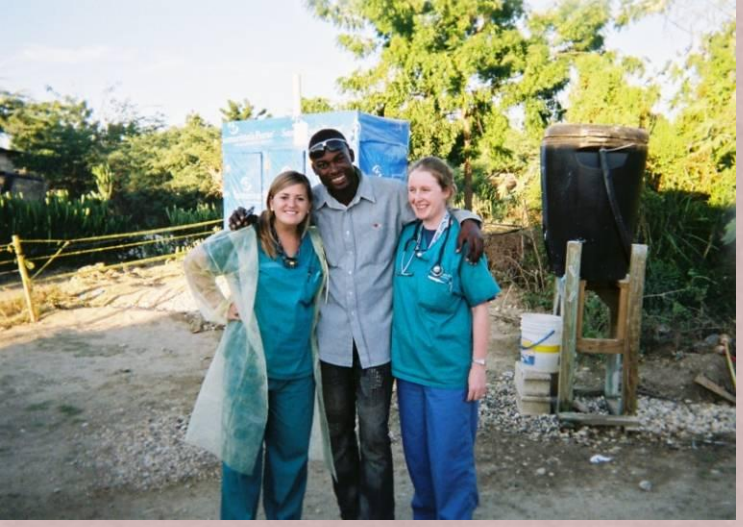

"CHOLERA"

"The [death] toll due to cholera in Haiti has reached 4672, since the 1st case was detected in October 2010, an official report said."
ProMED-mail 4.4.2011

A look at Cholera and the Role of Infectious Disease Medicine in Disaster Relief.

JAN 12TH, 2010 EARTHQUAKE: HAITI

- 250,000 people dead
- 300,000 injured
- >1.3 million homeless

Responding to Cholera in Post-Earthquake Haiti
David A. Walton, M.D., M.P.H., and Louise C. Ivers, M.D., M.P.H.
N Engl J Med 2011; 364:3-5

- 2002: Haiti ranked 147th out of 147 countries surveyed in the Water Poverty Index.
- 27% of the country - basic sewerage
- 70% of Haitian households - either rudimentary or no toilets

Responding to Cholera in Post-Earthquake Haiti
David A. Walton, M.D., M.P.H., and Louise C. Ivers, M.D., M.P.H.
N Engl J Med 2011; 364:3-5

- October 20th - 60 cases of acute, watery diarrhea - L'Hôpital de Saint Nicolas,
- Stool -> national laboratory in Port-au-Prince
- Within 48 hours, L'Hôpital de SN received >1500 additional patients with acute diarrhea.
- Rapid spread along river route
- Worsened after Hurricane in Nov

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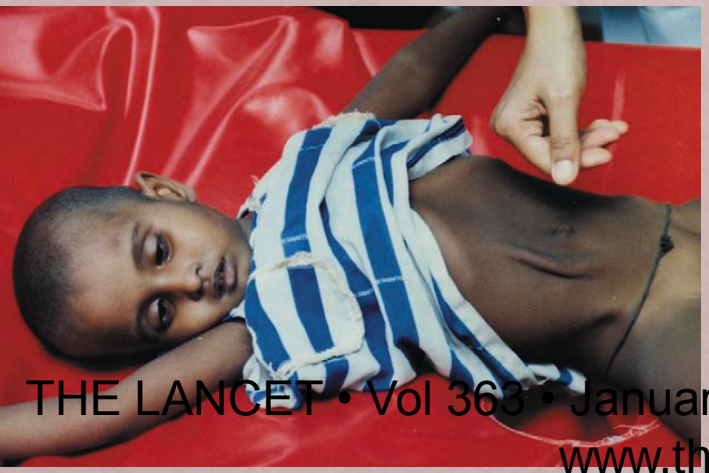

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WHO standard case definition of cholera:

- Area with no known cholera
  - a patient aged five years or more develops **severe dehydration or dies from acute watery diarrhea**

- Epidemic cholera area
  - a patient aged five years or more develops **acute watery diarrhea**, with or without vomiting

http://www.who.int/cholera/publications/cholera_vaccines_emergencies_2005.pdf

SOURCE OF OUTBREAK??

- South East Asia
- Human activity

- *Vibrio cholerae* O1, serotype Ogawa, biotype El Tor
  - increased virulence
  - enhanced ability to survive in the environment and in a human host
  - increased antibiotic resistance

Responding to Cholera in Post-Earthquake Haiti
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N Engl J Med 2011; 364:3-5

- One week trip to Haiti in Dec 2011 – Jan 2012

- 6 Night duties 7pm -> 8am
- In-patient and admission care of cholera patients
- Care of Pediatric tent!


