HY-03 Oral rehydration: the discovery that saved the most lives, and how to make it at home

HEALING after the FALL, research library, HY-03

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

A note on method. Over 25 searches were run. Read in full or in large part: the WHO 2005 diarrhoea manual and hospital pocket book, the Chowdhury 1986 thesis on BRAC, the Lazzerini and Wanzira Cochrane review, Nalin 2021, the MSF guidelines, and several histories and field sheets. Most trials were read as abstracts. Ruxin 1994, the Mahalanabis 1973 original and the 1978 Lancet editorial could not be opened. Conversions from grams of salt to millimoles of sodium (58.44 g/mol) are labelled as arithmetic.

Findings by section

1. Why watery diarrhoea kills, and why sugar helps

Acute watery diarrhoea kills by draining water and salt. In severe cholera, stool losses run at about 10 to 15 mL per kg per hour for the first 4 to 6 hours (MSF, cholera 5.1). A 50 kg adult in severe cholera has a deficit of about 5 litres and needs on average 200 mL/kg in the first 24 hours, some 350 mL/kg or more (WHO 2005a).

In August 1960 in Prague, Robert Crane proposed that sodium and glucose cross the gut wall together on one carrier (Hamilton 2013). In 1964 Stanley Schultz and Ralph Zalusky showed that sugar increased active sodium transport in rabbit ileum (Schultz and Zalusky 1964, via Hamilton 2013). Cholera toxin switches on secretion but leaves this coupled pathway intact, so a drink holding both sodium and glucose is absorbed even while the gut secretes. In Dhaka in 1968, Norbert Hirschhorn, David Sachar and colleagues perfused the intestines of cholera patients and showed that glucose cut net stool output (8 patients, 25 controls). Fructose was absorbed passively and did not pull sodium with it (Hirschhorn et al. 1968).

Two consequences follow. Salt and glucose must both be present in the right ratio. Too much sugar draws water into the gut and worsens diarrhoea. And ORS does not stop diarrhoea. It replaces what is lost, which disappoints mothers who expect the stools to stop. Rice-based solution does reduce stool output (section 9).

2. Before the oral solution

In 1832 Thomas Latta of Leith reported injecting saline into the veins of cholera patients. Of 9 gravely ill patients, 3 recovered (Latta 1832, Reynolds 2023). Robert Allan Phillips of the US Navy rebuilt intravenous treatment. In Cairo in September 1947 he treated 40 patients with intravenous saline and 3 died, against roughly half of the untreated (Reynolds 2023). His 1967 Lasker citation credits his methods with cutting mortality from over 60 per cent untreated to under 1 per cent (Lasker Foundation 1967).

In 1953 Hemendra Nath Chatterjee reported oral fluid treatment of cholera in the Lancet. Reynolds gives 186 patients, all surviving, and notes the report was overlooked (Chatterjee 1953, Reynolds 2023). Phillips tried oral glucose

saline in Manila in September 1962. According to Reynolds, 5 of 30 patients died and the solution was "far too concentrated" (Reynolds 2023). Bhattacharya instead reports a trial in two patients in 1964 (Bhattacharya 1994). No primary record was found [VERIFY].

3. Dhaka 1968: Nalin and Cash

At the Pakistan-SEATO Cholera Research Laboratory in Dhaka (later icddr,b), David Nalin and Richard Cash, with Rafiqul Islam, Majid Molla and Phillips, gave an oral glucose-electrolyte solution to 51 adults: 36 with cholera and 15 with severe non-cholera diarrhoea. The Lancet paper of 17 August 1968 reported that intravenous fluid needs fell by about 80 per cent. Charcoal increased stool volume (Nalin et al. 1968). Nalin later gave the trial solution's sodium as about 120 mmol/L (Nalin 2021).

The result replicated. In 1970 Cash and colleagues reported a trial at the rural Matlab treatment centre (Cash et al. 1970a) and rapid correction of acidosis with oral solution (Cash et al. 1970b). Reynolds summarises Matlab as 350 patients on oral therapy alone, with intravenous needs down 70 per cent (Reynolds 2023). In the Dhaka floods of 2009, icddr,b treated over 42,000 cholera patients in 9 weeks with no deaths from dehydration (Cash 2022).

4. Bongaon 1971: Mahalanabis in the refugee camps

In 1971 war drove millions of refugees from East Pakistan into West Bengal, and cholera broke out in the camps. Dilip Mahalanabis of the Johns Hopkins Center in Calcutta ran a treatment unit at Bongaon for about eight weeks in July and August 1971, with intravenous fluid in short supply (Hektoen International 2023). His team used 22 g glucose, 3.5 g sodium chloride and 2.5 g sodium bicarbonate per litre (arithmetic: about 90 mmol/L sodium). Packets were weighed out in Calcutta, carried about 50 miles, dissolved in drums and given by cup, often by relatives, at about 11 paise (1.5 US cents) per litre (Hektoen International 2023).

Among 3,703 patients the case-fatality rate was 3.6 per cent overall and 1 per cent among 1,190 in a demonstration unit (Mahalanabis et al. 1973). Camps relying on intravenous fluid alone reported 20 to 30 per cent (Hektoen International 2023). Reynolds puts mortality at outbreak onset at about 30 per cent and notes that half of Bongaon's deaths occurred before rehydration started (Reynolds 2023). The paper was rejected by several journals. The WHO Bulletin reprinted it in 2001 with a commentary by Olivier Fontaine and Charlotte Newton (Fontaine and Newton 2001). The comparison is historical, not randomised, but its direction matches the Dhaka trials.

5. WHO, the Lancet verdict and the 2002 formula

WHO launched its Diarrhoeal Diseases Control Programme in 1978. The first WHO ORS held, per litre, 3.5 g sodium chloride, 2.5 g sodium bicarbonate (later 2.9 g trisodium citrate), 1.5 g potassium chloride and 20 g glucose: 90 mmol/L sodium, 311 mOsm/L (Cash 2022, WHO 2005a). On 5 August 1978 an unsigned Lancet editorial, "Water with sugar and salt", is widely quoted as calling the discovery "potentially the most important medical advance this century" (Lancet 1978, restated by Santosham et al. 2010). The editorial itself was not read [VERIFY]. The same issue carried a double-blind trial in 57 children with rotavirus diarrhoea showing that sucrose worked as well as glucose (Sack et al. 1978), which made table sugar a legitimate base for a home solution.

Diarrhoea deaths under five fell from an estimated 4.6 million in 1980 to about 1.5 million around 2000 (Victora et al. 2000). WHO now estimates 443,832 a year, from 1.7 billion episodes (WHO diarrhoeal disease fact sheet). Sanitation, vaccines and nutrition share the credit. Modelling by the Child Health Epidemiology Reference Group estimated that ORS may prevent 93 per cent of diarrhoea deaths, while evidence for home fluids was insufficient for a figure (Munos et al. 2010). Reynolds cites over 70 million lives saved [VERIFY].

