NU-03 The sickroom: isolation, air, light, warmth, water and the household as hospital

HEALING after the FALL, research library, NU-03

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

1. Findings by section

NU-01 covered the body in the bed (THRIVING library, NU-01). This report covers the room around it: which nineteenth-century sickroom rules have measurements behind them, how large the effects are, and which kill people when followed badly.

Its only plant materials are bedding straw and the clean wood ash covered in HY-01, so this chapter has no binomials and no dangerous lookalikes.

What I could not reach is marked where it falls. In addition, I could not locate the WHO and UNICEF Ebola home-care document as a titled publication, so I use the 26 August 2014 key messages as HY-07 carries them.

1.1 Nightingale's rules, stated as claims that can fail

Notes on Nursing (1860, read in full) is a list of operations on a room, and each can be tested without accepting a word of the miasma theory behind it.

Her claims reduce to eight. **Air:** continuous outside air, never from corridors or drains, and "an open window most nights in the year can never hurt any one". **Light:** second only to air, specifically direct sunlight, a dark north room "inadmissible". **Warmth:** a procedure, not a number. Feel the feet and legs, warm a chilled patient with bottles, bricks or flannels, and no thermometer reading anywhere. **Noise:** "Never let a patient be waked out of his first sleep", and sudden noise harms more than continuous noise. **Cleanliness of rooms:** carpets are "perhaps the worst expedient", dust is wiped with a damp cloth and never flapped, oil paint beats plaster and plaster beats paper. **The bed:** iron frame, permeable springs, thin hair mattress, not above three and a half feet wide, no higher than a sofa, reachable from both sides, never against a wall, no curtains or four-poster, the sleeper's head "never higher than the throat of the chimney", and two complete beds for a confined patient, twelve hours in each. **Water and personal cleanliness:** in NU-01 and HY-01. **Observation:** replace "is he better" with counted questions, specified in NU-01, Protocol 2.

Several oddly specific rules are defensible for reasons she did not have. Reachable from both sides is a back-injury and pressure-care rule. The head below the chimney throat puts the face in the inflow of a naturally ventilated room. The thin mattress on permeable springs is a drying rule, and NU-01 shows moisture damage is the commonest injury miscounted as a pressure sore. Banning curtains and four-posters removes what reliably defeats ventilation.

1.2 Air: the rule that survives, with numbers attached

The claim. Nightingale costed fresh air. In *Notes on Hospitals* (1863) she put a healthy adult at 1,500 cubic feet per hour, about 11.8 litres per second, and a sick ward at 2,500 to 5,000 cubic feet per hour per person, about 20 to 39 litres per second (Hobday, CIBSE Journal, quoting the 1863 text, which I did not read in the original).

The record. Escombe and colleagues measured it. In eight Lima hospitals, carbon dioxide tracer gas was used in 70 naturally ventilated clinical rooms and 12 mechanically ventilated negative-pressure rooms. Open windows and doors gave a median of 28 air changes per hour, old buildings with high ceilings and large windows gave 40, and the mechanical rooms were designed for 12 with poor maintenance meaning many delivered half that. Fed into the Wells-Riley model, with an untreated infectious tuberculosis patient and 24 hours of exposure, the calculated proportion of susceptible people infected was 97 per cent in a closed unventilated room, 39 per cent in a negative-pressure room, 33 per cent in a modern naturally ventilated room with windows open, and 11 per cent in a pre-1950 ward (Escombe et al 2007).

A second source. WHO's 2009 natural ventilation guideline sets an airborne benchmark of at least 12 air changes per hour, about 80 litres per second per patient in a 24 cubic metre room, and is quoted at 60 litres per second for naturally ventilated general wards (WHO 2009, read through secondary summaries only, the primary document would not open) [VERIFY].

What a house achieves. Tracer gas in Scottish houses found background leakage of 0.52 to 1.65 air changes per hour with windows shut, and opening a window raising it by a factor of two to five. A classroom study gave 6.5 air changes per hour with 15 per cent of window area open and 11.2 with 30 per cent, while single-sided ventilation gave about 30 per cent of those values [VERIFY: both read as search summaries, the primary reports would not open]. One exchange takes 60 divided by the air-change rate in minutes, and clearing 99 per cent of the air takes about 4.6 times that, so a cross-ventilated room at 6 to 11 air changes clears in roughly 25 to 50 minutes, and a room with one window takes an hour and a half or more [VERIFY: my calculation, assuming well-mixed air and steady conditions, both of which flatter real rooms].

The operational rule. Two openings on different walls, not one. It costs nothing but a hole in a wall.

Camp Brooks. On 9 September 1918 the Massachusetts State Guard opened a 13-tent hospital on Corey Hill, Brookline, for merchant-marine trainees sick with influenza. By its closure on 12 October it had admitted 351 patients, about a third with pneumonia, and 36 died, about 10 per cent. Of the staff, 15 doctors, 45 nurses and aides, 20 sanitary corps men and 74 sailor orderlies, only six nurses and two orderlies caught influenza, and in five of those eight the exposure was reportedly elsewhere. Surgeon-General William A. Brooks described a general hospital of 76 cases where 20 died within three days and 17 nurses fell ill (Brooks 1918, in Hobday and Cason 2009). The regimen was not air alone: five-layer gauze masks replaced two-hourly and sterilised, plus gloves, gowns, head coverings, disinfectant handwashing and separately boiled utensils.

Hobday and Cason note the result may simply be higher ventilation, that the hygiene may have done the work, that there is no evidence fresh air helps an infected person recover, and that the airborne share of influenza transmission is unknown. The claim that open-air treatment cut hospital case fatality from about 40 to about 13 per cent appears in their paper as "one estimate", not a result.

The air rule passes for transmission between people, not for recovery of the person already sick.

1.3 Light: a weaker case than tradition or architecture allows

The claim. Nightingale means sunlight, not illumination. She moves the bed through the day to follow the sun, and notes patients turn to the window because "it is the instinct".