THE IV LEAGUE
Baxter


Purse
NAL RELIEF
30.12.2010 06:33

CHOLERA: INTRODUCTION

According to the WHO:

- ~3 – 5 million cholera cases / year
- 100,000 – 120,000 deaths / year
- ~80% of cases - successfully treated with oral rehydration salts
- Effective control measures require:
  - prevention
  - preparedness
  - response
- Safe water and sanitation are critical
- “Oral cholera vaccines are considered an additional means to control cholera, but should not replace conventional control measures”

http://www.who.int/mediacentre/factsheets/fs107/en/index.html

HISTORY OF CHOLERA

- 1st cholera pandemic 1817 - spread - outside the Indian subcontinent -> along trade routes -> west as far as southern Russia
- 2nd pandemic 1826 -> major European cities by early 1830s
- 1831- UK: establishment of local Boards of Health and a “Cholera Gazette”
- John Snow 1854
- Three more pandemics, continuing up to 1925, involved Africa, Australia, Europe, and all the Americas
- New York cholera epidemic - first Board of Health in the USA 1866
- 1st notifiable disease in USA

- The causative agent, *Vibrio cholerae,* was not identified until 1884 in Kolkata during the fifth pandemic

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7TH PANDEMIC

- Current pandemic – worldwide
- Began – Indonesia
- Biotype of ***V cholerae*** **serogroup O1** - **El Tor**.
  (1905 -Indonesian pilgrims travelling to Mecca – quarantine station in village of El Tor, Egypt)
- 1937 - Indonesia
- 1964 – India
- 1970 – Africa, S Europe
- 1991 – S America

- In 1992, a new non-O1 serogroup of *V cholerae,* designated **O139 Bengal** – cholera outbreaks in India and Bangladesh.

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VIBRIO CHOLERAE - MICROBIOLIGY

- Gram negative rod
- Identified on biochemical tests
  - oxidase positive
- >200 Serogroups based on O antigen
  - only 01 and 0139 cause pandemics
- Other serogroups may cause diarrheal disease, wound infection or sepsis especially in patients with liver disease & in immunocompromised patients

- Rapid ID by microscopy – darting organisms
  - movement inhibited by antisera
- Growth on TCBS (thiosulfate-citrate-bile salts-sucrose) yellow colonies raised centre

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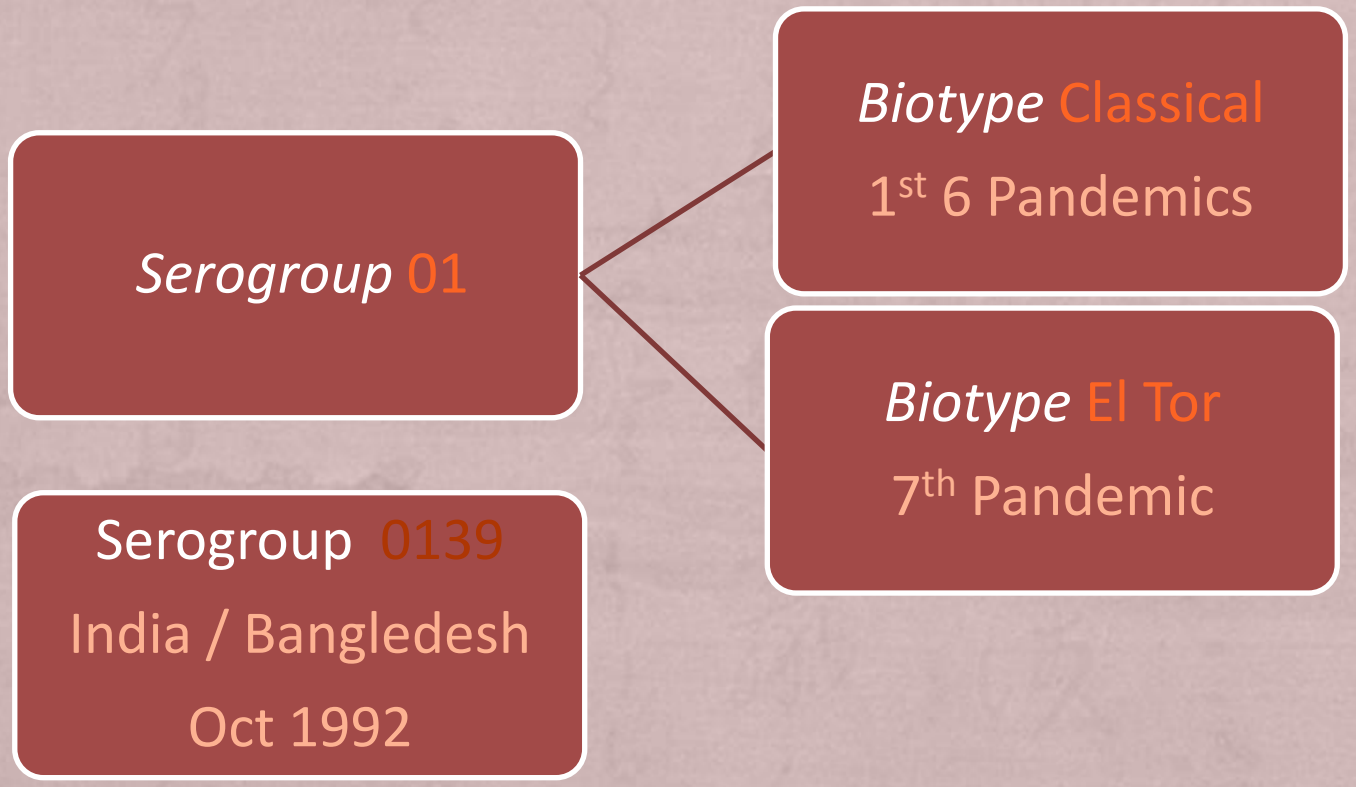
CLASSIFICATION
PATHOGENIC STRAINS OF V. *CHOLERAE*



