

Cholera in Haiti – Why U.S. Clinicians Need to Care

Clinician Outreach and Communication Activity (COCA) Conference Call December 14, 2010



Purpose

- ❑ Provide an overview of cholera
- ❑ Provide an update on current cholera situation in Haiti
- ❑ Discuss appropriate cholera treatment for infected persons traveling into the U.S.

Cholera in Haiti – Why U.S. Clinicians Need to Care

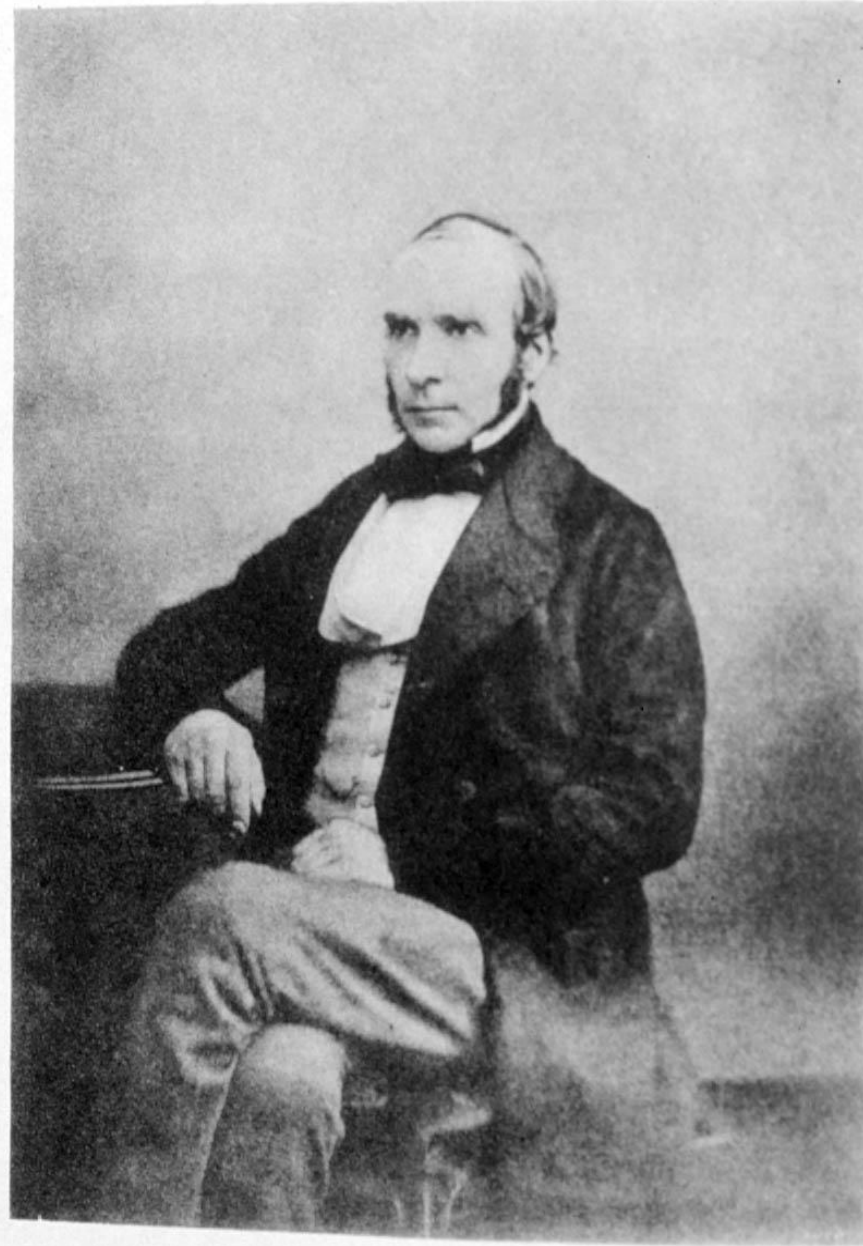
David L. Swerdlow, MD

Senior Advisor for Epidemiology

National Center for Immunization and Respiratory Diseases

Incident Manager, CDC Haiti Cholera Response

17 Nov – 09 Dec 2010



John Snow

Distribution of cholera cases and implicated water well —
Golden Square area of London, August–September, 1848

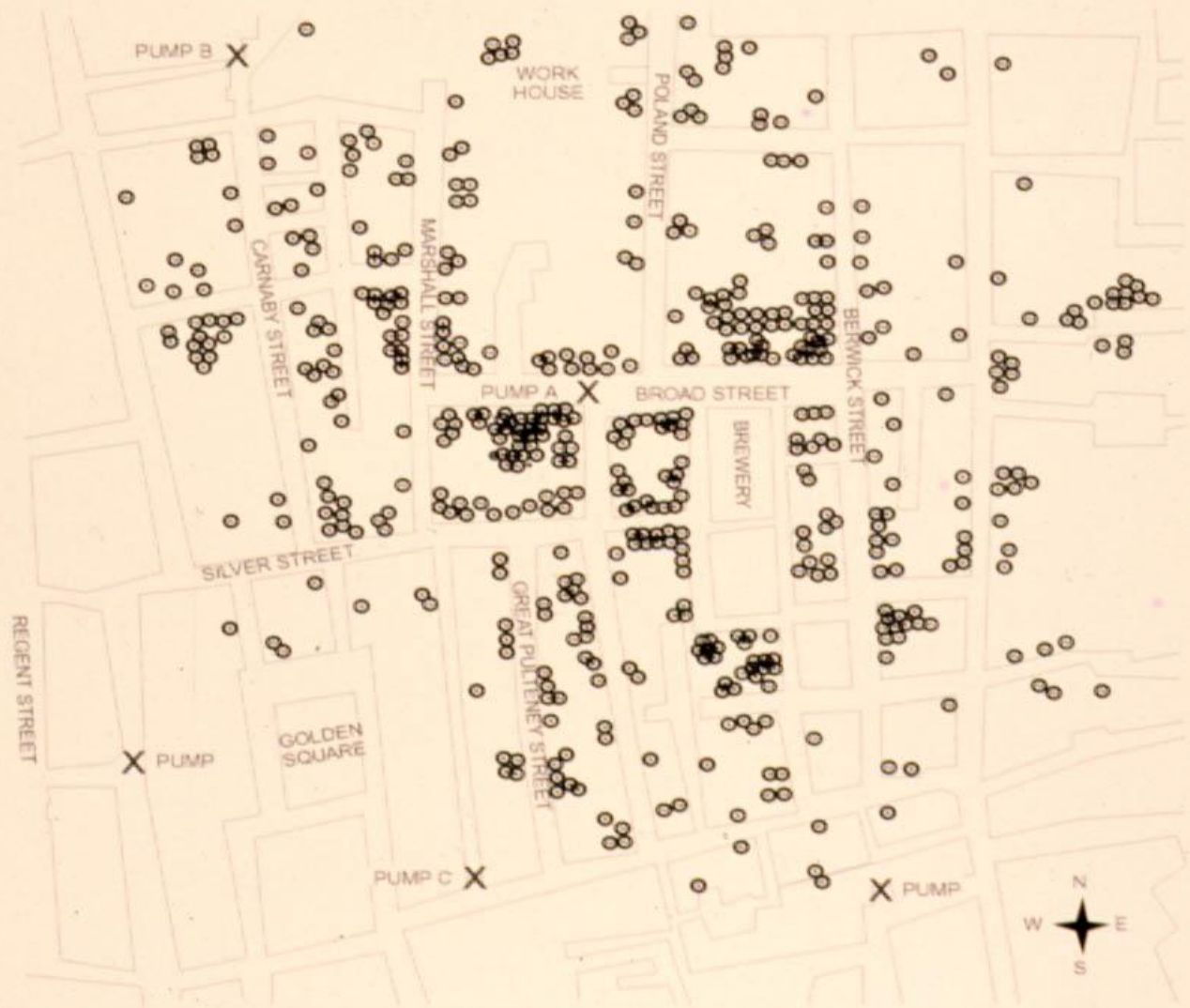


TABLE IX.

	Number of houses.	Deaths from Cholera.	Deaths in each 10,000 houses.
Southwark and Vauxhall Company	40,046	1,263	315
Lambeth Company	26,107	98	37
Rest of London	256,423	1,422	59

ON THE

MODE OF COMMUNICATION

OF

CHOLERA.

BY

JOHN SNOW, M.D.,

MEMBER OF THE ROYAL COLLEGE OF PHYSICIANS, FELLOW OF THE
ROYAL MED. AND CHIR. SOCIETY, FELLOW AND VICE-
PRESIDENT OF THE MEDICAL SOCIETY
OF LONDON.

Second Edition, much Enlarged.

LONDON:

JOHN CHURCHILL, NEW BURLINGTON STREET.

