



Module 6

Diarrhea and Dehydration

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Learning Objectives

- Identify different types of diarrhea and their causes
- Assessment of child with diarrhea and classification of dehydration
- Use IMCI guidelines to guide treatment of diarrhea and dehydration
- Describe how ORS works and indications
- Discuss treatment and prevention of acute diarrhea
- Define special considerations in the management of diarrhea
 - 0-2 months
 - Malnutrition
 - Persistent diarrhea

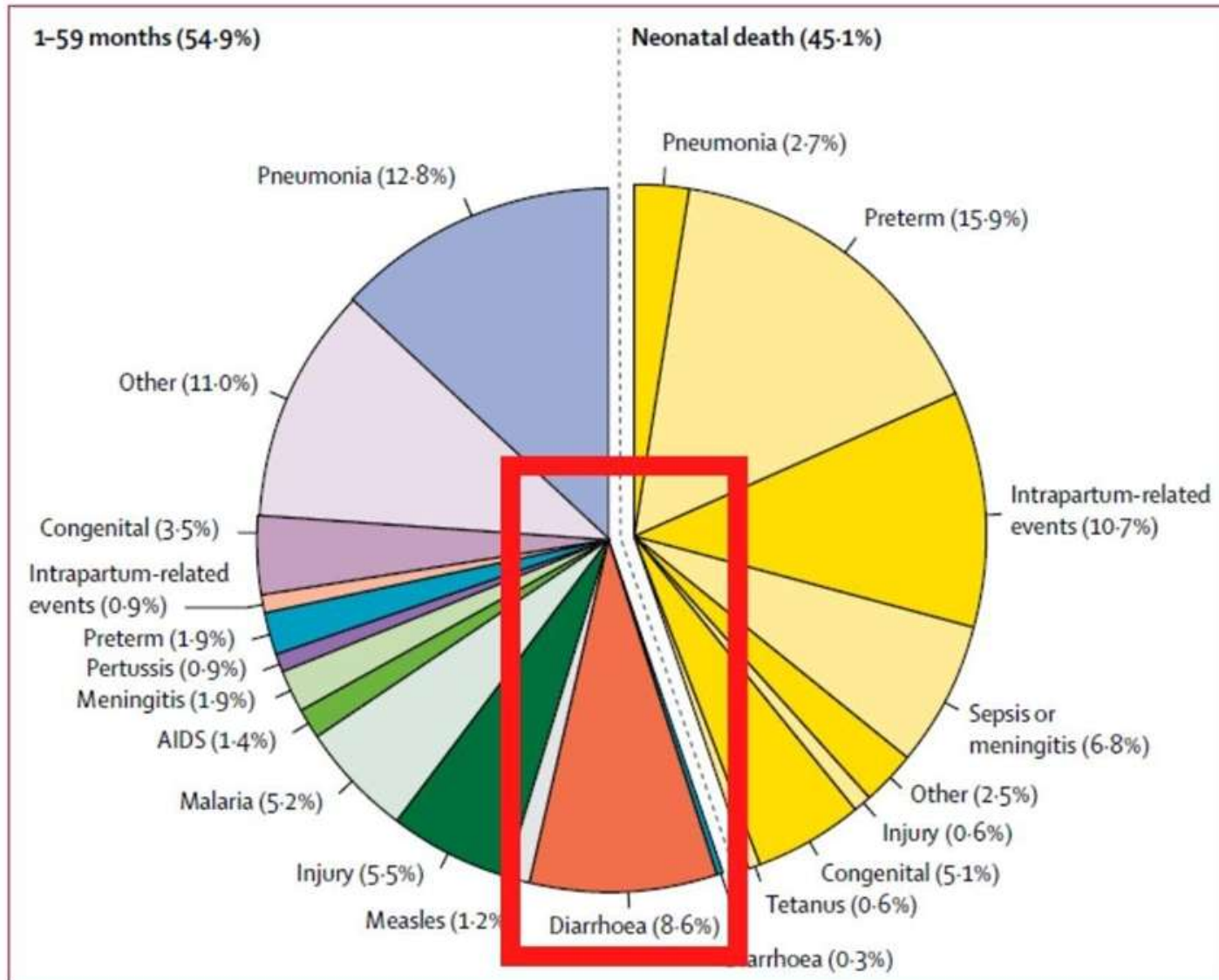
Introduction

- Diarrhea is one of the leading causes of under 5 mortality
- In 2015 diarrhea was estimated to cause over half a million deaths worldwide in the age group 1-59 months (1)
- In disaster settings risk of diarrhea is increased
 - Populations in flight, crowding
 - Breakdown of sanitation infrastructure
 - Limited access to vaccines
 - Inability to practice good hygiene measures

1. Global, regional, and national causes of under-5 mortality in 2000–15: an updated systematic analysis with implications for the Sustainable Development Goals Dr Li Liu, PhD, et al The Lancet Volume 388 Issue 10063 Pages 3027-3035 (December 2016)

Global, regional, and national causes of under-5 mortality in 2000–15: an updated systematic analysis with implications for the Sustainable Development Goals

Li Liu, Shefali Oza, Dan Hogan, Yue Chu, Jamie Perin, Jun Zhu, Joy E Lawn, Simon Cousens, Colin Mathers, Robert E Black *Lancet* 2016; 388: 3027–35



Diarrhea

Definition

Passage of three or more loose or liquid stools per day - WHO

Acute watery

Last hours or days

Acute bloody

Acute diarrhea with visible blood in stool (dysentery)

