FO-04 The lay healer in the record: barefoot doctors, village health workers and what they achieved

HEALING after the FALL, research library, FO-04

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How this report was made, and what it can and cannot claim

This report reviews programmes in which people with short training delivered health care at scale, and asks what they did to mortality. It draws on the Cochrane review of lay health workers, the controlled trials, programme histories, critics and the guidance that sets out what community workers may do. Where only an abstract or a secondary summary was read, the reference says so. Unconfirmed figures and my own inferences carry [VERIFY].

Three warnings run through the record. Most evaluations were written by the programmes' champions. The national declines in child mortality that coincided with these programmes also coincided with schooling, water, sanitation, vaccination and rising incomes. And almost every modern trial assumed a referral hospital, a drug supply and a supervisor, all of which the Fall removes. Each programme is therefore read twice: for what it achieved, and for what it leaned on.

The barefoot doctors' manual devoted hundreds of pages to Chinese medicinal plants, but those plants are not graded here and are left to the botanical documents. Related documents in this series: FO-06, OR-01, OR-03, OR-08, SY-01 and MI-02.

1. Findings by section

1.1 China's barefoot doctors, 1965 to 1985

What the tradition says. In 1965 Mao Zedong attacked the urban bias of Chinese medicine, and mobile teams of city doctors were sent to train local paramedics (Zhang and Unschuld 2008, abstract read). The name "barefoot doctor" spread after a People's Daily article of 1968 (WHO Bulletin 2008). Official accounts presented a peasant who farmed half the day and healed the other half with commune-grown herbs, acupuncture and a few Western drugs, paid through a cooperative medical scheme.

What the record shows. Barefoot doctors were chosen by their communities and spent half the day on health care and half farming (National Library of Medicine, read in full). Training length varied by place and period. The National Library of Medicine gives one to four months, an NPR retrospective of 2005 gives three to six months (search summary only), and a Chinese official recalled courses of three months, six months or a year (WHO Bulletin 2008). The defensible statement is that the basic course lasted months, not years, with short refresher courses afterwards. The curriculum covered anatomy, bacteriology, diagnosis, acupuncture, family planning, maternal and infant care, and traditional and Western medicines (National Library of Medicine). One village doctor trained in 1975 said he learned "something of everything" (WHO Bulletin 2008).

More than one million were trained by the 1970s (National Library of Medicine, and "over a million" in Hesketh and Wei 1997, abstract read). A figure of 1.8 million appears in reference works but was not traced to a primary source [VERIFY].

The English translation of the manual, published by the US Department of Health, Education and Welfare in 1974 and reprinted by Running Press in 1977, runs to about 942 pages (catalogue records). Reviews state that over 400 pages concern medicinal plants and that each disease is given a choice of acupuncture, herbs or Western medicine (catalogue and review summaries only [VERIFY]). The manual itself was too large to retrieve.

The cooperative medical scheme covered about 90 percent of villages at its peak in the 1970s (PAHO fact sheet, read in full). When agriculture was decollectivised in the early 1980s it lost its financial base and collapsed in most provinces. Rural insurance coverage of 12.8 percent in 1993 and 9.5 percent in 1998 is reported in the literature, but the original was not read, and the lead's figure of 5 percent was not confirmed [VERIFY]. From 1981 barefoot doctors who passed an examination became "village doctors". Without collective pay many left, few continued preventive work, and a former barefoot doctor told the WHO Bulletin that diseases once controlled "emerged in the countryside again" (WHO Bulletin 2008). By 2008 China had more than 880,000 rural doctors.

Mortality. The WHO Bulletin feature gives rural infant mortality falling from 200 per 1,000 before 1949 to 18.6, and rural maternal mortality from 150 to 41.3 per 100,000. These span sixty years and cannot be credited to the programme. Babiarz, Eggleston, Miller and Zhang (2015, abstract read) built a provincial panel for 1950 to 1980 and found that school enrolment and public health campaigns together were associated with 55 to 70 percent of the decline in infant and under-five mortality. The abstract assigns no separate share to barefoot doctors.

What modern science infers. The barefoot doctors were a channel for vaccination, sanitation campaigns, birth spacing and basic treatment, each of which has strong independent evidence. The claim that herbs and acupuncture in peasant hands could replace modern medicine is not supported. Fang Xiaoping's history (2012, read only through reviews and the publisher's description) argues that the barefoot doctors were the channel through which Western drugs, injections and intravenous drips reached the villages, and that by 1978 Western drugs were over-prescribed.

Grade. B for delivery of preventive campaigns, heavily confounded. Herbal and acupuncture content: not graded here.

1.2 Alma-Ata 1978 and the primary health care movement

The International Conference on Primary Health Care met at Alma-Ata, Kazakh SSR, from 6 to 12 September 1978. Its declaration (text read in full) lists eight elements of primary health care in Article VII.3: health education, food and nutrition, safe water and sanitation, maternal and child health including family planning, immunisation, control of endemic diseases, treatment of common diseases and injuries, and essential drugs. Article VII.7 places "community workers" and "traditional practitioners as needed" inside a team with physicians, nurses and midwives, at local and referral levels. Article V sets a target for the year 2000. The slogan "Health for All by the Year 2000" was not found in the declaration's text. The declaration imagined the lay healer as the first rung of a ladder, not alone.

A year later Julia Walsh and Kenneth Warren argued (1979, read through secondary accounts) that comprehensive care was too costly and that an interim "selective" package aimed at a few diseases would save more lives per dollar. UNICEF's GOBI package (growth monitoring, oral rehydration, breastfeeding, immunisation) followed. Debabar Banerji, Unger and Killingsworth (1986) and Walt and Rifkin (1986) answered that selectivity betrayed Alma-Ata (all read through secondary summaries). A village after the Fall cannot fund comprehensive care and will in practice choose a selective list. The record says which items on that list worked.

1.3 Jamkhed: the Aroles' village health workers

Rajanikant and Mabelle Arole founded the Comprehensive Rural Health Project at Jamkhed, Ahmednagar district, Maharashtra, in 1970. The project trained women chosen by each village, usually illiterate and often of low caste, who attended weekly training sessions at the project centre (Population Reference Bureau 2007, read in full). The share of training given to personal development and the length of initial training could not be confirmed from sources read [VERIFY].

