extrapolation, the entry says so. Sources were consulted in 2026; web pages change, and a link that moved can usually be recovered by searching its title.

Historical sources

1 - H1 - History of hospitals (encyclopaedia survey)

Read: The full survey article on the history of hospitals, used as the chronological spine for Parts I and II: King Pandukabhaya's hospitals in the Mahavamsa, the excavated ninth-century hospital at Mihintale, Buddhist monastic infirmaries and the story of the Buddha washing the sick monk, Fa Xian's fifth-century account of Indian hospitals, Roman valetudinaria, the Basilias of Caesarea, Bishop Masona's xenodochium at Merida, Byzantine hospitals, bimaristan departments and staffing, Qalawun's Mansuri hospital, St Leonard's York, the Holy Spirit hospitals, and Rahere's founding of St Bartholomew's in 1123.

Supports: The chronological spine of Chapters 1-6 (Mihintale, monastic infirmaries, valetudinaria, the Basilias, xenodochia, Byzantine hospitals, the bimaristan departments, the Hotel-Dieu family, St Bartholomew's), plus Chapter 8's American foundations and Chapter 9's Vienna General Hospital.

Limitations: A tertiary survey: individual claims rest on the cited scholarship, and some (such as the number of Roman valetudinaria) are contested, as the article itself notes.

Source: Wikipedia, "History of hospitals", en.wikipedia.org/wiki/History_of_hospitals (consulted 2026).

2 - H2 - Wujastyk on hospitals in ancient India

Read: Dominik Wujastyk's paper reviewing the textual and epigraphic evidence for hospitals in pre-modern South Asia.

Supports: Chapter 2's Ashoka judgement and the Baghdad transmission, and Chapter 5's note of Indian influence on the early bimaristans.

Limitations: A specialist argument from sparse sources; negative conclusions ("no evidence of hospital buildings") are about evidence, not certainty of absence.

Source: D. Wujastyk, History of Science in South Asia (hssa-journal), via journal web publication (consulted 2026).

3 - H3 - UNESCO, Sanctuary of Asklepios at Epidaurus

Read: The World Heritage listing for Epidaurus, describing the sanctuary's temples and hospital buildings and its development from the sixth century BCE.

Supports: Chapter 1's account of the Asklepios cult at Epidaurus.

Limitations: A heritage citation, not a medical history; the detail of incubation practice comes from the wider classical record summarised in H1.

Source: UNESCO World Heritage Centre, whc.unesco.org, Sanctuary of Asklepios at Epidaurus (consulted 2026).

4 - H4 - Sayili on the bimaristans

Read: Aydin Sayili's essay on the emergence of the modern hospital in medieval Islamic society.

Supports: Chapter 5's account of the bimaristans as hospitals in the modern sense, the Mansuri hospital, and the aside on bedside clinical teaching.

Limitations: A scholar's interpretive essay; "modern sense" is a historiographical judgement other historians qualify.

Source: A. Sayili, Belleten (Turkish Historical Society journal) (consulted 2026).

5 - H5 - Pennsylvania Hospital history

Read: Penn Medicine's account of the founding of the Pennsylvania Hospital (1751) by Benjamin Franklin and Thomas Bond.

Supports: Chapter 8's account of the Pennsylvania Hospital's founding.

Limitations: An institutional history published by the successor institution; founding stories flatter founders.

Source: Penn Medicine, pennmedicine.org, Pennsylvania Hospital history pages (consulted 2026).

6 - H6 - Guy's and the voluntary hospital movement

Read: The peer-reviewed history of Guy's Hospital and the voluntary hospital movement: the foundation wave, Thomas Guy's Bible fortune and South Sea Bubble gains, the mixed motives of subscribers, and Guy's opening for the patients St Thomas's discharged as incurable.

Supports: Chapter 8's foundation wave (Westminster 1719, Guy's 1721, St George's 1732, Royal London 1740, Middlesex 1745), Thomas Guy's South Sea fortune, and the mixed motives of the voluntary movement.