Persistent

Diarrhea lasting 14 days or longer

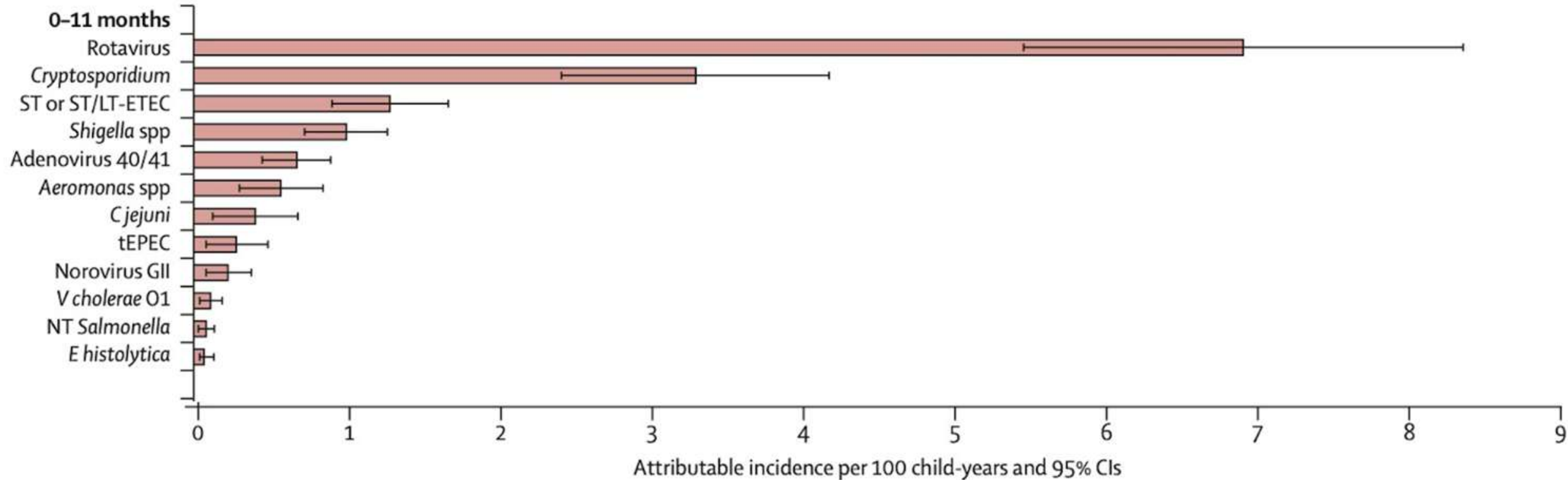
Etiology of Acute Diarrhea

- **Watery:** Rotavirus, noroviruses, enterotoxigenic E coli (ETEC), Vibrio cholerae, Clostridium difficile, Giardia, and cryptosporidia
- **Bloody:** Shigella and Entamoeba histolytica. Campylobacter organisms, invasive E coli, Salmonella, Aeromonas organisms, C difficile, and Yersinia

Rotavirus and Escherichia coli, are the two most common etiological agents of moderate-to-severe diarrhoea in low-income countries -WHO

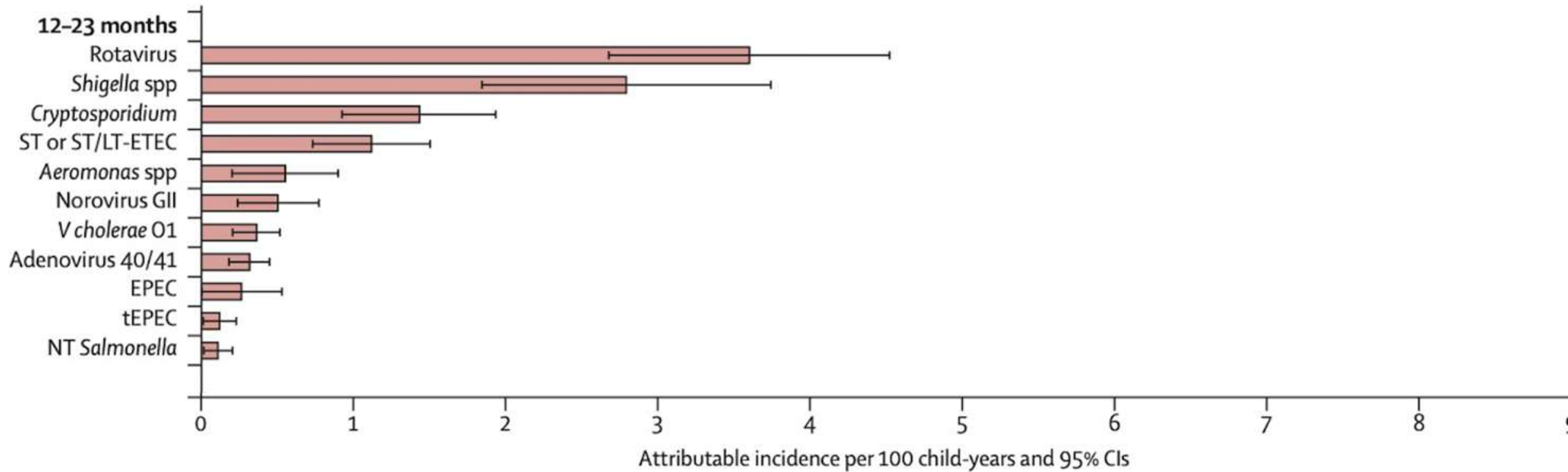
Etiology of Acute Diarrhea

0-11 months



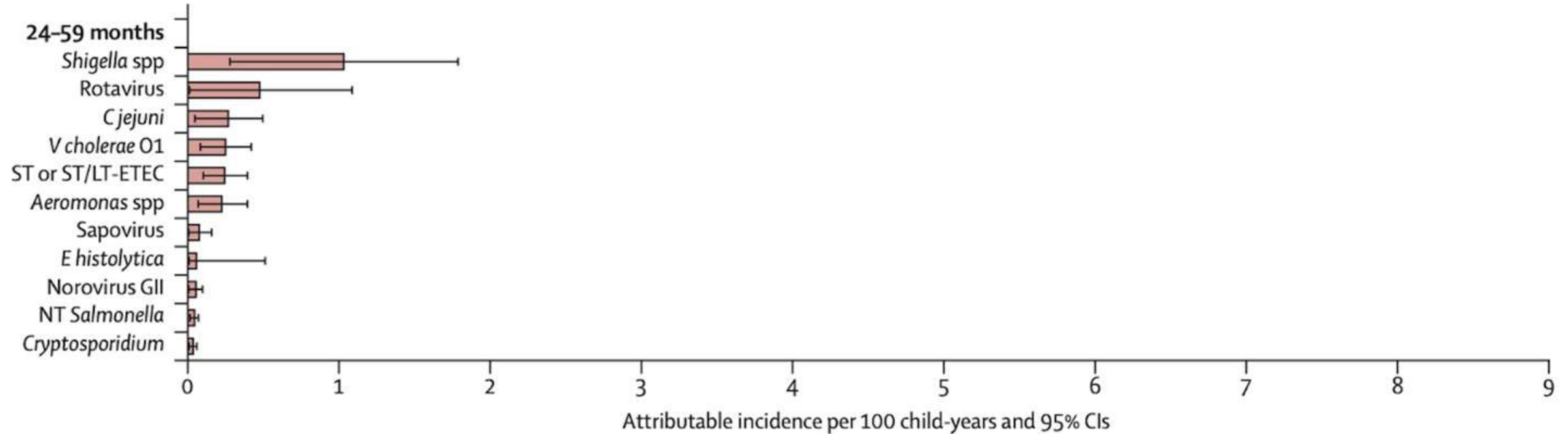
Kotloff KL, et al. Burden and aetiology of diarrhoeal disease in infants and young children in developing countries (the Global Enteric Multicenter Study, GEMS): A prospective, case-control study. Lancet. 2013 Jul 20;382(9888):209-22.