The village health workers gave antenatal and postnatal checks, conducted home deliveries, taught others to deliver safely, referred complications to the project's hospital, and organised women's and farmers' clubs.

Reported outcomes from about 1970 to 2007 (Population Reference Bureau 2007, figures supplied by the project): infant mortality from 176 to 24 per 1,000 births, maternal mortality from about 700 to 70 per 100,000 live births, antenatal care from under 1 percent to 99 percent of women, malnutrition in under-fives from 40 percent to under 5 percent, contraceptive use from under 1 percent to 68 percent, and near-universal immunisation. A study of 2,861 deliveries in 25 villages from 1996 to 1999 recorded two maternal deaths with 85 percent of births at home. That is about 70 per 100,000 (own arithmetic).

The weaknesses are plain. The figures are the project's own, with no contemporaneous control. Electricity and roads arrived over the same years, as the article notes. And the project ran its own hospital, so the worker always had somewhere to send a woman bleeding after birth. Rajanikant Arole estimated that ten to fifteen years were needed for lasting change in behaviour.

Grade. B (consistent internal series, uncontrolled).

1.4 BRAC and the oral rehydration teaching campaign, Bangladesh 1980 to 1990

This is the purest case of a lay workforce teaching one skill to a nation, and the most relevant to a world without supply chains, because the remedy was made at home. BRAC's Oral Therapy Extension Programme ran from 1980 to 1990. Richard Cash's account (2021, read in full) gives about 12 million households. Mushtaque Chowdhury's account (2019, read in full) gives over 14 million mothers.

The workers. Local women aged 20 to 35 with about ten years of schooling, so not illiterate (Cash 2021). They received five days of initial training, daily feedback meetings and a one-day refresher every three months. Teams of six to ten spent about four weeks in each union of about nine villages, each worker teaching up to ten women a day for about twenty minutes.

The message. A three-finger pinch of salt and a fistful of sugar or raw molasses (gur) in half a litre of water, with seven key points (Cash 2021). Chowdhury (2019) records that the first formula used two scoops of gur and was changed to a fistful.

Paying for results. Workers had no salary. A monitor revisited a 10 percent sample of each worker's mothers about a month later, asked them to recite the points and make the solution, and graded them. The worker earned 4 taka for each mother graded A, 2 for B, 1 for C, nothing for D (Cash 2021). Chowdhury (2019) adds that a sample of the solution was tested for salt and the worker was paid nothing if it fell outside the safe and effective range.

What it achieved. More than 90 percent of mothers knew of the solution and could prepare it, most within clinically safe limits, and about 70 percent still reported knowledge and use fifteen years after first contact (Cash 2021). ORT use rose from under 10 percent of diarrhoea episodes in early studies to over 80 percent in later Demographic and Health Surveys (Chowdhury 2019). Cash (2021) gives about half of all episodes and 82 percent of severe ones. A local test found the home solution held about 50 mEq of sodium per litre (Cash 2021).

What it did not show. Neither author reports a measured mortality effect. The link to Bangladesh's fall in child deaths is plausible, not proven.

Where it went wrong. In one area mothers made a hypertonic solution by using two pinches of salt to one scoop of gur. The monitoring system caught it (Chowdhury 2019). BRAC dropouts cost about US$24 each in lost training (Lehmann and Sanders 2007).

Grade. B for the teaching method (large process series, replicated nationally). The underlying therapy, oral rehydration, is A and is covered in other documents of this series.

1.5 Iran's behvarz and health houses

In Iran's rural network each "health house" serves about 1,500 people and is staffed by two behvarz recruited from the village and trained for two years (Javanparast and colleagues 2011, read in full). In 2007 there were about 17,000 health houses and nearly 31,000 behvarz covering most of the country's 65,000 villages. Behvarz are permanent salaried employees.

Their task list is broad: vaccination, growth monitoring, childhood illness, maternal care, family planning, detection and referral of infectious diseases, screening for chronic disease, environmental health, a household census, and simple treatment including painkillers, antibiotics and supplements (Javanparast 2011, table of roles).

Mortality: rural infant mortality fell from 120 per 1,000 in 1974 to 30 in 2000, against urban 62 to 28, closing the rural gap (Mehryar 2004, World Bank, search summary only). Maternal mortality fell from about 140 to 24 per 100,000 between 1985 and 2007 (secondary summary [VERIFY]).

Javanparast and colleagues themselves judge that these gains are unlikely to be due to primary care alone, given economic growth, literacy and safe water. Their respondents reported broken equipment and villages of 3,000 served by two workers meant for 1,500.

Grade. B (national series, confounded). Iran is the strongest example of a lay cadre with long training, a salary and a guaranteed referral chain.

1.6 Ethiopia's health extension workers

Ethiopia launched its Health Extension Program in 2004 (some sources say 2003). Two salaried female health extension workers, with at least grade 10 schooling and one year of training, staff a health post for each kebele of about 5,000 people. About 40,000 were deployed. In 2014 the base salary was about US$84 a month. From 2011 a Women's Development Army of about three million unpaid volunteers was organised to promote healthy behaviour (Damtew and colleagues, read in full). The workers deliver sixteen packages of prevention, family health and hygiene. The full list was not retrieved [VERIFY].

Under-five mortality fell 28 percent between the 2005 and 2011 surveys, from 123 to 88 per 1,000 (USAID programme overview, search summary only). The commonly quoted figure of 67 per 1,000 in 2016 was not confirmed [VERIFY]. No study read separates the programme's share from vaccination, nutrition and growth. Amouzou and colleagues (2015, abstract read) found that births and deaths reported by health extension workers were too incomplete to monitor child mortality. Maes and colleagues (2018, abstract read) found that women recruited as Women's Development Army leaders were more deprived and distressed than their neighbours, and argued that unpaid labour should be ended.

Grade. B for coverage of preventive services, C to D for any specific mortality share.