A UNICEF and WHO meeting in New York on 18 July 2001 recommended a reduced-osmolarity formula (WHO 2005a). Per litre: sodium chloride 2.6 g, anhydrous glucose 13.5 g, potassium chloride 1.5 g, trisodium citrate dihydrate 2.9 g. That gives sodium 75, chloride 65, glucose 75, potassium 20 and citrate 10 mmol/L, total 245 mOsm/L.

WHO reports 33 per cent less unscheduled intravenous therapy, 30 per cent less vomiting and 20 per cent less stool than with the old formula (WHO 2005a). The Cochrane review (Kim, Hahn and Garner, 2001, updated 2002, the "Hahn 2002" of the brief) found an odds ratio of 0.59 (95% CI 0.45 to 0.79) for unscheduled infusion, with no detected rise in hyponatraemia in children (Kim et al. 2001). WHO part-funded the review.

6. BRAC: teaching a nation to mix it

From July 1980, BRAC's Oral Therapy Extension Programme taught more than 12 million Bangladeshi mothers, house by house, to make lobon-gur (salt and molasses) solution (Chowdhury et al. 1997). The recipe was a three-finger pinch of salt and a fistful of gur in half a seer of water, about 467 mL. It had first been "two scoops" of gur, changed because women confused one pinch and two scoops with two pinches and one scoop (Chowdhury 1986).

Workers were paid by how well their mothers mixed when a monitor visited later: 4 taka for grade A, 2 for B, 1 for C, nothing for D. In the pilot, 87 per cent of solutions fell in the safe and effective range of 30 to 99 mmol/L sodium and under 1 per cent reached 120 mmol/L or more (Chowdhury 1986). Quality decayed. Dangerous solutions rose to 14.7, 18.2 and 25.6 per cent in different evaluation areas one to two years after teaching. Women forgot the pinch and fistful but remembered the half-seer. Untaught women's solutions were dangerous 18.8 per cent of the time (Chowdhury 1986, Table 10.5). Use lagged too: about 17 per cent of episodes one month after teaching. By 1993, a resurvey of 9,000 households in 90 villages found over 70 per cent of women could make a safe solution and ORT was used in about 60 per cent of episodes (Chowdhury et al. 1997).

7. The household recipe and its tolerances

Per litre of clean water, the sources disagree:

Source	Salt	Sugar	Note
UNICEF Facts for Life (via rehydrate.org extract)	1/2 level teaspoon	6 level teaspoons	Slightly too dilute is not harmful [VERIFY]
WHO, quoted on en-net	1/2 small spoon	6 level small spoons	For prevention when packets are absent
WHO 2005 manual	3 g, "one level teaspoonful"	18 g sucrose	Effective, not generally recommended
Older WHO recipe (Lukmanji 1988)	1 level teaspoon	8 level teaspoons	86 mmol/L sodium, 116 mmol/L glucose
IFRC volunteer sheet	1/2 small spoon (3.5 g)	40 g (8 small or 4 big spoons)	
Hesperian	1/2 level teaspoon	8 level teaspoons	"Less salty than tears"

The central conflict is the teaspoon. The USDA lists 2,325 mg sodium per teaspoon of table salt (USDA, via a mirror). Arithmetic: about 5.9 g of salt in a level 5 mL teaspoon. So WHO's "3 g, one level teaspoonful" fits only a small spoon of about 2.5 mL. Household spoons vary: in Sri Lankan homes they held 2.9 to 7.8 mL (Jayasinghe et al. 2026).

Arithmetic, sodium per litre:

Salt in 1 litre	Sodium (mmol/L)	Against BRAC thresholds
1.75 g	30	Lower limit of effective
3 g (half a 5 mL teaspoon)	51	Good
3.5 g	60	Good

Salt in 1 litre	Sodium (mmol/L)	Against BRAC thresholds
6 g (one level 5 mL teaspoon)	103	Above the safe range
7 g	120	Dangerous
18 g (one level tablespoon)	308	Lethal range

Sucrose must be about twice the weight of glucose to supply the same glucose (Sett and Mitra 1994). WHO's 18 g sucrose gives about 53 mmol/L glucose after digestion and IFRC's 40 g about 117 (arithmetic). Too much sugar worsens diarrhoea (WHO 2005a). Every source agrees on two rules: half a level 5 mL teaspoon of fine salt per litre is the safe centre, and too dilute is safe while too salty can kill. WHO rates the home solution as able to prevent or delay dehydration but inadequate to treat it, particularly cholera (WHO, via en-net). After the Fall there may be nothing better, so it must be taught with measuring tools, not fingers.

8. Hypernatraemia: the heaped spoon and the short bottle

In Lagos in 1978, Olikoye Ransome-Kuti and Adepeju Bamisaiye found only 34 per cent of 217 women mixed correctly (4 teaspoons sugar, a quarter teaspoon salt, one beer bottle). Most errors were too much salt, nearly half of them four times too strong, and three sixteen times. They proposed a standard spoon (Ransome-Kuti and Bamisaiye 1978). Myron Levine's team found pinch-and-scoop and teaspoon methods too variable even in nurses' hands and recommended a double-ended spoon (Levine et al. 1980). Zohra Lukmanji found official recipes in 16 African countries that would give 9 to 116 mmol/L sodium (Lukmanji 1988). Wilcox and Miller found the three-finger pinch inaccurate among 15 health workers (Wilcox and Miller 1996). In Natal, Brazil, 47 per cent of 100 home solutions were dangerous (over 100 mmol/L). With a double-ended spoon 63.8 per cent were appropriate, against 19.3 per cent with other utensils (Natal study 2001).

Deaths are documented. In Amsterdam, two infants of 6 and 2 months received ORS dissolved in too little water, at about 7 and 2 times strength. One died and the other was left with severe brain damage (Vreede and van der Vorst 1993). In Kashmir, a 21 g packet for 1 litre was dissolved in 200 mL through confusion with 4.2 g packets (arithmetic: about 375 mmol/L sodium). Of two children, one died (Quereshi et al. 2010). A French infant of five weeks reached a serum sodium of 211 mmol/L from a wrongly made home formula and survived intensive care (Paut et al. 1999). At Sardjito Hospital, Yogyakarta (2002 to 2005), hypernatraemia linked to improper ORS mixing killed 13 children, 29 per cent of cases (Sardjito study) [VERIFY].

WHO describes the mechanism: soft drinks, concentrated formula or salty solutions. Above 150 mmol/L there is thirst out of proportion to other signs. Convulsions usually occur above 165, especially when intravenous fluid is given fast. Correct ORS normalises sodium within 24 hours (WHO 2005a). The counterweight: among 48,511 cholera patients, Nalin reports 1 hypernatraemic and 47 hyponatraemic seizures (Nalin 2021). In adult cholera, too little salt may harm more often than too much.

