OR-03 Medicine without imports: Cuba's Special Period and the other cases

HEALING after the FALL, research library, OR-03

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How to read this

This report looks at places that lost their imported medicine and kept living: Cuba after 1990 above all, then Iran and Iraq under sanctions, Venezuela, the post-Soviet states, North Korea, besieged Sarajevo, Leningrad and Gaza, and the blockade pharmacies of the Confederacy, Germany, Britain and Japan. For each it asks what ran out first, what killed, what the substitutes achieved and what the place still had that the Fall will take away.

FO-01 already gives the death tolls and the large frame of drug, system and prevention losses for several of these cases (THRIVING library, FO-01). ME-09 already ranks the drugs worth salvaging (THRIVING library, ME-09). This report does not repeat them. Its ground is the supply side: the order in which things fail, and what replaced them. The growing lists belong to OR-02 and the shelf and its storage rules to OR-06.

Over 30 web searches and about 20 PubMed queries were run. Read in full: the CDC report on the Cuban neuropathy, Drain and Barry on Cuba, Setayesh and Mackey on Iran, Vitek and Wharton on Soviet diphtheria, the WHO report on Gaza drug stocks in 2011, Cox on German children, Shanks on wartime quinine, Raal and colleagues on pine needles, D'Arcy and the Salon report on Cuban green medicine, and the MSF and Amnesty press statements on North Korea. Most medical papers were read only as abstracts, and the reference list says which. Every statement of mine that goes beyond a source, and every figure seen only in a secondary summary, is marked [VERIFY].

Findings by section

1. Cuba 1990 to 1996: the best-recorded case

What was lost. Cuba lost Soviet trade worth 5 to 8 billion dollars a year, and it had imported up to 57% of its calories (D'Arcy 2006). Gross domestic product fell by 34.8% between 1989 and 1993 (De Vos et al. 2012). By 1983 Cuba made over 80% of its own medicines, but from Soviet and European raw materials. When those stopped, so did much of the domestic output. Before the Torricelli Act of 1992, US subsidiaries abroad sold Cuba 719 million dollars of goods a year, 90% of it food and medicine. From 1992 to 1995 licences worth only 0.3 million dollars were approved. The national formulary fell from 1,300 products to under 900 by 1996. Adult calorie intake fell by about 40%, surgical operations by 30%, and low birth weight rose by 23% (Drain and Barry 2010). Energy intake fell from 2,899 to 1,863 kcal a day (Franco et al. 2007). A doctor quoted by National Geographic said there were no pills in 1991 and 1992 (National Geographic, undated) [VERIFY].

The neuropathy. The signature illness of the crisis was not an infection but a nutritional nerve disease. From 1 January 1992 to 14 January 1994, 50,862 cases were reported in a population of 10.8 million. Of these, 26,446 had

the optic form, with painless loss of central and colour vision, and 24,416 the peripheral form, with burning and numb feet. Cumulative incidence was 461.4 per 100,000: 566.7 in women and 368.5 in men. It peaked at ages 45 to 65 (926.7 per 100,000) and was lowest in children under 15 (4.2), people over 65 (290.9) and pregnant women. Rates varied twentyfold between provinces, from 1,332.8 in Pinar del Río to 65 in Guantánamo. Nobody died of it (CDC 1994).

A case-control study of 123 severe optic cases in September 1993 found tobacco, above all cigars, raised the risk. Higher intakes of methionine, vitamin B12, riboflavin and niacin, and higher blood carotenoids, lowered it. So did keeping chickens at home and having relatives overseas (Cuba Neuropathy Field Investigation Team 1995). Thiamine depletion was measurable in 30 to 70% of every group, cases and healthy controls alike (Macias-Matos et al. 1996). Two years later, healthy men in Havana still had poor B-vitamin status (Arnaud et al. 2001).

The groups spared are the lesson. Children, pregnant women and the old were protected by the ration book, which gave them milk and extra food. The adults in between ate least, smoked, and gave their share to the children. The disease struck them [VERIFY, my reading of the pattern].

The state gave oral B-complex and vitamin A through the family doctors, from March 1993 in Pinar del Río and from May 1993 elsewhere. Incidence fell from May to June 1993. Severe cases recovered partly or wholly after injected B vitamins (CDC 1994). There was no control group, so the fall cannot be proved to be the vitamins' work. Seasonal food and an epidemic that may have run its course are alternatives. A Cuban virology group isolated a Coxsackie A9-like virus from 84% of 125 cerebrospinal fluid samples and proposed infection as a cofactor (Más et al. 1997). That remains a minority view [VERIFY].

The same island had seen almost exactly this before. During the US naval blockade of 1898, Cuban doctors described an "amblyopia of the blockade", the same failing sight in the same starving population (Ordúñez-García et al. 1996). Blockade neuropathy should be expected wherever a mixed diet collapses into starch.

Tuberculosis. Tuberculosis had fallen by about 5% a year since 1965. It rose from 4.8 per 100,000 in 1991 to 14.7 in 1994, with smear-positive cases rising from 4.4 to 8.3. Part of the rise was artefact: under-detection from 1988 to 1992, better case finding from 1993, and a wider case definition in 1994. Part was real: the delay from first symptom to diagnosis averaged 56.9 days in 1993. The rate fell back to 12.2 by 1997, through case finding and supervised treatment, not plants (Marrero et al. 2000). Drain and Barry (2010) report that tuberculosis deaths rose by 48% between 1992 and 1993.

Water. When chlorination chemicals ran short, diarrhoea rose in 1993 and 1994. In 1994 an outbreak of Guillain-Barré syndrome followed *Campylobacter* in the water (Drain and Barry 2010). Chlorine is a drug the village cannot see it has lost until the children fall ill.

Mortality and its distribution. Total mortality rose by 13% after a decade of decline (Drain and Barry 2010). Mortality among children and women of reproductive age stayed low, and the burden fell on adult men and the old, through infectious disease, violent death and failing infrastructure (Garfield and Santana 1997). Infant mortality and life expectancy kept improving through the crisis. Low birth weight and tuberculosis worsened (De Vos et al. 2012). Primary care expanded while hospital care, which depends on imported machines and parts, declined (Nayeri and López-Pardo 2005).