Limitations: Dates for the other London foundations are standard reference dates, cross-checked against H1; founding stories flatter founders.

Source: PubMed Central, PMC3072263, history of Guy's Hospital (consulted 2026).

7 - H7 - Historic England, hospitals and the dissolution

Read: Historic England's listing and research material on Tudor-era hospitals and the effect of the dissolution of the monasteries.

Supports: Chapter 7's dissolution figures and the civic re-foundings.

Limitations: Heritage-record prose; counts of closed houses vary by definition.

Source: Historic England, historicengland.org.uk (consulted 2026).

8 - H8 - Hotel-Dieu de Paris

Read: The reference survey of the Hotel-Dieu's history: foundation attributed to Saint Landry in 651, documentary record from 829, mixed charitable role, narrowing to the sick in the sixteenth century, and the 1605 founding of the Hopital Saint-Louis.

Supports: Chapter 6's account of the Hotel-Dieu.

Limitations: A tertiary survey; the 651 foundation is traditional, the 829 record documentary.

Source: Wikipedia, "Hotel-Dieu, Paris" (consulted 2026).

9 - H9 - The Ether Dome, 1846

Read: Massachusetts General Hospital's account of the first public demonstration of ether anaesthesia on 16 October 1846.

Supports: Chapter 10's Ether Dome narrative.

Limitations: Institutional commemoration; the priority disputes among Morton, Jackson, Wells and Long are noted in the book with that caution.

Source: Massachusetts General Hospital, massgeneral.org (consulted 2026).

10 - H10 - Semmelweis and childbed fever

Read: The peer-reviewed biographical and statistical review of Semmelweis's Vienna work.

Supports: Chapter 11's Semmelweis account: the two clinics, the May 1847 chlorine mandate, the relapse after 1850, and the modern re-analysis.

Limitations: Semmelweis's own statistics were compiled retrospectively; modern reviewers accept the direction of the effect while noting the data's rough edges.

Source: PubMed Central, PMC2870773 (consulted 2026).

11 - H11 - The Paris school of hospital medicine

Read: The Science Museum Group's account of the Paris clinical school and the birth of hospital medicine.

Supports: Chapter 9's account of the Paris school: systematic bedside examination, pathological anatomy, Laennec's stethoscope, and the school's precursors.

Limitations: Museum interpretation; the "first" is a historians' label, used in the book as such.

Source: Science Museum Group collection stories, sciencemuseumgroup.org.uk (consulted 2026).

12 - H12 - Nightingale at Scutari

Read: The National Army Museum's account of Florence Nightingale, the Barrack Hospital at Scutari, and the resistance of the army surgeons until Inkerman.

Supports: Chapter 12's Scutari narrative and Nightingale's statistical conversion.

Limitations: The Nightingale legend is larger than the record; the book notes her own statistics were contested even at the time.

Source: National Army Museum, nam.ac.uk (consulted 2026).

13 - H13 - The founding of Johns Hopkins Hospital

Read: Johns Hopkins Medicine's institutional history: the merchant's bequest, the thirteen-year delay, the Big Four recruitment.

Supports: Chapter 15's account of the Hopkins founding, the Big Four and the residency model.

Limitations: Institutional self-history; the "Big Four" framing is the institution's own tradition.

Source: Johns Hopkins Medicine, hopkinsmedicine.org (consulted 2026).

14 - H14 - Ether and chloroform: the first century

Read: The Countway Library's historical review of early anaesthesia practice.

Supports: Chapter 10's account of ether and chloroform spreading across the Atlantic world by 1847.

Limitations: A library exhibition essay; practice details are representative, not exhaustive.

Source: Countway Library, Harvard Medical School, collections.countway.harvard.edu (consulted 2026).

15 - H15 - Copenhagen 1952 and the birth of intensive care

Read: The University of Florida's historical account of the 1952 Copenhagen polio epidemic: casualties at Blegdam Hospital, Bjorn Ibsen's proposal of positive-pressure ventilation by hand, and the medical students who squeezed the bags.