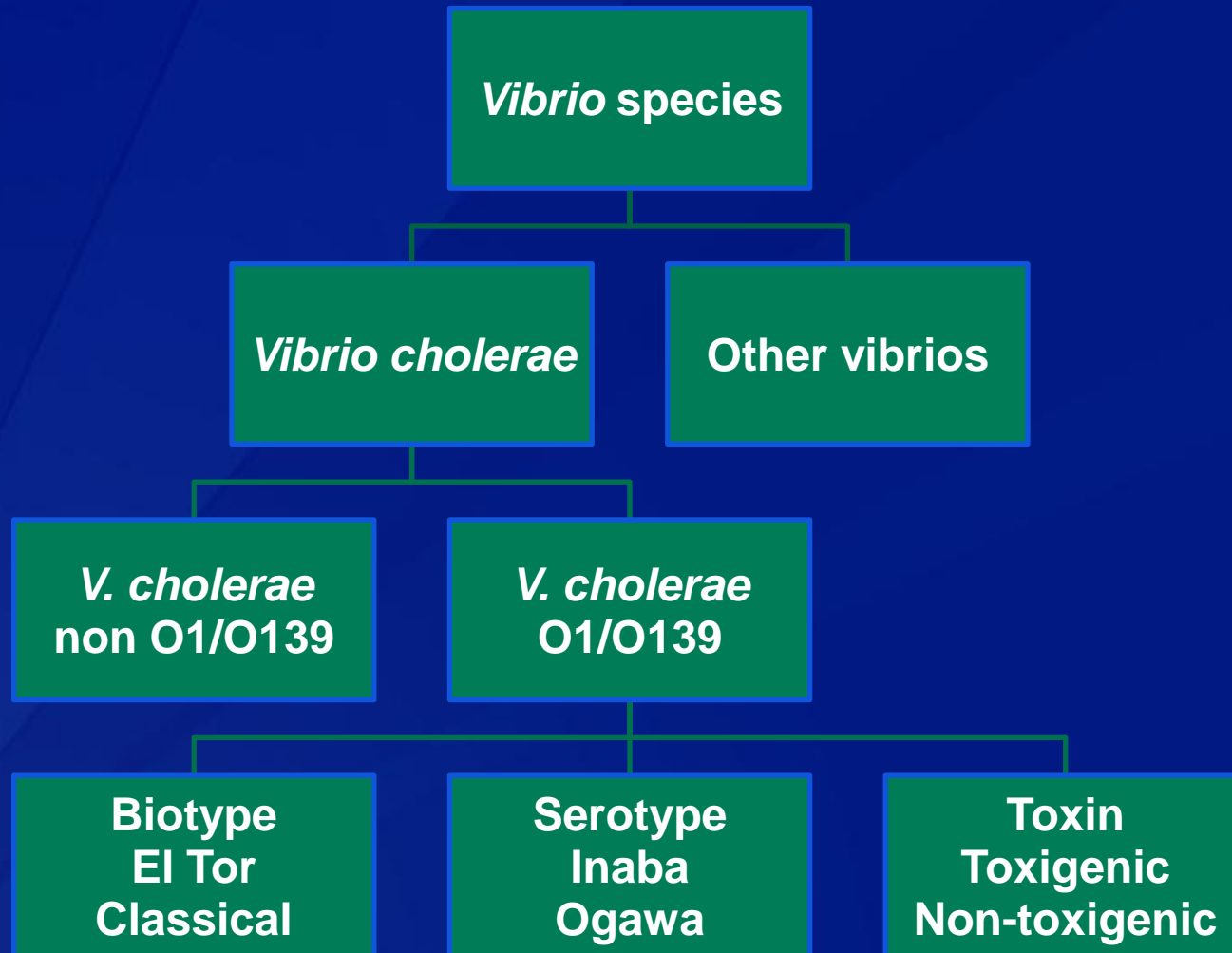
M.DCCC.LV.



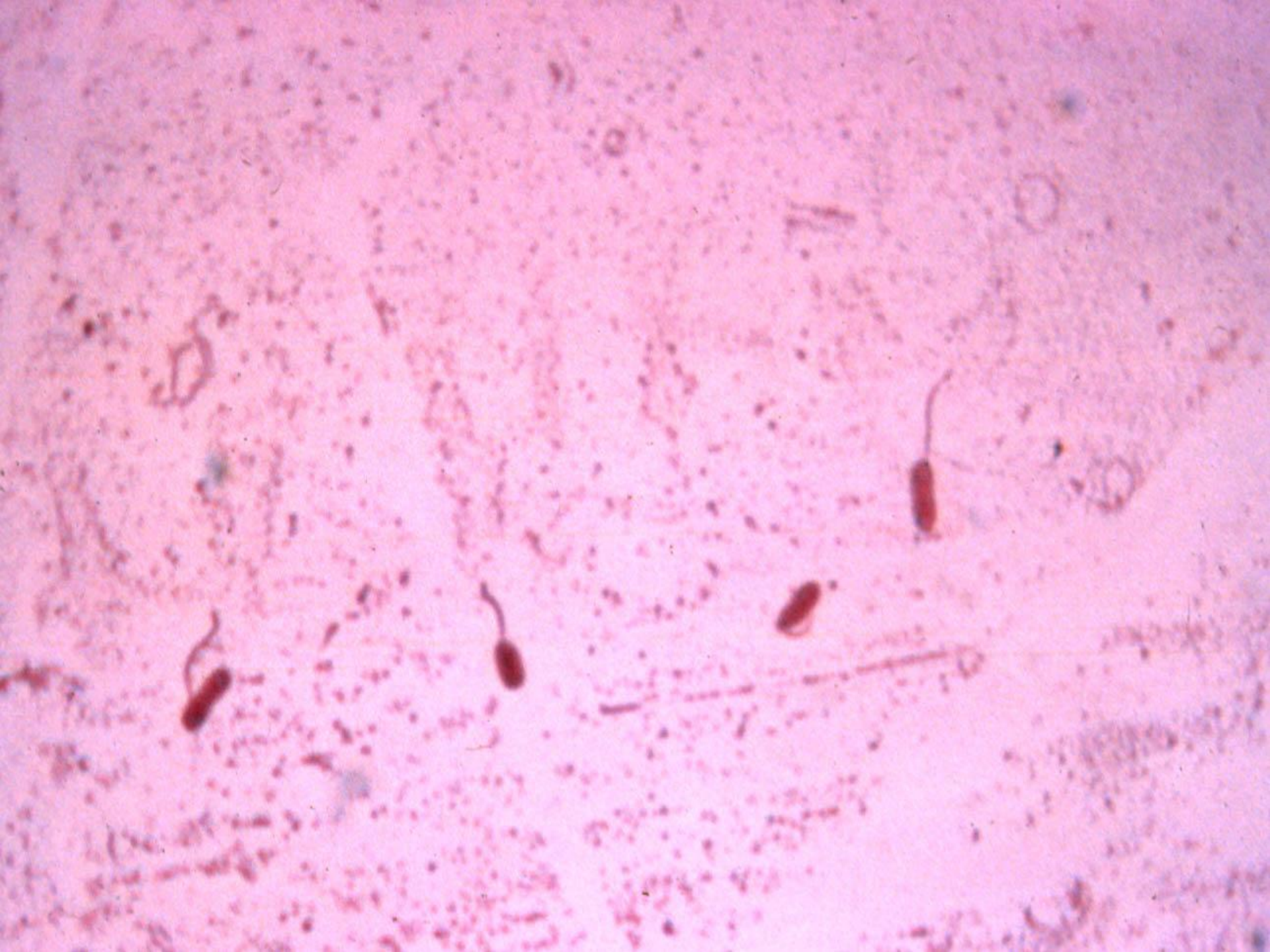
Objectives

- **The organism**
- **Clinical features**
- **Diagnosis**
- **Treatment**
- **Epidemiology**
 - **Cholera worldwide**
 - **Cholera in Latin America**
 - **Cholera in Haiti**
 - **Returning travelers**