Weight loss and diabetes. Forced hunger and cycling made Cubans thinner. Physically active adults rose from 30% to 67% and obesity fell from 14% to 7%. From 1997 to 2002, deaths from diabetes fell by 51%, from coronary heart disease by 35%, from stroke by 20% and from all causes by 18% (Franco et al. 2007). When food returned, mean weight rose again. Diabetes prevalence rose by 116%, and diabetes deaths rose by 49% between 2002 and 2010 (Franco et al. 2013). CH-01 draws the clinical lessons for diabetes (THRIVING library, CH-01). The point here is that this large benefit came from less food and more walking, and it vanished with the abundance that followed.

What Cuba kept. The state did not cut health spending in the crisis. It raised it. Family doctors rose from 9.22 to

27.03 per 10,000 people between 1989 and 2000 (De Vos et al. 2012). Drain and Barry give 59 doctors per 10,000 and 498 polyclinics, each serving 25,000 to 30,000 people (Drain and Barry 2010). Cuba kept its vaccine programme, its ration book, its training schools, its laboratories and an educated population that followed instructions (Garfield and Santana 1997). It also kept a domestic pharmaceutical industry which, starved of raw materials, still existed and could restart.

Green medicine. Raúl Castro began collecting and growing medicinal plants in 1990 (D'Arcy 2006). Search summaries attribute a national Programa de Plantas Medicinales to 1991 and a 1992 Ministry of Public Health guide to 233 plant and bee-product formulations [VERIFY]. A Ministry office for natural medicine was set up, and a resolution approved herbal medicine, acupuncture, homeopathy and thermal treatments (Webster 2000). An Office of Natural and Traditional Medicine under Dr Leoncio Padrón followed in 1995 (D'Arcy 2006).

The Pinar del Río provincial farm worked 200 acres with 45 people and oxen only. It began with 4 crops and had 45 by 2003, among them oregano, calendula, Japanese mint (*Mentha arvensis* var. *piperascens*), German chamomile (*Matricaria chamomilla*), aloe, eucalyptus, banana leaves and turmeric. Every neighbourhood had a green pharmacy. Oregano extract was prescribed for epilepsy and a eucalyptus and banana-leaf syrup for asthma. About a million Cubans a year had acupuncture (D'Arcy 2006). Padrón reported that patients using natural medicine more than doubled from 1996 to about 3 million in 1998. His office claimed it usually worked at least as well as drugs. The Salon reporter's own leg infection, treated with *caisimón* leaves, got worse and needed antibiotics in Toronto. Aspirin cost about a tenth of a monthly wage (Webster 2000).

No controlled evaluation of the 1990s programme was found. The Cuban pharmacovigilance studies of plant medicines that were found begin in 2001 (search summaries) [VERIFY]. The state also used its reach for things that do not work. In 2007 and 2008 it gave a homeopathic "prophylaxis" against leptospirosis to 2.3 million people and compared the result only with past years and other regions (Bracho et al. 2010). Edzard Ernst called the practice dangerous and unethical (Ernst 2014).

2. Sanctions with an industry left: Iran and Iraq

Iran. A study of the sanctions of 2012 and after counted 73 drugs in shortage. Of these, 44% were on the WHO essential list and 89% treated non-communicable disease: cancer 23%, respiratory disease 10%, heart and circulation 7%, diabetes 4%, including insulin, glucagon and metformin. And 96% were items that US rules nominally allowed to be exported. Iranian factories made 96% of the country's generics by volume but depended on imported active ingredients. Imports were about 40% of the market by value. Prices rose by 30 to 40%. About 6 million patients were affected, among them 7,000 with haemophilia and 8,000 with thalassaemia. A 15-year-old boy with haemophilia died of bleeding. Counterfeit and substandard medicines entered the market (Setayesh and Mackey 2016). A systematic review of 55 papers found that humanitarian exemptions failed in practice, through banks and insurers that would not handle payments, and that the poor and the chronically ill bore the cost (Kokabisaghi 2018).

The lesson for a village: an import ban strikes first not at antibiotics but at the expensive, specialised drugs for chronic disease, the ones a person takes every day for life.

Iraq. FO-01 gives the corrected mortality picture and the false figure of 500,000 child deaths (THRIVING library, FO-01). The supply record is plain. In April 1999 most basic drugs, antibiotics and intravenous fluids were short, morphine was generally unobtainable, and aspirin was rationed. Water chlorine was blocked or unaffordable. Cholera, tuberculosis, measles and polio were reported to rise (Wareham 2000). A WHO report of March 1996 found conditions worsening at an alarming rate (United Nations 1996). Iraq kept its doctors and hospitals, but without consumables and clean water.

3. Collapse from within: Venezuela and the Soviet successor states

Venezuela. FO-01 gives the headline numbers. Infant deaths rose by 63% and maternal deaths more than doubled between 2012 and 2016. Measles and diphtheria returned from 2016. Most people with HIV had their treatment interrupted in 2017 and 2018. The Ministry stopped publishing statistics in 2016 (Page et al. 2019). Malaria rose from 240,613 cases in 2016 to 411,586 in 2017 (Grillet et al. 2019), the largest rise in the world (Page et al. 2019). A national hospital survey by doctors reported that 88% of hospitals lacked medicines and 79% lacked water in 2018. Over 1,557 deaths were attributed to supply failure between November 2018 and February 2019, 79 of them to power cuts (Médicos por la Salud 2019, press reports only) [VERIFY]. Venezuela shows that a country can have doctors and buildings and still fail, once money, power and water fail together.

The Soviet successor states. Diphtheria shows what happens when vaccination lapses in a population that still has doctors and antitoxin. Cases rose from 1,431 in 1990 to 19,462 in 1993 and to 50,412 and 50,425 in 1994 and 1995, then fell to 20,215 in 1996. In all there were over 140,000 cases and over 4,000 deaths. Two thirds of cases were over 14 years old, and adults aged 40 to 49 made up 45% of deaths in Russia. The epidemic broke only when Russia raised adult vaccine output from under 6 million doses in 1992 to about 80 million in 1994 and 1995, and immunised 70 million adults (Vitek and Wharton 1998). Routine control measures had not been enough before mass adult immunisation (Vitek et al. 2000).