The record is thin. Hobday and Dancer reviewed exactly this and concluded that recent evidence supports the

historical data on natural ventilation but that there is virtually none for sunlight (Hobday and Dancer 2013, abstract read as a search summary only) [VERIFY].

- **Dust.** Fahimipour and colleagues built eleven identical climate-controlled model rooms, seeded them with household dust, and glazed them to pass visible light, ultraviolet, or nothing. After 90 days, 12 per cent of bacteria in dark rooms were viable against 6.8 per cent under daylight and 6.1 per cent under ultraviolet (Fahimipour et al 2018). A model system measuring dust, not illness.
- **Analgesia.** Walch and colleagues followed 89 patients after elective spinal surgery on the bright or dim side of one unit. The bright side received 46 per cent higher-intensity sunlight, and those patients used 22 per cent less analgesic per hour ($p = 0.047$), with less perceived stress ($p = 0.035$) and marginally less pain ($p = 0.058$) (Walch et al 2005). Observational, 44 against 45 patients, one hospital.
- **Depression.** Beauchemin and Hays reviewed a psychiatric unit at the University of Alberta where half the rooms were sunny. Mean stay was 16.9 days in sunny rooms against 19.5 in dull, a difference of 2.6 days, $p < 0.05$, with 6.8 days' advantage in men and 0.7 in women (Beauchemin and Hays 1996, figures read through secondary summaries, abstract not obtained) [VERIFY]. Retrospective, and length of stay is a clinician's decision. A secondary account states three randomised trials failed to reproduce it and a 2023 study found no association [VERIFY: I could not read those].

The inference. Sunlight is worth having, but not for the stated reasons. The measured effects run through pain, mood and dust, not infection, and the one mechanism with a hard number behind it comes with sunlight: a window that opens. Put the sick where the sun reaches because it is free, dries the room, and lets the carer see skin, stool and dressings. Do not tell a village that sunlight kills the disease.

Where the tradition over-claims. Moving the bed through the day costs labour and shears the skin at every move, a net harm on NU-01's evidence in anyone at risk of pressure injury. Put the bed in the light once and leave it.

1.4 Warmth, and the heater that kills the household

The claim. Keep the patient warm without closing the room. Nightingale is explicit the two do not conflict.

Cold, measured. WHO's 2018 guidelines recommend at least 18 °C indoors in temperate and colder climates, a strong recommendation whose own document concedes the evidence is insufficient to establish a threshold. A systematic review of 20 studies from 1,209 screened found 17 reporting harm below 18 °C, though most outcomes were physiological markers such as blood pressure rather than deaths, and the 18 °C figure traces to a 1987 recommendation later reviewers could not find evidence for [VERIFY: both read as search summaries]. From HY-11: 10 per cent of elderly people surveyed at home in Britain in the winter of 1972 had deep body temperatures below 35.5 °C, and the old lose both the ability to feel cold and the ability to vasoconstrict, so they do not complain (THRIVING library, HY-11).

Where HY-11 disagrees with FO-09, and what I take. HY-11 rejects FO-09's Swiss field staging because the overlap is enormous: the lowest recorded core temperature in a patient classified as conscious and shivering was 28.1 °C. **I take HY-11** and its carer's rule: shivering and still self-caring means cold-stressed, shivering and becoming clumsy means hypothermic, and in doubt treat as hypothermic. On cooling, HY-11 finds that ice to neck, groin and armpits does not work while cooling cheeks, palms and soles does, and that immersion water need not be iced, 1 to 26 °C being acceptable. **I take HY-11 here too** (Protocol 5, step 8).

The sickroom's own killer. In the documented record, warming a sickroom has killed more people than the cold has.

In Korea, coal briquettes spread from the mid-1950s, burned under *ondol* floors that leaked carbon monoxide into the room where the family slept. Kim and colleagues reconstructed the burden from 1951 to 2018 and estimate about 26 million poisonings, roughly 22.83 million mild and 3.57 million severe, and about 65,000 deaths. Victims peaked

around 1980 at approximately one million in a single year, about 134,000 of them severe, with about 2,400 deaths. A survey covering 1965 to 1976 attributed about 80 per cent of cases to *ondol* heating, 54.2 per cent through the floor structure and 26.3 per cent from the fuel hole. The decline came from piped hot-water floors, at an annual poisoning probability of 6.6 per cent against 11.1 per cent for fuel-hole systems, and then from fuel switching, household briquette use falling from a 1980 peak of 69.5 per cent to 1.8 per cent by 2000 (Kim et al 2020).

A post-Fall village will reinvent exactly this: cheap solid fuel burned in or under a sleeping room, in a house made tight against the cold. Carbon monoxide is odourless, and its early signs, headache, nausea and confusion, are what a sickroom patient already has.

The rule that resolves the conflict. A fire belongs in a sickroom only with a flue and only with air entering from outside. Otherwise heat is carried in, wrapped, with the fire outside, which is Nightingale's applied heat and the correct engineering answer. Scalds from hot water bottles are in NU-01 and remain the second commonest warming injury.

1.5 Noise, sleep and the night

The record. WHO sets a time-averaged 35 dB in rooms where patients are treated, with 40 dB for single night-time events [VERIFY: sources differ and I read the guidance only through secondary accounts]. In five UK adult intensive care units, average sound levels always exceeded 45 dBA and for half the time 52 to 59 dBA, with peaks above 85 dBA at all sites up to 16 times an hour overnight, and the authors conclude the WHO levels are unachievable there (Darbyshire and Young 2013).

Where it bites. In a village house the noise is nursing itself. NU-01 established that multicomponent delirium prevention, with protected sleep as one of six components, cut delirium from 15.0 to 9.9 per cent in 852 patients, and that no trial of repositioning has recorded sleep as an outcome. The night rule is Protocol 6.

1.6 The bed, the laundry and the floor

The bed. Copy Nightingale's specification, but use NU-01's dimensions, six feet six inches by thirty-six inches at twenty-four to twenty-six inches high, because hers are wrong for a carer turning a heavy patient. Keep light blankets over heavy impervious counterpanes, air dirty bedding as well as clean, and keep the two-bed rule where cloth and space allow. Her claim that feverishness is "in nine cases out of ten" the bedding rather than the disease is a grade D assertion with no supporting record.