Microbiologic Characterization of *Vibrio cholerae*



All eight combinations of serogroup/biotype/serotype exist

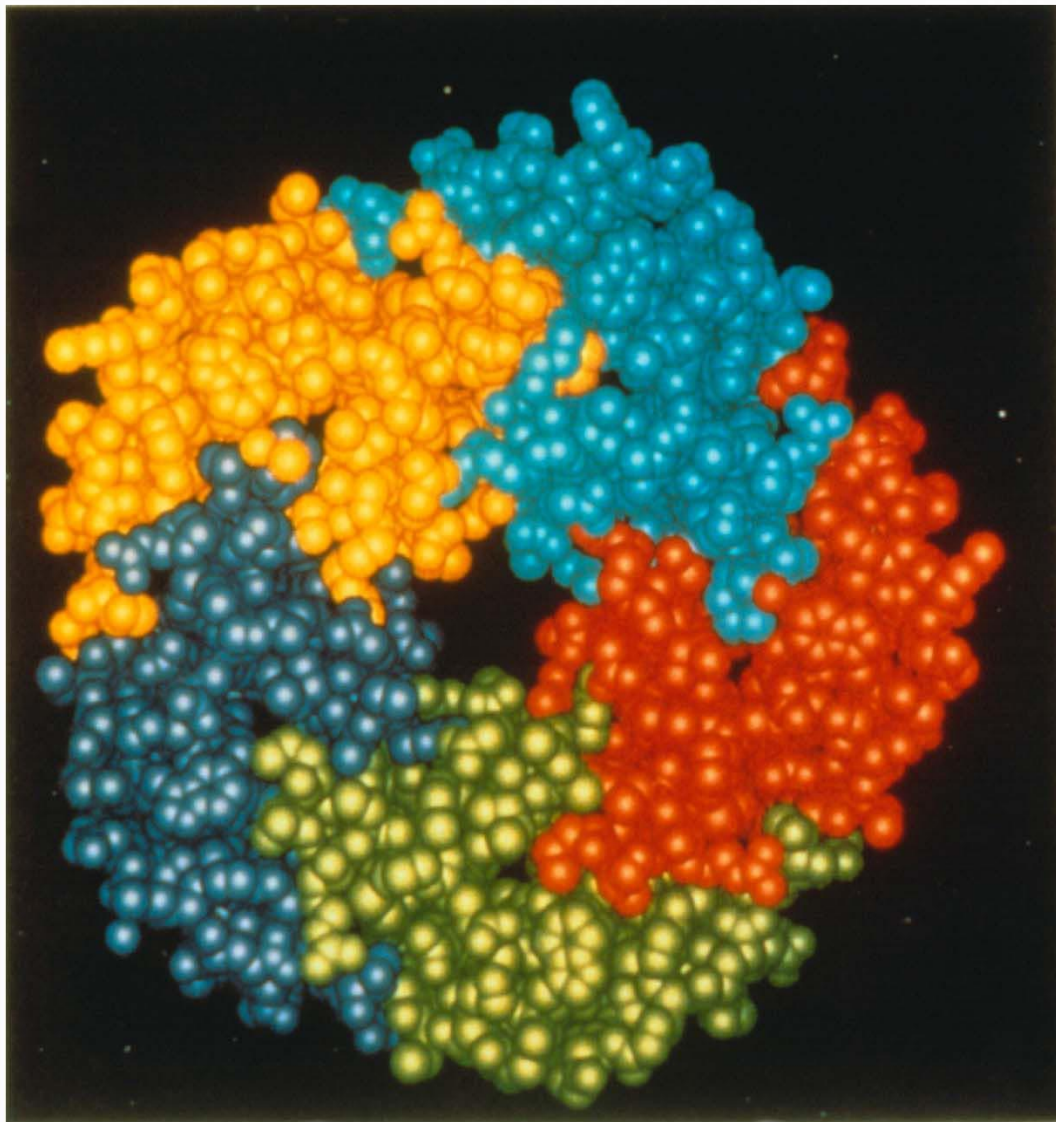


***Vibrio cholerae* O1**

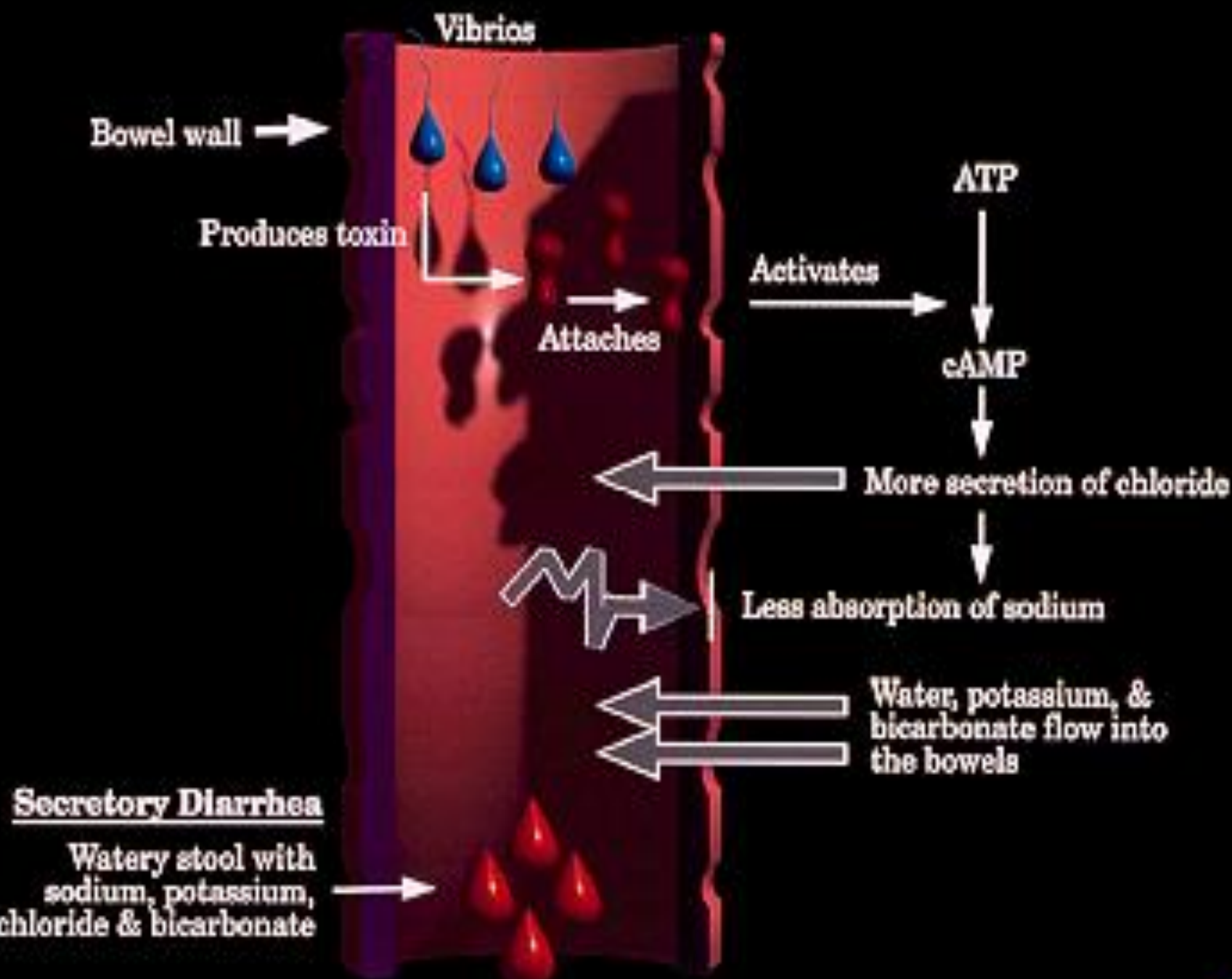
- **Salt resistant**
- **Heat and acid sensitive**
- **El Tor biotype**
 - **Asymptomatic infections common**
 - **75% asymptomatic**
 - **18% mild diarrhea**
 - **1-2% severe-cholera gravis**
 - **Fast growing in food**
 - **Lengthy survival in environment**

***Vibrio cholerae* O1**

- **Infectious dose: $10^6 - 10^8$**
 - **Varies with vehicle of transmission**
 - **Gastric acidity**
- **Incubation period**
 - **1-3 days ($1/2$ -5 days)**



Poisoned doughnut. *The B subunit of the cholera toxin.*



Cholera Gravis (severe cholera)

- Severe diarrhea
- Vomiting
- Muscle cramps
- Dehydration
- Electrolyte imbalance
- Death

Cholera Gravis

- **Loss of 1 liter of fluid/hour**
- **>10% of body weight**
- **Hypotension in 1 hour (usually 4-12 hours)**
- **Death in 2 hours (usually >18 hours)**



Dehydration

- **Hypotension**
 - **Rapid thready pulse**
- **Loss of skin turgor**
- **Sunken eyes**
- **Thirst**
- **Altered mental status but arousable**
- **Anuria**
 - **Renal failure**





Sack, D. et al.
Lancet 2004;
363:223-33



*Jeune femme de Venise,
âgée de 23 ans*



*La même, 1 heure après l'arrivée de Choléra,
et 24 heures avant sa mort*

Electrolyte composition of diarrheal stools: cholera

	Na ⁺	K ⁺	Cl ⁻	HCO ₃ ⁻
Adults	135	15	100	45
Children	105	25	90	30

Complications

- **Na⁺**
 - Hypotension
- **K⁺**
 - Muscle cramps, ileus, arrhythmias
- **HCO₃**
 - Acidosis (worsens vomiting)
- **Hypoglycemia**
 - Convulsions and unconsciousness

Diagnosis

- Stool culture
 - Toxigenic *Vibrio cholerae* O1 or O139
- Rapid test
- Serology
 - Vibriocidal antibodies
 - Peak 1-3 weeks after infection
 - Remained elevated 1-2 months
 - Anti-toxic antibodies
 - Remained elevated for years

Microbiological Diagnosis

- ❑ Culture of rectal swab or stool specimen
 - Transport medium: Cary Blair
 - Selective agar: TCBS
 - Thiosulfate
 - Citrate
 - Bile salts
 - Sucrose
 - Takes 2-3 days



V. parvitylosus
10/1/75

Rapid Diagnostic Test (Crystal VC Dipstick)



Rapid Diagnostic Test for screening

- Test fresh stools in the field
 - can be read within 15-20 minutes
- Early presumptive diagnosis
- Not definitive

Diagnosis

- Suspicion increased:
 - Adults with dehydrating diarrhea
 - Deaths from dehydration
 - Recent travel to affected area
 - Recent consumption of high-risk foods
 - Undercooked seafood and shellfish i.e. crabs, etc.
 - Initially all cases should be cultured. Once diagnosis confirmed as needed based on epidemiology
- All isolates should be confirmed by state laboratory and CDC and reported

Treatment

- **Assess degree of dehydration**
- **Determine if rehydration should be oral or IV**
- **Do not wait for laboratory confirmation to treat**
- **Death rates from severe cholera can be decreased from 50% to <1%**

Treatment According to Dehydration Status

EXAMINE

Well, alert
Sunken eyes: No
Drinks normally
Skin pinch goes back quickly

Restless, irritable
Sunken eyes: Yes
Thirsty, drinks eagerly
Skin pinch goes back slowly

Lethargic or unconscious
Sunken eyes: Yes
Not able to drink
Skin pinch goes back very slowly