The interval matters for planning. Diphtheria took about three years after the collapse to become epidemic, because adult immunity faded slowly. The village of the Fall can expect diphtheria not in the first year but in the fifth to the fifteenth [VERIFY, my inference from the Soviet interval and the absence of any vaccine].

4. Sieges: Sarajevo, Leningrad, Gaza

Sarajevo. FO-01 gives the death rates. The medicine record is about chronic disease. Among 3,002 strokes treated in the war, incidence rose by 25% and one-month mortality by 36%. Patients stopped anticoagulants and drugs for diabetes and the heart because there was no more medicine in the city (Dimitrijević et al. 1999). Stroke mortality was 35% before the war, 48% during it and 38% after (Dimitrijević et al. 2002). On a siege diet covering 48% of protein, 56% of fat and 58% of carbohydrate needs, insulin-dependent patients on irregular treatment showed better blood chemistry than expected (Pleho et al. 1994). FO-08 reports that 55 of 279 people with type 2 diabetes no longer needed treatment (THRIVING library, FO-08). Surgeons operated by candlelight and with dental tools, and amputated without anaesthesia (Detektor 2016).

Leningrad. The siege had no fresh vegetables, and scurvy came with the hunger. Scientists turned to Scots pine (*Pinus sylvestris*) needles, and canteens, schools and factories served a needle drink, about 16 million doses in 1942 (Moskoff 2002, cited by Raal et al. 2018). Measured, the needles are weak. Fresh Scots pine needles hold about 10.8 mg of vitamin C per 100 g, with 5.2 to 15.7 mg in winter and only 0.5 to 2.8 mg in summer. Dried needles average 2.7 mg per 100 g. The authors calculate that meeting a 60 mg daily need from dried needles would take over 2 kg a day (Raal et al. 2018). Rose hips hold about 426 mg per 100 g (THRIVING library, HY-08). A glass of needle drink can have supplied only a few milligrams [VERIFY, my arithmetic]. It may have helped in winter, and it surely helped morale, but most of its fame is not earned.

Gaza. At the end of May 2011, 178 of 480 essential drugs (37%) and 190 of 700 disposables (27%) were at zero stock, meaning less than a month left. The share of drugs at zero stock had risen every year, from 14% in 2007 to 24% in 2010. By category, 17% of antibiotics, 10% of chronic-disease drugs and 9% of cancer drugs were out. Elective, laparoscopic, vascular and neurosurgery stopped, children's surgery was cut back for want of sutures, disposables were reused at the cost of infection control, and dialysis sessions were rescheduled. Part of the cause was internal: suppliers held back deliveries after a political dispute between authorities (WHO and OCHA 2011). A WHO update of March 2026 reports 46% of essential medicines and 66% of consumables at zero stock (search summary only) [VERIFY]. In Gaza, consumables run out faster than drugs.

5. The blockade pharmacies: Confederacy, Germany, Britain, Japan

Confederacy, 1861 to 1865. The Confederate Surgeon General had Francis Porcher taken off hospital duty in 1862 to write a guide to the South's own plants. The 1863 book ran to about 600 pages and some 3,500 species (Hicks 2013). For malaria the Confederacy issued substitutes for quinine: dogwood (*Cornus florida*, bark), tulip poplar (*Liriodendron tulipifera*, bark), willow (*Salix* species, bark), boneset (*Eupatorium perfoliatum*, leaf and flower, 30 g of dried herb to a pint of boiling water) and others, often steeped in whiskey (Hicks 2013). Officers sent them when quinine was ordered. The record of their effect is thin and they were judged less effective than quinine (Hasegawa 2007). One historian puts it more bluntly: none of Porcher's quinine suggestions worked (Hicks 2013). Quinine was smuggled, sewn into clothing and hidden in dolls' heads (Hicks 2013).

The Confederate medical laboratories were more useful than the herb lists. They made medicines from plants but also made ether, chloroform and opiates, which were their most useful products. Quality was uneven, and hospitals tested the native remedies empirically (Hasegawa and Hambrecht 2003). Captured stocks mattered too: 15,000 cases of chloroform were taken in the Shenandoah in May and June 1862, and Julian Chisolm's small inhaler stretched the supply (Koznarsky, undated). A modern laboratory study found that extracts of three of Porcher's wound plants, white oak (*Quercus alba*, bark), tulip poplar and devil's walking stick (*Aralia spinosa*, root and bark), inhibited drug-resistant *Staphylococcus aureus*, *Acinetobacter baumannii* and *Klebsiella pneumoniae* in a dish (Emory University 2019). That is a test in glass, not in wounds.

Germany, 1914 to 1919. Germany imported about a quarter of its food before the war. The blockade's death toll is disputed: a German newspaper claimed 763,000 in January 1919, a 1928 study 424,000, and Jay Winter about 475,800, with perhaps 100,000 of the deaths after the armistice (Cox 2013, and secondary summaries) [VERIFY]. About 600,000 measurements of children show that they were up to 2 cm shorter than normal from 1917 to 1922, that working-class children suffered most, and that they caught up by 1921 to 1924 with foreign food aid (Cox 2013). Cotton ran out, and German hospitals used crepe paper bandages and wadding, washing and reusing cloth bandages (Museums Victoria, undated).

Britain, 1939 to 1945. Britain had imported its drug plants from Hungary, Italy, Germany and Yugoslavia. From 1941 a Vegetable Drugs Committee of the Ministry of Supply, advised by the Medical Research Council, organised over 70 county herb committees through the Women's Institutes. They gathered foxglove (*Digitalis purpurea*), deadly nightshade (*Atropa belladonna*), henbane (*Hyoscyamus niger*), thorn apple (*Datura stramonium*), autumn crocus (*Colchicum autumnale*) and valerian (*Valeriana officinalis*), the same list as in the first war, and sphagnum moss for dressings (Hudson 2017). Kew's leaflet asked for drying at 90 to 100°F, since careless drying ruins the foxglove's glycosides (Wikipedia, County Herb Committee) [VERIFY]. Rose hips were picked for syrup from 1941, with secondary sources giving about 200 tons that year and 1,957 tons by 1945, mostly for children (Bushcraft 2014) [VERIFY].

The British scheme is the clearest example of plant medicine that worked, because the plants went to a working pharmaceutical industry that measured, standardised and dosed them. Village volunteers supplied the raw material. Factories turned it into tablets of known strength.