Serogroup 01 can also be divided into 3 serotypes: Ogawa, Inaba and Hikojima according to somatic antigens

- 01 and O139 serotypes have different ribotypes
- Molecular studies show only certain clonal ribotyps responsible for outbreaks

EPIDEMIOLOGY

- Water/Food Bourne
- Reservoir in shellfish and plankton
- Seasonality of infection

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- Rice-water stools contain 10^{11} to 10^{12} *V. cholerae* organisms per liter.
- 50% of household contacts of a patient who is the index case in Bangladesh develop diarrhea about 2 days after the index case occurs

Antibiotics for Both Moderate and Severe Cholera, Eric J. Nelson, M.D., Ph.D., Danielle S. Nelson, M.D., M.P.H., Mohammed A. Salam, M.B., B.S., and David A. Sack, M.D. N Engl J Med 2011; 364:5-7

FACTORS AFFECTING INFECTION

- Ratio of cases to infections ranges from 1:3 to 1:100*
- Local intestinal immunity
  - from previous natural exposure or vaccination
- Size of inoculum ingested
- Gastric-acid barrier
- Patient's blood group
  - blood group O - higher risk

- A high infectious dose (10^8 bacteria)->severe cholera in healthy volunteers
- Lower dose (10^5) - with antacids

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*Ratio of infected symptomatic : asymptomatic varied
classical cholera ~ 50:50, El Tor ~ 1:20-100

Infectious dose differs by vehicle – higher if water, lower dose if food

Mandell, Principles and Practices of Infectious Disease

PATHOGENESIS

- Pass through stomach
- Colonization of upper intestine
  - by fimbriae
  - virulence gene tcpA – codes for toxin coregulated pilus extending from the cell wall-> attach to receptors on the mucosa
  - bacterium's motility -> penetrate mucous
- Multiply
  - Concentrations of vibrios on the mucosal surface rapidly increase to 10^7 or 10^8 cells / g.
- Effectively deliver toxin to mucosal surface

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VIRULENCE FACTORS

- ctx genetic element
  - genome of a lysogenic bacteriophage designated ctx
  - carries the genes encoding cholera toxin
- vibrio pathogenicity island (VPI)
  - carries genes for the pilus colonisation factor TCP.
  - facilitates microcolony formation via pilus-mediated bacterial interactions and perhaps direct attachment to the intestinal brush border
- horizontal gene transfer may lead to the development of new epidemic strains.
- Multiple virulence genes - regulated by environmental conditions

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UpToDate: http://www.uptodate.com/contents/pathogenesis-of-vibrio-cholerae-infection?source=preview&anchor=H6697671&selectedTitle=1~1#H6697671

TOXIN

- Virulence genes ctxA, ctxB -> cholera toxin subunits A & B

  Mandell, Principles and Practices of Infectious Disease
- B subunits bind the holotoxin to the GM1 ganglioside receptors in the small-intestinal mucosa
- A subunit -> cell -> Activates adenylate cyclase
- Increase c-AMP
  - chloride secretion in the crypt cells
  - inhibition of neutral sodium chloride absorption in the villus cells
- Massive outpouring of fluid -> the small intestine
- Volume secreted > normal absorptive capacity of bowel
  - PROFUSE WATERY DIARRHEA

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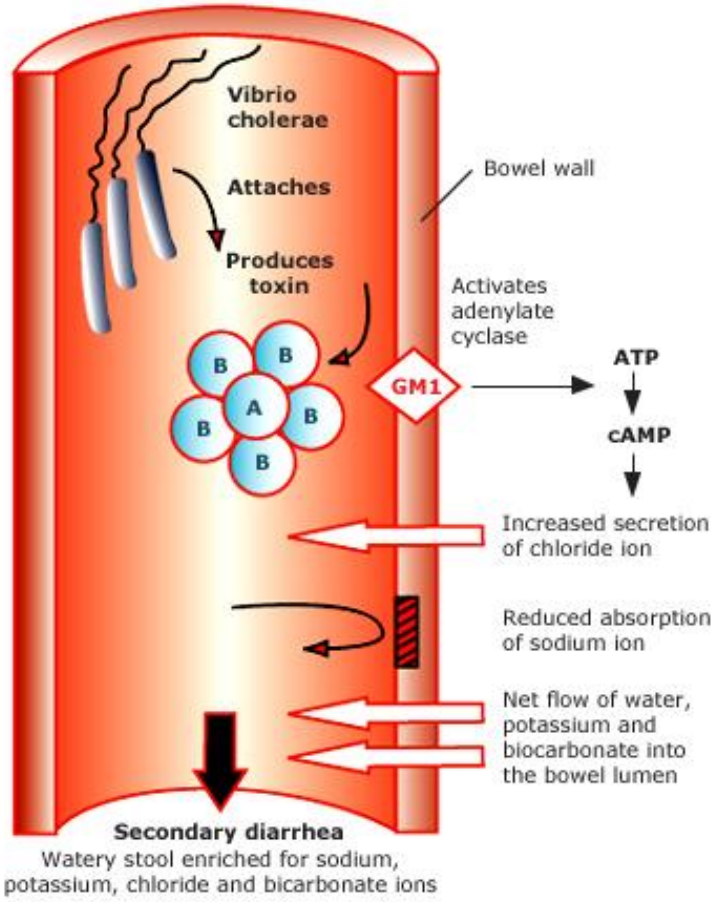
Pathophysiology of vibrio cholerae infection



Schematic representations of the mechanisms involved in diarrhea production by Vibrio cholerae.