Etiology of Acute Diarrhea 12-23 months



Kotloff KL, et al. Burden and aetiology of diarrhoeal disease in infants and young children in developing countries (the Global Enteric Multicenter Study, GEMS): A prospective, case-control study. Lancet. 2013 Jul 20;382(9888):209-22.

Etiology of Acute Diarrhea 24-59 months



Kotloff KL, et al. Burden and aetiology of diarrhoeal disease in infants and young children in developing countries (the Global Enteric Multicenter Study, GEMS): A prospective, case-control study. *Lancet*. 2013 Jul 20;382(9888):209–22.

Cholera

- Acute diarrheal disease caused by *Vibrio cholerae*
- Secretion of fluid and electrolytes into the lumen of the small intestine
- Death from dehydration and acidosis can occur within hours if not adequately managed
- Transmission linked to inadequate access to clean water and sanitation facilities (Can survive for 7-10 days in water)
- Cholera outbreaks suspected when **adults with severe diarrhea and dehydration** are identified

Shigellosis

Influenza, dysentery, and typhoid fever were the most important diseases in The Great War (WW1)
-A brief history of Shigella, Keith Lambel et al

In 1994, an explosive outbreak among Rwandan refugees in Zaïre caused approximately 20,000 deaths during the first month alone.

-WHO

Shigellosis

- Shigella remains most common cause of dysentery in developing countries and disaster settings (1)
- Bacterial spread through epithelium of gut and the inflammatory cascade leads to local ulceration and abscess formation-**blood and pus in stool**
- Most common age group 6mth -5 years
- Associated with extragastrointestinal complications e.g. bacteremia, HUS, Reiter syndrome
- Early treatment with appropriate antibiotics improves outcomes

1. Guerin, P. J., Brasher, C., Baron, E., Mic, D., Grimont, F., Ryan, M., ... & Legros, D. (2004). Case management of a multidrug-resistant Shigella dysenteriae serotype 1 outbreak in a crisis context in Sierra Leone, 1999–2000. Transactions of the Royal Society of Tropical Medicine and Hygiene, 98(11), 635-643.

Salmonellosis

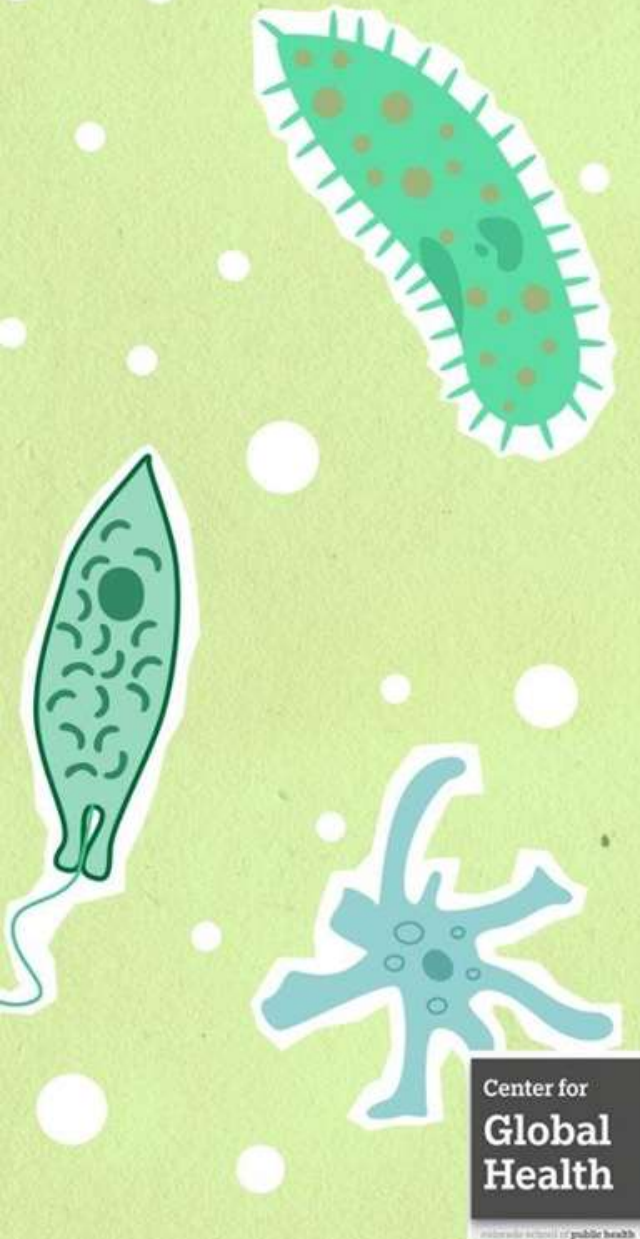
- 1 of 4 key global causes of diarrheal diseases, mainly food borne.
- Causes a spectrum of disease; gastroenteritis, enteric fever, bacteraemia, focal infections and a carrier state
- Serotype and host factors determine manifestations
- Diarrhea may be severe, occasionally bloody with abdominal cramping vomiting and fever

Typhoid

- Caused by *Salmonella Typhi*
- Symptoms include prolonged fever, fatigue, headache, nausea, abdominal pain, and constipation or diarrhoea
- Some patients may have a rash
- Can lead to serious complications such as bowel perforation and death
- Management includes antibiotics, WASH interventions and enhancing clean food preparation

Amoebic Dysentery

- Feco-oral transmission
- Most severe in infants, pregnant women and malnourished children
- Complications include fulminant colitis, toxic megacolon and liver abscess
- Should not be first consideration for dysentery
- May consider metronidazole when treatment for shigella with appropriate antibiotics fails



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Diarrhea Outbreak

- Epidemiologic surveillance
- **SUSPECT!** (adults with dehydration)
- Early identification & culture/PCR confirmation
- Report
- Active investigation and treatment of secondary cases
- Strengthen preventive measures



Differential Diagnosis for Dysentery

- Infection
- Allergic colitis (Cow milk protein allergy)
- Malabsorption
- Food intolerance
- Intussusception
- Necrotizing enterocolitis
- Hemorrhagic disease of the newborn
- DIC (sepsis)

Assessing a child with acute diarrhea

- Clinical history:
 - Number of stools, for how long?
 - Volume of stools
 - Others in home with similar symptoms
 - Ability to drink and other danger signs
- Clinical Examination
 - Hydration status: Classify dehydration
 - Other associated symptoms

Does the child have diarrhoea?