Japan and the Pacific. In 1942 Japan took Java, the source of most of the world's cinchona bark, and the Allies lost their quinine. Malaria then disabled whole armies. At Milne Bay it removed 10% of the force a week, and at Guadalcanal over 80% of the Marines were hospitalised within nine months. Japan had quinine but rationed it strictly. At Camp O'Donnell in 1942 about a fifth of the 29,589 prisoners who died were killed directly by malaria, and deaths fell sharply when quinine was released. Cinchona takes about five years to yield bark. A plan to synthesise antimalarials in Australia needed about 20 times more imported precursor than the drug it made, and 100,000 kg of bark captured in Mindanao could not be processed (Shanks 2024). No source was found on Japan's own domestic substitutes or on kampo medicine in the war years.

6. North Korea: doctors without anything

In December 1997 MSF reported from North Hamgyong province that the health system had collapsed. There were doctors and buildings but no aspirin, no anaesthetic and no basic medicines, and there had been none for three to four years. Four drug factories had stopped. Patients were left almost entirely to traditional Koryo herbal medicine, stayed home to die, and came back to the hospitals when supplies came back. There was about one doctor for every 300 people (MSF 1997). Amnesty, interviewing over 40 people who left between 2004 and 2009, reported amputations without anaesthesia, needles reused without sterilising, spending below one US dollar per person per year, payment in cigarettes, alcohol and food, self-medication from markets and drug-resistant tuberculosis. WHO distanced itself from the report (Amnesty International 2010). Hospitals were later ordered to make their own medicines (Daily NK, undated) [VERIFY].

North Korea is the case closest to the Fall: a dense network of doctors, a state ideology of traditional medicine, and almost no drugs. The reported result was not equivalence but patients going home to die.

7. What ran out, and when

Case	Month 1	Month 6	Year 2 and after
Cuba, 1990 to 1993	Fuel, imported finished drugs, spare parts (inference) [VERIFY]	Raw materials for local drugs, chlorine, food energy	B vitamins in diet (neuropathy 1992 to 1993), surgery down 30%, tuberculosis up
Iran, 2012	Expensive specialist imports	Cancer, haemophilia, insulin, active ingredients	Counterfeits, price rises of 30 to 40%
Iraq, 1991 to 2003	Imported drugs	Intravenous fluids, morphine, chlorine	Cholera, tuberculosis, measles reported rising
Venezuela, 2014 to 2019	Chronic drugs, HIV treatment (inference) [VERIFY]	Water, power, hospital supplies	Vaccine-preventable disease, malaria
Soviet successor states	Vaccine output	Vaccine coverage in adults	Diphtheria epidemic from year 3
Sarajevo, 1992 to 1995	Chronic-disease drugs, electricity	Anaesthetics, fuel for heating	Stroke deaths up, surgery by candle
Leningrad, 1941 to 1942	Food, fuel	Fresh vegetables (scurvy)	Mass death in the first winter, before year 2
Gaza, 2007 to 2026	Disposables and dialysis supplies	Antibiotics, chemotherapy	Elective surgery stopped
Confederacy	Quinine, morphine	Chloroform (stretched by capture)	Substitute barks, uneven local products
North Korea, 1990s	Imports from former allies	Domestic factory output	Nothing for three to four years

Read across the table, the pattern repeats [VERIFY, my synthesis]. Daily chronic drugs fail first, because each patient holds only weeks of stock. Disposables, water chlorine and anaesthesia fail next. Micronutrients and adult immunity fail last, after one to three years. Antibiotics fail somewhere in between, and their loss kills more slowly than history-book images suggest, because most infections are not fatal and their deaths are spread out.

8. What each case kept that the Fall removes

Case	Doctors	A state	Generic industry	Food imports or aid	Vaccines
Cuba	Yes, rising	Yes, strong	Yes, short of inputs	Partial	Yes
Iran	Yes	Yes	Yes, short of active ingredients	Yes	Yes
Iraq	Yes	Yes	Weak	Oil for Food from 1996	Partial
Venezuela	Leaving	Failing	Weak	Partial	Failing
Soviet successor states	Yes	Weak	Restarted	Yes	Restarted by 1994
Sarajevo	Yes	Besieged	No	Air bridge	Partial
Leningrad	Yes	Yes	Some local	Ice road	Not decisive
Gaza	Yes	Divided	No	Through crossings	Mostly
Confederacy	Yes	Yes	Small, improvised	Blockade runners	Smallpox only
North Korea	Yes, many	Yes	Stopped	Aid from 1995	Partial
The Fall	Few, then none trained	No	No	No	No

Every case kept something the Fall removes. Most kept trained doctors, many kept a state that could print a ration book, and several kept factories or an outside world to trade or smuggle with. None of them is a fair model of a village with no outside at all. The nearest are North Korea in the late 1990s and the Confederacy, and both turned to plants and did badly with them.

9. Did green medicine change outcomes, or only morale?

The record supports a hard verdict [VERIFY, my synthesis of the cases].

Plants changed outcomes in three ways only. First, where the plant was food that supplied a missing nutrient: rose hips gave British children vitamin C. Second, where the plant fed a factory that made a standard drug: the British county herb committees supplied foxglove and belladonna to working manufacturers, and the Confederate laboratories' best products were ether, chloroform and opiates. Third, where the effect was local and simple: dressings of moss, oak-bark washes and turpentine on the skin.

Everywhere else the protection came from people and systems. In Cuba the outcomes that held were held by tripled family doctors, rationing that favoured children and mothers, vaccination, case finding for tuberculosis, and vitamins handed out by doctors. Herbal medicine expanded in the same years and claimed the credit in official speeches, but no study shows it saved a life. The Confederate quinine substitutes failed. Leningrad's pine drink was weak. North Korea's Koryo medicine left patients at home to die. Homeopathy was given to millions in Cuba with no fair test.

What green medicine plausibly did was keep the clinic open. It gave doctors something to hand over, kept patients coming back, and so kept the doctor seeing the patient who did need help. That is a real service. It is not the same as a drug, and a village that confuses the two will stop looking for the drug [VERIFY].