Supports: Chapter 17's account of Copenhagen 1952 and the birth of intensive care.

Limitations: A teaching-history summary; exact case and mortality figures vary between retellings and are used here qualitatively.

Source: University of Florida, anesthesiology history pages, ufl.edu (consulted 2026).

16 - H16 - Hounsfield and the EMI scanner

Read: The Science Museum Group's account of Godfrey Hounsfield at EMI's Central Research Laboratory.

Supports: Chapter 19's account of Hounsfield and the EMI scanner's conception.

Limitations: Museum narrative; EMI's commercial story is told elsewhere.

Source: Science Museum Group, sciencemuseumgroup.org.uk (consulted 2026).

17 - H17 - The 2003 Nobel Prize for MRI

Read: The Nobel Prize materials for Lauterbur and Mansfield, including the background on Bloch and Purcell's 1952 prize for nuclear magnetic resonance and Damadian's tissue-signal observations.

Supports: Chapter 19's MRI narrative and the 2003 Nobel Prize.

Limitations: Prize citations compress priority disputes; Damadian's exclusion remains contested, as the book notes.

Source: Nobel Prize, nobelprize.org, Prize in Physiology or Medicine 2003 (consulted 2026).

18 - H18 - Landsteiner and blood transfusion

Read: The AABB's history of transfusion: Landsteiner's first three blood groups (1900), the fourth group (1902), citrate anticoagulation from 1914, and the Rous-Turner storage solution.

Supports: Chapter 16's transfusion narrative: blood groups, anticoagulation, storage and blood banking.

Limitations: A professional association's commemorative history; dates for early experiments vary slightly between sources.

Source: AABB, aabb.org (consulted 2026).

19 - H19 - The first transplants

Read: The Organ Procurement and Transplantation Network's historical timeline: Murray's 1954 identical-twin kidney transplant at the Peter Bent Brigham Hospital and Starzl's first successful liver transplant.

Supports: Chapter 18's transplant narrative: the 1954 kidney, the 1967 heart and liver, and cyclosporine.

Limitations: A registry timeline; "first successful" depends on definitions of success and survival.

Source: OPTN, optn.transplant.hrsa.gov (consulted 2026).

20 - H20 - Kolff and the artificial kidney

Read: The Edinburgh Renal Unit's history pages on Willem Kolff's 1943 rotating-drum dialyser in the occupied Netherlands and the Kolff-Brigham modification in Boston.

Supports: Chapter 16's dialysis narrative: Kolff's 1943 machine and the Kolff-Brigham kidney.

Limitations: A unit history; early clinical results were mixed, as the book states.

Source: edren.org, Edinburgh Renal Unit history (consulted 2026).

21 - H21 - The CT scanner spreads

Read: The American Association of Physicists in Medicine's history of CT: the first production scanner at Atkinson Morley Hospital, Wimbledon, first patients scanned in 1971, and 1,130 machines installed worldwide by 1977.

Supports: Chapter 19's account of CT adoption: Atkinson Morley 1971 and 1,130 machines by 1977.

Limitations: Installation counts from the era are industry estimates; the order of magnitude is secure.

Source: AAPM, aapm.org, CT history (consulted 2026).

22 - H22 - Ulrich, view through a window

Read: Roger Ulrich's 1984 study of gallbladder surgery patients in a Pennsylvania hospital (1972-1981), comparing recovery in rooms facing trees versus a brick wall.

Supports: Chapter 14's Ulrich study and the founding of evidence-based design.

Limitations: One study, one hospital, one operation; the effect has been replicated in spirit more often than in exact design, and the book says so.

Source: R. Ulrich, Science 1984, via PubMed (consulted 2026).

25 - H25 - Nightingale's Notes on Hospitals and the pavilion plan

Read: King's College London's exhibition of the 1859 edition of Nightingale's Notes on Hospitals, describing the defective back-to-back and closed-corridor ward designs and her pavilion remedy, and the Wellcome Collection's account of the pavilion principle: the Lariboisiere archetype, opposing windows for cross-ventilation, twenty to thirty-two patients per ward and a minimum of one hundred square feet per patient.