9. Rice and cereal ORS

Cooked starch releases glucose slowly without the osmotic load of free sugar. A meta-analysis of 13 trials (1,367 patients) found rice ORS cut stool output by 36 per cent in adults with cholera, 32 per cent in children with cholera and 18 per cent in non-cholera diarrhoea (Gore et al. 1992). A WHO consultation in Dhaka, 10 to 12 December 1994, reviewing 22 trials, judged rice ORS better than glucose ORS in cholera but not better than reduced-osmolarity ORS in children's non-cholera diarrhoea (WHO 2005a).

WHO uses 50 to 80 g rice powder per litre, boiled (at least 10 minutes in early trials, a footnote says 5), cooled, then the salts added (WHO 2005a). Hesperian's version is half a level teaspoon of salt and 8 heaping teaspoons of powdered cereal per litre, boiled 5 to 7 minutes into a thin gruel, from rice, maize, wheat, sorghum or mashed potato. It spoils

within a few hours in heat and should be tasted before each use (Hesperian). It costs fuel and time but uses food already in the house and is hard to make too sweet.

10. Home fluids that work and those that harm

WHO groups home fluids in three (WHO 2005a). Salt-containing fluids are ORS, salted rice water, salted yoghurt drink and salted vegetable or chicken soup. About 3 g of salt per litre can be added to an unsalted drink. Fluids without salt that are acceptable for prevention are water, unsalted rice water or soup, yoghurt drink, green coconut water, weak unsweetened tea and unsweetened fresh fruit juice. Fluids to avoid are commercial carbonated drinks, commercial fruit juices and sweetened tea, which cause osmotic diarrhoea and hypernatraemia, and coffee and purgative herbal teas.

Carbonated drinks hold 1.0 to 9.9 mmol/L sodium with osmolality of 388 to 790 mOsm/kg (Jacobs and Reece 2008). Coconut water holds 2.9 to 12.5 mEq/L sodium, too little to treat dehydration (Fagundes Neto et al. 1993). In Toronto, 647 children with minimal dehydration did better on half-strength apple juice than on electrolyte solution: treatment failure 16.7 against 25.0 per cent, intravenous use 2.5 against 9.0 per cent (Freedman et al. 2016). That applies to well-nourished children with minimal dehydration, not to cholera or the malnourished.

Honey is about 38 per cent fructose and 31 per cent glucose (National Honey Board, search extract) [VERIFY], and only the glucose drives sodium uptake (Hirschhorn et al. 1968). A South African trial found that honey could replace glucose in an electrolyte solution and shortened bacterial diarrhoea, if correctly diluted (Haffejee and Moosa 1985). Never give honey under 12 months: botulism spores need about 121 °C (250 °F) for 3 minutes to be destroyed (UF/IFAS).

Traditional fluids converge across unrelated cultures: rice congee and kanji in Asia, salted yoghurt drinks (lassi, ayran), pulse waters, carrot soup in Central Europe [VERIFY], carob and banana. Salted, these behave like weak cereal ORS.

11. Recognising dehydration

WHO grades by four signs. Two or more in a column decide the class (WHO 2005a).

Sign	No dehydration	Some dehydration	Severe dehydration
General condition	Well, alert	Restless, irritable	Lethargic or unconscious
Eyes	Normal	Sunken	Sunken
Thirst	Drinks normally	Thirsty, drinks eagerly	Drinks poorly or not able to drink
Skin pinch	Goes back quickly	Goes back slowly	Very slowly (over 2 seconds)

The deficit is under 5 per cent of body weight (under 50 mL/kg) with no dehydration, 5 to 10 per cent (50 to 100 mL/kg) with some, and over 10 per cent (over 100 mL/kg) when severe. Lethargic is not asleep. Ask the mother whether the eyes are more sunken than usual. The skin pinch misleads in severely malnourished and obese children (WHO 2005a). A systematic review found the best single signs to be prolonged capillary refill (likelihood ratio 4.1), abnormal skin turgor (2.5) and abnormal breathing (2.0), and combinations to be better than any one sign (Steiner et al. 2004).

12. Volumes by weight and age

Plan A, at home. After each loose stool: under 2 years 50 to 100 mL, 2 to 10 years 100 to 200 mL, older as much as wanted (WHO 2005a, WHO 2005b). MSF gives the same by weight: under 5 kg 50 mL, 5 to 10 kg 100 mL, 10

to 20 kg 200 mL, over 20 kg 300 mL (MSF Appendix 14). Keep breastfeeding and feeding. Return for very frequent stools, repeated vomiting, marked thirst, poor eating or drinking, fever, blood in the stool, or no improvement in 3 days (WHO 2005a).

Plan B, some dehydration. 75 mL/kg over 4 hours (WHO 2005a):

Age	Under 4 months	4 to 11 months	12 to 23 months	2 to 4 years	5 to 14 years	15 years and over
Weight	Under 5 kg	5 to 7.9 kg	8 to 10.9 kg	11 to 15.9 kg	16 to 29.9 kg	30 kg and over
ORS in 4 hours	200 to 400 mL	400 to 600 mL	600 to 800 mL	800 to 1,200 mL	1,200 to 2,200 mL	2,200 to 4,000 mL

Adults can take up to 750 mL an hour, children up to 20 mL/kg an hour. Under 2 years, a teaspoonful every 1 to 2 minutes, never by feeding bottle. Puffy eyelids mean overhydration: stop, give breast milk or water, no diuretic. Reassess at 4 hours. Start zinc after the first 4 hours (WHO 2005a). MSF suggests 5 mL every 5 minutes for small children and admits children with some dehydration who are under 4 months or under 4 kg (MSF Appendix 14).

Plan C, severe. Ringer's lactate 100 mL/kg intravenously. Under 12 months: 30 mL/kg in 1 hour, then 70 mL/kg in 5 hours. Older: 30 mL/kg in 30 minutes, then 70 mL/kg in 2.5 hours. Repeat the first step once if the radial pulse is still weak (WHO 2005a). MSF's cholera guideline gives 70 mL/kg over 3 hours after the first step, and for children under 5 starts with 20 mL/kg boluses over 15 minutes, up to three (MSF, cholera 5.3).

Plan C without a drip. WHO: if a drip can be reached within 30 minutes, go, giving ORS on the way. Otherwise give ORS by nasogastric tube at 20 mL/kg per hour for 6 hours (120 mL/kg), or by mouth at the same rate if there is no tube and the patient can drink. Slow down if the abdomen swells. Reassess hourly, and transfer if there is no improvement after 3 hours. Plain glucose intravenously is not acceptable (WHO 2005a). MSF disagrees: a nasogastric tube "should not be used" for severe dehydration or shock, and if no vein is found within 90 seconds the intraosseous route is used (MSF, cholera 5.3). MSF writes for teams that always have a drip. For a village without one, the WHO fallback is the only option, used only in a patient awake enough to protect the airway.

Adult cholera. Suspect cholera in anyone over 5 years with severe watery diarrhoea, or over 2 years during an outbreak. Give a 50 kg adult with severe dehydration about 2 litres in 30 minutes and the rest of 5 litres within 3 hours. Antibiotics shorten severe cholera (WHO 2005a). MSF replaces 200 to 250 mL per stool in those over 10 years and uses a single 300 mg dose of doxycycline in adults (MSF, cholera 5.3).