1.7 Brazil's family health programme

Brazil's Programa Saúde da Família places teams of a doctor, a nurse and several community health agents (agentes comunitários de saúde) in defined areas. The community health agent is the lay element. Details of their training could not be confirmed from sources read [VERIFY].

Macinko and colleagues (2006, abstract read) analysed state-level panel data for 1990 to 2002. Infant mortality fell from 49.7 to 28.9 per 1,000 as coverage rose from 0 to 36 percent, and each 10 percent rise in coverage was associated with a 4.5 percent fall in infant mortality after controlling for water, income, literacy and other factors. This is an ecological study. Aquino, de Oliveira and Barreto (2009, abstract read) used 771 municipalities from 1996 to 2004 and found infant mortality reductions of 13, 16 and 22 percent at three rising levels of coverage, larger where mortality had been high. Rasella and colleagues (2014, search summary only) linked consolidated coverage to lower heart and stroke mortality (rate ratios 0.79 and 0.82).

Brazil shows a lay worker inside a team with a doctor. It is not a test of the lay worker alone.

Grade. B (consistent ecological series).

1.8 Cuba: the counter-example

Cuba is often cited in the primary care literature, but it chose doctors, not lay healers. Its Family Doctor and Nurse Programme began in 1984 and spread nationally [VERIFY: start date from a search summary only]. Infant mortality is reported at 17.3 per 1,000 in 1982, 10.2 in 1992 and 4.5 in 2010 (MEDICC table, search summary only). The figures are contested. Roberto González argued that late fetal deaths are abnormally high and early neonatal deaths abnormally low, consistent with misclassification or late termination of high-risk pregnancies (González 2013, blog summary read in full).

Cuba matters here for another reason. Its Special Period after 1989 is the nearest modern case of a health system losing its supplies. Per-capita energy intake fell from 2,899 to 1,863 calories, the population lost weight, and all-cause mortality among the elderly rose modestly, while later deaths from diabetes and heart disease fell (Franco and colleagues 2007, abstract read). A dense network of trained people held the system together through a collapse in supplies, but it was a network of doctors.

Grade. Not graded as a lay programme.

1.9 Partners in Health and the accompagnateurs

Paul Farmer and colleagues introduced directly observed antiretroviral therapy in rural Haiti, building on village workers who already observed tuberculosis treatment (Farmer and colleagues 2001, abstract read). The 2001 paper concluded that the approach works in poor settings "if there is an uninterrupted supply of high-quality drugs". That condition is the hinge for this book.

The best controlled comparison is Franke and colleagues (2013, full text read) in rural Rwanda: 610 adults starting antiretroviral therapy, comparing the national clinic model with the same model plus accompaniment (daily home visits, observed doses, food, transport money, social support). At one year, 85 percent of the accompanied group and 79 percent of the clinic group were alive, retained and virally suppressed (adjusted risk ratio 1.15, 95 percent CI 1.03 to 1.27). Attrition was sharply lower (adjusted hazard ratio 0.17, 95 percent CI 0.09 to 0.35). The workers had a multi-day initial training and monthly refreshers. The design is observational, and the accompanied area also had extra staff and tuberculosis screening. A separate retrospective review of 1,041 patients found 92 percent retained at two years against an African average of 70 percent (Harvard news release, search summary only).

Farmer's Pathologies of Power (2003), a lead in the brief, was not read for this report.

Grade. B for accompaniment improving retention. The underlying treatment is outside this document.

1.10 The controlled evidence: what lay healers measurably achieved

The Cochrane review. Lewin and colleagues (2010, full text read in part) included 82 randomised trials, of which 55 were in high-income countries (41 in the United States), 12 in middle-income and 15 in low-income countries.

Compared with usual care, lay health workers:

Outcome	Risk ratio (95% CI)	Trials	Certainty
Under-five mortality	0.75 (0.55 to 1.03)	3	Low
Neonatal mortality	0.76 (0.57 to 1.02)	4	Low
Child morbidity (fever, ARI, diarrhoea)	0.86 (0.75 to 0.99)	6	Low
Care-seeking for sick child	1.33 (0.86 to 2.05)	3	Low
Immunisation up to date	1.22 (1.10 to 1.37)	4	Moderate
Breastfeeding initiation	1.36 (1.14 to 1.61)	12	Moderate
Exclusive breastfeeding	2.78 (1.74 to 4.44)	10	Moderate
Smear-positive TB cure	1.22 (1.13 to 1.31)	4	Moderate

No trial measured maternal mortality. The mortality intervals cross 1, so the honest summary is "may reduce" child and newborn deaths by about a quarter. Whether this review has been updated since 2010 was not checked.

Newborn care at home. Abhay and Rani Bang's SEARCH team in Gadchiroli, Maharashtra, compared 39 intervention and 47 control villages. After a baseline from 1993 to 1995, village health workers gave home-based newborn care from 1995 to 1998, including, from 1996, diagnosis of sepsis by clinical algorithm and treatment with intramuscular gentamicin and oral co-trimoxazole (Bang and colleagues 1999, abstract read). Neonatal mortality fell by a net 25.5 per 1,000 (62 percent), infant mortality by 38.8 (46 percent), perinatal mortality by 47.8 (71 percent). Sepsis case fatality fell from 16.6 to 2.8 percent. Cost was about US$5.3 per neonate, and in 1997 to 1998 one fetal or neonatal death was averted for every 18 neonates cared for. Supervision was fortnightly. Over 1996 to 2003 the workers monitored 93 percent of 5,268 neonates and correctly diagnosed 89 percent of sepsis cases (Bang 2005, abstract via search summary). The design was controlled but not randomised. The workers' schooling, training days and the antibiotic doses could not be retrieved [VERIFY].

Gogia and Sachdev (2010, abstract read) pooled five trials of home visits by community workers, all in South Asia: neonatal mortality risk ratio 0.62 (95 percent CI 0.44 to 0.87), stillbirths 0.76 (0.65 to 0.89). The benefit was larger where home-visit coverage exceeded 50 percent.