The laundry. The United States standard for health-care linen is detergent at not less than 71 °C for 25 minutes. The United Kingdom standard is 65 °C for 10 minutes or 71 °C for 3 minutes plus mixing, generally about a 5-log reduction, and Germany's is 90 °C for 10 minutes [VERIFY: I read a comparison table, not each national standard]. Jones and colleagues found that in the laboratory only two of 40 enterococcal strains were reduced by more than 5 log at those temperatures, yet across ten working hospital laundries decontamination succeeded, and occurred during the washing stage (Jones et al 2002). A village cannot hold a thermostat but it can hold a boil, and ten minutes at 100 °C exceeds every standard above, which is already the library's outbreak rule (THRIVING library, HY-07). For the ordinary wash, water too hot for the hand, held hot ten minutes, is not enough alone, and soap and agitation do most of the work.

Sun on the line. A Korean study exposed bacteria on cotton, silk and polyester to ultraviolet and daylight-simulating light for 5 to 30 minutes, found a large reduction under ultraviolet, *Staphylococcus aureus* most susceptible and *Escherichia coli* most resistant [VERIFY: abstract and search summary only]. I found no solar log-reduction data for viruses on bedding and no dose in hours of sun. Dry in the sun because it dries, bleaches and costs nothing, and do not substitute it for the boil.

Floor and walls. Nightingale's ranking of surfaces is a cleanability ranking and remains correct, and her damp-cloth dusting rule is the rule modern hospital cleaning uses.

1.7 Isolation inside a house: the attack rates and the four behaviours

HY-07 settles when to isolate at all, with Fraser's rule that isolating the sick can stop an outbreak only when the share of transmission occurring before symptoms is below one divided by R0. IN-13 settles who decides, how it is enforced and how it is fed.

The household attack rates.

- **Ebola.** In 94 Sierra Leone households with 937 members, 109 primary or co-primary cases gave 201 secondary cases among 827 exposed, an adjusted household secondary attack rate of 18 per cent and an unadjusted 24 per cent, both of which the authors note may be overestimates. Variation was enormous, from one case with no spread to households where everyone was affected, and about 28 per cent of households had no secondary case [VERIFY: the 28 per cent is my derivation from their table, not a figure they state]. **All 25 households in which a primary case died at home had secondary cases** (Glynn et al 2017). A companion analysis found 448 of 937 members had had the disease, with risk from 83 per cent for touching a corpse down to 8 per cent for minimal contact (Bower et al 2016). Reichler's cohort found 24 per cent of household care providers developed the disease, over three times the rate among non-caring contacts (THRIVING library, IN-13).
- **COVID-19.** Pooled secondary attack rate 18.9 per cent through June 2021, rising by variant: Beta 22.5, Delta 29.7, Alpha 36.4, Omicron 42.7. Unvaccinated index to unvaccinated contact ran 15.5 per cent through April 2020 and 37.3 per cent in 2021 to 2022 (Madewell et al 2022).
- **Influenza.** In Hong Kong households, RT-PCR-confirmed secondary attack rates were 8 per cent pandemic and 9 per cent seasonal (Cowling et al 2010, search summary). Across 27 studies of 2009 pandemic influenza, estimates ran 3 to 38 per cent [VERIFY: search summary].
- **Tuberculosis.** In Kampala households the rate was 3.0 per cent (95 per cent CI 2.2 to 3.8) for disease and 47.4 per cent (44.3 to 50.6) for infection, highest in the young and the HIV-infected (Kampala household study 2011, search summary). A review of 41 household contact studies pooled 2.3 per cent for confirmed disease and 51.4 per cent for latent infection [VERIFY: read through citation].
- **Cholera.** No clean household rate found. The pooled estimate from 110 studies is an odds ratio of 2.91 (1.62 to 5.25) for symptomatic infection with household contact, I squared 89 per cent (Richterman et al 2018). A Bangladesh genomic study found nearly 80 per cent of secondary infections linked to the household's first case and occurring within five days [VERIFY: search summary]. This fits HY-07's bin: for cholera, isolate the water and the latrine, not the patient.
- **Measles.** I could not source the household rate among susceptible contacts or trace the figure near 90 per cent that circulates everywhere, and **the book should print none.** HY-07 places measles where isolation helps but cannot stop transmission, because infectiousness begins about four days before the rash.

The shape of those numbers. Every rate is well under 100 per cent. Nursing a sick relative at home is not a death sentence, and the fear that it is drives what actually kills: abandonment, concealment and refusal to report.

What protected people. In Reichler's cohort only 14 per cent of care providers used any barrier protection at all, including plastic bags over the hands, so the study cannot value gloves. What it can say is that contacts who **stayed at least one metre away, stopped eating meals with the patient, avoided touching them, and stopped sleeping in the same room** had significantly lower attack rates. Risk rose with providing care, physical contact, contact with body fluids, contact with clothing or linen, sleeping in the same room, and being a first-degree relative, and piped drinking water was protective (THRIVING library, IN-13). Those four behaviours cost nothing, and the designated-carer rule exists to make them possible: one person accepts the contact so nobody else has to.

Masks in a household, honestly. Sydney, winters of 2006 and 2007, 143 households and 286 exposed adults ran-

domised to surgical masks, non-fit-tested P2 masks, or none, worn whenever in the same room as the sick child. Influenza-like illness occurred in 21 of 94 surgical mask users (22.3 per cent), 14 of 92 P2 users (15.2 per cent) and 16 of 100 controls (16.0 per cent), with no significant difference. Adherence was the story: 38 to 46 per cent wore masks most or all of the time on day one, falling to 25 to 31 per cent by day five, and overall only 21 per cent reported wearing them often or always. Among adherent users, adjusted hazard ratios were 0.26 (0.09 to 0.77) and 0.32 (0.11 to 0.98) under one-day and two-day incubation assumptions, which the authors label observational (MacIntyre et al 2009).