If yes, ask:

- For how long?
- Is there blood in the stool?

Look and feel:

- Look at the child's general condition. Is the child:
 - Lethargic or unconscious?
 - Restless and irritable?
- Look for sunken eyes.
- Offer the child fluid. Is the child:
 - Not able to drink or drinking poorly?
 - Drinking eagerly, thirsty?
- Pinch the skin of the abdomen. Does it go back:
 - Very slowly (longer than 2 seconds)?
 - Slowly?

Classification of Dehydration

Classification of Dehydration

No Dehydration

Not enough signs to classify as some or severe dehydration

Some Dehydration

Two of the following signs:

- Restless/Irritable
- Sunken eyes
- Drinks eagerly, thirsty
- Skin pinch goes back slowly

Severe Dehydration

Two of the following signs:

- Lethargic or unconscious
- Sunken eyes
- Not able to drink /drinking poorly
- Skin pinch goes back very slowly

Shock

All four of

- Weak/absent pulse
- Lethargic or unconscious
- Cold hands + Temp gradient
- Cap refill >3sec

Plus

- Sunken eyes /Slow Skin pinch

IMCI Classification of Dehydration

Two of the following signs: • Lethargic or unconscious • Sunken eyes • Not able to drink or drinking poorly • Skin pinch goes back very slowly.	Pink: SEVERE DEHYDRATION	■ If child has no other severe classification: ◦ Give fluid for severe dehydration (Plan C) - OR ■ If child also has another severe classification: ◦ Refer URGENTLY to hospital with mother giving frequent sips of ORS on the way ◦ Advise the mother to continue breastfeeding ■ If child is 2 years or older and there is cholera in your area, give antibiotic for cholera
Two of the following signs: • Restless, irritable • Sunken eyes • Drinks eagerly, thirsty • Skin pinch goes back slowly.	Yellow: SOME DEHYDRATION	■ Give fluid, zinc supplements, and food for some dehydration (Plan B) ■ If child also has a severe classification: ◦ Refer URGENTLY to hospital with mother giving frequent sips of ORS on the way ◦ Advise the mother to continue breastfeeding ■ Advise mother when to return immediately ■ Follow-up in 5 days if not improving
Not enough signs to classify as some or severe dehydration.	Green: NO DEHYDRATION	■ Give fluid, zinc supplements, and food to treat diarrhoea at home (Plan A) ■ Advise mother when to return immediately ■ Follow-up in 5 days if not improving

Degree of Dehydration

DEGREE OF DEHYDRATION	0-5 yrs	>5yrs
MILD/NO DEHYDRATION	UP TO 5%	3%
MODERATE/SOME DEHYDRATION	>5-10%	6%
SEVERE/ SEVERE DEHYDRATION	10%	9%

TABLE 2. **Clinical Dehydration Scale (CDS) for Children**

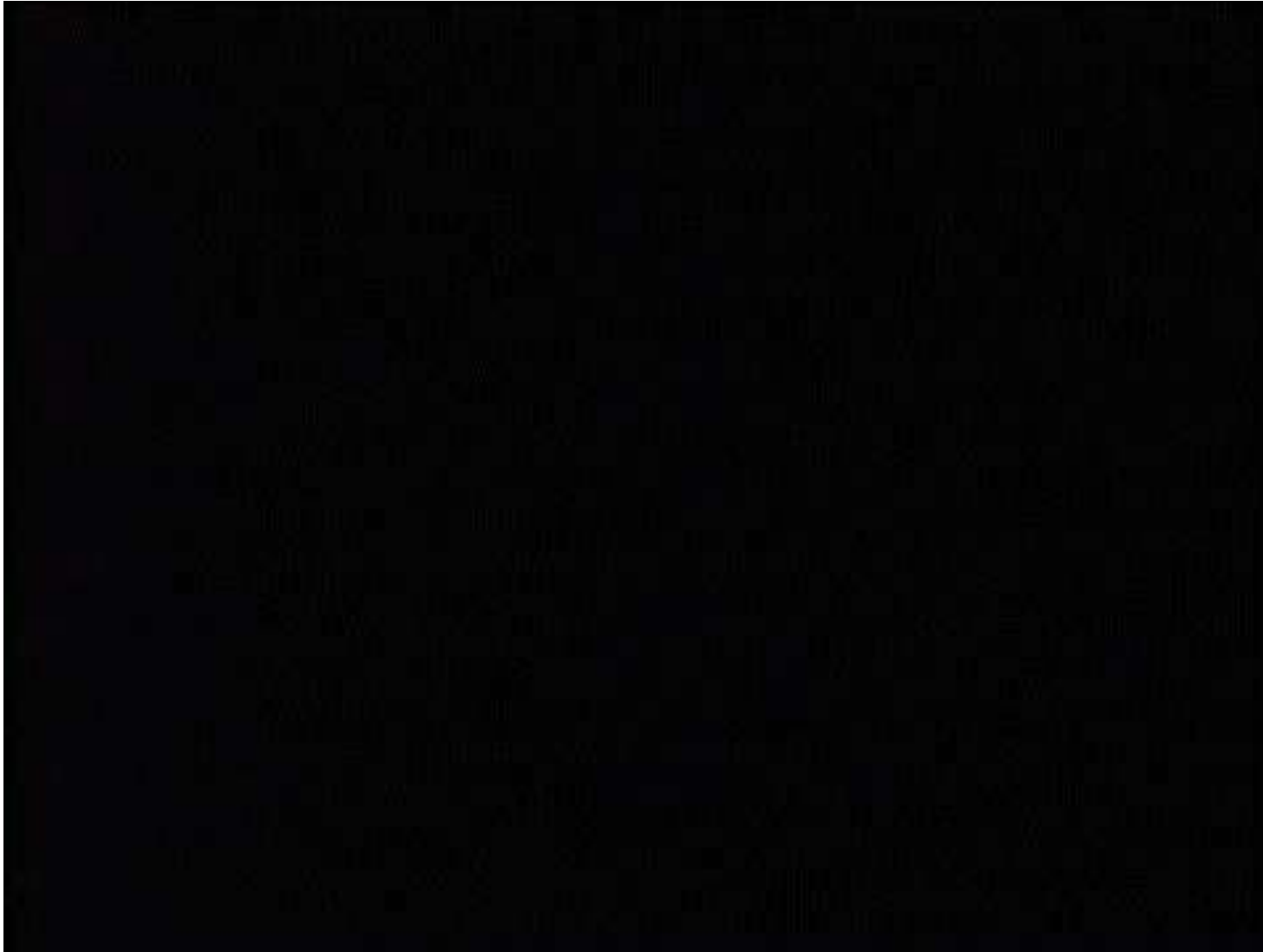
CHARACTERISTICS	0	1	2
General appearance	Normal	Thirsty, restless, or lethargic but irritable when touched	Drowsy, limp, cold, or sweaty ± comatose
Eyes (periorbital skin turgor)	Normal	Slightly sunken	Extremely sunken
Mucous membranes (tongue)	Moist	Sticky	Dry
Tears	Tears	Decreased tears	Absent tears