Modified from Butterton, JR, Calderwood, SB. Vibrio cholerae O1. In: Infections of the Gastrointestinal Tract, Blaser, MJ, Smith, PD, Ravdin, LI, et al (Eds), Raven Press, New York, 1995, p. 649.

http://www.lww.com

- Loss of blood volume -> hypotension and shock
- Loss of Bicarbonate and Potassium -> metabolic acidosis and hypokalemia
- Highly infectious stools
  - Contamination of food and water
  - Environmental seeding

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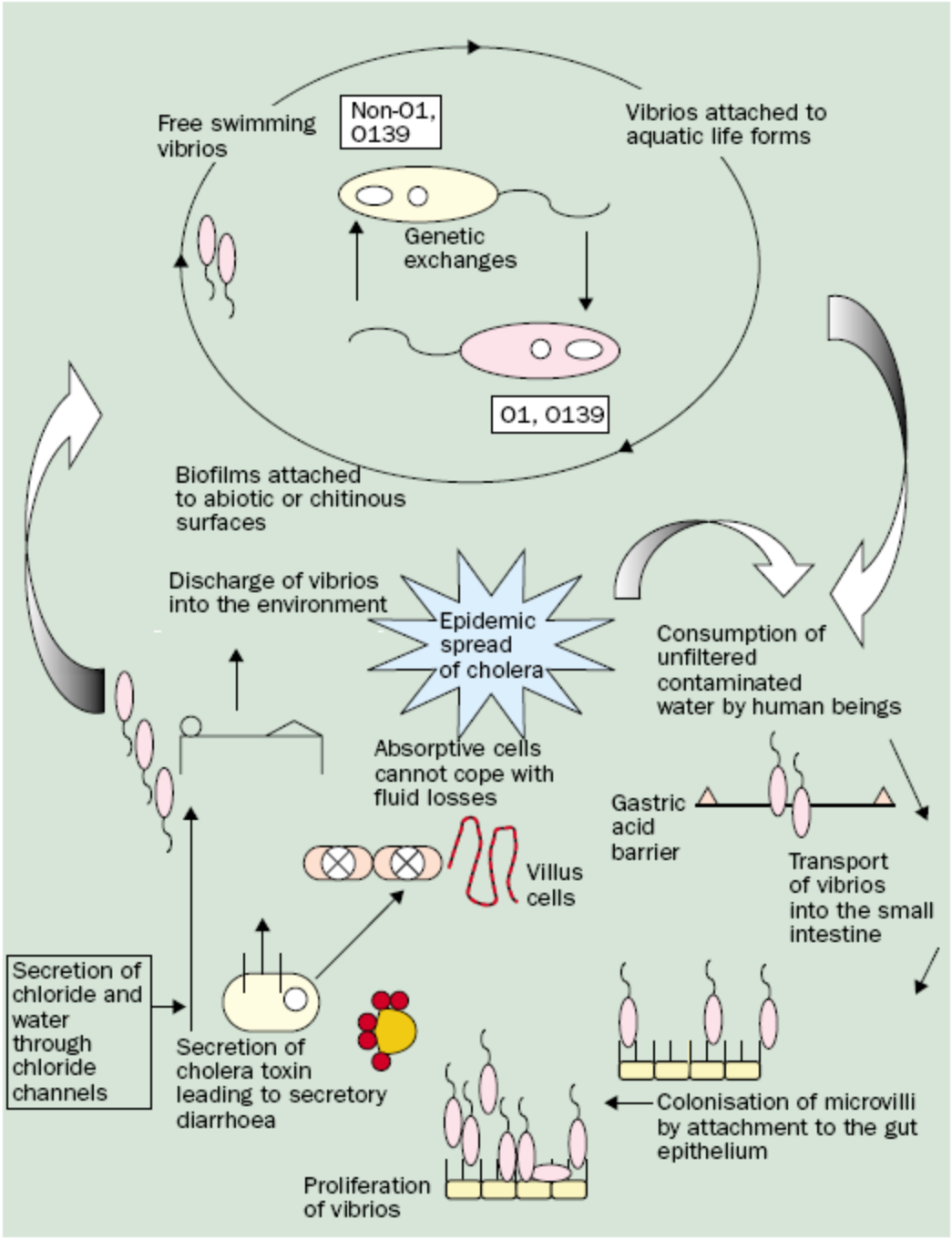

Figure 4: **Life cycle of *V cholerae* involves both environmental and human segments, which sometimes intersect**