Evidence grades

Grades as the library uses them. A: a strong and repeated record. B: a good record with gaps. C: plausible but weakly recorded. D: assertion or anecdote. X: contradicted or harmful.

Claim	The tradition's or state's claim	The record	Inference	Grade
Cuban neuropathy came from poor diet and tobacco	Official Cuban account	Case-control study, thiamine assays, fall after supplements (Cuba Neuropathy Field Investigation Team 1995, Macias-Matos 1996, CDC 1994)	No control group, virus cofactor not excluded	B
B vitamins ended the neuropathy epidemic	Ministry of Health	Fall in incidence follows distribution by a month or two	Probable but unproved	B
Cuban green medicine works as well as drugs	Padrón's office (Webster 2000)	No controlled evaluation found	Not supported	D
Oregano extract treats epilepsy	Cuban practice (D'Arcy 2006)	None found	Dangerous if it replaces phenobarbital	X
Homeopathic leptospirosis prophylaxis worked	Bracho 2010	Before-and-after comparison only	Not supported	X
Doctors and primary care protected Cuban mortality	Cuban state, Garfield and Santana	Doctors tripled, infant mortality kept falling (De Vos 2012)	Strong, though statistics are disputed	B
Hunger lowered diabetes and heart deaths	Franco 2007	Repeated surveys, rebound on regain (Franco 2013)	Ecological, but coherent	B
Confederate bark substitutes treated malaria	Porcher, Confederate Surgeon General	Thin record, judged inferior (Hasegawa 2007)	Failed	X
Pine-needle drink prevented scurvy in Leningrad	Soviet account	Content measured low (Raal 2018)	Small effect at best	C
Rose hips supplied children's vitamin C	British Ministry	Content high (HY-08), distribution recorded	Likely real	B
Home-grown foxglove and belladonna supplied British medicine	Ministry of Supply	Industry processing recorded (Hudson 2017)	Worked because of the industry	B

Claim	The tradition's or state's claim	The record	Inference	Grade
Sanctions' humanitarian exemptions protect patients	Sanctioning states	Shortages of 73 drugs, 96% nominally exempt (Setayesh 2016)	Exemptions failed	X
Routine measures control diphtheria without mass adult vaccination	Soviet routine	Epidemic until mass adult vaccination (Vitek 1998, 2000)	Not enough	C
Koryo medicine replaced drugs in North Korea	North Korean policy	MSF: patients stayed home to die	Failed	X
Wound plants of the Confederacy inhibit bacteria	Porcher	In vitro inhibition (Emory 2019)	Untested in wounds	C

Means ledger

What the lessons of these cases need, at each rung. Entries name the action, not a recipe.

Need, from the cases	Hands	Hearth	Garden and still	Village dispensary of 300	District infirmary of 3,000	Hospital
B vitamins (Cuba)	Stop smoking, share food fairly	Unpolished grain, pulses, eggs cooked	Hens, legumes, greens	B-complex stock for cases (OR-06)	Injectable thiamine and B12	Diagnosis of other neuropathies
Vitamin C (Leningrad, Britain)	Pick rose hips, greens	Syrup, quick cooking	*Rosa canina* hedges, blackcurrant, cabbage, potatoes	Winter stock list	Treatment doses	None needed
Clean water (Cuba, Iraq)	Hand washing	Boiling	Hypochlorite and filters (HY-02, IN-07)	Chlorine testing	Outbreak control	Laboratory
Rehydration (all)	Feeding by cup	Home salt and sugar solution	Rice water	Weighed packets	Intravenous fluids	Same
Chronic drugs (Iran, Sarajevo)	Lists of who takes what	Diet, salt reduction	Walking, food that lowers weight	Phenobarbital, salvaged stocks (ME-09)	Rationing decisions (FO-08)	Insulin, dialysis, gone
Dressings (Germany, Gaza)	Pressure	Boiled cloth, dried in sun	Sphagnum moss dried and boiled	Sterile packs (WO-12)	Sutures, surgery	Same

Need, from the cases	Hands	Hearth	Garden and still	Village dispensary of 300	District infirmary of 3,000	Hospital
Anaesthesia (Confederacy, Sarajevo)	Holding, cold	None	Ethanol for antisepsis (ME-03)	Local measures (WO-11)	Ether or ketamine (WO-10)	Same
Malaria (Confederacy, Pacific)	Nets, drainage	None	*Artemisia annua*, cinchona if climate allows (IN-09)	Microscopy if any	Treatment	Same
Tuberculosis (Cuba)	Cough hygiene	Ventilation	Food	Cough register, isolation	Microscopy, drugs while they last	Surgery
Vaccine-preventable disease (Soviet states)	Isolation of the sick	None	None	Variolation questions (HY-10)	Antitoxin, gone	Vaccine, gone

Harm test

The substitutes of these cases did damage in five ways.

1. **Delay.** A remedy that seems to help keeps a patient from the treatment that would work. Webster's leg infection got worse under leaves (Webster 2000). North Korean patients went home (MSF 1997). This is the commonest harm and it does not show up in any register [VERIFY].
2. **False equivalence.** An official claim that plants work as well as drugs makes it harder to keep a scarce drug for the patient who needs it. Oregano for epilepsy is the clearest danger: stopping an anticonvulsant can bring on continuous seizures [VERIFY].
3. **Poisoning.** Several of the British wartime plants are deadly in the wrong dose: foxglove, belladonna, henbane, thorn apple and autumn crocus. They were safe only because a factory assayed them. A village that grows them without assay has a poison, not a medicine (THRIVING library, ME-02). Pine-needle tea risks confusion with yew (*Taxus baccata*), whose needles kill, and some conifers such as *Pinus ponderosa* cause abortion in cattle (THRIVING library, HY-08).
4. **Infection from reuse.** Gaza's reused disposables and North Korea's unsterilised needles spread infection (WHO and OCHA 2011, Amnesty International 2010). Reuse is unavoidable after the Fall, which makes sterilising mandatory (THRIVING library, WO-12).
5. **Counterfeits and poor quality.** Iran's shortages brought in fake drugs (Setayesh and Mackey 2016), and the Confederate laboratories' output varied in strength (Hasegawa and Hambrecht 2003). A salvaged shelf after the Fall will hold drugs of unknown strength, and ME-09 deals with degraded tetracycline and concentration traps (THRIVING library, ME-09).