A score of 0 represents no dehydration, a score of 1 to 4 represents some dehydration, and a score of 5 to 8 represents moderate/severe dehydration.

http://publications.aap.org/pediatricsinreview/article-pdf/37/8/313/825109/pedsinreview_20150099.pdf



SLOW SKIN PINCH



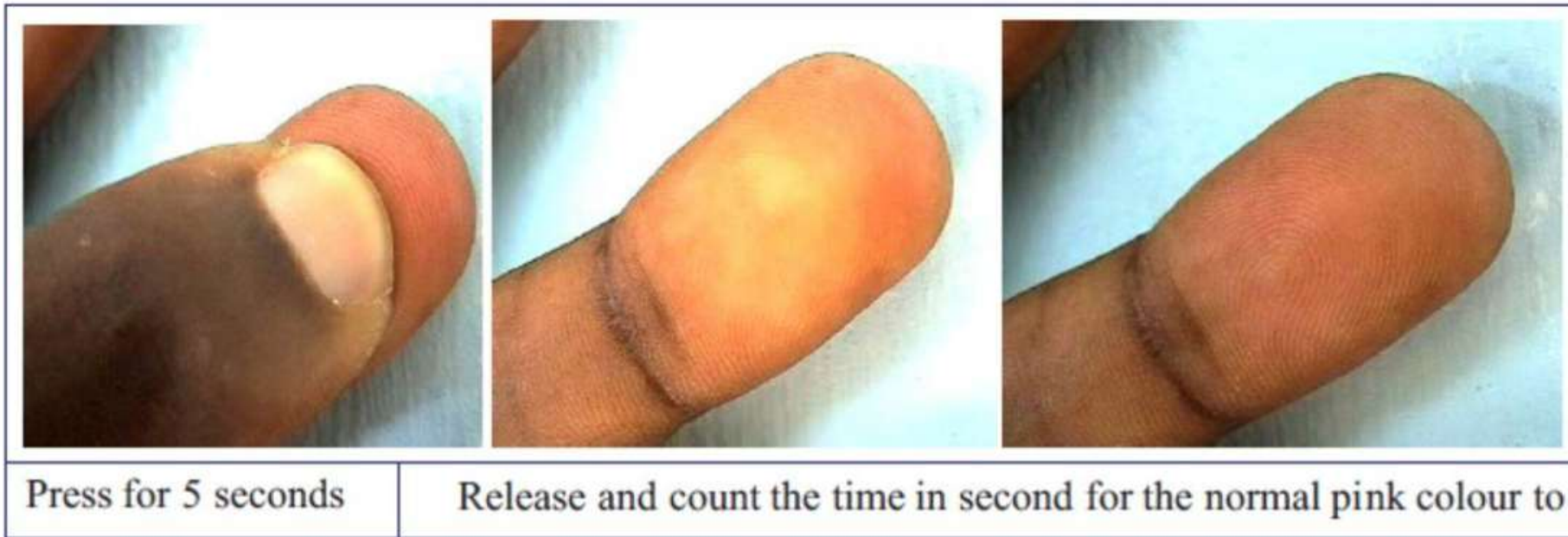
SUNKEN EYES



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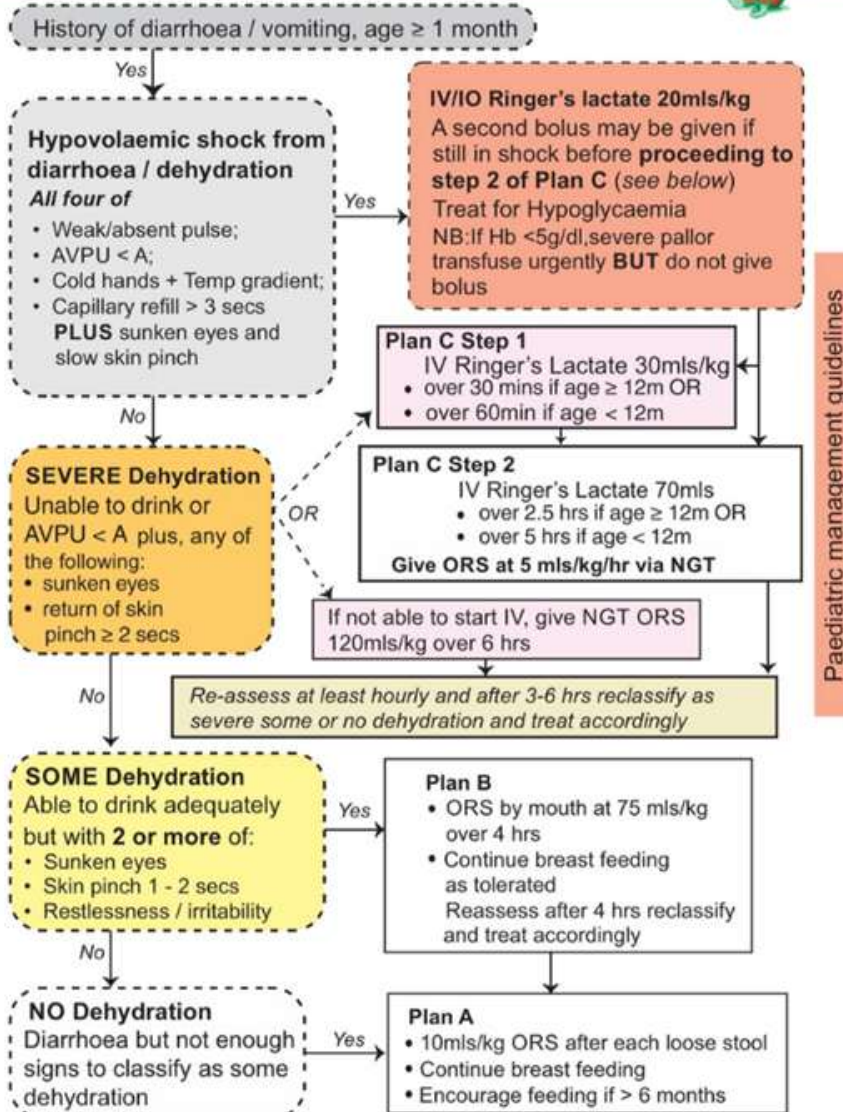