Supports: Chapter 14's pavilion paragraph: the 1859 Notes on Hospitals, opposing windows, sanitary towers, ward sizes and bed spacing.

Limitations: Museum and archive interpretation; the garden-separation detail is the pavilion plan's open-space principle, stated as such.

Source: King's Collections, kingscollections.org; Wellcome Collection, wellcomecollection.org (consulted 2026).

26 - H26 - Lister and antisepsis

Read: The peer-reviewed review of Joseph Lister's antiseptic system: carbolic acid from 1867, the technique, and the evidence that adoption was slower and more contested than later legend allows.

Supports: Chapter 11's account of Lister's antiseptic system and its contested adoption.

Limitations: A historical review; the book presents the contested-adoption point as the article does.

Source: PubMed Central, PMC3744349 (consulted 2026).

23 - H23 - A history of emergency medical services

Read: The Emergency Medicine Residents' Association's history of EMS, from battlefield evacuation to the modern ambulance and paramedic system.

Supports: Chapter 20's account of ambulances, the 1966 white paper, paramedic training and the emergency-medicine specialty.

Limitations: A professional association's survey; US-centred, and the book flags where other countries differ.

Source: EMRA, emra.org (consulted 2026).

24 - H24 - The randomised trial and the evidence movement

Read: The reference histories of the randomised controlled trial and of Cochrane: the 1948 MRC streptomycin trial as the first published RCT in medicine, Austin Bradford Hill's role, the ISIS heart-attack trials of the 1980s, Archie Cochrane's call for systematic reviews of all relevant trials, and Iain Chalmers founding the Cochrane Collaboration in 1993 with NHS research and development backing.

Supports: Chapter 9A's account of the randomised trial and the evidence movement.

Limitations: Tertiary surveys; the Lind 1747 scurvy comparison is cited in the book as a forerunner, the conventional framing, not as a modern trial.

Source: Wikipedia, "Randomized controlled trial" and "Cochrane (organisation)" (consulted 2026).

Contemporary and statistical sources

27 - C1 - AHA Fast Facts 2025

Read: The American Hospital Association's Fast Facts 2025 figures, from the 2023 AHA Annual Survey: 6,093 US hospitals, 34.4 million admissions, $1.32 trillion in annual hospital spending; and national health accounts putting hospital care at $1.6 trillion in 2024.

Supports: The Prologue's and Chapter 22's US scale figures (6,093 hospitals, 34.4 million admissions), and Chapter 29's $1.6 trillion 2024 hospital-spending figure.

Limitations: Trade-association compilation of survey and federal data; the 2024 spending figure is a national-accounts estimate.

Source: American Hospital Association, aha.org, Fast Facts 2025 (consulted 2026).

28 - C2 - HCA Healthcare results

Read: HCA's reported 2024 revenue of about $70.6 billion across 190 hospitals.

Supports: The Prologue's and Chapter 25's HCA revenue comparison.

Limitations: Company-reported figures; one firm, however large, is not the industry.

Source: HCA Healthcare investor reporting, 2024 (consulted 2026).

29 - C3 - Largest US health systems

Read: Becker's Hospital Review's listing of the largest US health systems, including Kaiser Permanente's reported $115.8 billion.

Supports: Chapter 25's Kaiser Permanente revenue comparison.

Limitations: Trade-press compilation of self-reported figures; definitions of "system" vary.

Source: Becker's Hospital Review, beckershospitalreview.com (consulted 2026).

30 - C4 - OECD beds and occupancy

Read: OECD Health at a Glance indicators for 2023: 4.2 hospital beds per 1,000 people on average (down from 5.7 in 2000), average occupancy 72 percent, 17 intensive care beds per 100,000 people.

Supports: Chapter 17's ICU-bed average, Chapter 29's beds and occupancy figures, and Chapter 33's capacity comparison.

Limitations: Cross-country averages conceal huge variation; ICU bed definitions differ by country.