Malaria treated by mothers. Kidane and Morrow (2000, abstract read) randomised village clusters in Tigray, Ethiopia. Mother coordinators taught mothers to recognise malaria and give chloroquine promptly. In 1997, 190 of 6,383 under-fives died in intervention clusters (29.8 per 1,000) against 366 of 7,294 in controls (50.2 per 1,000), a 40 percent reduction (95 percent CI 29.2 to 50.6). Sources disagree on the number of clusters (37 or 24). Later guidance replaced chloroquine with artemisinin combination therapy (WHO and UNICEF 2012).

Pneumonia treated in the community. Sazawal and Black (2003, abstract and press release read) pooled nine community studies, none randomised: total mortality fell by 27 percent in neonates, 20 percent in infants and 24 percent (95 percent CI 14 to 33) in children under five, and pneumonia mortality by 36 percent in under-fives. A later modelling review estimated that community case management could reduce under-five pneumonia mortality by 70 percent (Theodoratou and colleagues 2010, summary read). The gap is between real programmes and modelled full coverage. In Nepal, research in the 1980s found community pneumonia management reduced under-five mortality by 28 percent, and female community health volunteers, many illiterate, were later allowed to treat it with co-trimoxazole (Dawson and colleagues 2008, abstract read).

A selling model. Björkman Nyqvist and colleagues (Living Goods, Uganda, 214 clusters, summaries read) tested community health promoters who visited homes and sold health products at about 10 percent below market price. Under-five mortality fell 27 percent, infant mortality 33 percent and neonatal mortality 27 to 28 percent. The au-

thors stress that the effect depended on referral facilities existing. A later scaled-up trial found no significant overall difference in child mortality (J-PAL and author summaries).

Postpartum haemorrhage. Mobeen and colleagues (2011, abstract read) randomised 1,119 home births in Chitral, Pakistan: trained traditional birth attendants gave 600 micrograms of oral misoprostol or placebo after the birth. Postpartum haemorrhage fell from 21.9 to 16.5 percent (risk ratio 0.76, 95 percent CI 0.59 to 0.97). Shivering and chills were commoner. There were no maternal deaths. WHO in 2012 recommended lay health workers give misoprostol to prevent haemorrhage, but limited lay workers' use of injectable antibiotics for neonatal sepsis and of neonatal resuscitation to research settings (WHO 2012, search summary only). The 2018 update allows 400 or 600 micrograms by mouth where no injectable uterotonic is available (secondary summary).

How accurate lay workers are. In Malawi, classifications of common childhood illness by Health Surveillance Assistants agreed with physicians' in 68 percent of cases, and 63 percent of children got appropriate medication (WHO and UNICEF 2012, read in full). Even well-run lay services get about a third of cases wrong. The book's protocols must be built to fail safe.

1.11 Failures: where lay healers harmed, overreached, sold drugs or were captured

After the money stopped: China. When collective financing ended, village doctors lived on fees and drug sales. Dong and colleagues (2011, abstract read) examined 20,125 prescriptions from 680 village clinics in ten western provinces: 22.93 percent included an injection. Injections were likelier for children under three (odds ratio 1.72) and less likely from doctors with full-time medical education (0.65). In Shandong, Sun and colleagues (2008, abstract read) found antibiotic and injection rates higher in villages under the new insurance scheme. Figures of 65 and 56 percent of visits with injections, and 72 and 59 percent with antibiotics, appear in summaries but were not confirmed in the original [VERIFY]. The barefoot doctor, cut loose from a salary, became a drug seller.

Informal providers in India. Das and colleagues (2012, secondary summaries) sent standardised patients to 305 providers for 926 consultations. In rural Madhya Pradesh 67 percent of providers had no medical qualification. Correct treatment was given in about 30 percent of cases and incorrect or harmful treatment in more than 40 percent (secondary summary). In West Bengal a randomised trial of training improved correct case management by 7.9 percentage points but did not reduce unnecessary medicines or antibiotics (Das and colleagues 2016, abstract read). Training improves diagnosis faster than it changes selling.

Injections. At least half of injections were unsafe in 14 of 19 developing countries studied (Simonsen and colleagues 1999, abstract read). A model estimated that unsafe injections caused 8 to 16 million hepatitis B, 2.3 to 4.7 million hepatitis C and 80,000 to 160,000 HIV infections each year (Kane and colleagues 1999, abstract read). In Roka commune, Battambang, Cambodia, an unlicensed village medic who had practised from 1996 reused syringes. From December 2014, 242 villagers aged 2 to 89 were diagnosed with HIV, and 78.5 percent of the cases tested were also infected with hepatitis C (Rouet and colleagues 2018, abstract read). He was jailed for 25 years in 2015. Cambodia then banned unlicensed health workers, and remote villagers complained that care became harder to find. The ban is the second harm.

Attrition and the volunteer trap. Reported attrition among community health workers ranges from 3.2 to 77 percent, higher among volunteers, and workers dependent on community financing leave at twice the rate of salaried ones (Lehmann and Sanders 2007, read in part). In the Solomon Islands only 58 percent of village health workers were paid regularly, and many quit for that reason. The same review states that supervision "is often among the weakest links". Sustained community financing was rare except where institutionalised, as in China. Kenneth Maes (2017, book review read) documented unpaid women doing HIV home care in Addis Ababa and argued that appeals to sacrifice exploited them.

Capture. The barefoot doctor was also a political cadre, selected by and accountable to the brigade. David Werner's essay title, "The Village Health Worker: Lackey or Liberator?" (catalogue record only, text not read), names the

dilemma. The Living Goods model shows the opposite risk: a worker whose income depends on sales.

Overreach. No case was found of lay workers systematically doing surgery or other major procedures. The overreach in the record is injections and unneeded drugs [VERIFY: absence of evidence only].

1.12 What the programmes assumed, and what survives the Fall

Every programme with measured mortality benefit leaned on at least one of five supports:

1. **A drug supply.** Antibiotics, antimalarials, misoprostol, antiretrovirals, vaccines, zinc. Without it, the healer keeps only what can be made at home.
2. **A referral chain.** Jamkhed had a hospital, Iran and Ethiopia sit on health centres, and Living Goods' result was conditional on facility care.
3. **Supervision.** Fortnightly in Gadchiroli, monthly in Rwanda, a 10 percent re-check in BRAC.
4. **Pay.** Iran, Ethiopia and BRAC paid. Volunteer schemes leaked workers.
5. **Schooling or long training.** BRAC's workers had ten years of schooling. Jamkhed's could not read but trained weekly for years.