CAPILLARY REFILL

Figure: 1.2.1. Assessing capillary refill time

ETAT Module for Distance Learners

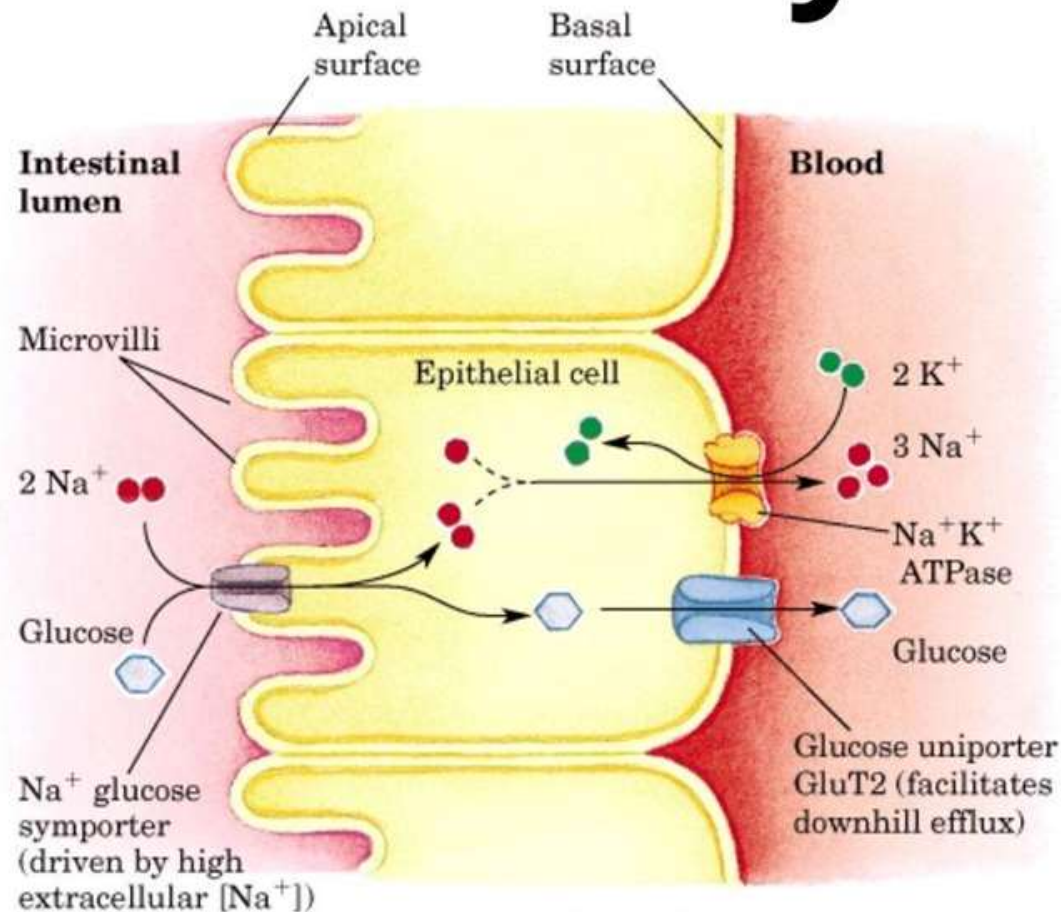


All cases to receive Zinc. Antimicrobials are NOT indicated unless there is dysentery or proven amoebiasis or giardiasis.

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Management of Dehydration

ORS Physiological Basis



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- Na/glucose symporter at lumen transports Na into the cell
- At the base Na pumped into blood and K pumped into the cell
- Glucose also pumped into the blood
- Osmotic gradient created which pulls water into the blood

Advantages of ORS

- Physiological
- Effective in 90-95% of cases; same for all diarrhea types
- **REDUCES MORBIDITY AND MORTALITY!**
- Low cost , simple implementation
- Accessibility
- No infective, metabolic or electrolytic complications

Contraindications for ORS

- Shock
- Age < 1 month
- Functional obstruction/ paralytic Ileus
- Bilious emesis
- Severely impaired consciousness
- Severe respiratory distress
- Tense and/or tender abdomen



ORS units



- Set up ORT units in disaster settings
- Require ORS packets, clean drinking water and utensils to mix the batches
- Staff in the unit should keep records of number of patients treated
- They should be trained to identify suspected cases of cholera to improve public health interventions

PLAN A

PLAN A: TREAT DIARRHOEA AT HOME

Counsel the mother on the 4 Rules of Home Treatment:

1. Give Extra Fluid
2. Give Zinc Supplements (age 2 months up to 5 years)
3. Continue Feeding
4. When to Return.

1. GIVE EXTRA FLUID (as much as the child will take)

▪ TELL THE MOTHER:

- Breastfeed frequently and for longer at each feed.
- If the child is exclusively breastfed, give ORS or clean water in addition to breast milk.
- If the child is not exclusively breastfed, give one or more of the following: ORS solution, food-based fluids (such as soup, rice water, and yoghurt drinks), or clean water.

▪ It is especially important to give ORS at home when:

- the child has been treated with Plan B or Plan C during this visit.
- the child cannot return to a clinic if the diarrhoea gets worse.

▪ TEACH THE MOTHER HOW TO MIX AND GIVE ORS. GIVE THE MOTHER 2 PACKETS OF ORS TO USE AT HOME.