ASSESS

No dehydration

Moderate dehydration

Severe dehydration

TREAT

Maintain hydration

Oral rehydration

IV and oral rehydration

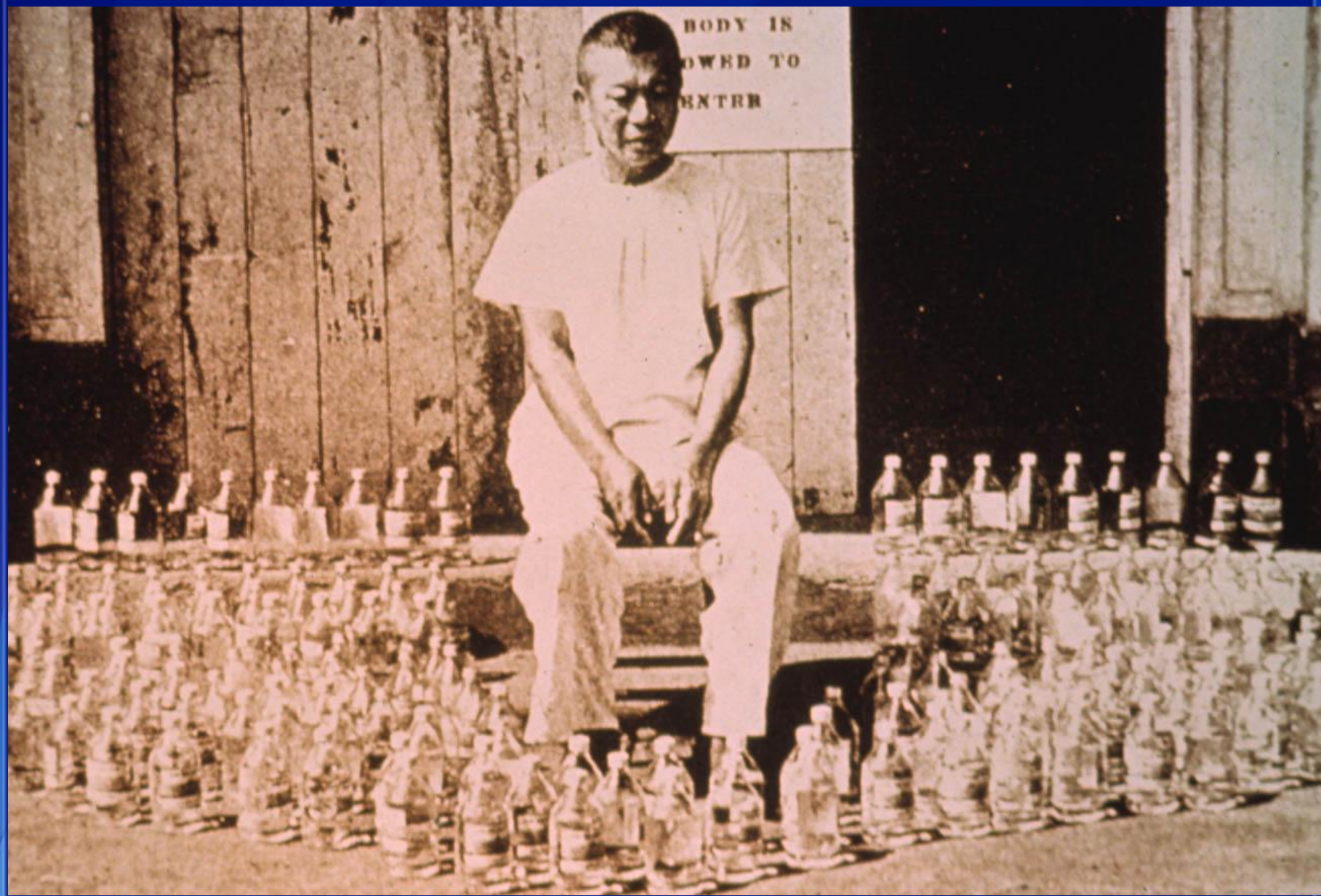
Rehydration Therapy

□ Oral therapy:

- Oral rehydration salts (ORS) are recommended
- 80-90% of patients can be treated with ORS
- Patients requiring IV can soon switch to ORS

□ Intravenous therapy:

- Ringer's lactate is the recommended IV fluid
- Normal or $\frac{1}{2}$ normal saline are less effective, but can be used
- D5W is ineffective, and should not be used









Composition of rehydration solutions

	Na+	K+	Cl-	HCO ₃ ⁻	Glucose
Cholera stools	135	15	100	45	
<u>ORAL</u> WHO-ORS	90	20	80	30	111
Rehydralyte	75	20	65	30	25
<u>IV</u> Ringer's Lactate	131	4	109	29	

Antimicrobial Therapy

- ❑ **Antimicrobial therapy reduces**
 - Fluid losses
 - Duration of illness
 - Duration of carriage
- ❑ **Recommended for severe cases**
- ❑ **Resistance pattern can change over time**
- ❑ **Not recommended for prophylaxis**

Antimicrobials Recommended by WHO for Treatment of Cholera for Haitian Adults

Patient classification	First choice	Second choice
Adults (non-pregnant)	Doxycycline: 300 mg by mouth in 1 dose	Azithromycin: 1 gram in 1 dose Tetracycline: 500 mg 4 x/day for 3 days Ciprofloxacin: 1 gram in 1 dose* Erythromycin: 500 mg 4 x/day for 3 days
Pregnant women	Azithromycin: 1 gram in 1 dose	Erythromycin: 500 mg 4 x/day for 3 days

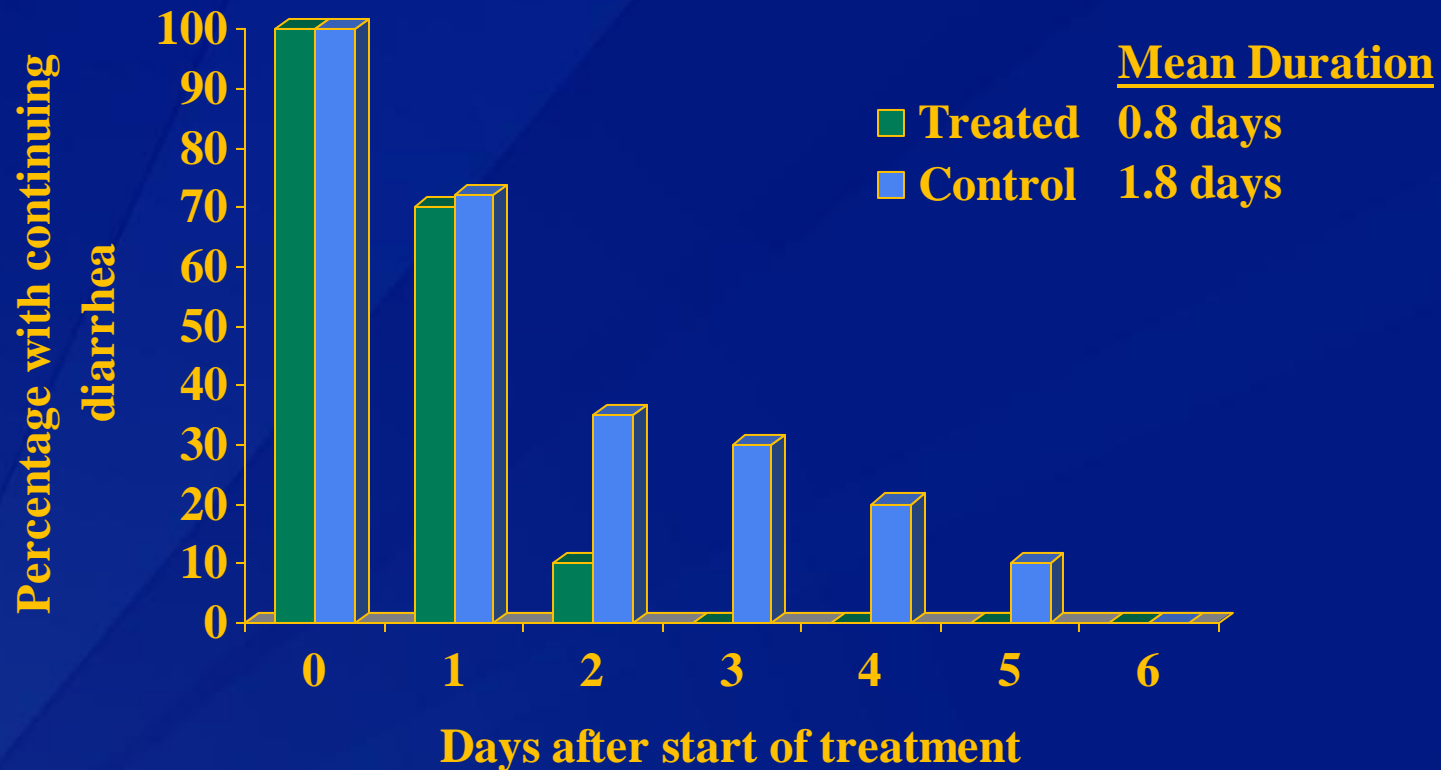
*Ciprofloxacin: 500 mg twice daily for three days for treatment of adults with cholera is widely practiced

Antimicrobials Recommended by WHO for Treatment of Cholera for Haitian Children

Patient classification	First choice	Second choice
Children \geq 12 months old and capable of swallowing pills and/or tablets	<p>Azithromycin: 20 mg/kg in one dose</p> <p>Erythromycin: 12.5 mg/kg 4 times a day for 3 days</p> <p>Doxycycline: 2-4 mg/kg in one dose*</p>	<p>Ciprofloxacin: 20 mg/kg in one dose</p> <p>Tetracycline: 12.5 mg/kg 4 times a day for 3 days</p>
Children <12 months old and others unable to swallow pills and/or tablets	<p>Azithromycin oral suspension: 20 mg/kg in one dose</p> <p>Erythromycin oral suspension: 12.5 mg/kg 4 times a day for 3 days</p> <p>Doxycycline oral suspension: 2-4 mg/kg in one dose*</p>	<p>Ciprofloxacin oral suspension: 20 mg/kg in one dose</p> <p>Tetracycline oral suspension: 12.5mg/kg 4 times a day for 3 days</p>

* Doxycycline is safe for treatment of cholera in children at the recommended dose. The Pan American Health Organization recommends doxycycline as a second-line choice because of limited regional availability and to avoid future overuse in children.