13. The vomiting child

Vomiting is common in the first 1 to 2 hours of Plan B and usually settles as the child rehydrates. Wait 5 to 10 minutes, then give a spoonful every 2 to 3 minutes (WHO 2005a). Hesperian adds that small sips should continue through vomiting, because not all of it comes back. The reduced-osmolarity formula causes about 30 per cent less vomiting (WHO 2005a). Sett and Mitra advise against antiemetic drugs and against oral rehydration when vomiting comes three or more times an hour (Sett and Mitra 1994).

14. Zinc

The 2004 WHO and UNICEF joint statement recommended zinc for all children with diarrhoea. The dose is 10 mg a day under 6 months and 20 mg a day from 6 months, for 10 to 14 days, dispersed in water, breast milk or ORS (WHO 2005a, WHO 2005b). MSF gives 10 days (MSF, cholera 5.3). WHO says zinc reduces duration and severity

and lowers the chance of further episodes for 2 to 3 months (WHO 2005a). Its fact sheet gives 25 per cent shorter duration and 30 per cent less stool (WHO diarrhoeal disease fact sheet).

The Cochrane review by Marzia Lazzerini and Humphrey Wanzira (2016, 33 trials, 10,841 children) is more cautious:

- **Over 6 months:** diarrhoea about 11 hours shorter (mean difference minus 11.46 hours, 95% CI minus 19.72 to minus 3.19), low certainty, heterogeneity I^2 84 per cent. Diarrhoea at day 7 reduced (risk ratio 0.73).
- **Malnourished children:** about 26 hours shorter, high certainty.
- **Persistent diarrhoea:** about 16 hours shorter.
- **Under 6 months:** no benefit shown.
- **Vomiting:** increased (risk ratio about 1.5).
- **Deaths:** risk ratio 0.29, but with too few deaths to be sure (95% CI 0.04 to 2.20).

Benefit is clearest where zinc deficiency and malnutrition are common (Lazzerini and Wanzira 2016). Walker and Black modelled a 23 per cent reduction in diarrhoea mortality (Walker and Black 2010). After the Fall, deficiency is likely to be common, which raises the value of stored tablets. A village cannot make zinc, only stockpile it.

15. Failure modes: when the drink is not enough

ORS works in over 90 per cent of acute diarrhoea, but not in severe dehydration with shock (WHO 2005a). Plan B fails in about 5 per cent with the old formula and an estimated 3 per cent or less with the new. Failures come from stool losses above 15 to 20 mL/kg per hour (usually cholera), poor intake from fatigue or drowsiness, or severe vomiting (WHO 2005a). The Cochrane comparison in children found oral failure 4 per cent higher than intravenous (number needed to treat for harm 25), with 2 deaths in oral groups and 6 in intravenous groups. Paralytic ileus was more frequent with oral treatment (number needed to harm 33), though not significantly with low-osmolarity ORS. Drips caused phlebitis (Hartling et al. 2006).

- **Shock.** Unconscious or unable to drink, with a weak or absent pulse. Needs fluid in a vein or the bone marrow. A systematic review found nasogastric rehydration as effective as intravenous and the right second line, intraosseous effective, subcutaneous and intraperitoneal unproven, and no studies of rectal rehydration (Rouhani et al. 2011). A trial found rapid nasogastric and rapid intravenous rehydration equal for moderate dehydration (Nager and Wang 2002).
- **Ileus.** A swollen, silent belly with vomiting. Causes include opiates (codeine, loperamide) and low potassium (under 3 mmol/L). WHO forbids oral and nasogastric fluid in ileus and in glucose malabsorption. Banana and green coconut water supply potassium (WHO 2005a).
- **The child who will not drink.** "Drinks poorly or not able to drink" is a sign of severe dehydration (WHO 2005a). Spoon and cup by a patient adult, then the tube.
- **Severe malnutrition.** Use ReSoMal: one WHO-ORS packet in 2 litres, plus 50 g sucrose and 45 mL of 10 per cent potassium chloride (sodium about 37.5, potassium 40 mmol/L). The pocket book gives 5 mL/kg every 30 minutes for 2 hours, then 5 to 10 mL/kg per hour for up to 10 hours (WHO 2005b). The manual gives 70 to 100 mL/kg over 12 hours starting at 10 mL/kg per hour (WHO 2005a). Intravenous fluid is for shock only. A rise in breathing of 5 a minute and pulse of 15 a minute signals overload (WHO 2005b). MSF uses 10 and 20 for children generally (MSF Appendix 14).
- **Volume.** Nalin reports up to 100 litres of ORS in antibiotic-resistant cholera (Nalin 2021).
- **Hyponatraemia.** Sodium under 130 mmol/L after large volumes of water or low-salt fluid, common in shigellosis (WHO 2005a) and reported in adult cholera on low-sodium solutions (Nalin 2021).

16. Salt, sugar and measuring tools after the Fall

Feasible today against after the Fall. Today, WHO ORS packets and zinc tablets are cheap and can be stockpiled, with the expiry date checked. After the Fall, packets and zinc last only as long as the stock. Salt, sugar, starch, boiled

water and made tools are what remain.

Salt. Sea salt, rock salt and brine-spring salt are mostly sodium chloride. Coarse crystals fill a spoon differently from fine table salt, so grind before measuring or weigh. Never use a white powder of uncertain identity. Curing salt (nitrite or saltpetre), washing soda, caustic soda, fertiliser, salt substitutes (mostly potassium chloride) and plant-ash "salt" (mostly potassium, often alkaline) can harm or kill [VERIFY]. Never use seawater as a drink. It is many times saltier than ORS [VERIFY].

Sugar and starch, with identification.

- *Saccharum officinarum* L. (sugar cane): stem juice boiled to jaggery or gur, BRAC's sweetener. No dangerous lookalike for the cultivated stem.
- *Beta vulgaris* L. (sugar beet): root sliced, leached in hot water and boiled down. Rough syrup varies in strength, so weigh it or use cereal ORS.
- *Oryza sativa* L. (rice): dehusked grain, ground and boiled. Hesperian also accepts *Zea mays* (maize), *Triticum aestivum* (wheat), *Sorghum bicolor* (sorghum) and *Solanum tuberosum* (potato, peeled tuber, never green or sprouted). The dangers are contaminants, not lookalikes: ergot (*Claviceps purpurea*) on rye and wheat, darnel seed (*Lolium temulentum*) in grain, and mould on damp-stored grain [VERIFY].
- *Cocos nucifera* L. (coconut): water of the green nut. A preventive drink with potassium, not a treatment (WHO 2005a, Fagundes Neto et al. 1993).
- *Musa* spp. (banana, plantain): ripe fruit, mashed, for potassium (WHO 2005a, Hesperian).
- Honey: as the sugar for those over 12 months, never under (Haffejee and Moosa 1985, UF/IFAS).