Cowling adds the timing. In Hong Kong, 259 households, 407 index patients and 794 contacts randomised to lifestyle education, hand hygiene, or masks plus hand hygiene. Sixty contacts (8 per cent) had confirmed influenza within seven days and the overall differences were not significant, but in the 154 households where the intervention began within 36 hours of symptom onset the adjusted odds ratio was 0.33 (0.13 to 0.87), with hand-hygiene adherence at 44 to 62 per cent (Cowling et al 2009). That subgroup was post hoc.

I adopt IN-13's judgement: mask the patient, not the household, with a clean dry cloth over a coughing patient's mouth and nose, changed and boiled daily. The trials add a timing rule: the decision to set up a sickroom is made on the first day of the illness or it is not worth making.

The home-care kit as delivered. Médecins Sans Frontières distributed 65,609 household disinfection kits in Monrovia between September and November 2014, 7,359 targeted and 58,250 by mass distribution, and telephoned 1,386 recipients. Of 60 households reporting sickness or death, kit use was documented in 56, all using chlorine. Among 1,322 unaffected households, 583 (44 per cent) used some element, mostly chlorine for handwashing (94 per cent). The authors note 10 per cent of the highest-risk households had sickness or death against an expected 32 per cent drawn from a separate meta-analysis, then say that **it is unknown whether the kits halted transmission** (Ali et al 2020). Feasible, done at scale, never shown to work.

1.8 Tents, verandahs and the sanatorium

The claim. Put the sick outdoors, or nearly outdoors, and they do better. The record is a long series without controls. Camp Letterman at Gettysburg grew past 400 tents, ten feet apart, twelve patients each, and Joseph Jones, reporting on hospital gangrene, recorded that in one known instance it originated in a wooden pavilion hospital and in no instance, so far as he knew, in a tent [VERIFY: one observer's impression, not a count]. Renkioi, Brunel's prefabricated hospital built for ventilation and open from October 1855, ran at 3.8 per cent deaths over admissions against Scutari's 11.9 (THRIVING library, NU-01).

The sanatorium. A Portuguese sanatorium archive compared male admissions from 1931 to 1944 with 1955 to 1961. Crude in-hospital mortality was 18.2 and 11.2 per cent, not significantly different, but age-adjusted the pre-chemotherapy group had a hazard ratio of 1.94 (1.03 to 3.63) for dying during admission (Matos and Santos 2015, abstract only, via HY-07). A pooled analysis of historical tuberculosis literature found five-year survival of 65 per cent (44 to 88) before 1930 and 72 per cent (41 to 94) after [VERIFY: preprint read as a search summary]. **No controlled study compares the rest cure with no treatment.**

What transfers. The outdoor ward is a ventilation strategy with a roof, not a treatment. It transfers to one situation: when more people are sick than the houses can hold apart, build shelter outdoors rather than crowd indoors. Sphere's planning figure is 3.5 square metres of covered living space per person [VERIFY: secondary summary], and MSF's cholera guidance gives about 4 square metres per bedridden and about 2 per seated patient.

1.9 The household as hospital, measured against a real one

Edgar, Shepperd and colleagues reviewed admission-avoidance hospital at home, acutely ill adults randomised to care at home rather than admission. Mortality at six months was risk ratio 0.88 (0.68 to 1.13) on 5 studies and 1,502 participants, moderate certainty, against a baseline of 208 deaths per 1,000 in inpatient care and 183 (141 to 235)

at home, and the review concludes it makes little or no difference to death at six months or to readmission (Edgar et al 2024, figures read through a quoted extract of the summary-of-findings table) [VERIFY]. A 2008 individual-patient-data meta-analysis of 10 trials and 1,327 patients found lower six-month mortality, adjusted hazard ratio 0.62 [VERIFY: search summary]. The largest single trial randomised 1,055 older adults and found 16.9 against 17.7 per cent dead at six months, relative risk 0.98 (0.65 to 1.47) (Shepperd et al 2021) [VERIFY: search summary].

What this licenses and what it does not. These trials compare a house with visiting clinicians, drugs, oxygen and a telephone against a modern hospital, not a house with nothing. For the acutely ill adult who is not surgical and not in organ failure, the building does not carry the treatment. People, drugs and fluids carry it, and they can be brought to a bed anywhere. Add Nightingale's lying-in figures, 888,312 institutional deliveries at 34 deaths per 1,000 against 5.1 per 1,000 at home (THRIVING library, NU-01), and the pre-Fall hospital stops looking like a standard a village is failing to meet.

The two costs the house carries. First the carer, whose four-year mortality runs 63 per cent higher when strained (THRIVING library, NU-01). Second the patient's isolation. Holt-Lunstad and colleagues pooled studies from 1980 to 2014 covering over three million people and found mortality odds ratios of 1.29 for social isolation, 1.26 for loneliness and 1.32 for living alone, with no difference between objective and subjective isolation (Holt-Lunstad et al 2015). **Isolation that becomes abandonment is not a smaller harm than the infection.**

1.10 The chart, and who keeps it

The chart specification is NU-01's Protocol 2.

The manual lineage. The American Red Cross ran this as a public course through seven editions (1913, 1918, 1922, 1933, 1942, 1943 and 1950), from Delano and McIsaac's *Elementary Hygiene and Care of the Sick* (1913), rewritten by Anne Hervey Strong in 1918 as *Home Hygiene and Care of the Sick*, to the 1950 *Home Nursing Textbook*. I could find no enrolment figures for any edition, so the brief's lead that this was a mass training programme is plausible and unquantified [VERIFY]. The 1918 edition is free in full and is the most useful artefact in this report: this chapter already written, for a household with no trained nurse (Delano and Strong 1918).

Barrier nursing as a named technique. The 1913 British description is a cord stretched between two standards at the foot of the bed, past which a nurse must gown, with hands immersed in a disinfectant lotion such as lysol or mercuric chloride before and after each bedside visit, and soiled linen steeped before the laundry (Royal College of Nursing archive summaries, and Parsons 1913, whose text I could not read) [VERIFY]. What transfers is not the lysol, which HY-01 rules out as a routine hand agent. It is **the line on the floor**. A visible boundary that forces a conscious decision at every crossing is the whole of barrier nursing.