Red flags, including honest comfort

Red flags. - A healer, official or book that says a plant works "as well as" the drug it replaces. - Any plan to stop an anticonvulsant, a heart drug, a steroid or insulin because a herb is available. - Adults in middle age losing central or colour vision, or with burning feet, in a hungry year: blockade neuropathy. - A cough lasting over two weeks that nobody has recorded: Cuba's diagnostic delay averaged 57 days. - A sore throat with a grey membrane in an adult,

years after the Fall: diphtheria. - A rise in diarrhoea after the chlorine or the fuel for boiling runs out. - Any count of deaths that comes from a regime or a propaganda paper without a method.

Honest comfort. - Cuba lost most of its imports and its children still did well, because people, food rules and vaccines were organised (Garfield and Santana 1997, De Vos et al. 2012). Organisation is something a village can make. - The neuropathy killed nobody and was largely reversible when food and vitamins returned (CDC 1994). - Hunger and walking cut deaths from diabetes and heart disease by large margins (Franco et al. 2007). The Fall will bring some of that benefit with its harms. - Sarajevo's insulin-dependent patients survived irregular treatment better than feared (Pleho et al. 1994). - Some plants are real medicine: rose hips for scurvy, and, with an assay, foxglove and the poppy.

The case against

Cuban statistics are not trustworthy. Katherine Hirschfeld, an anthropologist who worked in Cuba, argues that all Cuban health statistics should be read with suspicion, given the political pressure on doctors to meet targets such as infant mortality (Hirschfeld 2007, secondary summary). Carmelo Mesa-Lago has argued that emigration and how deaths are counted may flatter Cuban figures (secondary summary only) [VERIFY]. If they are right, Cuba's success through the crisis is overstated, and so is the protective role of its doctors. The neuropathy and tuberculosis data survived outside checks, since the CDC, the Pan American Health Organization and US researchers took part (CDC 1994, Cuba Neuropathy Field Investigation Team 1995), but the mortality series did not have that check.

The neuropathy may not have been only dietary. Más and colleagues isolated a virus from most of the spinal fluid they tested (Más et al. 1997), and a later study isolated a different virus (Ito et al. 1998, title only). Thiamine depletion was as common in healthy controls as in cases (Macias-Matos et al. 1996), which weakens a simple dietary account. Without a control group, the effect of the vitamins remains unproved.

Death tolls in famine and sanction cases are political. The 500,000 Iraqi child deaths claim was false as Dyson and Cetorelli showed (THRIVING library, FO-01). The 763,000 German blockade figure was a newspaper claim in a year of propaganda (Cox 2013). Venezuelan figures come from opponents of a government that stopped publishing its own (Page et al. 2019). North Korean testimony comes from people who left. WHO distanced itself from Amnesty's report (Amnesty International 2010).

Green medicine's defenders. D'Arcy (2006) and Padrón (Webster 2000) argue that Cuba's herbal pharmacies met needs and that the programme grew year after year. Growth in output and in patient numbers is not proof of effect, but neither is the absence of a trial proof of harm. A defender could say that the chamomile, mint and aloe of the green pharmacies treated minor complaints adequately and saved scarce drugs for serious ones [VERIFY]. That claim is plausible and untested.

This report's own frame may mislead. Every case kept doctors, and most kept a state. A village that lacks both may do worse than any case here, or it may do better on the things these cases did badly, such as fair sharing of food, because it is small and its members know each other [VERIFY].

10-line summary

1. Cuba lost most imports in 1990 to 1993, yet infant mortality kept falling because family doctors tripled and rationing protected children and mothers.
2. The crisis's signature disease was a nutritional neuropathy in 50,862 adults, peaking at ages 45 to 65, made worse by tobacco and prevented by eggs, chickens and B vitamins.
3. Cuba had seen the same "amblyopia of the blockade" in 1898.
4. Daily chronic-disease drugs run out first, then disposables, chlorine and anaesthesia, and immunity and micronutrients last.
5. Iran's sanction shortages were 89% non-communicable-disease drugs, 96% nominally exempt.

6. Diphtheria returned three years after Soviet vaccination fell, mostly in adults, and stopped only with 70 million adult doses.
7. Gaza ran out of consumables faster than drugs.
8. Plant substitutes worked only as food (rose hips), as factory feedstock (British foxglove) or as simple dressings, and failed as quinine replacements.
9. Leningrad's pine-needle drink held little vitamin C.
10. Every case kept doctors, a state or trade. The Fall keeps none, so the village must build the organisation those cases had.

Open questions

1. Was there any controlled or even systematic record of outcomes in Cuba's green pharmacies of the 1990s? None was found.
2. How much of Cuba's neuropathy was dietary and how much infective? The viral findings have not been settled in the sources read.
3. What did Japanese civilians use when imported drugs ran out in 1944 and 1945? Nothing was found.
4. What were Leningrad's vitamin C intakes from the pine drink, measured in milligrams? Only dose counts were found.
5. How long do salvaged chronic-disease drugs actually last in a household that rations them? OR-06 may answer this.
6. At what interval after the Fall will diphtheria, measles and whooping cough return, given different adult immunity? IN-12 and HY-10 bear on it.
7. Did Cuba's family doctors themselves rely on herbal medicine, or prescribe it to patients as a placebo? Brotherton's ethnography may answer this but was not read.

Sources to read in full

1. Drain and Barry 2010, Science, for the whole Cuban supply picture in two pages.
2. Garfield and Santana 1997, AJPH, for the distribution of harm in the crisis. Only a scan exists.
3. The Cuba Neuropathy Field Investigation Team 1995, NEJM, for the case-control method.
4. CDC MMWR 1994 on the neuropathy, for the epidemic's shape.
5. Setayesh and Mackey 2016, Globalization and Health, for the order of sanction shortages.
6. Vitek and Wharton 1998, Emerging Infectious Diseases, for the diphtheria timetable.
7. WHO and OCHA 2011 on Gaza's drug and consumable stocks, for a method of counting a shelf.
8. Hasegawa and Hambrecht 2003 and Hasegawa 2007 on Confederate laboratories and quinine substitutes.
9. Porcher's *Resources of the Southern Fields and Forests*, 1863, as a model and a warning.
10. Brotherton's *Revolutionary Medicine* (2012), for how Cubans actually sought care in the crisis.