What happens when these go is measured in one natural experiment. During the West African Ebola epidemic of 2014 to 2015, clinics closed and outpatient attendance fell to as low as 10 percent. Parpia and colleagues (2016, abstract read) modelled a 50 percent fall in access and estimated 6,269 additional deaths from malaria, HIV and tuberculosis in Guinea, 1,535 in Liberia and 2,819 in Sierra Leone. [VERIFY: own inference that these are of the same order as the Ebola deaths.] In China, when the cooperative scheme collapsed, preventive work stopped and drug selling took its place.

What survives the Fall is what needs no supply, hospital or wage: teaching, counting (breaths, days of fever, arm circumference), recording, visiting and the community's own organisation. What does not survive is everything that came in a packet. The lay healer after the Fall is closer to the BRAC teacher than to the Gadchiroli worker with gentamicin.

1.13 Deriving the task list

A lay healer should own a task when the benefit was shown in lay hands, error does little harm, and the decision reduces to "one observation leads to one action" (WHO and UNICEF 2012). The healer should refuse when error is dangerous, the skill decays without practice, or the task needs equipment or follow-up the village lacks [VERIFY: these criteria are my own synthesis].

Own (with training, a written protocol and a record): - Teaching and checking home-made oral rehydration solution, and supervising its use. - Promoting immediate and exclusive breastfeeding. - Home visits in pregnancy and for the first weeks after birth: warmth, cord care, feeding, recognition of danger. - Recognising the danger signs in a sick child and acting on them the same day. - Counting breaths and treating fast-breathing pneumonia with oral amoxicillin, while stock lasts. - Testing and treating fever with an antimalarial where malaria exists, while stock and tests last. - Measuring mid-upper-arm circumference and acting on it. - Giving oral misoprostol after the birth of the baby, if stock exists. - Directly observed treatment and daily accompaniment for long courses such as tuberculosis. - Keeping a register of births, deaths, illness and treatment. - Organising water, sanitation and waste work with the village.

Refuse, or do only with special training at the dispensary or infirmary rung: - Any injection without a sterile, single-use or properly sterilised syringe and needle for each person. - Injectable antibiotics for newborn sepsis, unless trained, supervised and supplied as in Gadchiroli. - Neonatal resuscitation beyond drying, warming and stimulating, unless trained and practised. - Treating infants under two months as if they were older children. - Prescribing antibiotics for coughs without fast breathing, for diarrhoea without blood, or "to be safe". - Intravenous fluids or drips. -

Any treatment sold for profit by the person who prescribes it. - Promising a cure when a red flag is present.

2. Evidence grades

Key: A randomised trials or systematic reviews, B consistent observational series, C convergent tradition with plausible mechanism, D single tradition or anecdote, X shown ineffective or harmful.

Practice	Grade	What the tradition says	What the record shows	What modern science infers
Lay health workers in maternal and child health overall	A (low certainty for mortality)	Peasants can serve peasants	RR 0.75 under-five, 0.76 neonatal, intervals cross 1 (Lewin 2010)	Probably a quarter fewer deaths where a system backs them
Lay promotion of immunisation, breastfeeding, TB cure	A		RR 1.22, 1.36 to 2.78, 1.22 (Lewin 2010)	Robust
Home-based newborn care with home visits	A		RR 0.62 neonatal deaths, five South Asian trials (Gogia 2010)	Robust in South Asia, larger above 50 percent coverage
Lay diagnosis and injection treatment of newborn sepsis	B		Case fatality 16.6 to 2.8 percent (Bang 1999), non-randomised	WHO limits to research settings (2012)
Mothers treating malaria at home	A (single trial)		40 percent fewer under-five deaths (Kidane 2000)	Holds where drug works and supply exists
Community pneumonia treatment	B		24 percent fewer under-five deaths, non-randomised (Sazawal 2003)	Up to 70 percent pneumonia deaths modelled
Teaching home-made salt and sugar solution at scale	B	A pinch and a fistful	90 percent able to make it, use from under 10 to over 80 percent (Cash 2021, Chowdhury 2019)	Mortality effect not measured directly
Misoprostol by birth attendants after birth	A		RR 0.76 for haemorrhage (Mobeen 2011)	Recommended by WHO for lay workers
Accompaniment and directly observed therapy	B		RR 1.15 retained and suppressed (Franke 2013)	Observational, with extra staff as confounder
Health-product selling by health workers	A (one trial, not replicated at scale)		27 percent fewer under-five deaths, then null at scale	Conditional on referral

Practice	Grade	What the tradition says	What the record shows	What modern science infers
Barefoot doctor programme as a whole	B to C	Herbs and acupuncture by peasants	Delivered campaigns, confounded by schooling and sanitation (Babiarz 2015)	Value lay in prevention and access
Barefoot doctor herbal and acupuncture content	D (not assessed here)	Equal to Western drugs	Western drugs and injections spread instead (Fang 2012)	See plant documents
Untrained, unsupervised fee-earning providers	X		Over 40 percent harmful treatment (Das 2012)	Harmful
Injections without sterile supply	X		Roka outbreak, millions of infections modelled (Kane 1999)	Harmful
Unpaid volunteer-only workforce	X for sustainability	Service as virtue	Attrition up to 77 percent (Lehmann and Sanders 2007)	Pay or lose them

3. Means ledger

The ledger is given for the lay healer service itself and for its five core practices. "Outcome change" states what the rung adds.