Measuring tools that can be made. Water is the reference: 1 mL weighs 1 g. The litre is 1 kg of water in a vessel marked permanently, and BRAC found the water measure was what people remembered longest (Chowdhury 1986). The salt scoop is a carved or cast bowl holding 2.5 mL of water (from a salvaged syringe), which by the USDA figure holds about 3 g of fine salt. A sugar scoop at the other end makes a double-ended spoon, the design Levine recommended and the Natal study tested (Levine et al. 1980, Natal study 2001). A forge can make an equal-arm balance, calibrated with water: 3 mL of water balances 3 g of salt. The taste test ("less salty than tears", Hesperian) is a last check, not a measure. No source tested how well people taste the difference between 50 and 120 mmol/L [VERIFY].

17. What rehydration did to case fatality

Setting	Without effective rehydration	With rehydration	Source
Cholera, historical	Up to 50 per cent, over 60 per cent	Under 1 per cent with IV	WHO cholera fact sheet, Lasker 1967
Cairo 1947	About 50 per cent	3 of 40 with IV	Reynolds 2023
Bongaon 1971	20 to 30 per cent in IV-only camps	3.6 per cent overall, 1 per cent in demonstration unit	Mahalanabis et al. 1973, Hektoen 2023
Dhaka floods 2009		Over 42,000 patients, no deaths from dehydration	Cash 2022
Cholera treatment centres		Target under 1 per cent	WHO cholera fact sheet
Diarrhoea deaths under 5, world	4.6 million (1980)	About 1.5 million (2000), 443,832 now	Victora et al. 2000, WHO fact sheet

WHO estimates 1.3 to 4.0 million cholera cases and 21,000 to 143,000 deaths a year. In 2025, 451,499 cases and 7,870 deaths were reported (WHO cholera fact sheet).

Evidence grades

Grades follow the brief: A for trials or systematic reviews, B for consistent clinical series, C for convergent tradition with plausible pharmacology, D for a single tradition or anecdote, X for ineffective or harmful. Where no tradition line appears, the remedy has none.

Reduced-osmolarity WHO ORS for acute diarrhoea in children. Grade A. - Record: fewer drips, less vomiting, less stool than the old formula. - Science: Cochrane odds ratio 0.59 for unscheduled IV (Kim et al. 2001), with no detected rise in hyponatraemia in children.

Oral against intravenous rehydration in some dehydration. Grade A. - Record: oral failure 4 per cent higher, deaths no higher (Hartling et al. 2006). - Science: the coupled sodium-glucose pathway survives the toxin (Hirschhorn et al. 1968).

Glucose-electrolyte ORS in adult cholera. Grade A to B. - Record: about 80 per cent less IV need in Dhaka (Nalin et al. 1968), Matlab replication (Cash et al. 1970a), Bongaon 3.6 per cent mortality (Mahalanabis et al. 1973). - Science: sodium content for adults is contested (Nalin 2021).

Rice-based ORS. Grade A in cholera, A for no added benefit in non-cholera diarrhoea of children. - Tradition: rice water and congee across Asia. - Record: 36 per cent less stool in adult cholera (Gore et al. 1992). - Science: starch releases glucose slowly without an osmotic load.

Home salt-sugar solution. Grade B, with documented harm when mixed wrong. - Record: BRAC taught over 12 million mothers, with 87 per cent safe solutions at first (Chowdhury 1986) but 15 to 26 per cent dangerous within two years. Deaths from errors are documented (section 8). - Science: effective where the salt is between about 30 and 99 mmol/L.

Salted cereal water, soups and yoghurt drinks. Grade C. - Tradition: rice kanji, lassi, pulse water, carrot soup, convergent across unrelated cultures. - Record: WHO accepts them as home fluids (WHO 2005a), but CHERG found the evidence for mortality insufficient (Munos et al. 2010). - Science: plausible when salted at about 3 g per litre.

Unsalted home fluids (water, coconut water, weak tea) for prevention. Grade C for prevention, X as treatment of real dehydration. - Science: too little sodium (Fagundes Neto et al. 1993). Water alone risks hyponatraemia (WHO 2005a).

Half-strength apple juice for minimal dehydration in well-nourished children. Grade A in that setting only (Freedman et al. 2016).

Soft drinks, undiluted juice, sweetened tea, "flat cola". Grade X (Jacobs and Reece 2008, WHO 2005a).

Honey as the sugar in an electrolyte solution. Grade D to B. One trial (Haffejee and Moosa 1985). Only half its sugar is glucose. Grade X under 12 months because of botulism.

Zinc, 10 to 14 days. Grade A over 6 months in deficient settings, A for no benefit under 6 months. The mortality effect is uncertain (Lazzerini and Wanzira 2016).

Nasogastric rehydration. Grade A for moderate dehydration (Nager and Wang 2002, Rouhani et al. 2011). For shock, B as a fallback (WHO 2005a), discouraged by MSF.

Intraosseous infusion. Grade B (Rouhani et al. 2011, MSF cholera 5.3).

Subcutaneous or rectal fluid. Grade D, unproven, with no rectal studies (Rouhani et al. 2011).

Charcoal for diarrhoea. Grade X. It increased stool volume in the Dhaka trial (Nalin et al. 1968).

Antidiarrhoeal opiates (loperamide, codeine) in children. Grade X. They cause ileus (WHO 2005a).

Antiemetics in children. Grade D. Advised against (Sett and Mitra 1994). Newer trials were not reviewed.

Withholding food or breast milk. Grade X. WHO advises continued feeding (WHO 2005a).

Means ledger

Rung	What can be done	What it changes
Hands and knowledge alone	Recognise the four signs. Keep breastfeeding. Give clean water and any food. Spoon-feed patiently. Know the red flags	Prevents some dehydration in mild illness. Cholera still kills at historical rates (up to half untreated, WHO cholera fact sheet)
Hearth (fire, clean water, salt, sugar, honey, cloth)	Boil water. Make the salt-sugar solution with a marked litre and a fixed salt scoop. Make salted rice gruel. Give banana or coconut water for potassium	Treats the large majority of non-severe diarrhoea (over 90 per cent respond to ORS, WHO 2005a). In cholera, volume kept up early prevents shock. The main new risk is a salt error
Garden and still (scale, pressure cooker, forge)	Weigh salt and sugar exactly. Grow rice, cane or beet, bananas. Make the balance and double-ended spoons for the whole hamlet. If baking soda is salvaged, reproduce the 1971 Bongaon formula (3.5 g salt, 2.5 g baking soda, 22 g glucose per litre. With sucrose, about 44 g by the doubling rule of Sett and Mitra 1994, arithmetic not tested)	Removes most mixing error. Bicarbonate corrects acidosis (Cash et al. 1970b)
Village dispensary (300 people, trained lay healer)	Stock of WHO ORS packets and zinc tablets. A rehydration corner with cups, spoons and a clock. Plan B by weight. Nasogastric tubes and syringes. ReSoMal for malnourished children. Written charts	Catches the 3 to 5 per cent who fail Plan B. NG at 20 mL/kg per hour can rescue many severe cases without a drip. Zinc shortens episodes in malnourished children by about a day
District infirmary (3,000 people, nurse or doctor, ten beds)	Ringer's lactate by drip or bone. Doxycycline in cholera. Cholera beds with buckets to measure stool. Daily fluid balance	Treats shock. Brings cholera mortality toward the under 1 per cent target
Hospital before the Fall	Serum sodium and potassium on demand. Slow, controlled correction of hypernatraemia. Intensive care for seizures	Rescues the salt-poisoned child, the ileus and the mixed cases