Effect of tetracycline treatment on duration of diarrhea

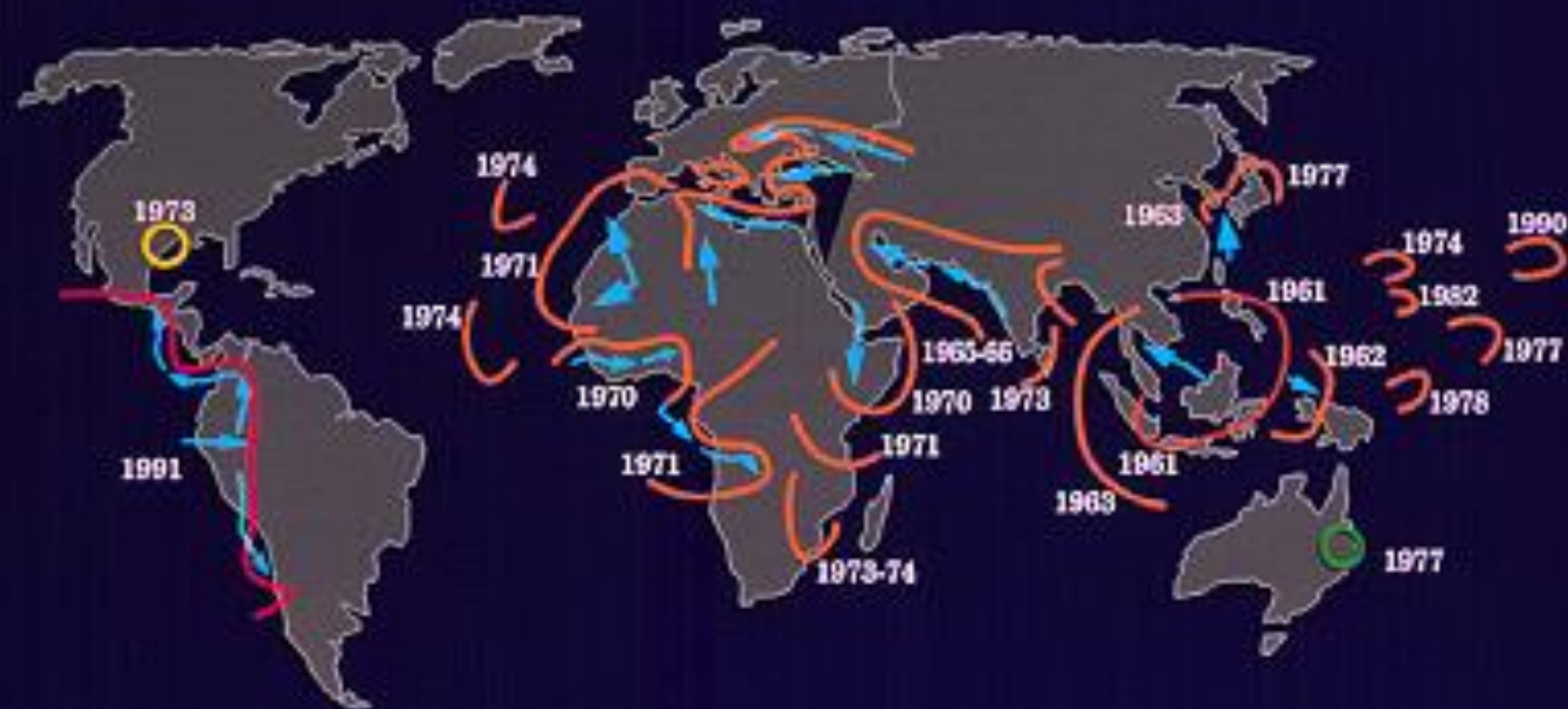




Cholera pandemics

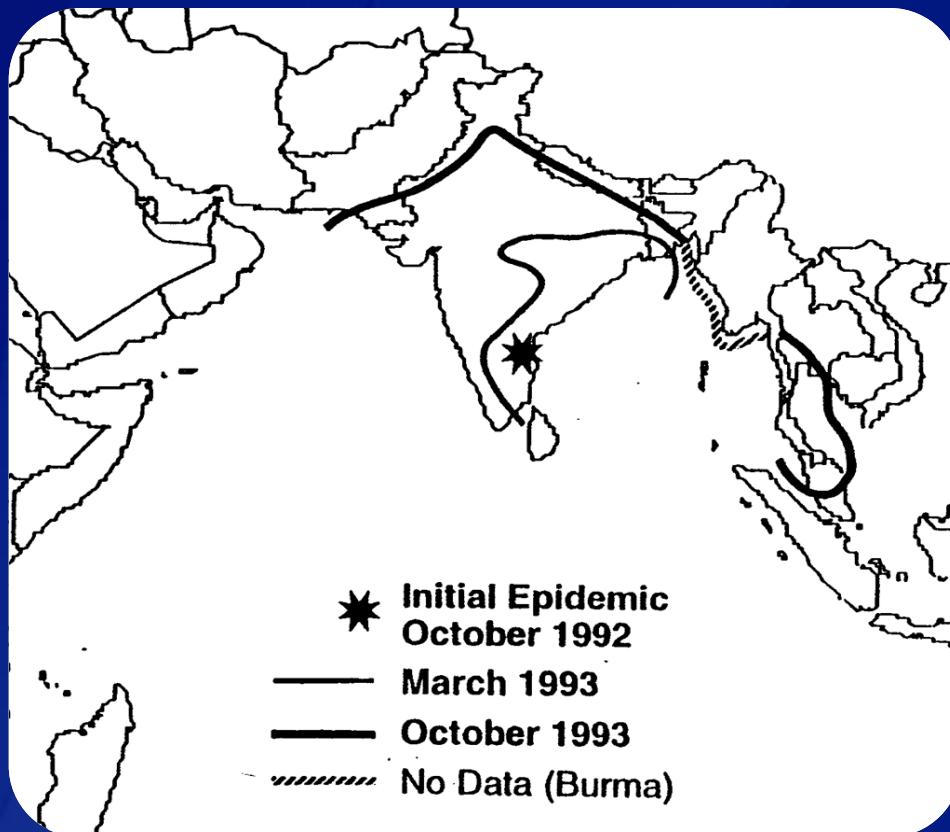
No.	Years	Serogroup	Biotype
1	1817-1823	?	?
2	1829-1851	?	?
3	1852-1859	?	?
4	1863-1879	?	?
5	1881-1896	O1	Classical
6	1899-1923	O1	Classical
7	1961-ongoing	O1	El Tor
8	1992-ongoing	O139	

Global Spread of Cholera, 1961-1991



As of August 26, 1991

New Epidemic of Cholera in 1992: *Vibrio cholerae* O139



- Immune population got cholera again
- Genetically resembles *V. cholerae* O1, El tor
- New O antigen= mutation in Rfb genes that make O antigen
- Shellfish, foods, water
- No further spread since then

Transmission

- **By water or food contaminated with *V. cholerae* O1 from:**
 - Human feces
 - Environmental reservoir (estuarine environment)
 - **NOT thought to be** by person-to-person contact

Documented Vehicles of Cholera Transmission

Water:

Municipal

Shallow wells

River water

Bottled water

Ice

Seafood:

Raw mussels

Raw oysters

Raw “concha”

Raw clams

Raw fish

Partly dried fish

Undercooked crab

Street-vended squid

Others:

Millet gruel

Leftover rice, corn porridge, peas

Rice with peanut sauce

Airline hors d'oeuvres

Frozen coconut milk

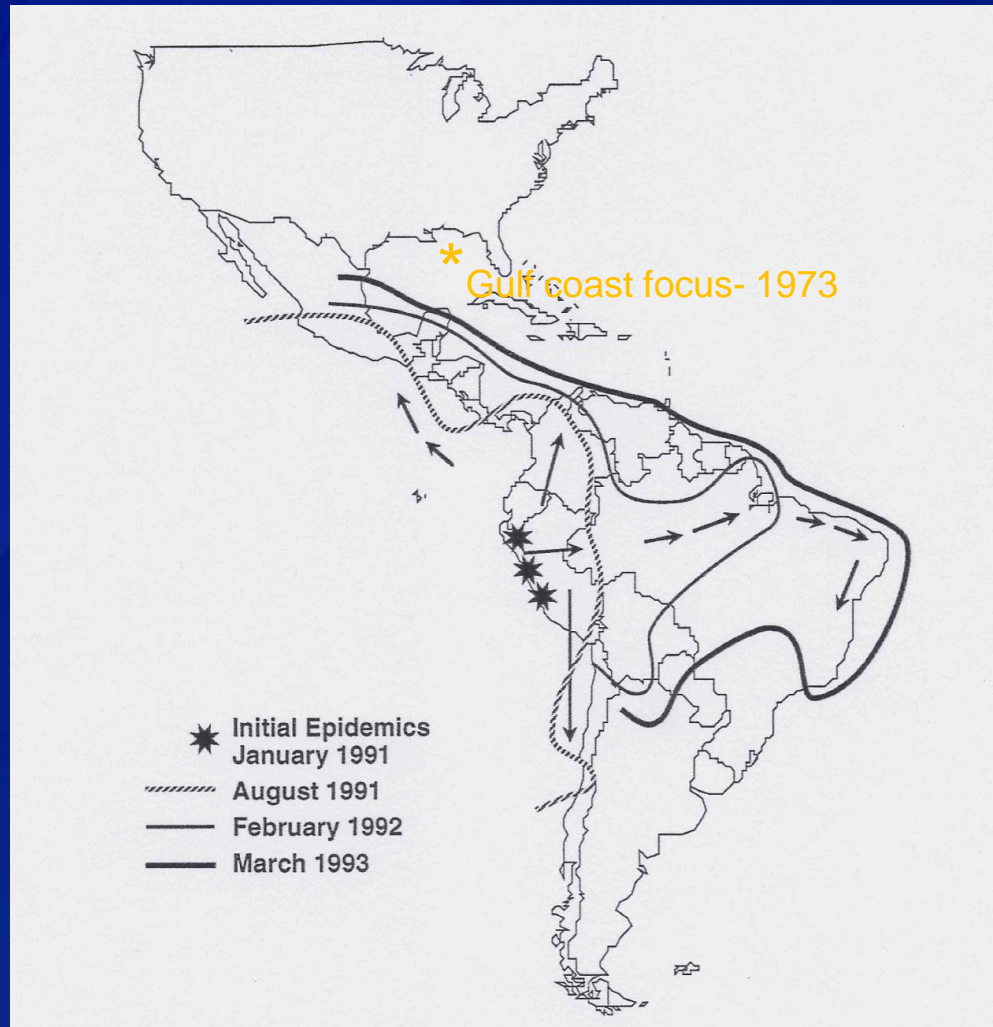
Raw vegetables

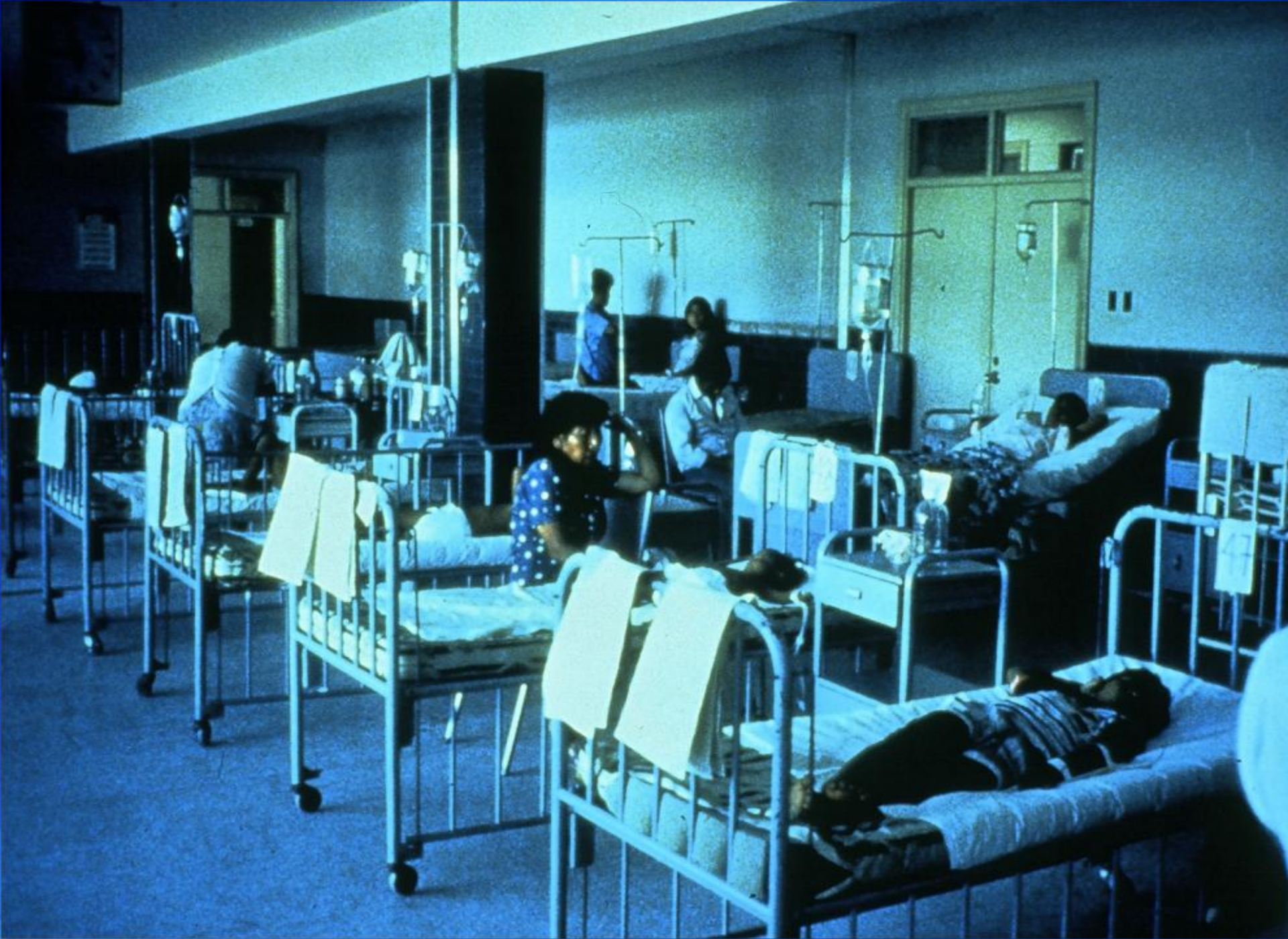




Cholera in the Americas

Cholera in the Americas, 1973-1995





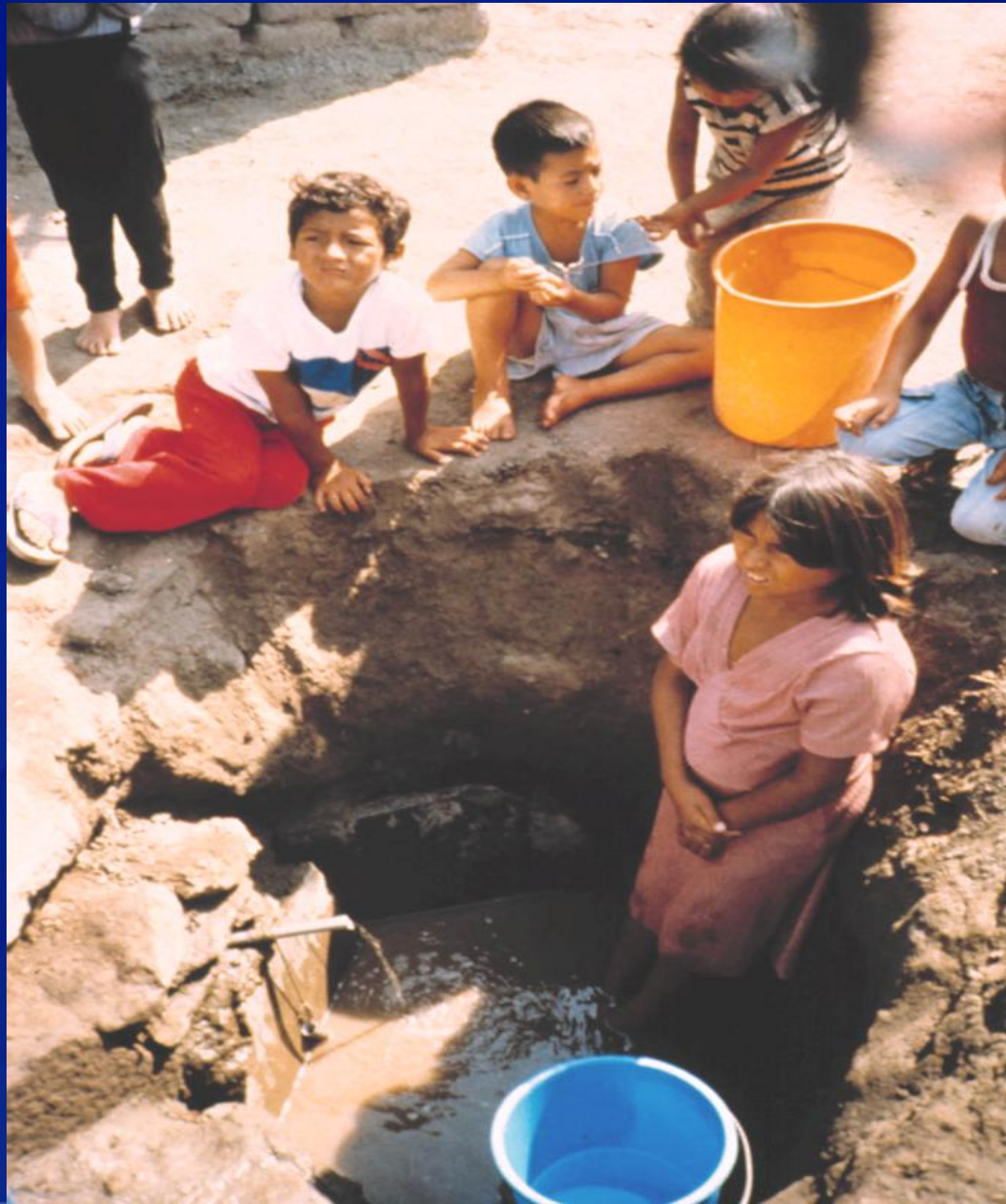
Cholera in the Western Hemisphere Related to the Latin American Epidemic: Reported Cases 1991-1994

Country	Cases	Deaths
Argentina	3522	64
Bolivia	35310	695
Brazil	137896	1444
Chile	147	3
Colombia	28334	383
Ecuador	86808	993
French Guiana	19	0
Guyana	622	10
Paraguay	3	0
Peru	628733	4410
Suriname	12	1
Venezuela	3264	80
Belize	300	8
Costa Rica	64	0
El Salvador	27365	133
Guatemala	54170	719
Honduras	7660	181
Mexico	25623	382
Nicaragua	17520	400
Panama	3636	82
TOTAL	1,061,008	9,988

Cholera in Latin America – Risk Factors for Transmission

- ❑ **Drinking unboiled water**
 - Large municipal water systems
 - Deficient peripheral distribution
 - Home water storage
 - Water contamination in the home
 - Ice made from untreated water
- ❑ **Eating raw and undercooked shellfish**
 - Shrimp, concha, oysters, crabs
- ❑ **Eating foods and drinking beverages from street vendors**
- ❑ **Eating rice left out for > 3 hours**









Cholera in the Americas –Control Measures

- ❑ **Short term:** **Emergency Interventions**
 - Improve diagnosis, treatment, and surveillance
 - Chlorinate water supplies
 - Educate public
 - Boil water, avoid raw shellfish
 - Identify other control measures by epidemiologic investigations

- ❑ **Mid term:**
measures **Sustainable, cheap control**
 - Home water storage vessels
 - Home chlorination of water

- ❑ **Long term:** **“Sanitary Reform”**
 - Maintain and upgrade water systems
 - Build sewage treatment systems
 - Implement shellfish sanitation

Cholera in Haiti



Background

- ❑ **Population ~ 10 million**
- ❑ **Western Hemisphere's highest infant mortality rate**
- ❑ **Lowest GDP in hemisphere**
 - 55% extreme poverty
- ❑ **Lowest water and sanitation coverage in Hemisphere**
 - 12% received piped water
 - 17% had adequate sanitation
- ❑ **Earthquake January 12, 2010**
 - Over 200,000 dead
 - Estimated 1.3 million remain displaced in ~1,300 internally displaced persons (IDP) camps
- ❑ **Outbreak of watery diarrhea identified Oct 19, 2010**