▪ SHOW THE MOTHER HOW MUCH FLUID TO GIVE IN ADDITION TO THE USUAL FLUID INTAKE:

Up to 2 years	50 to 100 ml after each loose stool
2 years or more	100 to 200 ml after each loose stool

Tell the mother to:

- Give frequent small sips from a cup.
- If the child vomits, wait 10 minutes. Then continue, but more slowly.
- Continue giving extra fluid until the diarrhoea stops.

2. GIVE ZINC (age 2 months up to 5 years)

▪ TELL THE MOTHER HOW MUCH ZINC TO GIVE (20 mg tab):

2 months up to 6 months	1/2 tablet daily for 14 days
6 months or more	1 tablet daily for 14 days

▪ SHOW THE MOTHER HOW TO GIVE ZINC SUPPLEMENTS

- Infants - dissolve tablet in a small amount of expressed breast milk, ORS or clean water in a cup.
- Older children - tablets can be chewed or dissolved in a small amount of water.

3. CONTINUE FEEDING (exclusive breastfeeding if age less than 6 months)

4. WHEN TO RETURN

- ORS 10mls/kg after each loose stool
- Adequate feeds
- Tell mother when to return

PLAN B

PLAN B: TREAT SOME DEHYDRATION WITH ORS

In the clinic, give recommended amount of ORS over 4-hour period

▪ DETERMINE AMOUNT OF ORS TO GIVE DURING FIRST 4 HOURS

WEIGHT	< 6 kg	6 - <10 kg	10 - <12 kg	12 - 19 kg
AGE*	Up to 4 months	4 months up to 12 months	12 months up to 2 years	2 years up to 5 years
In ml	200 - 450	450 - 800	800 - 960	960 - 1600

* Use the child's age only when you do not know the weight. The approximate amount of ORS required (in ml) can also be calculated by multiplying the child's weight (in kg) times 75.

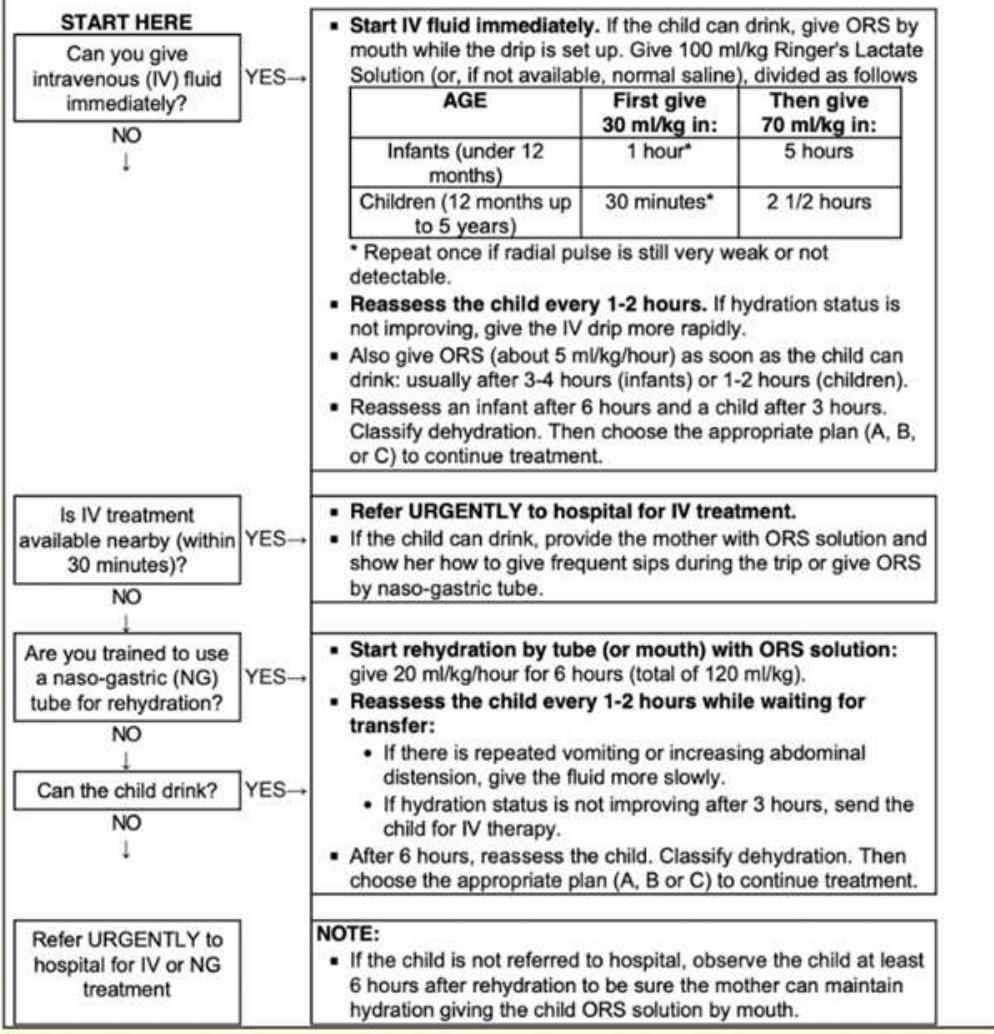
- If the child wants more ORS than shown, give more.
- For infants under 6 months who are not breastfed, also give 100 - 200 ml clean water during this period if you use standard ORS. This is not needed if you use new low osmolarity ORS.
- **SHOW THE MOTHER HOW TO GIVE ORS SOLUTION.**
 - Give frequent small sips from a cup.
 - If the child vomits, wait 10 minutes. Then continue, but more slowly.
 - Continue breastfeeding whenever the child wants.
- **AFTER 4 HOURS:**
 - Reassess the child and classify the child for dehydration.
 - Select the appropriate plan to continue treatment.
 - Begin feeding the child in clinic.
- **IF THE MOTHER MUST LEAVE BEFORE COMPLETING TREATMENT:**
 - Show her how to prepare ORS solution at home.
 - Show her how much ORS to give to finish 4-hour treatment at home.
 - Give her enough ORS packets to complete rehydration. Also give her 2 packets as recommended in **Plan A**.
 - Explain the 4 Rules of Home Treatment:
 1. **GIVE EXTRA FLUID**
 2. **GIVE ZINC** (age 2 months up to 5 years)
 3. **CONTINUE FEEDING** (exclusive breastfeeding if age less than 6 months)
 4. **WHEN TO RETURN**

- ORS 75mls/kg over 4 hours
- Then reassess hydration status
- Should be done in the clinic

PLAN C

PLAN C: TREAT SEVERE DEHYDRATION QUICKLY

FOLLOW THE ARROWS. IF ANSWER IS "YES", GO ACROSS. IF "NO", GO DOWN.