At the bedside after the Fall

The household. The first failure to expect is the daily medicine: insulin, heart and blood-pressure drugs, anticonvulsants, anticoagulants, thyroid hormone, inhalers. Sarajevo and Iran show that these go first, within weeks, and that stopping them kills by stroke and fits [VERIFY]. What the household needs is a list of who takes what and how many days remain, a rule that no anticonvulsant, steroid or heart drug is stopped suddenly, and the ME-09 and ME-10 guidance on which can be stretched. Second, the household needs food rules that protect the adults as well as the children. Cuba's neuropathy struck parents who gave their food to their children. Keep hens, eat the eggs, and do not let anyone in the house smoke away their share of food. Third, it needs boiled water and the home rehydration drink (Protocol 3).

The village of 300. The first failure to expect is consumables: dressings, gloves, needles, sutures, chlorine. Gaza ran

out of them faster than drugs. The village needs a dispensary keeper who counts stock monthly as WHO counted Gaza's, with zero stock meaning less than a month left. It needs a person trained to the level of a Cuban family doctor's assistant who sees every adult once a season, asks about vision, feet, cough and weight, and keeps a register. It needs a garden of food plants that supply what the shelf will lose: rose hips, blackcurrants, cabbage, legumes, potatoes, hens. And it needs a rule that the herb garden makes no claim to replace a drug [OWNER]. Expect neuropathy in the second and third hungry years.

The district of 3,000. The first failure to expect is anaesthesia and surgery, followed within years by vaccine-preventable disease and tuberculosis. Sarajevo and the Confederacy show that a district can keep surgery going with captured, stretched and improvised anaesthetics, and that it cannot without them. The district needs ether or ketamine and someone trained to give it (THRIVING library, WO-10), a sterilising room, a tuberculosis register with sputum microscopy while slides and stain last, and a disease watch for diphtheria in adults. It also needs the authority to ration the last doses fairly (THRIVING library, FO-08). If plants are to supply real drugs, as in Britain, it is at this level that someone must learn to dry, assay and standardise them, or not try [OWNER].

Protocols

Protocol 1. The substitution ledger

Ranked by what runs out first, drawn from the cases. Times are from the start of isolation and are inferences from the cases [VERIFY].

Rank	What runs out	When, from the cases	What replaces it	Harms of the substitute
1	Daily chronic drugs held at home (insulin, blood pressure, heart, anticonvulsants, anticoagulants)	Weeks (Sarajevo, Iran)	Salvage (ME-09), weight loss and walking (Cuba), salt reduction, phenobarbital for epilepsy (ME-09). Type 1 diabetes has no replacement (CH-01, ME-10)	Strokes and fits on stopping. Herb "replacements" such as oregano for epilepsy are grade X
2	Disposables: gloves, syringes, sutures, gauze, dialysis supplies	1 to 6 months (Gaza)	Boiled reused cloth, sphagnum moss dried and sterilised, paper wadding (Germany), reused instruments sterilised (WO-12, WO-15)	Cross-infection if sterilising fails. Dialysis has no substitute
3	Water chlorine	1 to 6 months (Cuba 1993, Iraq)	Boiling, made hypochlorite (HY-02, IN-07), sand filters	Fuel cost of boiling, burns, chemical errors in home-made chlorine

Rank	What runs out	When, from the cases	What replaces it	Harms of the substitute
4	Morphine and anaesthetics	1 to 12 months (Iraq, Sarajevo, North Korea)	Ethanol, cold, local methods (WO-11), ether or ketamine at district level (WO-10), the opium poppy (*Papaver somniferum*, latex) under strict control (WO-11)	Overdose and dependence with poppy. Surgery without anaesthesia. Fire risk with ether
5	Antibiotics	6 to 18 months (Gaza, Iraq)	Hygiene, wound cleaning and honey (WO-02), isolation (NU-03)	Treatable infection kills. Plant "antibiotics" tested only in glass (Porcher's wound plants) give false hope
6	Antimalarials, where malaria exists	Months (Confederacy, Pacific)	Nets and drainage, *Artemisia annua* (IN-09), cinchona needing 5 years to grow	Bark substitutes failed (Hasegawa 2007). Delay kills children
7	Tuberculosis drugs	1 to 2 years (Cuba, North Korea)	Case finding, isolation, food, sanatorium methods (IN-10)	Drug resistance from part-courses (North Korea). Hidden spread
8	Dietary B vitamins and vitamin C	1 to 3 years (Cuba, Leningrad)	Eggs, hens, legumes, unpolished grain, rose hips, cabbage, potatoes (HY-08). Not pine needles alone	Wrong plants in place of real ones: yew (*Taxus baccata*) is fatal. Pine needles are too weak to rely on
9	Adult immunity to diphtheria and others	3 to 15 years (Soviet states) [VERIFY]	Isolation, contact watch, the HY-10 options	Isolation alone failed in the Soviet states. No antitoxin

The rule that follows [OWNER]: the dispensary spends its first effort on items 1 to 3, because they fail first, and its gardeners on item 8, because only food can replace it.

Protocol 2. Neuropathy watch in a hungry year (from Cuba)

Who to watch. Adults aged 40 to 65, smokers and drinkers, and anyone who gives their food to others. Children, pregnant women and the old, if fed first, are at lower risk (CDC 1994).

When. From the second hungry year, ask every adult once a month [OWNER, the interval].

The questions. - [ ] Is your sight dimmer in the centre, or are colours, especially red, fading? Test both eyes separately with a red cloth at arm's length. - [ ] Do your feet burn, tingle or feel numb? - [ ] Have you lost hearing or balance? -

[ ] Do you smoke? How many eggs, beans or pieces of meat did you eat this week?

What to do. - [ ] Stop tobacco completely. Cigars carried the clearest risk in Cuba (Cuba Neuropathy Field Investigation Team 1995). - [ ] Give food rich in B vitamins at once: eggs, pulses, liver, unpolished grain, greens (HY-08). - [ ] If B-complex tablets survive on the shelf, give them. For suspected thiamine lack, the library gives thiamine 50 mg three times a day for a few days, then 10 mg a day (THRIVING library, CH-05, citing HY-08). - [ ] Expect improvement over weeks to months. In Cuba incidence fell within one to two months of supplements (CDC 1994). Some cases took longer than three weeks to normalise even with vitamins (Macias-Matos et al. 1996). - [ ] Refer anyone with one-sided loss of sight, pain in the eye or sudden onset: that is not blockade neuropathy.