Who keeps it. NU-01 found a village's first failure is that nobody reads the chart. In isolation it is also the only thing that crosses the boundary, so it stays on the clean side.

2. Evidence grades

Practice	Tradition says	Record shows	Grade
Two openings on different walls	Fresh air prevents disease	28 ACH median, 40 in old rooms, 12 mechanical, modelled 24 h risk 11 to 33 vs 97 per cent closed (Escombe 2007)	B
Open air to help the sick recover	Fresh air cures	No controlled evidence (Hobday and Cason 2009)	D

Practice	Tradition says	Record shows	Grade
Outdoor or tent ward in epidemic	Outdoors is safer	Camp Brooks uncontrolled, 10 per cent mortality	C
Sunlight into the sickroom	Second only to air	Virtually no evidence (Hobday and Dancer 2013)	D
Daylight on room dust	Sun purifies	6.8 vs 12 per cent viable, model rooms (Fahimipour 2018)	C
A sunny room	Patients turn to the light	22 per cent less analgesic, 89 patients (Walch 2005)	C
Moving the bed to follow the sun	Nightingale's rule	No evidence, each move shears skin (NU-01)	X
Indoor temperature 18 °C or above	Keep the sick warm	Strong WHO recommendation, insufficient evidence for threshold	C
Unflued brazier in a sickroom	Warmth	~65,000 CO deaths, Korea 1951 to 2018 (Kim 2020)	X
Heat carried in, fire kept out	Not traditional as a rule	No trial, mechanism certain, Korean record decisive	B
Protecting first sleep	Never wake from first sleep	Delirium prevention grade A (NU-01), sleep not trialled alone	C
One designated carer	Universal	24 per cent of Ebola carers infected vs 8 per cent minimal contacts	B
The four behaviours	Folk practice everywhere	Significantly lower attack rates, Reichler cohort (IN-13)	B
Household mask use by contacts	Masks protect	Null on intention to treat in two RCTs, adherent HR 0.26	D
Barrier measures within 36 h	Act at once	Adjusted OR 0.33 (0.13 to 0.87), post hoc (Cowling 2009)	C
A cloth over a coughing patient	Mask the sick	Lab filtration good, field evidence absent (IN-13)	C
Household disinfection kits	Kits stop spread	65,609 distributed, effect unknown (Ali 2020)	D
Boiling soiled linen 10 minutes	Boil it	Standards 71 °C/25 min or 65 °C/10 min, a boil exceeds both	B

Practice	Tradition says	Record shows	Grade
Drying bedding in full sun	Sun cleans cloth	Shown for bacteria, nothing for viruses, no dose	C
Damp dusting, no carpets, limewash	Dust carries disease	The rule modern cleaning uses, no trial	C
Bed reachable both sides, no canopy	Nightingale's bed	No trial, mechanisms certain	C
Treating acute illness at home	Home is safer	Six-month mortality RR 0.88 (0.68 to 1.13) (Edgar 2024)	A
Isolation without daily contact	Keeps the family safe	Isolation OR 1.29 for mortality (Holt-Lunstad 2015)	X
Isolating the patient in cholera	Isolate the sick	Isolate the water and the latrine instead (HY-07)	X

3. Means ledger

Rung	What it can do	What it changes
Hands and knowledge alone	Two windows on different walls, bed into the light and left there, head below the chimney throat, a line at the door, one named carer, the four behaviours, daily speech from the doorway, bundled night tasks	Most of the total effect: modelled 24-hour risk from 97 to 11 to 33 per cent, without abandoning the patient
The hearth	Boil linen and utensils 10 minutes, dry in sun, separate plate cup and spoon, soap and water at the door, covered bucket for stool, heat carried in as wrapped stones with the fire outside	The scald and the carbon monoxide risk both begin and end here
Garden and still	A bed 6ft6in by 36in at 24 to 26in with a permeable base, a second set of bedding, limewashed walls, a cut second window, a thermometer, a clock, chlorine of known strength	One carer can nurse without injuring themselves, and the room can be charted rather than guessed
Village dispensary (300)	A detached sickroom sited per HY-07, a carers' rota of at least six, a trained inspector and teacher, cloth, soap and buckets stocked before the epidemic, a register	The rota is the intervention, and the pre-positioned bucket makes a 36-hour response possible

Rung	What it can do	What it changes
District infirmary (3,000)	Outdoor or tent wards when houses cannot hold the sick apart, 3.5 to 4 m^2 per bedridden patient, triage at the door, separate clean and dirty zones, night cover	Gains capacity and covers the family-less patient. Loses the home's hygiene advantage and gains cross-infection, HY-07's failure mode
Hospital before the Fall	Mechanical negative-pressure isolation at 12 ACH, filtered air, single rooms, oxygen, monitoring	On transmission, worse than a high-ceilinged ward with the windows open. Adds oxygen, drugs and surgery, nothing else belonging to the room

4. Harm test

Carbon monoxide, the sickroom's own killer (Kim et al 2020): unflued charcoal, coal, briquettes or a brazier in a closed room, or a flue leaking under a sleeping floor. *Signs:* headache, nausea, dizziness and confusion in more than one person in the room, worst in whoever is there longest, better outdoors. *What to do:* everyone into the open air at once, doors and windows wide, no re-entry to put the fire out until the room has been open some minutes, nobody sleeps there until the fire is moved or flued. *The rule:* no unflued fire where anyone sleeps, ever, and especially not a pregnant woman, an infant or anyone already breathless.

Chilling the patient while airing the room. *Signs:* shivering that stops, new clumsiness, slurred or absent speech, a cold trunk under the arm and over the belly rather than cold hands. *What to do:* close the window, cover head and neck, then Protocol 5, step 7. *Not:* a warm bath, which HY-11 rules out even in apparently mild cases.