Initial Investigation, Hospital A, October 21, 2010

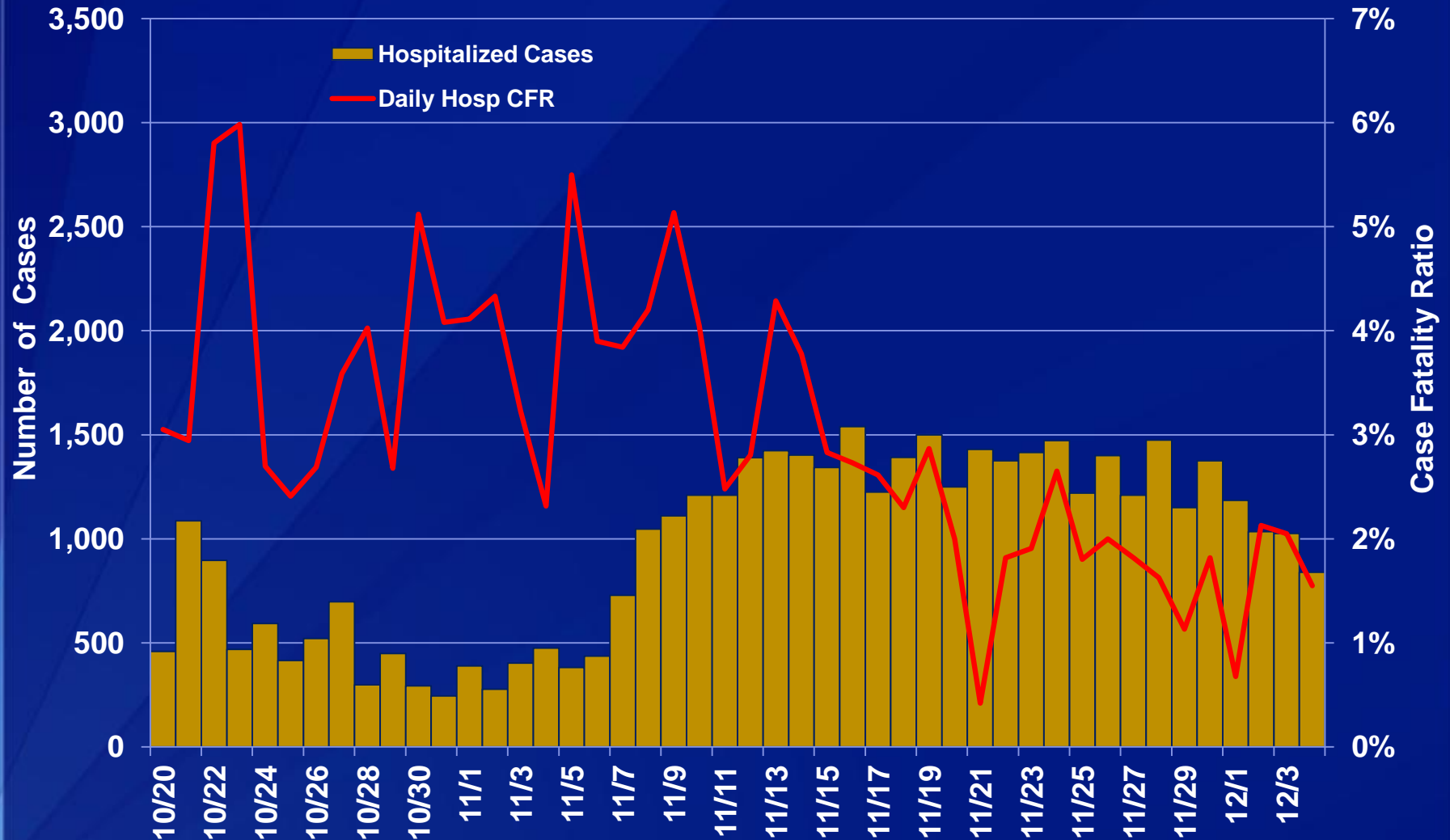


Current Situation

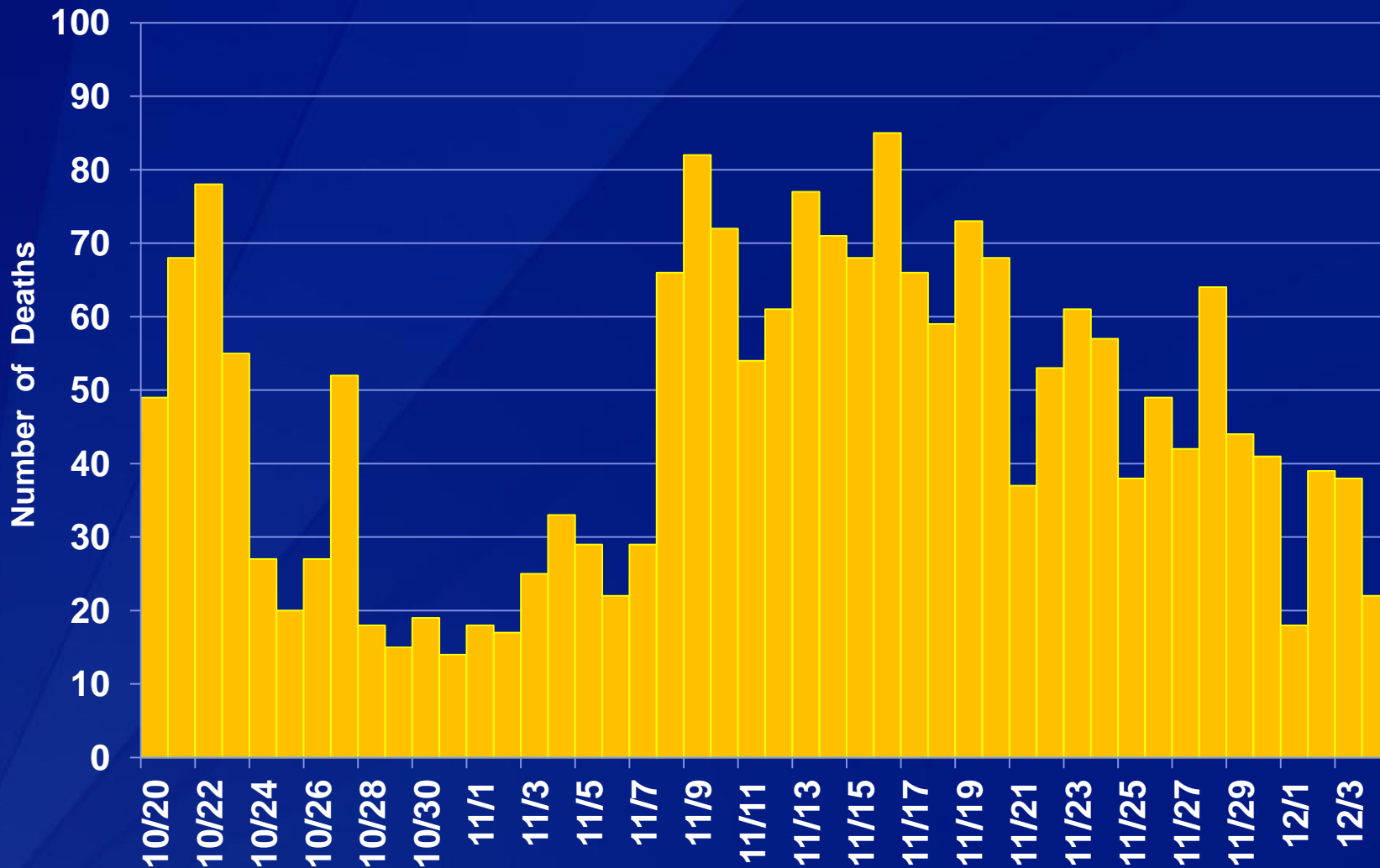
As of 09-Dec-2010:

Total Cases: 104,614
Hospitalizations: 50,923
Deaths: 2,323

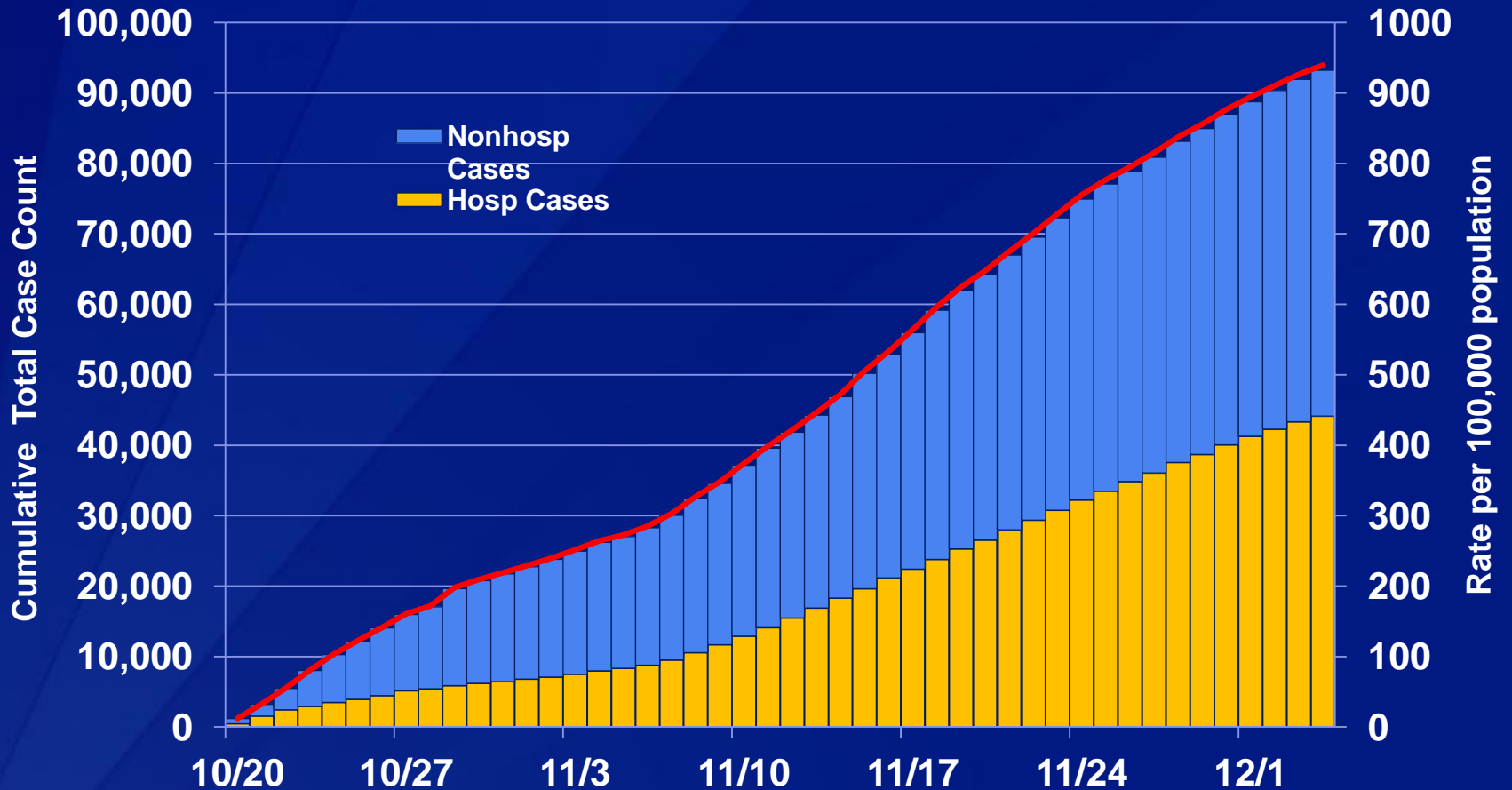
Total (n=93,222) and Hospitalized (n=44,157) Cholera Cases by Day Haiti, October 20 – December 4, 2010