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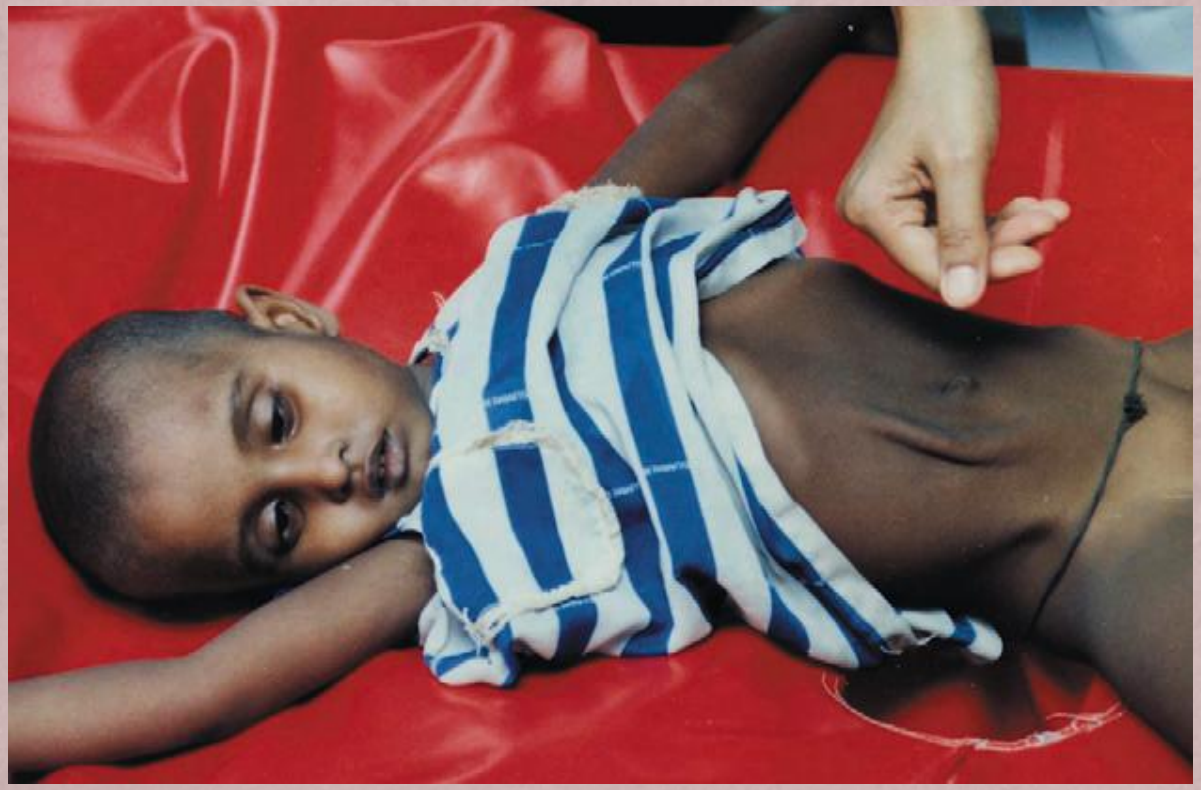
CLINICAL PRESENTATION

http://bcove.me/tpzkcp1n



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CLINICAL PRESENTATION

- Incubation 18 hours to 5 days
- May be asymptomatic / mild diarrhea
- Painless severe watery diarrhea (500-1000 ml/hr)
- Vomiting
- Cholera “sicca” – abdominal distension and ileus
- Signs of dehydration
- < 5% have fever

Mandell, Principles and Practices of Infectious

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EXPECTED LABORATORY FINDINGS & COMPLICATIONS

- Increased packed cell volume and protein
- Prerenal azotemia
- Metabolic acidosis with high anion gap (lactate), normal/low potassium, normal/low sodium
- High calcium / magnesium
- High white cell count in severe disease

- Acute renal failure
- Hypoglycemia / seizures / fever / altered mental status more common in children
- Electrolyte imbalance - Hypokalemia
- Fetal loss ~ 50%

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Mandell, Principles and Practices of Infectious Disease

TREATMENT

- Assess dehydration
- Rapidly rehydrate -intravenous Ringer's solution /ORS
- Monitor stool output
- Monitor hydration
- Monitor severity of purging
- Maintain hydration
- Oral antibiotic (eg, doxycycline) to dehydrated patients as soon as vomiting stops
- Provide food as soon as patient is able to eat

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WHO guidelines for assessment of dehydration

Clinical feature	Predicted degree of dehydration		
	None (<5 percent)	Some dehydration (5-10 percent)	Severe dehydration (>10 percent)
General appearance	Well, alert	Restless, irritable	Lethargic or unconscious
Eyes	Normal	Sunken	Sunken
Thirst	Drinks normally, not thirsty	Thirsty, drinks eagerly	Drinks poorly or unable to drink
Skin pinch	Goes back quickly	Goes back slowly	Goes back very slowly
Estimated fluid deficit	<50 mL/kg	50-100 mL/kg	>100 mL/kg

Data from: World Health Organization. The treatment of diarrhea: A manual for physicians and other senior health workers, 4th revision. WHO/FCH/CAH/05.1. World Health Organization, Geneva 2005. (Available at http://whqlibdoc.who.int/publications/2005/9241593180.pdf).