Scalds. NU-01 has the data: 85 hot-water-bottle injuries in one UK burns unit between 2004 and 2013, 39 in children, 48.2 per cent from rupture. Every bedridden person is in the never-give category, because they cannot feel the heat or move away. Two layers of cloth, never against skin, never under the patient, removed before sleep.

The mask that makes things worse. A cloth mask worn continuously in a small room, damp and reused without boiling, may be worse than none. The only cluster-randomised trial of cloth against medical masks found more illness in the cloth arm, risk ratio 13.00 (1.69 to 100.07), an extremely imprecise estimate from a trial whose control arm also used masks (THRIVING library, IN-13). *What to do:* take it off, boil it, dry it, and fall back on distance and handwashing.

Isolation that becomes abandonment. *Signs:* nobody has entered the back room today, food is left at the door and returns untouched, the family has stopped using the patient's name. *What to do:* name a second person whose only job is to speak to the patient daily from the boundary, and never isolate anyone whose illness does not spread person to person.

Isolating the wrong thing: the patient in cholera, typhoid, dysentery, hepatitis A or malaria, while leaving the water, the latrine and the shared meal alone. HY-07 names this the commonest mistake a frightened village makes.

The carer as the vector between rooms. NU-01's failure mode: washing between tasks but not between patients. With more than one sick person, a line at each door and a wash at each crossing.

Smothering the room to keep it warm. Blocking the chimney, sealing the window, heavy curtains, a four-poster. This converts a modelled 11 to 33 per cent transmission risk into 97 per cent, and with any unflued fire it becomes lethal within hours.

Over-airing a newborn. The ventilation rule is about the room's air, not the patient's skin. HY-11 is unambiguous:

skin-to-skin with the mother, relative risks of 0.22 to 0.28 for hypothermia in neonates of 2,000 g or less, about 25 per cent better survival with immediate kangaroo care, number needed to treat about 27.

5. Red flags

1. **More than one person in the room with headache, nausea and confusion, better in the open air.** Carbon monoxide. Do anyway: everyone outside, open everything from the doorway, no re-entry to tend the fire. There is no antidote a village can make.
2. **A patient who was shivering and has stopped, now clumsy, slurred or silent, in a cold room.** Do anyway: Protocol 5, step 7, no alcohol, and handle gently, because rough movement can stop a cold heart (THRIVING library, HY-11).
3. **A household where the sick person died at home and nobody was separated.** All 25 Ebola households where the primary died at home had secondary cases (Glynn et al 2017). Do anyway: IN-13 Protocol 7 for burial where it matters, the four behaviours for everyone in the house for the full incubation period, a daily named check on each of them.
4. **Breathlessness worsening when the patient lies flat, with blue lips.** Needs oxygen, which a village has not got. Do anyway: sit them fully upright, open both windows, move air across the face, stop unnecessary handling, and say plainly what is happening.
5. **A sickroom nobody has entered since yesterday.** The patient will die of thirst, pressure injury or despair before the disease. Do anyway: enter, with the four behaviours, and reorganise the rota the same hour.
6. **More sick people arriving than the houses can hold a metre apart.** Household isolation has stopped working. Do anyway: build outdoors before crowding indoors, triage at the door, never mix undiagnosed fevers with confirmed cases.

6. The case against

The air finding is a model, not a measurement of illness. Escombe measured air changes and then calculated infection risk with the Wells-Riley equation. Nobody randomised patients to open or closed windows and counted tuberculosis. The equation assumes well-mixed air, a steady quantum generation rate and uniform exposure, and real rooms violate all three. Escombe's own paper concedes it is not an easy solution where winters are cold, which is precisely the trade-off a post-Fall village faces.

The 1918 open-air record cannot carry weight, and its own authors say so (section 1.2). Camp Brooks had no control group, its comparison hospital is described in a sentence, and its patients were young merchant seamen.

The sunlight case has been tested by its own advocates and failed (section 1.3).

Household isolation evidence is almost all observational, and the randomised evidence is null. Two cluster-randomised trials returned non-significant primary results, and the positive findings in both come from adherence subgroups and post-hoc timing subgroups, the two analyses most likely to be artefacts. Reichler's four protective behaviours come from a cohort in which people who stayed away from the patient differed in every other respect from those who did not.

The household-as-hospital trials do not test what the book needs (section 1.9). They do not show that a village does as well as a hospital.

Nightingale's room rules come as a package and should not. She was wrong about contagion, about the bedding causing feverishness, and, by NU-01's evidence, about moving beds through the day.

The named critics. Hobday and Dancer (2013), MacIntyre and colleagues (2009), the Cochrane reviewers (Edgar et al 2024), Escombe and colleagues (2007) and Hobday and Cason (2009) each argue against the strong reading

of their own work. Lynn McDonald and Hugh Small argue against the Nightingale legend generally (THRIVING library, NU-01).

7. Ten-line summary of robust findings

1. Open windows and doors gave a median 28 air changes per hour in eight Lima hospitals, and 40 in old high-ceilinged wards, against 12 designed for negative-pressure rooms.
2. Modelled 24-hour tuberculosis infection risk was 97 per cent in a closed room, 39 negative-pressure, 33 in a modern ward with windows open and 11 in a pre-1950 ward.
3. Two openings on different walls clear a room in roughly 25 to 50 minutes, one opening in an hour and a half or more.
4. Evidence for sunlight in the sickroom is close to absent. Its measured effects run through pain, mood and dust.
5. Korea recorded about 26 million carbon monoxide poisonings and about 65,000 deaths from 1951 to 2018, about 80 per cent from domestic heating.
6. Household secondary attack rates: Ebola 18 per cent adjusted, COVID-19 18.9 per cent pooled rising to 42.7 for Omicron, influenza 8 to 9 per cent, tuberculosis 3.0 per cent for disease and 47.4 for infection.
7. All 25 Sierra Leone households in which an Ebola primary case died at home had secondary cases.
8. Staying a metre away, not eating with the patient, not touching them and not sleeping in the same room protected household contacts. Only 14 per cent of carers used any barrier equipment.
9. Two randomised household trials of masks and hand hygiene were null on intention to treat. The signal lies in adherence (hazard ratio 0.26) and in starting within 36 hours (odds ratio 0.33).
10. Admission-avoidance hospital at home gives six-month mortality risk ratio 0.88 (0.68 to 1.13) on 1,502 patients. For non-surgical acute illness, the building does not carry the treatment.