Harm test

How the remedy kills or maims. - **Too much salt (hypernatraemia).** Comes from a full or heaped spoon, a tablespoon for a teaspoon, a packet in too little water, or repeated boiling down. Signs are extreme thirst, irritability, a doughy skin, then convulsions. Above 165 mmol/L convulsions are usual (WHO 2005a). Infants under 6 months

are most at risk (Vreede and van der Vorst 1993, Quereshi et al. 2010, Paut et al. 1999). Arithmetic: 7 g of salt in a litre reaches the BRAC danger line of 120 mmol/L. - **Too much sugar.** Draws water into the gut and worsens diarrhoea (Facts for Life extract, WHO 2005a). - **Too little salt or water only, in large volumes.** Causes hyponatraemia, with lethargy and seizures, especially in adult cholera and shigellosis (WHO 2005a, Nalin 2021). - **Too fast in the malnourished or in infants.** Causes overload. Signs are puffy eyelids (WHO 2005a), or breathing up 5 and pulse up 15 in the malnourished child (WHO 2005b), or crackles, liver enlargement and oedema (MSF Appendix 14). - **Contamination.** Unboiled water spreads the disease being treated. Cereal ORS spoils within hours in heat (Hesperian). Made-up ORS should be used within 24 hours (Sett and Mitra 1994). - **Honey under 12 months.** Risk of infant botulism (UF/IFAS). - **Nasogastric tube in a drowsy patient.** Risk of aspiration. Discouraged in shock by MSF (cholera 5.3). - **Delay.** Giving ORS to a child in shock instead of seeking a drip, where one can be reached within 30 minutes (WHO 2005a). - **Lookalike powders.** Curing salt, washing soda, salt substitute and plant-ash salt [VERIFY]. - **Opiate antidiarrhoeals.** Cause ileus and hide the fluid loss (WHO 2005a).

Who must never receive what. No honey under 12 months. No standard ORS at full speed for the severely malnourished, who need ReSoMal (WHO 2005b). No oral or nasogastric fluid in ileus or glucose malabsorption (WHO 2005a). No feeding bottle (WHO 2005a).

What to do when it goes wrong. If the child is extremely thirsty and irritable after the home solution, suspect too much salt. Stop the solution. Remake it with a fresh litre and a measured half scoop. Continue breastfeeding. Do not give large volumes of plain water quickly. Correctly made ORS is the treatment WHO describes for hypernatraemia (WHO 2005a). If the eyelids swell, stop and give breast milk or water (WHO 2005a).

Historical cases. Manila 1962, Lagos 1978, Amsterdam 1993, Kashmir 2010 and Yogyakarta 2002 to 2005 (section 8).

Red flags (with honest comfort)

Red flag	What it means	What to do anyway
Lethargic, unconscious or floppy	Severe dehydration or shock, or salt poisoning	Drip or bone needle if anyone can. If not, NG ORS at 20 mL/kg per hour if a tube exists and the airway is safe. Otherwise spoon ORS at the same rate if the child can swallow
Cannot drink or drinks poorly	Severe dehydration	As above. Reassess every hour
Skin pinch goes back over 2 seconds	Severe dehydration	As above
Weak or absent pulse at the wrist, cold hands	Shock	Fluid into the vein or bone is the only reliable answer. Keep warm. Spoon-feed if awake
Swollen, silent belly, repeated vomiting	Ileus	Stop oral fluid. Needs IV. Check whether any opiate was given
Blood in the stool	Dysentery, often shigella	Keep rehydrating. Needs antibiotics (see the dysentery prompt in this series)
Convulsions	Very high or very low sodium, or fever	Protect from injury. Do not force fluid into a fitting child. Resume measured ORS when awake
Severe wasting or swelling of the feet	Severe malnutrition	ReSoMal, slowly, and watch the breathing and pulse

Red flag	What it means	What to do anyway
Diarrhoea over 14 days	Persistent diarrhoea	Zinc helps (Lazzerini and Wanzira 2016). Feed
Infant under 4 months or under 4 kg with some dehydration	High risk	MSF would admit (MSF Appendix 14). Watch closely, spoon every minute or two

Honest comfort. Most diarrhoea in children is self-limiting, and over 90 per cent of cases respond to oral fluid alone (WHO 2005a). Even in the 1971 camps, with refugees arriving exhausted, 96 in every 100 cholera patients survived on mostly oral fluid (Mahalanabis et al. 1973). Half of the Bongaon deaths came before treatment began (Reynolds 2023). The lesson for a village is speed. Some children will still die, especially those who arrive in shock, the severely malnourished and the very young, when there is no drip. When a child cannot be saved, keep giving small sips if the child can swallow, keep the child clean, warm and held, and keep the mother close. Nothing in the record suggests that this care adds suffering.

The case against

David Nalin, co-author of the 1968 trial, against the low-sodium formula. Nalin argues that 75 mmol/L sodium is too low for adult cholera, where stool sodium is high. He reports hyponatraemia in over half of adults given an earlier 90 mmol/L solution (from unpublished data), and 47 hyponatraemic against 1 hypernatraemic seizure among 48,511 patients (Nalin 2021). His argument implies that the household recipe at 51 mmol/L may underdose adults with cholera. The WHO answer is that the reduced formula performs well in cholera trials and that antibiotics and food supply further salt (WHO 2005a). The disagreement is unresolved in the sources read.

The packet camp against home mixing. Myron Levine and colleagues (1980), Ransome-Kuti and Bamisaiye (1978), Lukmanji (1988) and Wilcox and Miller (1996) all documented that home mixing errs widely and dangerously. WHO itself does not generally recommend the home salt-sugar solution, because recipes are forgotten (WHO 2005a, WHO via en-net). The BRAC data show that error grows with time after teaching (Chowdhury 1986).

The home-recipe camp against the packet. BRAC and its evaluators, notably A. Mushtaque R. Chowdhury and Richard Cash, argued that packets create dependency on supply chains that fail the poor (Chowdhury et al. 1997, Cash 2022). David Werner and David Sanders went further in *Questioning the Solution* (1997), arguing that the "selective primary health care" behind global ORS promotion favoured a marketable packet over cereal-based home fluids and over the causes of diarrhoea: poverty, water and sanitation [VERIFY: the book itself was not read]. After the Fall, the home-recipe camp wins by default, but the packet camp's warnings about error become the main design problem.