Physical findings of volume depletion in infants and children

Finding	Mild (3-5 percent)	Moderate (6-9 percent)	Severe (≥10 percent)
Pulse	Full, normal rate	Rapid	Rapid and weak OR absent
Systolic pressure	Normal	Normal to low	Low
Respirations	Normal	Deep, rate may be increased	Deep, tachypnea OR decreased to absent
Buccal mucosa	Tacky or slightly dry	Dry	Parched
Anterior fontanelle	Normal	Sunken	Markedly sunken
Eyes	Normal	Sunken	Markedly sunken
Skin turgor	Normal	Reduced	Tenting
Skin	Normal	Cool	Cool, mottled, acrocyanosis
Urine output	Normal or mildly reduced	Markedly reduced	Anuria
Systemic signs	Increased thirst	Listlessness, irritability	Grunting, lethargy, coma

Composition of oral rehydration solutions (ORS) and commonly used beverages

	Carbohydrate (g/L)	mEq/L			Osmolarity (mOSM/kg H2O)
		Sodium	Potassium	Base (HCO3-)	
Oral rehydration solutions					
CeraLyte®	40	70	20	10	235
Enfalyte®	30	50	25	30	200
Pedialyte®	25	45	20	30	250
Rehydralyte®	25	75	20	30	310
WHO (1975)	20	90	30	30	310
WHO (2002)	13.5	75	20	30	245
Commonly Used Beverages (not appropriate for repletion therapy)					
Apple juice	100-150	3	20	0	700
Chicken broth	0	250	5	0	450
Colas	100-150	2	0.1	13	550
Gatorade®	45	20	3	3	330
Ginger Ale	90	3.5	0.1	3.6	565
Tea	0	0	0	0	5

Composition (mEq/L) of common solutions used for rehydration

Route	Solution	Na+	K+	Cl-	HCO3-	Citrate	Ca++	Glucose/carbohydrate
Intravenous	Normal saline	154	-	154	-	-	-	-
	Ringer's Lactate	130	4	111	28	-	3	-
	Ringer's Lactate + 5 percent dextrose	130	4	109	28	-	3	278
	Cholera saline ("Dhaka solution")	133	13	98	48	-	-	140
Oral	Standard ORS	90	20	80	-	10	-	111
	Hypo-osmolar ORS	75	20	65	-	10	-	75
	ReSoMal* (Reduced Osmolarity ORS for Malnourished Children)	45	40	76	-	7	-	125

ORS is reviewed in detail separately. (See "Oral rehydration therapy").
ORS: oral rehydration solution(s).
* Also contains Mg 6 mmol/L, Zn 300 umol/L, Cu 45 umol/L.
Data from: World Health Organization. The treatment of diarrhea: A manual for physicians and other senior health workers - 4th revision. World Health Organization, Geneva 2005. Available at:
http://whqlibdoc.who.int/publications/2005/9241593180.pdf.

Fluid	Sodium (mmol/L)	Chloride (mmol/L)	Potassium (mmol/L)	Bicarbonate (mmol/L)	Carbohydrate (g/L)	Osmolality (mmol/L)
Cholera stool						
Adults	130	100	20	44	..	..
Children	100	90	33	30	..	..
ORS						
Glucose (WHO)	75	65	20	10*	13·5†	245
Rice	75	65	20	10*	30–50‡	About 180
Intravenous fluids						
Lactate Ringer's	130	109	4	28§		271
Dhaka solution	133	154	13	48‖		292
Normal saline	154	154	0	0		308

*Trisodium citrate (10 mmol/L) is generally used rather than bicarbonate. †Glucose 13·5 g/L (75 mmol/L). ‡30–50 g rice contains about 30 mmol/L glucose depending on degree of hydrolysis. §Base is lactate. ‖Base is acetate.

Table 2: **Composition of cholera stools and electrolyte rehydration solutions used to replace stool losses**

THE PRINCIPLES OF REHYDRATION THERAPY

- Rapid replacement of fluid deficits
- Correction of the metabolic acidosis
- Correction of potassium deficiency
- Replacement of continuing fluid losses

- “Because of the acidosis, the serum potassium concentration may be normal or even high, so the potassium deficiency may not be apparent. As the acidosis is corrected, the serum potassium concentration will fall to dangerously low values unless additional potassium is provided.”

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Patient Name/*Nom*: JOHN DOE Date/ *Date*: _____ Age: 12 kg: _____

Admission: LR bolus: ☐ 30mL/kg children/*Enfants* ☐ 1500mL Women/*Femmes* ☑ 2000mL Men/*Hommes*