8. Open questions

- What is the right trade in a cold winter between air changes and warmth? Escombe declines the question, and WHO's 18 °C is a convention.
- Does drying bedding in sun reduce viral contamination, and at what dose in hours?
- Can a household without equipment change its attack rate, beyond one observational cohort?
- What is the real household secondary attack rate for measles?
- Does a visible boundary line change carer behaviour? Barrier nursing is a century old and the barrier itself has never been tested.
- What did the Red Cross home nursing course achieve? Seven editions over 37 years and no enrolment or outcome data.

9. The sources to read in full

1. Escombe et al (2007), *PLoS Medicine*, open access, eight pages.
2. Nightingale, *Notes on Nursing* (1860), chapters I, IV, VIII, IX and X.
3. Delano and Strong, *Home Hygiene and Care of the Sick* (1918). Free.
4. Hobday and Cason (2009), *American Journal of Public Health*, for the caveats.
5. Hobday and Dancer (2013), *Journal of Hospital Infection*.
6. Glynn et al (2017), on Ebola household transmission.
7. MacIntyre et al (2009) and Cowling et al (2009), read as a pair.
8. Kim et al (2020), *Epidemiology and Health*.
9. Edgar et al (2024), Cochrane CD007491, admission-avoidance hospital at home.
10. Holt-Lunstad et al (2015), after any chapter recommending that people be isolated.

10. At the bedside after the Fall

The household. *To start:* the room, bed, line and carer of Protocol 1, a pot large enough to boil cloth, soap, a basin, a covered bucket, a separate plate, cup and spoon, a slate, and a wrapped stone for warmth with the fire outside. *Skills:* the four behaviours, washing at the line, boiling linen, and the chart from NU-01. *Records:* who is sick, since when, who nurses them, who else slept in that room. *The first failure to expect* is that the window gets closed on the second cold night, and the second is that the carer moves their own bed into the room to save walking.

The village of 300. *To start:* a store of cloth, soap, buckets and chlorine of known strength, held before any epidemic, because the measured effect sits inside the first 36 hours. A trained lay carer who can site and inspect a sickroom and teach the four behaviours. A rota of at least six. A register. A detached hut for the household with no second room. *The first failure to expect* is that the stores were used for something else, and the second is that the one carer who knows the technique falls sick.

The district of 3,000. *To start:* the infirmary row of the means ledger, and a school for carers that teaches and tests the protocols below. *The first failure to expect* is cross-infection inside the facility, HY-07's failure mode and the reason Nightingale's lying-in figures belong on that building's wall.

11. Protocols

Protocol 1. Setting up a sickroom, in one hour

1. **Choose the room by its openings.** Two on different walls beats one large window. If the only room has one, cut or unblock a second, even a hand-sized vent high on the opposite wall, before anything else.
2. **Choose the room by its door.** Onto the outside, or onto a passage nobody sleeps in. Never a room people must walk through.
3. **Move the vulnerable out that day:** infants under six months, pregnant women, the frail old, anyone with a chronic cough or wasting (THRIVING library, HY-07).
4. **Place the bed** away from the wall, reachable from both sides, in the light, head below the chimney throat, out of the direct line between the two openings. Leave it there.
5. **Draw the line.** A rope, a chalk mark, a plank, or the doorsill. Everything beyond it is the patient's, and nobody crosses without a decision.
6. **Furnish the line:** water, soap and a drying cloth on the clean side, within reach of the door.
7. **Furnish the room:** own plate, cup, spoon, towel and bedding, a covered bucket for stool and vomit, drinking water within reach, the slate on the clean side.
8. **Remove** carpets, hangings, bed curtains and anything that cannot be wiped with a damp cloth.
9. **Decide the heat before the first night.** No flue means no fire in the room, and warmth comes in as wrapped stones or bottles. A flue means air must enter from outside while it burns.
10. **Name the carer, the relief and the speaker** before the first night. The speaker's only job is daily conversation from the boundary.
11. **Tolerance.** With one room and no door, do steps 3, 4, 5, 6, 7 and 10 anyway, with the patient's head toward the opening and at least two metres from any sleeping place. That is most of the benefit.

Protocol 2. The rules of entry

1. **One carer,** in this order: a survivor of this illness in this outbreak, then a healthy adult of 20 to 50, then anyone. Never anyone pregnant, nursing, under 15, over 60 or chronically ill (THRIVING library, IN-13).
2. **Everyone else, the four behaviours:** at least one metre away, no shared meals, no touching, no sleeping in the same room.
3. **Wash with soap at the line before and immediately after every crossing,** a full count of twenty, both hands, every surface (THRIVING library, HY-01).

4. **Change outer clothing at the line** where there is vomiting, diarrhoea or bleeding, and boil it.
5. **A clean dry cloth over the patient's mouth and nose if they are coughing,** changed and boiled daily. Do not mask the household.
6. **Carry nothing back across the line** except what will be boiled. The chart stays on the clean side.
7. **Speak to the patient by name at every entry, and from the doorway at least three times a day when nobody is entering.** Say the day and the time.
8. **Count the days aloud.** On the first day say which day the isolation ends, and keep to it (HY-07 has the lengths by disease).
9. **Start within 36 hours of the first symptom,** or accept that the measures are mostly ritual.

Protocol 3. The air, by the clock

1. **Open both openings fully twice a day,** morning and afternoon, at least 30 minutes with cross-ventilation and at least 90 minutes with only one opening.
2. **Cover the patient first,** head and neck included, and move them out of the straight line between the openings. A screen or hung blanket breaks the draught.
3. **Leave a small opening open at all other times,** including at night, unless the patient is hypothermic or it is below freezing outside.
4. **In hard frost:** open fully for 10 minutes four times a day rather than leaving anything open, with the patient covered and warmed first [VERIFY: my compromise between Escombe 2007 and the WHO 18 °C recommendation, untested].
5. **Never block the chimney, curtain the window, or canopy the bed.**
6. **Check by stepping outside and coming back in.** If the room smells of the room, it has not cleared.
7. **Signs the airing is harming:** the patient shivers, or stops shivering and becomes clumsy. Close the opening, insulate, go to Protocol 5.