Elliott and colleagues on sodium for well-nourished children. Elizabeth Elliott, Michael Farthing and colleagues argued in 1989 that 50 to 60 mmol/L is enough for non-cholera diarrhoea in developed countries (Elliott et al. 1989). This supports a lower-salt household recipe for children.

The zinc sceptics. The best review rates the duration benefit as low certainty, finds no benefit under 6 months, more vomiting, high heterogeneity and no proven reduction in deaths (Lazzerini and Wanzira 2016). The 23 per cent mortality figure is a model (Walker and Black 2010).

The romance of the solution. ORS does not stop diarrhoea, so a mother who expects the stools to stop may judge it useless. Uptake in BRAC villages was about 17 per cent one month after teaching (Chowdhury 1986). Diarrhoea still kills over 440,000 children under five a year (WHO diarrhoeal disease fact sheet). Clean water, sanitation, breastfeeding and food prevent the episodes that ORS only treats.

The romance of the hospital. At Bongaon, the IV-only camps did worse than the mainly oral unit. The oral route had fewer deaths than IV in the Cochrane pooled trials (2 against 6) and caused no phlebitis (Hartling et al. 2006).

10-line summary

1. Sodium and glucose are absorbed together even during cholera. This was shown in Dhaka in 1968 (Hirschhorn et al. 1968).
2. Oral solution cut IV needs by about 80 per cent in adult cholera (Nalin et al. 1968).
3. Mostly oral treatment held cholera mortality at 3.6 per cent in a 1971 refugee camp, against 20 to 30 per cent in IV-only camps (Mahalanabis et al. 1973).
4. Reduced-osmolarity ORS (75 mmol/L sodium, 245 mOsm/L) cuts the odds of needing a drip by about 40 per cent against the old formula (Kim et al. 2001).
5. The safe household recipe is 1 litre of clean water, half a level 5 mL teaspoon (about 3 g) of salt and 6 level teaspoons of sugar. Too dilute is safe, too salty can kill.
6. Salt errors are common (up to a quarter of solutions dangerous two years after teaching) and have killed infants. A fixed scoop and a marked litre are the fix.
7. Rice ORS reduces stool output by about a third in cholera (Gore et al. 1992).
8. Give 75 mL/kg over 4 hours for some dehydration, and 20 mL/kg per hour for 6 hours by tube or mouth for severe dehydration without a drip.
9. Zinc 20 mg (10 mg under 6 months) daily for 10 to 14 days shortens diarrhoea in children over 6 months, most clearly in the malnourished.
10. Shock, ileus and the child who cannot drink need fluid by another route. Without a drip, WHO's fallback is ORS by tube or mouth at 20 mL/kg per hour.

Open questions

- The right sodium content for adults with cholera on a household recipe: 51 mmol/L (half teaspoon), 75 (WHO ORS) or 90 (old formula). Nalin and WHO disagree.
- How accurately can an untrained person detect a dangerous solution by taste? No study was found [VERIFY].
- How long does a village keep mixing correctly after teaching, without the BRAC pay incentive, and what refresher interval holds error under 5 per cent?
- Whether honey-based ORS performs comparably in cholera. Only one trial in infant gastroenteritis was found.
- Whether the NG route is safe enough in shock for lay hands. WHO allows it as a fallback, MSF forbids it.
- How to supply zinc after stocks expire, and what dietary sources can substitute.
- Whether salted traditional fluids (kanji, lassi, carrot soup) reduce mortality. CHERG found insufficient evidence (Munos et al. 2010).

Sources to read in full

1. WHO 2005, *The treatment of diarrhoea: a manual for physicians and other senior health workers*, 4th revision. The basis of the protocols here.
2. WHO 2005, *Pocket book of hospital care for children*, the diarrhoea and severe malnutrition chapters.
3. Chowdhury AMR 1986, the LSHTM thesis on BRAC's OTEP. The best field record of mass teaching.
4. Mahalanabis et al. 1973, with the 2001 WHO Bulletin reprint and Fontaine and Newton's commentary.
5. Nalin et al. 1968 (Lancet) and Hirschhorn et al. 1968 (NEJM). The founding trials.
6. Ruxin JN 1994, "Magic bullet", Medical History. The standard history (not read in full here).
7. Nalin D 2021, "Issues and controversies in the evolution of ORT". The insider's critique.
8. Lazzerini and Wanzira 2016, Cochrane review of zinc.
9. MSF, *Management of a cholera epidemic* and Appendix 14 of the clinical guidelines.

10. Reynolds M 2023, *Asterisk*, a readable narrative.

At the bedside after the Fall

Household. - *Minimum viable version.* A marked litre vessel, a fixed salt scoop (about 3 g, made as in section 16), a sugar measure, a cup and a spoon. Boiled water. The four signs of dehydration. Plan A after every stool. Plan B for some dehydration. - *What it needs to start.* Salt, sugar or honey or gur or rice, fuel to boil water, one adult who has made the solution under supervision at least once. A card with the recipe and the volume table. - *Skills.* Mixing, spoon-feeding a vomiting child, counting stools, recognising the red flags. - *Records.* A tally of stools and cups given, chalked on a board. - *First failure to expect.* The salt scoop gets lost and a kitchen spoon is used instead, or the solution is made in a smaller pot "to save fuel". Both raise the salt. The second is forgetting the solution altogether and giving plain water or sweet drinks.

Village of 300. - *Minimum viable version.* One trained healer with a rehydration corner: weighed and labelled salt scoops for every household, a scale for children, a clock or sand-glass, cups, spoons, two or three NG tubes and syringes, a stock of ORS packets and zinc for as long as they last, and a big pot for cereal ORS in an outbreak. - *Skills.* Plan B by weight. NG placement and feeding at 20 mL/kg per hour. ReSoMal for malnourished children. Teaching mothers, BRAC-style, with a check that they mix correctly before the healer leaves. - *Records.* Each patient's weight, signs, volumes given each hour, and outcome. A household register of who has been taught and when they were last checked. - *First failure to expect.* Teaching decays. Expect dangerous solutions in 15 to 25 per cent of households within two years unless re-checked (Chowdhury 1986). Re-check each household's mixing every season, ideally by watching it made. In a cholera outbreak, the volume needed outruns one healer. Train relatives as feeders, as at Bongaon.

District of 3,000. - *Minimum viable version.* A cholera-ready infirmary: ten beds (cholera beds with a hole and bucket to measure stool if possible), Ringer's lactate stock and giving sets, intraosseous needles, doxycycline, a store of salt and sugar sufficient for an outbreak, and a scale to make up ORS in bulk. A trainer for village healers. - *Skills.* Plan C, IV and IO access, outbreak organisation (separate area, chlorinated water, safe disposal of stool), bulk mixing by weight, recognising hypernatraemia and ileus. - *Records.* Case counts and deaths per week, to calculate case-fatality. The target is under 1 per cent in a treatment centre (WHO cholera fact sheet). - *First failure to expect.* IV fluid runs out in the first outbreak, as at Bongaon. Plan for oral and NG rehydration as the main treatment, with IV reserved for shock. A second: bulk ORS made up in a new container with the wrong water volume. Weigh the water.