- Ringer's lactate step 1: 30mls/kg then step 2: 70ml/kg
- Reassess hydration status every 1- 2 hrs
- Also give ORS 5mls/kg/hour

SHOCK

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812

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Mortality after Fluid Bolus in African Children with Severe Infection

B., B.S., Ph.D., Sarah Kiguli, M.B., Ch.B., M.Med., Robert O. Opoka, M.B., Ch.B., M.Med., M.B., Ch.B., M.Med., Peter Olupot-Olupot, M.B., Ch.B., Samuel O. Akech, M.B., Ch.B., M.B., Ch.B., M.Med., George Mtove, M.D., Hugh Reyburn, M.B., B.S., Trudie Lang, Ph.D., M.B., B.S., Jennifer A. Evans, M.B., B.S., James K. Tibenderana, M.B., Ch.B., Ph.D., M.D., Elizabeth C. Russell, M.Sc., Michael Levin, F.Med.Sci., Ph.D., Abdel G. Babiker, Ph.D., and Diana M. Gibb, M.B., Ch.B., M.D., for the FEAST Trial Group*

IV/IO Ringer's lactate 20mls/kg

A second bolus may be given if still in shock before **proceeding to step 2 of Plan C** (see below)

Treat for Hypoglycaemia

NB: If Hb <5g/dl, severe pallor transfuse urgently **BUT** do not give bolus

Alternative: ORS via NGT 20-25 ml/kg/hr where IV access unavailable

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Other Supportive Care

- Zinc sulphate: Given from 2 months of age, decreases the severity and duration of diarrhoea and prevents recurrence in the following 3 months (1,2)
- Adequate feeds
- Encourage exclusive breastfeeding for the first 6 months
- Vaccines : Rota virus and Cholera
- Management of malnutrition (10 steps)

1. Fontaine O. Effect of zinc supplementation on clinical course of acute diarrhoea. J Health Popul Nutr. 2001 Dec;19(4):339-46. PMID: 11855358

2. Zinc Investigators' Collaborative Group Bhutta, Z. A., Bird, S. M., Black, R. E., Brown, K. H., Gardner, J. M., Hidayat, A., Khatun, F., Martorell, R., Ninh, N. X., Penny, M. E., Rosado, J. L., Roy, S. K., Ruel, M., Sazawal, S. & Shankar, A. (2000) Therapeutic effects of oral zinc in acute and persistent diarrhea in children in developing countries: pooled analysis of randomized controlled trials. Am. J. Clin. Nutr. 72:1516-1522.

Antibiotic Therapy

- Bacterial dysentery
 - Ciprofloxacin (drug of choice)
 - Ceftriaxone
 - Azithromycin
- Amebiasis /Giardiasis
 - Metronidazole
- Cholera
 - TMP/SMX
 - Doxycycline
 - Azithromycin



Antibiotic Therapy

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 - Ciprofloxacin (drug of choice)
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- Amebiasis /Giardiasis
 - Metronidazole
- Cholera
 - TMP/SMX
 - Doxycycline
 - Azithromycin

Resistance patterns where available can guide choice of antibiotic



Diarrhea Treatment Summary

- Anticipate needs in the rehydration posts according to the population affected by the disaster
- Determine degree of dehydration and proceed
- Initiate ORT, except in cases of severe dehydration and shock
- Reinitiate feeding immediately after rehydration
- Antibiotic treatment only for dysentery or if cholera is suspected
- NO antidiarrheals

Diarrhea 0-2 Months

- Severe disease if:
 - Newborn (differentiate from transition stools)
 - Persistent (> 7 days)
- Bloody (different DDX in young infants)
 - Cow's milk allergy
 - Necrotizing enterocolitis
 - Hemorrhagic disease of the newborn
 - DIC (sepsis)
- Manage with breastfeeding not ORS

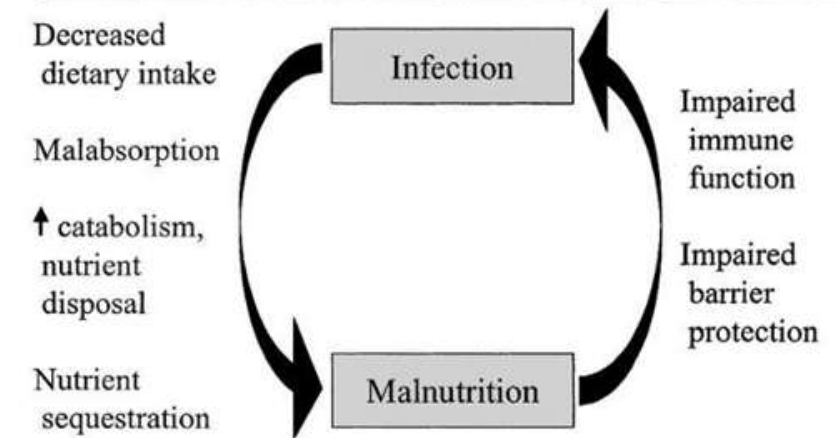
Persistent Diarrhea

- > 14 days (IMCI > 7 days)
- Causes
 - Inadequate diet
 - Malabsorption
 - Parasitosis - dysbiosis (Giardia, Cryptosporidium)
- Management
 - Adjust diet
 - Consider anti-parasitic agents

Diarrhea and malnutrition

- Diarrhea is a leading cause of malnutrition in under 5's
- Malnutrition increases susceptibility to diarrheal disease and vice versa
- Persistent diarrhea from infections and malabsorption
- Use ResoMal instead of ORS (lower Na+ higher K+ than ORS)

Relationship between nutrition and infection



J Nutr, Volume 133, Issue 1, January 2003, Pages 328S–332S, <https://doi.org/10.1093/n/133.1.328S>
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Take Home Points

- Disaster settings promote easy spread of diarrheal diseases
- Early identification allows for adequate public health measures to be instituted for outbreak control
- Correct classification of dehydration is vital to initiate appropriate rehydration in good time
- Caregivers should be counselled on when to return for followup
- **ORS WORKS!!!**

References

- <https://www.who.int/health-topics/cholera>
- <https://www.who.int/news-room/fact-sheets/detail/diarrhoeal-disease>
- Integrated management of childhood illnesses (WHO)
- emedicine.medscape.com
- ETAT plus module for participants (KPA)