Hour/*Heure*	Intake/ *Réhydratation* IV and Oral (mL)	Output/ *Expulsion*			Physical Exam/*Examen Physique* Alert/Lethargic/Unresponsive *Reveillé/Lethargique/Pas de réponse* Lung Sounds: Clear or Crackling *Tones de Poumons: Claires ou Grinçants* ↑ Respiratory Rate ↑ *Taux de Respiration*
		Vomit/ *Vomi*	Diarrhea/ *Diarrhé*	Urine/ *Urine*	
FIRST 4 HR PLAN / Premiere 4h *Plan d'évaluation* - MD Orders/*Les ordinances de Docteur*: Repeat/repetez Bolus: LR 1000 mL/hr (_____ gtt/min) over /*durant* **30 minutes** or/*ou* **60 minutes** (circle one/ *choisissez*) LR 720 mL/hr (120 gtt/min) x 3 hr					
7: AM/PM	LR #1 #2 1500 cc	/	////	HR = 180	
8: AM/PM	#2 LR #3 LR 1500 cc		//		
9: AM/PM	#4 LR 700cc	/	//		HR = 120
10: AM/PM	#5 LR 700cc		/		
11: AM/PM	#6 LR 700		/	/	
12: AM/PM	#6 LR 780		/		
Reassess 6hr Plan/6h *Plan de Reévaluation* – Doctors Orders/*Les ordinances de Docteur*: Adjusted IV Rate: LR 720 mL/hr (120 gtt/min) x _____ h					ORS as Tolerated
1: AM/PM	7 LR 800cc ORS	//	/	//	HR 80s
2: AM/PM	7 LR 800 ORS	//			
3: AM/PM	#8 LR 700cc ORS	/	/		↓ IVF to 360 cc/hr (60 gtt/min)
4: AM/PM	#8 LR 400				
5: AM/PM	#9 LR 400 ORS	//	/		Doxycycline 300mg P.O. x1
6: AM/PM	#9 LR 300		/		Bullion / Soup as tol

Hour/*Heure*	Intake/ *Réhydratation* IV and Oral (mL)	Output/ *Expulsion*			Physical Exam/*Examen Physique* Alert/Lethargic/Unresponsive *Reveillé/Lethargique/Pas de réponse* Lung Sounds: Clear or Crackling *Tones de Poumons: Claires ou Grinçants* ↑ Respiratory Rate ↑ *Taux de Respiration*
		Vomit/ *Vomi*	Diarrhea/ *Diarrhé*	Urine/ *Urine*	

Reassess 6 hr Plan/*Plan de Reévaluation* – Doctors Orders/*Les ordinances de Docteur:*

Adjusted IV Rate: LR 360 mL/hr (60 gtt/min) x _____h

Potassium:

☐ Peds/*L'enfants*: Potassium **1 mEq/kg PO BID**

☐ Adult/*Adulte*: Potassium **60 mEq PO BID** or **if vomiting** change IV fluids to / *S'il vomi, le changez pour:*

☐ LR with/*avec* **KCl 10mmol/L** _____mL/hr (_____ gtt/min) x _____h

DO NOT BOLUS WITH KCL / NE PAS LE METTEZ A FLO

7:___ AM/PM	#9 LR 300	1	1 1 1		
8:___ AM/PM	#10 1000		1 1		↑ IVF 1000cc / Hr
9:___ AM/PM	#11 1000		1		
10:___ AM/PM	#12 1000		1 1		
11:___ AM/PM	#13 1000			1	KCL 60meq IV. XT
12:___ AM/PM	#14 1000				

Reassess 6h Plan/6h *Plan de Reévaluation* – Doctors Orders/*Les ordinances de Docteur:*

Adjusted IV Rate: LR _____ mL/hr (_____ gtt/min) x _____h

Every 24hours administer / *Chaque 24 heures de temps administrez:*

☐ Dextrose Tablets : **0.5tab / 1tab** or ☐ Banana/fig mi

☐ **D5 LR KCl 20mmol/L** _____ mL/hr (_____ gtt/min) x **over/durant 2h (adult)**.

DO NOT USE -*D5 LR KCl 20mmol/L*- FOR CHILDREN UNDER 14yr/NE PAS LE UTILISEZ POUR LES ENFANTS MOINS QUE 14 ans.

1:___ AM/PM				
___:___ AM/PM				
___:___ AM/PM				

ROLE OF ANTIBIOTICS

- Effective (depending on S/T):
  - Doxycycline
  - Ciprofloxacin
  - Azithromycin
- Epidemic strain in Haiti:
  - Susceptible to tetracycline and azithromycin
  - Resistant to nalidixic acid, sulfisoxazole, and trimethoprim–sulfamethoxazole

Antibiotics for Both Moderate and Severe Cholera, Eric J. Nelson, M.D., Ph.D., Danielle S. Nelson, M.D., M.P.H., Mohammed A. Salam, M.B., B.S., and David A. Sack, M.D. N Engl J Med 2011; 364:5-7

USEFULLNESS OF ANTIBIOTICS

With antibiotics

- Decreased purging rate by ~50%
- Shorter illness by ~ 50%,
- Shorter excretion of *Vibrio cholerae* in the stool to 1 or 2 days
- Quicker recovery
- Less nursing care required
- Discharge home earlier

Without effective antibiotics

- Excrete *V. cholerae* for 5 or more days

Antibiotics for Both Moderate and Severe Cholera, Eric J. Nelson, M.D., Ph.D., Danielle S. Nelson, M.D., M.P.H., Mohammed A. Salam, M.B., B.S., and David A. Sack, M.D. N Engl J Med 2011; 364:5-7

- WHO only recommends antibiotics in severe cholera (>10% dehydration)
- Antibiotics for moderate cases (see prev. slide)
- Antibiotic prophylaxis of contacts
  - not recommended
- Timing of antibiotic
  - after vomiting stops

N Engl J Med 2011; 364:5-7

- Zinc replacement especially in children
  - 30mg/day -> 12% decrease in duration and 11% decrease in stool volume