Protocols

Protocol 1. Make the household solution (salt and sugar)

- ☐ Wash hands. Boil water and let it cool, covered.
- ☐ Measure exactly 1 litre into the marked vessel. Never less.
- ☐ Add salt: half a level 5 mL teaspoon (about 3 g). Level it off with a knife. Never heaped. If the scoop is the made 3 g scoop, use one level scoop.
- ☐ Add sugar: 6 level 5 mL teaspoons (WHO's weighed figure is 18 g). Up to 8 is acceptable (Hesperian, IFRC). Gur or brown sugar will do.
- ☐ Stir until dissolved. Taste it: it should be less salty than tears. If in doubt, add more water, never more salt.
- ☐ Optional for potassium: half a cup of coconut water or a mashed ripe banana (Hesperian).
- ☐ Cover. Discard and remake after 24 hours.

- Tolerance: salt 1.75 to 5.5 g per litre (30 to 94 mmol/L, arithmetic) is inside the BRAC safe range. 7 g or more is dangerous.

Protocol 2. Make cereal ORS (best in cholera)

- ☐ 1 litre clean water in a pot.
- ☐ Add 50 to 80 g rice powder (WHO), or 8 heaped teaspoons of powdered cereal (Hesperian).
- ☐ Boil, stirring, for 5 to 10 minutes into a thin, drinkable gruel.
- ☐ Add half a level teaspoon of salt (or an ORS packet's salts if available). Top up to 1 litre with boiled water if it has boiled down.
- ☐ Cool. Taste before each use. Discard when sour, and within a few hours in hot weather.

Protocol 3. Assess the patient

- ☐ General condition: alert, restless, or lethargic and unconscious?
- ☐ Eyes: sunken? Ask the mother.
- ☐ Offer a drink: drinks normally, eagerly, poorly or not at all?
- ☐ Skin pinch on the belly, held 1 second: back quickly, slowly, or over 2 seconds?
- ☐ Weigh if possible.
- ☐ Two or more signs in a column decide: no, some or severe dehydration. Check the red flags.

Protocol 4. Plan A at home (no dehydration)

- ☐ After each loose stool: under 2 years 50 to 100 mL, 2 to 10 years 100 to 200 mL, older as much as wanted.
- ☐ Keep breastfeeding. Keep feeding.
- ☐ Give zinc (Protocol 8).
- ☐ Return if any sign in section 12 appears, or if there is no improvement in 3 days.

Protocol 5. Plan B (some dehydration), 4 hours

- ☐ Amount: 75 mL x weight in kg. Or use the age table. Example: 10 kg child gives 750 mL.
- ☐ Under 2 years: one teaspoon (5 mL) every 1 to 2 minutes. Older: sips from a cup.
- ☐ Mark the target on the vessel. Check progress each hour (about a quarter each hour).
- ☐ Vomiting: stop 5 to 10 minutes, then a spoonful every 2 to 3 minutes.
- ☐ Puffy eyelids: stop, give breast milk or water.
- ☐ At 4 hours: reassess (Protocol 3). Rehydrated, go to Plan A. Still some, repeat Plan B and start food. Severe, go to Protocol 6.
- ☐ Start zinc after the first 4 hours.

Protocol 6. Severe dehydration without a drip

- ☐ If a drip is within 30 minutes, go now, giving ORS on the way.
- ☐ If not, and the patient is awake enough to swallow or protect the airway: NG tube if available, otherwise cup and spoon.
- ☐ Rate: 20 mL/kg per hour for 6 hours (120 mL/kg total). Example: 10 kg child gives 200 mL each hour, about 3 mL a minute.
- ☐ Reassess every hour. If the belly swells, slow down. If vomiting repeats, slow down.
- ☐ No improvement after 3 hours: seek a drip by any means.
- ☐ At 6 hours, reassess and continue Plan A, B or C as needed.

Protocol 7. Adult with cholera

- ☐ Estimate deficit: severe in 50 kg adult is about 5 litres.

- ☐ Give up to 750 mL an hour by mouth. Aim for 2 litres in the first 30 minutes if the patient can drink fast, then the rest within 3 hours.
- ☐ Then replace losses: 200 to 250 mL after every stool. Expect 200 mL/kg or more over the first day.
- ☐ Use cereal ORS if possible.
- ☐ Doxycycline 300 mg once if available (MSF).
- ☐ Shock or unable to drink: Protocol 6, or IV if possible.

Protocol 8. Zinc

- ☐ Under 6 months: 10 mg (half a 20 mg tablet) once a day.
- ☐ 6 months and over: 20 mg once a day.
- ☐ Dissolve in a spoon of breast milk, water or ORS.
- ☐ Continue for 10 to 14 days, even after diarrhoea stops.

Protocol 9. Make and check measuring tools

- ☐ Litre: 1 kg of water in the vessel. Mark the line permanently.
- ☐ Salt scoop: carve to hold 2.5 mL of water (syringe). Check with salt on a balance: about 3 g of fine salt, level.
- ☐ Sugar scoop: size so that 6 level scoops weigh about 18 g (WHO 2005a) to 40 g (IFRC).
- ☐ Join them as a double-ended spoon. Label with a burnt mark: one salt, six sugar, one litre.
- ☐ Check every household's tools and mixing once a season.

Protocol 10. Severely malnourished child with diarrhoea

- ☐ Use ReSoMal if available (one ORS packet in 2 litres, plus 50 g sugar and 45 mL 10 per cent potassium chloride).
- ☐ 5 mL/kg every 30 minutes for 2 hours, then 5 to 10 mL/kg per hour for up to 10 hours.
- ☐ Count breathing and pulse before starting and every 30 minutes. If breathing rises by 5 a minute and pulse by 15, stop.
- ☐ IV only for shock.

Numbers to carry

1. **1 litre, half a level teaspoon of salt (about 3 g), 6 level teaspoons of sugar.** Never a heaped spoon. Too dilute is safe, too salty kills.
2. **7 g of salt in a litre (120 mmol/L) is dangerous.** A full 5 mL teaspoon of salt is about 6 g.
3. **75 mL/kg over 4 hours** for some dehydration.
4. **After each loose stool, 50 to 100 mL under 2 years, 100 to 200 mL from 2 to 10 years.**
5. **20 mL/kg per hour for 6 hours** by NG or mouth for severe dehydration without a drip.
6. **100 mL/kg IV Ringer's lactate**, 30 then 70, for shock.
7. **Skin pinch over 2 seconds = severe.**
8. **Zinc 20 mg daily (10 mg under 6 months) for 10 to 14 days.**
9. **Vomiting: wait 10 minutes, then a spoonful every 2 to 3 minutes.**
10. **Adult cholera: about 5 litres deficit in a 50 kg adult, and up to 750 mL an hour by mouth.**

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