Source: OECD Health at a Glance / Health Statistics, oecd.org (consulted 2026).

31 - C5 - Hospitals' share of health spending

Read: OECD provider-spending analysis putting hospitals at an average of 39 percent of health spending across member countries.

Supports: The Prologue's and Chapters 25 and 29's hospitals'-share-of-spending figure (39 percent).

Limitations: An average of national accounts with different classifications; country values spread widely around it.

Source: OECD Health Statistics, oecd.org (consulted 2026).

32 - C6 - NHS workforce

Read: The King's Fund's analysis of the NHS workforce in England, around 1.5 million people.

Supports: Chapter 24's and Chapter 28's NHS workforce scale.

Limitations: Headcount versus full-time-equivalent differ; the book uses the headcount as a scale marker only.

Source: The King's Fund, kingsfund.org.uk (consulted 2026).

33 - C7 - Largest hospital, Guinness record

Read: Guinness World Records' entry for the Chris Hani Baragwanath Hospital, Soweto, 3,294 beds.

Supports: The Prologue's and Chapter 25's largest-hospital comparison (Baragwanath, 3,294 beds).

Limitations: Record-keeping of a moving target; bed counts fluctuate with funding and definition.

Source: Guinness World Records, guinnessworldrecords.com (consulted 2026).

34 - C8 - Largest hospital campuses

Read: Reference material on the largest hospital campuses, including the West China Medical Center in Chengdu and the Zhengzhou megahospitals.

Supports: Chapter 25's Chinese hospital-campus scale.

Limitations: Campus versus single-hospital definitions blur; figures are used as scale markers, not rankings.

Source: Wikipedia, "List of largest hospital campuses" (consulted 2026).

35 - C9 - Top medical device companies

Read: MassDevice's ranking of the largest medtech companies, with Medtronic at about $32.4 billion annual revenue.

Supports: Chapter 21A's and Chapter 25's supplier-industry scale (Medtronic revenue).

Limitations: Trade-press ranking of company-reported revenues; fiscal years differ.

Source: MassDevice, massdevice.com (consulted 2026).

36 - C10 - Intuitive Surgical installed base

Read: Intuitive Surgical's 2024 reporting: 9,902 da Vinci systems installed worldwide.

Supports: Chapter 25's da Vinci installed-base figure.

Limitations: Company-reported installed base; says nothing about utilisation per system.

Source: Intuitive Surgical quarterly reporting, 2024 (consulted 2026).

37 - C11 - Blue Cross and the Baylor plan

Read: The Blue Cross Blue Shield historical material on the 1929 Baylor University Hospital teachers' contract: twenty-one days of hospital care for six dollars prepaid.

Supports: Chapter 23's Baylor account of 1929.

Limitations: The Blues' own origin story; other prepayment experiments existed, as the book notes.

Source: Blue Cross Blue Shield history pages, bcbs.com (consulted 2026).

38 - C12 - The founding of the NHS

Read: The National Archives' material on 5 July 1948: roughly 3,000 hospitals taken over, and an estimated 95 percent of the population registered by autumn.

Supports: Chapter 24's NHS founding narrative.

Limitations: The 95 percent figure is a contemporary estimate; hospital counts depend on what was counted.

Source: The National Archives, nationalarchives.gov.uk (consulted 2026).

Strain and society sources

39 - C13 - Group purchasing organisations

Read: The reference survey of US healthcare group purchasing: the Hospital Bureau of New York's first GPO in 1910, ten by 1962, growth after Medicare, Medicaid and the 1983 prospective payment system, the 1986 anti-kickback safe harbor with the 3 percent administrative fee cap, 96 percent acute-care membership by 2007, about 72 percent of purchases through GPO contracts in a 2009 report, and the GAO's 2002 finding that GPOs sometimes raised costs by up to 37 percent.

Supports: Chapter 21A's history and critique of group purchasing.

Limitations: US-specific; some underlying figures are trade or government reports of their era, quoted with their years.

Source: Wikipedia, "Group purchasing organization" (consulted 2026).