Mandell, Principles and Practices of Infectious Disease

ANTIBIOTIC RESISTANCE

- *V cholerae O1* conjugative-plasmid mediated multiply antibiotic-resistant (including to tetracycline) *(MARV)*
  - *Spatial and temporal fluctuatoins in drug resistance depending on antibiotic selection pressure*
  - Conjugative plasmids
  - Conjugative transposons
  - Integrons (group of gene expression elements - incorporate open reading frames (gene cassettes) - convert them to functional genes
- *V cholerae O139*
  - Novel conjugative, self-transmissible, chromosomally integrating SXT element
  - Conferred resistance to sulphamethoxazole, trimethoprim, chloramphenicol, and low levels of streptomycin
- *gyrA and parC,* efflux -quinolone resistance

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VACCINATION

- "Dukoral" - WHO prequalified
  - consists of killed *V cholerae organisms along* with the cholera B subunit
  - stimulates both antibacterial and antitoxic immunity
  - Give in 150ml of safe water
  - two doses 1–6 weeks apart
  - recommended for use in refugee settings at risk of cholera
- Licensed >60 countries
- Short-term protection 85–90% against *V. cholerae* O1
  - all age groups
  - 4–6 months following immunization.

- "Shanchol" pending WHO prequalification
  - longer-term protection against *V. cholerae* O1 and O139 in children under five years of age.
  - doesn't contain B subunit of toxin

- Both vaccines are administered in two doses given between seven days and six weeks apart.

http://www.who.int/mediacentre/factsheets/fs107/en/index.html

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CONTROL

- Safe water supply
- Sanitation
- Food safety
- Health education / Media
  - importance of purifying water and seafood
  - washing hands after defecation and before food preparation
  - recognition of the signs of cholera
  - locations of treatment

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DEAD BODIES

- Individuals handling human remains risks:
  - Hepatitis B and C.
  - HIV.
  - Tuberculosis.
  - Diarrheal disease.
- Graveyards - 30m from groundwater sources for drinking water
- Bottom of grave -1.5m above the water table with a 0.7m unsaturated zone. Surface water from graveyards must not enter inhabited areas.
- Universal precautions for blood and body fluids
- Correct use and disposal of gloves
- Use of body bags
- Hand – washing with soap after handling bodies and before eating
- Disinfection of vehicles and equipment
- Bodies do not need to be disinfected before disposal (**except in case of cholera,** shigellosis, or hemorrhagic fever)
- Vaccinate workers against hepatitis B”

World Health Organization: http://www.who.int/hac/techguidance/ems/flood_cds/en/index1.html
http://www.paho.org/english/dd/ped/DeadBodiesFieldManual.pdf
CDC: http://www.cdc.gov/ncidod/eid/13/1/1-T.htm

BAD NEWS

- The onset of the rainy season is leading to a new upsurge in Cholera cases in Haiti

INTERNATIONAL DISASTER RELIEF

In 2010:

- 373 natural disasters
- ~300,000 deaths
- ~207 million affected
- Cost ~US$110 billion in economic losses

The Lancet, Volume 377, Issue 9764, Page 439, 5 February 2011

Ten critical emergency relief measures

1. Rapidly assess the health status of the affected population
2. Establish disease surveillance and a health information system
3. Immunize all children aged 6 months to 5 years against measles and provide vitamin A to those with malnutrition
4. Institute diarrhea control programmes
5. Provide elementary sanitation and clean water
6. Provide adequate shelters, clothes, and blankets
7. Ensure at least 1900 kcal of food per person per day
8. Establish curative services with standard treatment protocols based on essential drug lists that provide basic coverage to entire community
9. Organize human resources to ensure one community health expert per 1000 population
10. Coordinate activities of local authorities, national agencies, international agencies, and non-governmental organizations

EK Noji. ABC of Conflict and Disaster.
Public Health in the aftermath of disasters.
BMJ 2005;330:1379–81

What accounts for 60-95% of the mortality among internally displaced persons?

60 – 95% OF MORTALITY AMONG DISPLACED PERSONS:

1. Malnutrition
2. Diarrheal diseases
3. Malaria
4. Measles
5. Acute respiratory infections

EK Noji. ABC of Conflict and Disaster. Public Health in the aftermath of disasters. *BMJ* 2005;330:1379–81

FACTORS INFLUENCING DISEASE TRANSMISSION AFTER DISASTERS

- Pre-existing disease
  - E.g. cholera, measles, typhus
- Immunization rates
- Concentration of population
- Damage to utilities, contamination of water or food
- Increased disease transmission by vectors
  - E.g. breeding sites
- Personal hygiene,
- Interruption of control programmes

EK Noji. ABC of Conflict and Disaster.
Public Health in the aftermath of disasters.
BMJ 2005;330:1379–81

FACTORS CONTRIBUTING TO INCREASED RISK OF INFECTION IN DISASTERS

- Destruction of water sanitation facilities
  - if present
- Destruction of sewage systems
- Displacement of populations
- Disruption of local healthcare facilities

ROLE OF INFECTIOUS DISEASE SPECIALISTS

- Acute patient care
- Prevention
- Control
- Research
- …

- “…disaster preparedness and prevention programmes remain in the domain of assumptions instead of evidence”

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