The lay healer service

Rung	What can be done	What it changes
Hands and knowledge	One trusted person who knows danger signs, teaches rehydration and breastfeeding, visits newborns, keeps a written or remembered register	Most of the preventive and teaching benefit, early recognition of deaths that cannot be prevented
Hearth	Salt, sugar or honey, clean water, a measuring cup and spoon, cloth for warmth, a watch or counting method for breaths	Home rehydration, newborn warming, breath counting
Garden and still	Scale for weighing babies, soap, ethanol for hand hygiene, a pressure cooker to sterilise instruments, paper records	Weighing low birth weight infants, safer delivery hygiene

Rung	What can be done	What it changes
Village dispensary	A trained lay healer with protocols, salvaged amoxicillin, antimalarials, misoprostol, zinc, a few sterilisable syringes, a MUAC tape, a supervisor visiting every two weeks	Treatment of pneumonia, malaria and haemorrhage while stock lasts, the Gadchiroli level of newborn care if trained
District infirmary	Nurse or doctor, sterile room, ten beds, a lab bench, the place to refer to	Injectable antibiotics, oxygen if any, managed delivery complications, the referral that every trial assumed
Hospital before the Fall	Full intensive and surgical care, blood, caesarean section	Reference standard

By practice. Oral rehydration teaching works fully at the hearth (Cash 2021). Pneumonia care begins with counting breaths but saves lives only at the dispensary, where an antibiotic exists, and when the amoxicillin runs out mortality returns towards the untreated level. Newborn warmth and feeding work at the hearth, while sepsis treatment needs the dispensary and the Gadchiroli result needed injectable gentamicin and fortnightly supervision. Misoprostol is a dispensary item only. Accompaniment works with hands and knowledge, but its outcome depends on the drug being accompanied.

4. Harm test

Injections. Harm: hepatitis B and C and HIV through reused needles and syringes, and abscesses. Error that harms: one reused needle. Who must never receive an unsterile injection: anyone. Signs going wrong: abscesses, clusters of jaundice months later. What to do: stop injecting until sterile equipment exists and trace patients. Cases: Roka (Rouet 2018), Simonsen 1999, Kane 1999.

Antibiotics given when not needed. Harm: allergic reactions, diarrhoea, resistance, exhaustion of scarce stock. Error that harms: treating every cough or every diarrhoea. Who must not receive amoxicillin: anyone with known penicillin allergy. Signs going wrong: rash, wheeze, swelling of lips. What to do: stop the drug and refer. Cases: Chinese village clinics (Sun 2008), Indian informal providers (Das 2012, 2016). After the Fall, the worst harm of waste is an empty shelf when a true pneumonia arrives.

Home-made rehydration solution too salty or too sweet. Harm: a solution that is too salty or too sweet can worsen dehydration and diarrhoea (Rehydration Project, search summary only). Error that harms: heaped instead of level spoons, a whole spoon of salt instead of a half, too little water. In Bangladesh one area doubled the salt (Chowdhury 2019). Who is most at risk: infants. Signs going wrong: the child refuses it, vomits repeatedly, becomes more irritable, or the solution tastes saltier than tears [VERIFY]. What to do: discard and remake with more water. Too dilute is far safer than too strong.

Misoprostol given before the baby is born. Harm: violent contractions, uterine rupture and death of mother or baby [VERIFY: mechanism from general obstetric knowledge, not from sources read here]. Who must never receive it: a woman whose baby is not yet born. Signs going wrong: strong contractions after a dose given in labour. What to do: carry to the infirmary at once. Side effects after correct use: shivering and fever, usually brief.

Antimalarials. Harm: overdose in small children [VERIFY], and treating every fever as malaria, which wastes stock and misses pneumonia [VERIFY: own inference]. Infants under two months are outside the iCCM scheme.

False reassurance and missed referral. This is the commonest harm of a lay service. In Malawi a third of classifications disagreed with a physician's (WHO and UNICEF 2012). Most at risk: infants under two months and

malnourished children. Sign: a child who was "fine" yesterday is now drowsy or not drinking. Remedy: build a revisit into every protocol.

Selling. Harm: the healer prescribes what pays (post-collective China, Indian informal providers). Remedy: never let the prescriber profit from the prescription.

Burnout and abandonment. Most at risk: those trained young and unpaid volunteers (Lehmann and Sanders 2007). Signs: missed visits, stale registers. Remedy: pay, train two per post, limit the task list.

5. Red flags

These signs mean a child or mother may die without care the village cannot give. Child signs come from the WHO and UNICEF community chart (2014, summary read) and the iCCM statement (2012).

Child two months to five years: - Convulsions now or with this illness. - Not able to drink or feed anything. - Vomits everything. - Unusually sleepy or cannot be woken. - Chest indrawing (the lower chest sucks in when the child breathes in). - Cough for 14 days or more, diarrhoea for 14 days or more, blood in stool, or fever for 7 days or more. - Arm circumference in the red zone (under 115 mm), or swelling of both feet.

Newborn under two months: any illness at all, poor feeding, cold to touch, fast breathing at 60 or more per minute, convulsions, jaundice reaching the palms or soles [VERIFY for the palms and soles sign], a red or discharging cord.

Mother: bleeding that soaks cloths after birth, fits, severe headache with blurred vision in late pregnancy, fever after birth, labour lasting more than a day [VERIFY: thresholds left to the obstetric documents].

What to do anyway. The WHO community chart instructs the worker to give the first dose of available treatment before referral, start oral rehydration at once if the child can drink, and keep the child warm and feeding on the way. After the Fall, referral may mean a day's carry, or nowhere. If there is nowhere to go: give fluid in small sips, keep the child warm and held, continue breastfeeding, give the first antibiotic dose if any exists, stay with the family and record what happened. Tell the family plainly that the child is very ill and that they have done what can be done.

6. The case against

The confounding critique. Babiarz and colleagues (2015) attribute most of China's child mortality fall under Mao to schooling and sanitation campaigns. Javanparast and colleagues (2011) concede the same for Iran. The lay healer's own share at national scale is unmeasured.

The champion critique. Jamkhed, BRAC and Partners in Health each report their own results. The controlled studies are fewer, smaller and more conditional, and the second Living Goods trial at scale found no overall effect.

The selective care critique. Walsh and Warren (1979) argued that a few cost-effective interventions beat comprehensive care. Their critics (Banerji, Unger and Killingsworth, Walt and Rifkin) argued that selectivity produces donor-driven vertical programmes that collapse. Both sides are partly right. The trial evidence supports a short list. The history of collapse supports community ownership.