40 - S1 - WHO on healthcare-associated infection

Read: The WHO's infection prevention and control report: 7 of every 100 acute-care patients in high-income countries and 15 in low- and middle-income countries acquire an infection during their stay; up to 30 percent in intensive care; about one in ten of affected patients die; up to 70 percent preventable.

Supports: Chapter 26's healthcare-associated infection figures.

Limitations: Pooled estimates across heterogeneous studies and countries; the preventable share is a best-practice estimate, not a current achievement.

Source: World Health Organization, who.int, global report on infection prevention and control (consulted 2026).

41 - S2 - The 2019 AMR burden (GRAM)

Read: The Oxford-led Global Research on Antimicrobial Resistance study: about 1.27 million deaths directly attributable to bacterial antimicrobial resistance in 2019, 4.95 million associated, exceeding HIV/AIDS and malaria.

Supports: Chapter 26's 2019 antimicrobial-resistance burden, quoted with its year.

Limitations: A statistical model with wide uncertainty intervals; 2050 projections are scenario ranges, and the book presents them as such.

Source: University of Oxford / The Lancet, GRAM study (consulted 2026).

42 - S3 - To Err Is Human (1999)

Read: The Institute of Medicine report's summary: 44,000 to 98,000 US deaths a year from hospital medical errors, extrapolated from two state studies against 33.6 million admissions; $17 to 29 billion in total costs.

Supports: Chapter 27's error estimates, quoted as 1999-era extrapolations.

Limitations: The report itself caveated the range; later studies moved the estimate in both directions, and the book says so.

Source: National Academy Press, To Err Is Human brief (consulted 2026).

43 - S4 - The health workforce shortfall

Read: The WHO Director-General's stated projection of a ten million health worker shortfall by 2030, concentrated in low- and middle-income countries.

Supports: Chapter 28's and Chapter 33's workforce projections.

Limitations: A projection resting on demand, training and migration assumptions; used in the book as a direction, not a destiny.

Source: WHO Director-General's speeches and WHO workforce reporting, who.int (consulted 2026).

44 - S5 - Skilled birth attendance

Read: UN/UNICEF delivery-care data: skilled health personnel attended about 86 percent of births worldwide in 2023, up from roughly three-quarters a decade earlier.

Supports: Chapter 33's skilled-birth-attendance measure.

Limitations: Facility-reported and survey data of varying quality; regional gaps are the point, as the chapter stresses.

Source: UNICEF data, data.unicef.org (consulted 2026).

45 - S6 - US emergency department visits

Read: CDC figures of roughly 130 million US emergency department visits a year.

Supports: Chapter 20's US emergency-department volume.

Limitations: Survey-based national estimate; the year varies by release and the book uses the round figure.

Source: CDC/NCHS, cdc.gov (consulted 2026).

46 - S7 - Hospital at home

Read: Johns Hopkins Medicine's material on its Hospital at Home programme and the evidence for home-based acute care.

Supports: Chapter 31's hospital-at-home claims.

Limitations: Programme literature from the model's leading developer; selection effects favour suitable patients, and the chapter says so.

Source: Johns Hopkins Medicine, hopkinsmedicine.org (consulted 2026).

47 - S8 - FDA list of AI-enabled devices

Read: The FDA's public list of AI-enabled medical devices authorised for marketing, numbering in the many hundreds, led by radiology.

Supports: Chapter 32's AI-device deployment claims.

Limitations: Authorisation is not adoption; the list counts cleared devices, not daily clinical use, and the chapter keeps that distinction.

Source: US Food and Drug Administration, fda.gov (consulted 2026).

48 - S9 - Huoshenshan Hospital

Read: Associated Press reporting on the construction of the 1,000-bed Huoshenshan hospital in Wuhan in about ten days in early 2020.

Supports: Chapter 30's Huoshenshan surge narrative.

Limitations: News reporting of a state showcase project; the book notes the element of national theatre.

Source: Associated Press, apnews.com, 2020 (consulted 2026).