Protocol 4. Laundry, dishes and the floor

1. **Soiled cloth goes straight into a covered container in the room,** never shaken out, never carried loose through the house.
2. **Boil soiled cloth at a rolling boil for at least 10 minutes,** stirred, in a pot used for nothing else.
3. **For cloth that cannot be boiled:** wash with soap in the hottest water the hands can work in, agitate hard, rinse in clean water.
4. **Dry in full sun** where possible, both sides, several hours. A supplement, not a disinfection.
5. **Iron or press if there is a flat iron.**
6. **The patient's plate, cup and spoon are theirs alone,** washed separately in boiled water with soap or clean wood ash.
7. **Wipe surfaces with a damp cloth.** Never sweep or flap dust in a sickroom.
8. **Waste, stool and vomit** into a deep pit at least 30 metres from any water source and never uphill of one, covered with ash or lime each time (THRIVING library, HY-07).
9. **Where bleach of known strength exists:** about 1 part in 10 of a 5 per cent bleach for surfaces, vomit and blood, about 1 part in 100 for soaking linen and utensils, mixed fresh daily, after cleaning the surface first. Never on hands, never sprayed into an occupied room [VERIFY: dilution arithmetic from IN-13].

Protocol 5. Warmth without poison

1. **No unflued fire, brazier, charcoal pan or stove in a room where anyone sleeps.** Not banked for the night, not "just until it warms up".
2. **Heat the room before the patient is in it, with the fire outside or flued, then carry heat in:** stones or bricks heated at the hearth and wrapped in two layers of cloth, or bottles of hot but not boiling water.

3. **Never against skin, never under the patient, removed before sleep** (THRIVING library, NU-01).
4. **Clothe and cover rather than heat the air.** Two layers with the inner nap turned in, head and neck covered, the patient inside the covering and not under it, insulated from the floor (THRIVING library, HY-11).
5. **Check warmth by hand on the trunk, under the arm and over the belly,** not on hands and feet, which lie.
6. **Headache, nausea or confusion that improves outdoors is carbon monoxide** until proved otherwise. Everyone out, everything open, nobody back in to tend the fire.
7. **If the patient is shivering and clumsy, or has stopped shivering:** close the openings, insulate inside the covering, heat to armpits, chest and back and never limbs, inspect the skin every 20 to 30 minutes for burns, warm sweet drinks only if fully awake, no bath, no rubbing, handle gently (THRIVING library, HY-11).
8. **A feverish patient in a hot room is cooled on face, palms and soles** with wet cloth and moving air, not with packs to neck, groin and armpits, which do not work (THRIVING library, HY-11).

Protocol 6. The night watch

1. **Plan the night before dark.** Water within reach, the bedpan emptied, the mouth cleaned, bedding straightened, the lamp ready, the opening set.
2. **Bundle every task into one visit.** Turn, check, offer the pan, give a drink, note the chart, in one go.
3. **Two visits a night on a good surface, three on a hard one.** Do not wake a patient every two hours to turn them if the surface is sound (THRIVING library, NU-01).
4. **Never wake a patient out of their first sleep** for anything that can wait an hour.
5. **Speak quietly and plainly in the room rather than whispering outside the door.**
6. **The carer sleeps outside the sickroom.**
7. **Wake the relief rather than finish the night alone.** A carer who has not slept three nights is the main danger in the room.

Protocol 7. The room for the dying

1. **Stop what no longer serves.** No turning schedule for its own sake, no forced feeding, no waking for observations, no enemas, no cold baths.
2. **Keep three things:** the mouth wet and clean with a damp cloth every hour, the position changed for comfort when they ask or wince, and pain relieved with whatever exists.
3. **Open the window.**
4. **Lift the isolation to the minimum the disease actually requires.** For influenza, measles, typhoid and most illnesses the family may sit with the dying. For a haemorrhagic fever or pneumonic plague one carer stays and the rest speak from the boundary, and the reason is explained aloud rather than enforced.
5. **Let the room be entered.** A slightly less safe arrangement the family accepts is safer than a safe one they evade.
6. **Where the illness kills by contagion, prepare the burial before the death,** using IN-13 Protocol 7, and name the three people who will not touch the body: the supervisor, the family liaison, and whoever leads the prayers.
7. **After the death:** nobody washes or kisses the body of a feared-fever death, the body is wrapped in the bedding it died in without shaking it out, the room is opened to sun and air for a day, all bedding is boiled or sunned, and the carer washes and changes (THRIVING library, HY-07, IN-13).
8. **Write the name in the register.** For every death, in every illness.

12. Numbers to carry

1. **Two openings, two walls.** Clears a sickroom in 25 to 50 minutes. One opening takes 90 minutes or more.
2. **28 against 12.** Air changes per hour, open windows and doors against a negative-pressure room's design. Old high-ceilinged rooms reached 40.

3. **97, 39, 33, 11.** Modelled per cent infected in 24 hours: closed room, negative-pressure room, modern room with windows open, old ward.
4. **One metre, no shared meals, no touching, no sleeping in the room.** The four protective behaviours.
5. **36 hours.** The window within which household barrier measures showed any effect.
6. **18 per cent, and 25 out of 25.** The Ebola household secondary attack rate, and the households with a death at home that then had secondary cases.
7. **18 °C, and no fire without a flue.** Korea: about 65,000 carbon monoxide deaths in 67 years.
8. **Ten minutes at a rolling boil.** Soiled linen, against standards of 71 °C for 25 minutes or 65 °C for 10.
9. **3.5 to 4 square metres per bedridden patient** when the sick must go outdoors.
10. **1.29.** The odds ratio for death from social isolation.

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