The quality critique. Das and colleagues show frequent wrong treatment in India, and that training changes diagnosis more than prescribing. Malawi shows a one-third error rate even with support.

The labour critique. Maes (2017) and Lehmann and Sanders (2007) show that programmes built on unpaid women's labour exploit and lose them.

The romance of the herbal. Fang (2012) shows that the barefoot doctors' lasting effect was the spread of Western drugs and injections, not herbal self-sufficiency.

Against the critics. The Gadchiroli and Tigray studies show that lay workers with a protocol and a drug can cut newborn deaths by more than half and child deaths by two-fifths far from a hospital.

Feasible today against after the Fall. Today every model can be rebuilt with bought drugs and salaries. After the Fall, the drug-dependent half of the record lasts as long as salvaged stock, and the teaching half lasts indefinitely.

7. Ten-line summary of robust findings

1. Lay health workers raise immunisation, breastfeeding and TB cure with moderate-certainty trial evidence (Lewin 2010).
2. They probably reduce child and newborn deaths by about a quarter where a system supports them, with low certainty.
3. Home visits around birth cut newborn deaths by about 40 percent in South Asian trials, and up to 62 percent in Gadchiroli.
4. Mothers taught to treat malaria with a working drug cut under-five deaths by 40 percent in one Ethiopian trial.
5. Community pneumonia treatment with oral antibiotics cut under-five deaths by about a quarter in non-randomised studies.
6. A five-day course and a paid-by-results check taught 12 million Bangladeshi households to make safe rehydration solution.
7. Every mortality benefit depended on a drug supply, a referral point, supervision or pay, often all four.
8. Without salary and supervision, lay healers leave, or turn to selling drugs and injections.
9. The commonest harms are unsterile injections, unneeded antibiotics, wrong-strength solutions and missed referral.
10. What survives the Fall is teaching, counting, visiting and recording, and the community organisation behind them.

8. Open questions

- How much of China's, Iran's and Ethiopia's child mortality decline was due to the lay cadre itself rather than to schooling, water and income?
- Does the Gadchiroli sepsis result replicate without injectable gentamicin, and what is the safest oral-only regimen when injections cannot be sterilised?
- How long does lay skill in breath counting and danger-sign recognition last without refresher training? No study read measured this.
- Can a healer who cannot read keep a useful register? Jamkhed used non-literate workers, but no data on their records were found.
- What payment survives the loss of money: a share of harvest, labour exchange, exemption from other work? No programme paying in kind at scale was found.
- Did barefoot doctors' herbal remedies have any measured effect, or did benefit come entirely from the Western drugs and campaigns they carried?
- How should a village ration salvaged antibiotics when the lay healer's diagnosis is wrong a third of the time?

9. Sources to read in full

1. Lewin S and colleagues 2010, Cochrane review of lay health workers (CD004015.pub3).
2. Bang AT and colleagues 1999, Lancet, and the 2005 Journal of Perinatology supplement on Gadchiroli, for the training, algorithm and doses not retrieved here.
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10. Farmer P 2003, Pathologies of Power (not read for this report).

10. At the bedside after the Fall

Household. Minimum viable version: one adult in each household who can make rehydration solution correctly, keep a newborn warm and at the breast, count a child's breathing for a full minute, and recognise the red flags. Needs: a one-litre vessel, a level teaspoon, salt, sugar or molasses, clean water, a way to count a minute, warm cloth. Records: a dated note of births, illnesses and deaths. First failure to expect: a heaped spoon of salt.

Village of 300. Minimum viable version: two lay healers chosen by the village, as in Jamkhed and Iran, owning the task list in section 1.13. They visit every pregnant woman and newborn, run rehydration teaching with BRAC-style checking, hold salvaged antibiotics, antimalarials and misoprostol under lock with a written count, and keep the register. Needs: a MUAC tape or a marked string (115 mm and 125 mm), a timer, a scale if possible, a lockable box, a register book, the protocols below, and a fixed payment in food or labour. Skills: five days of initial training as BRAC gave, then weekly or fortnightly sessions as in Jamkhed and Gadchiroli. First failure to expect: the salvaged amoxicillin is spent on coughs in the first winter, and there is none when a child with fast breathing comes.

District of 3,000. Minimum viable version: about ten village healers (one per 300) supervised by the infirmary's nurse or doctor, who visits each fortnight, rechecks a sample of cases and solutions, collects the registers, and holds the district stock of drugs and the only sterile injecting equipment. The infirmary is the referral point every trial assumed. It keeps the district register of births and deaths, the only way to know whether the healers do good. Needs: a sterile room and pressure-cooker sterilisation, a stock ledger, a messenger or path between village and infirmary, and an agreed rule for who may inject. First failure to expect: supervision lapses within the first year, as Lehmann and Sanders found nearly everywhere, and the village healers drift into either inactivity or selling.

11. Protocols

These are written for a careful lay reader. Quantities are given with sources. Where two sources differ, both are given.

Protocol A. Choosing and keeping a village lay healer

1. Let the village choose. Prefer adults over 20 (Lehmann and Sanders 2007).
2. Choose two per village of about 300, so the work is shared.
3. Train for at least five days (Cash 2021), covering only the protocols below.
4. Meet weekly or every two weeks for the first year (Jamkhed weekly, Gadchiroli fortnightly supervision).
5. Pay something regular. Irregular pay drove workers to quit (Lehmann and Sanders 2007).
6. Never let the healer's income depend on what they prescribe.
7. Each month re-check one case in ten: the mother repeats the advice and makes the solution in front of the supervisor (BRAC method).
8. Keep a register: date, name, age, complaint, breaths per minute, what was given, outcome on revisit.

Protocol B. The sick child aged two months to five years

1. Ask: how many days of cough, diarrhoea, fever? Any blood in stool? Any fits? Can the child drink or breast-feed? Does the child vomit everything?