Protocol 3. Water and rehydration when the chlorine fails (from Cuba and Iraq)

The water. When chlorine runs out, boil drinking water and water for babies' food. HY-02 gives boiling times, solar disinfection and chlorine making (THRIVING library, HY-02).

The home rehydration drink. For each person with watery diarrhoea, start at the first loose stool. - [ ] 1 litre of clean, boiled and cooled water. - [ ] Half a level 5 mL teaspoon of salt (about 3 g). - [ ] Six level teaspoons of sugar (UNICEF Facts for Life). Hesperian gives eight level teaspoons (both via THRIVING library, HY-03). - [ ] Tolerance: the drink must taste no saltier than tears. A full level 5 mL teaspoon of salt in a litre is too much (HY-03). - [ ] Give by cup or spoon, small and often, after every loose stool. Make a fresh batch each day. - [ ] It does not stop the diarrhoea. It replaces what is lost (HY-03).

The watch. A rise in diarrhoea cases among children in one week is a sign the water has failed. In Cuba it was followed by Guillain-Barré cases in 1994 (Drain and Barry 2010). Record cases weekly [OWNER].

Protocol 4. The chronic-drug register (from Sarajevo and Iran)

Done in the first week after the Fall, by the village dispensary keeper.

- ☐ List every person on a daily medicine, the drug, the dose and the number of days left.
- ☐ Mark the drugs that must not be stopped suddenly: anticonvulsants, steroids, beta-blockers, insulin [VERIFY, standard teaching, see ME-09 and ME-10].
- ☐ For type 2 diabetes and high blood pressure, start the diet and walking plan now. Cuba's weight loss of about 5.5 kg cut diabetes deaths by half (Franco et al. 2007, Franco et al. 2013).
- ☐ Decide who gets the last doses, by the FO-08 rules, before the stock runs out, not after [OWNER].
- ☐ Recount every month. Zero stock means less than one month left (WHO and OCHA 2011).

Protocol 5. The green pharmacy rules (from Cuba, Britain and the Confederacy)

- ☐ A village herb garden grows food plants first: rose hips (*Rosa canina*, ripe hips with the irritant hairs removed, no deadly lookalike in the hedge), blackcurrant (*Ribes nigrum*, fruit, not to be confused with the single shiny black berries of deadly nightshade, *Atropa belladonna*), cabbage, legumes, potatoes. Potato leaves and green tubers are poisonous.
- ☐ Mild plants for comfort may be grown and given as comfort: German chamomile (*Matricaria chamomilla*, flower heads, hollow cone-shaped centre, not to be confused with stinking chamomile, *Anthemis cotula*, which irritates), peppermint (*Mentha x piperita*, leaf, not to be confused with pennyroyal, *Mentha pulegium*, whose oil has killed by liver failure), aloe (*Aloe vera*, clear leaf gel only, not the yellow latex under the skin, which purges). Label them as comfort, not cure [OWNER].
- ☐ Potent plants (foxglove, belladonna, henbane, thorn apple, autumn crocus, poppy) are grown only if the district can dry, assay and dose them, as Britain's factories did. Otherwise they are not grown [OWNER].
- ☐ No plant is given in place of a drug that is still on the shelf.

- ☐ Every plant remedy given is entered in the register with the complaint and the result after a week, so that the village learns what Cuba never measured [OWNER].
- ☐ Nobody collects conifer needles for tea without being shown the tree. Yew (*Taxus baccata*, flat needles, green underneath, red cup-shaped berries) kills (HY-08). Scots pine (*Pinus sylvestris*) has needles in pairs.
- ☐ Foxglove leaves have been gathered in mistake for comfrey (*Symphytum officinale*) and borage. Foxglove is grown, if at all, in its own marked bed [OWNER] [VERIFY].

Protocol 6. Adult disease watch for the returning killers (from the Soviet states and Cuba)

- ☐ **Diphtheria.** Any sore throat with a grey membrane, a swollen "bull neck" or hoarse breathing, in an adult or child: isolate at once, keep contacts separate for 7 days [VERIFY, see IN-12 for the interval], and record it.
- ☐ **Tuberculosis.** Any cough over two weeks: enter in the register the same day. Cuba's average delay was 57 days, and closing that gap was part of how it recovered (Marrero et al. 2000). Isolate sleeping places and see IN-10.
- ☐ **Measles.** Fever and rash: isolate, and see IN-12.
- ☐ Review the register each season to see which diseases are returning [OWNER].

Numbers to carry

1. **50,862**: Cuban neuropathy cases in 1992 and 1993 in 10.8 million people, 461 per 100,000, peaking at 927 per 100,000 at ages 45 to 65 (CDC 1994).
2. **1,300 to under 900**: Cuba's formulary from before the crisis to 1996 (Drain and Barry 2010).
3. **9.2 to 27.0**: Cuban family doctors per 10,000 people from 1989 to 2000, while infant mortality kept falling (De Vos et al. 2012).
4. **4.8 to 14.7**: Cuban tuberculosis per 100,000 from 1991 to 1994, back down to 12.2 by 1997 (Marrero et al. 2000).
5. **89% and 96%**: Iranian shortage drugs that treated non-communicable disease, and the share nominally exempt from sanctions (Setayesh and Mackey 2016).
6. **37% and 27%**: Gaza's essential drugs and disposables at zero stock in May 2011 (WHO and OCHA 2011).
7. **1,431 to 50,425**: Soviet diphtheria cases from 1990 to 1995, ended by about 70 million adult doses (Vitek and Wharton 1998).
8. **About 10 against 426**: mg of vitamin C per 100 g in fresh pine needles and in rose hips (Raal et al. 2018, THRIVING library, HY-08).
9. **5 years**: for cinchona to yield bark (Shanks 2024).
10. **Down 51%, then up 49%**: Cuban diabetes deaths after population weight loss, then after regain (Franco et al. 2007, Franco et al. 2013).

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