2. Look: is the child unusually sleepy or hard to wake? Is there chest indrawing? Are both feet swollen?
3. Count breaths for one full minute while the child is calm [VERIFY: one-minute count is standard IMCI practice, not confirmed in sources read here].
4. Fast breathing is 50 or more per minute from 2 to 11 months, and 40 or more per minute from 12 months to 5 years (Indian Pediatrics 2004, IRC flowchart 2010, both citing WHO).
5. From 6 months, measure arm circumference halfway between shoulder and elbow. Under 115 mm is severe, 115 to under 125 mm is moderate (WHO 2013, secondary summary).
6. If any red flag in section 5 is present: give the first dose of any treatment you have, start rehydration solution if the child can drink, keep warm, refer the same day.
7. If fast breathing and no red flag, and amoxicillin 250 mg tablets exist: give twice daily for 5 days. Age 2 to 12 months: 1 tablet per dose (10 tablets total). Age 12 months to 5 years: 2 tablets per dose (20 tablets total) (WHO and UNICEF 2012). The WHO 2014 facility table, based on at least 40 mg per kg per dose, gives 3 tablets for children of 14 to 19 kg (WHO 2014, secondary summary). The sources differ for the heaviest children, so weigh where possible.
8. If diarrhoea under 14 days and no blood: give rehydration solution (Protocol C) and, if zinc exists, one dose daily for 10 days: half a 20 mg tablet from 2 to 6 months, one tablet from 6 months to 5 years (WHO and UNICEF 2012). The 2004 statement gives the same daily doses for 10 to 14 days (WHO and UNICEF 2004, secondary summary).
9. If fever under 7 days in a malaria area and a rapid test exists, treat only if positive with the national antimalarial at the stated dose. Do not use chloroquine for falciparum malaria where resistance is known.
10. Revisit every treated child on day 2 or 3 [VERIFY: interval not confirmed in sources read]. If worse, or a red flag has appeared, refer.
11. Never treat a baby under two months with this protocol. Refer.

Protocol C. Making and checking home rehydration solution

1. Wash hands. Use the cleanest water available, boiled and cooled if possible.
2. Measure 1 litre of water exactly once with a marked vessel, and keep that vessel for this use only.
3. Add 6 level teaspoons of sugar and half a level teaspoon of salt. Stir until dissolved (Rehydration Project, search summary). The BRAC field version is a three-finger pinch of salt and a fistful of sugar or gur in half a litre (Cash 2021). The two versions agree in proportion only roughly, because a pinch and a fistful vary by hand [VERIFY: own inference]. Where in doubt, use less salt.
4. Level each spoon with a knife. Never heap.
5. Taste it. It should taste no saltier than tears [VERIFY]. If saltier, add water.
6. Give small sips or spoonfuls often. After each loose stool give at least half a cup to a young child (WHO and UNICEF 2012).
7. Make fresh each day [VERIFY: 24-hour limit is standard advice, not confirmed in sources here].
8. Continue breastfeeding and food.
9. Supervisor's check: once a month, ask a sample of mothers to make it in front of you. Taste it. Teach again any mother whose solution is too salty.
10. Refer if the child cannot drink, vomits everything, has blood in stool, or diarrhoea lasts 14 days or more.

Protocol D. Visiting the newborn

1. Visit on the day of birth if possible, and again on days 3 and 7 (schedule adapted from home-visit programmes [VERIFY: exact day schedule not taken from a source read here]).
2. Check: is the baby warm, breastfeeding, passing urine? Is the cord dry?
3. Keep the baby skin to skin and wrapped. Delay bathing.
4. Support breastfeeding from the first hour.

5. Count breaths: 60 or more per minute is fast in a baby under two months (Indian Pediatrics 2004, secondary).
6. Any illness, poor feeding, cold baby, fits, fast breathing, red cord: refer the same day.
7. Injectable antibiotics only if the healer has been trained and supervised to Gadchiroli standard and has sterile equipment. WHO in 2012 recommended this for lay workers only within research.

Protocol E. Misoprostol after birth (only if stock exists)

1. Confirm the baby is born. Confirm there is no second baby [VERIFY: twin check is standard obstetric practice, not from sources here].
2. Give 600 micrograms by mouth (three 200 microgram tablets) (Mobeen 2011). WHO 2018 allows 400 or 600 micrograms (secondary summary).
3. Warn the mother she may shiver and feel hot for a while.
4. If bleeding continues to soak cloths, refer at once.
5. Never give it before the baby is born.

Protocol F. Accompaniment for long treatments

1. Agree with the patient a fixed time each day.
2. Watch each dose taken. Record it.
3. Ask about food, pain, mood and side effects. Bring food if hunger stops the patient taking the drug (food support was part of the Rwanda package, Franke 2013).
4. If a dose is missed twice or the patient worsens, tell the supervisor.
5. Keep doing it when the patient feels well. That is when people stop.

Protocol G. Injection rule

1. No injection without a new or properly sterilised needle and syringe for each person.
2. Never reuse a syringe on a second person, even with a new needle.
3. If sterile equipment is not available, use the oral form or refer.
4. Count injection equipment like drugs.

12. Numbers to carry

1. **Fast breathing:** 60 or more per minute under 2 months, 50 or more from 2 to 11 months, 40 or more from 12 months to 5 years. Count for a full minute.
2. **Home rehydration solution:** 1 litre of clean water, 6 level teaspoons of sugar, half a level teaspoon of salt. Too weak is safer than too strong.
3. **Arm circumference:** under 115 mm means severe malnutrition. Refer.
4. **Amoxicillin 250 mg for fast breathing:** twice daily for 5 days, 1 tablet from 2 to 12 months, 2 tablets from 1 to 5 years.
5. **Zinc for diarrhoea:** 10 mg a day under 6 months, 20 mg a day from 6 months, for 10 days.
6. **Misoprostol:** 600 micrograms by mouth after the baby is born, never before.
7. **Danger signs:** cannot drink, vomits everything, fits, very sleepy, chest indrawing. Any one means refer today.
8. **What lay healers achieved with a system behind them:** about a quarter fewer child deaths overall, 40 percent fewer with home malaria treatment, about 60 percent fewer newborn deaths with full home newborn care.
9. **Accuracy:** expect about one case in three to be misjudged (68 percent agreement in Malawi). Build in the revisit.
10. **Staffing:** one lay healer per 300 to 1,500 people, supervised at least every two weeks, and paid.

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