Total Cholera Deaths (n=2,120) by Day Haiti, October 20 – December 4, 2010

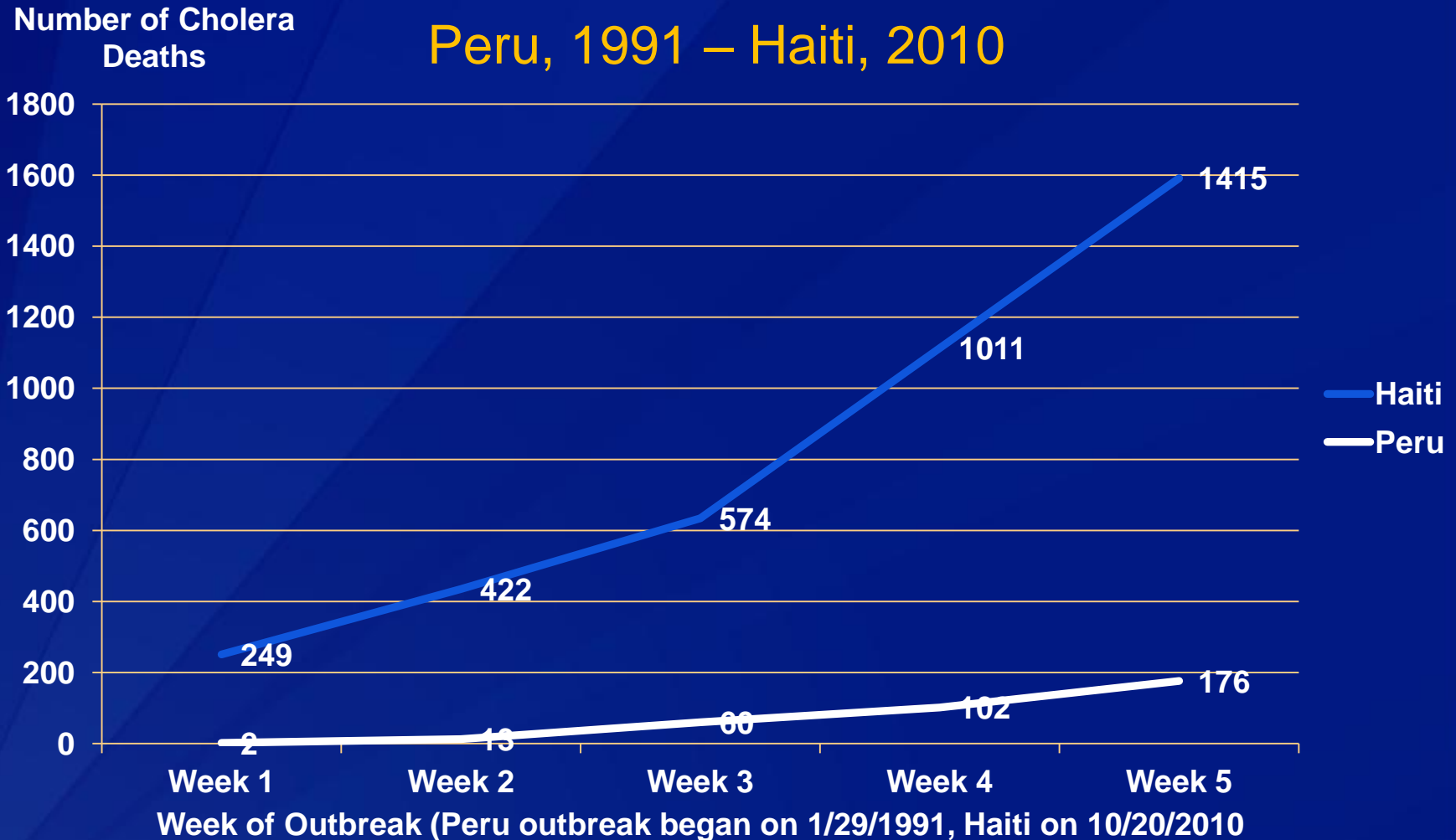


Cumulative Total Cholera Cases and Case Rate per 100,000 Population by Day, Haiti, October 20 – December 4, 2010



Cumulative Number of Cholera Deaths by Week of Outbreak

Peru, 1991 – Haiti, 2010



*Update- Outbreak of Cholera, Haiti 2010. *MMWR* 2010;59:1586-90

Artibonite mortality study*

- 87 deaths
 - Nearly half died outside the hospital
 - <50% drank ORS at home (23% among community deaths)
 - Median time to death from onset of symptoms in the community was 12 hours (range 2 hrs to 8 days)
- Among those who sought medical care:
 - 13% died en route
 - 13% died at home after discharge
- Common barriers to seeking health care:
 - Did not think they had cholera or appreciate the need to seek care
 - Health facility was too far away and lacked transportation
 - *Convenience sample, from early in outbreak*

*Update- Outbreak of Cholera, Haiti 2010. *MMWR* 2010;59:1586-90

Factors that contribute to the severe outbreak in Haiti?

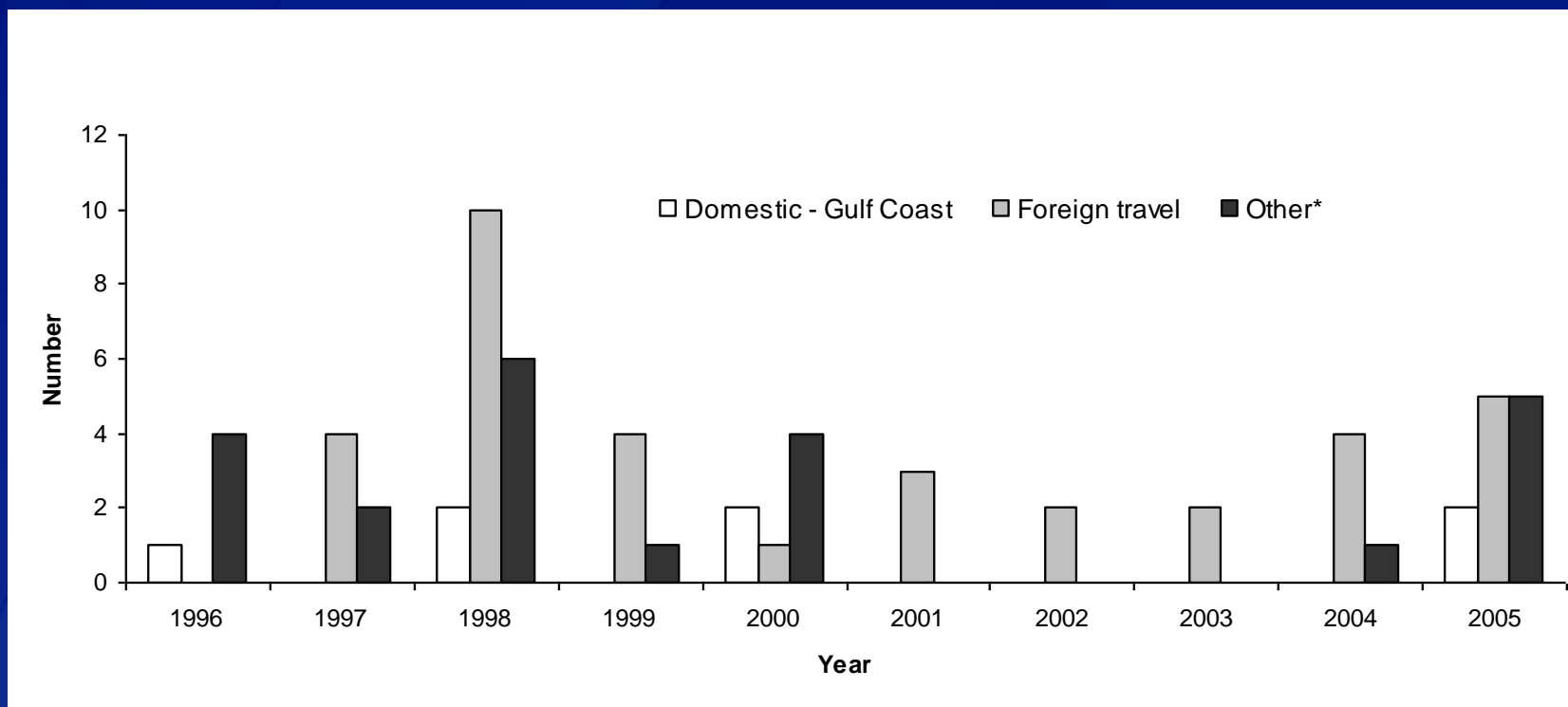
- Poor water and sanitation
- Limited access to treatment, inexperience with treatment
- Underlying conditions
- ? Blood group O*
- Hybrid strain- El Tor biotype with Classic toxin gene

*Swerdlow D et al. *JID* 1994;170:468-72.

Cholera in the United States and Travelers



Cases of cholera by year and exposure, USA 1996-2005



Source: MMWR 2006;55:31-32.

Cholera Cases in the DR and the US, 2010

- ❑ Dominican Republic
 - Lab-confirmed cases have been reported
 - Some with Haiti travel history
 - Will be reviewed in upcoming MMWR
- ❑ US
 - Lab-confirmed cases
 - All cases are in travelers recently in Haiti
 - Will be reviewed in upcoming MMWR

Advice for Travelers to Areas Affected by Epidemic Cholera

- Avoid unboiled or untreated water.
- Carbonated drinks without ice are safe.
- Avoid foods and beverages from street vendors.
- Avoid raw and undercooked seafood.
- Eat foods that are cooked and hot, and fruits you peel yourself.
- Do not bring perishable seafood back into the United States.
 - ***Boil it, cook it, peel it, or forget it.***



Other control measures

- Antibiotic treatment of family contacts?
Maybe
- Mass chemoprophylaxis? No except under rare circumstances
- Quarantine? No
- Vaccine?

Cholera Vaccine

- ❑ One oral vaccine is commercially available and prequalified by WHO**
- ❑ Not licensed in the U.S. or Haiti**
- ❑ Requires a cold chain and two doses 7–14 days apart**
- ❑ Protective effectiveness 85% for first 6 months, lasts at least two years**
- ❑ Not recommended by WHO at current time for epidemic control**
- ❑ Vaccine policy and use of vaccines being re-evaluated**

SAFE WATER FORMATION

[What is the Safe Water System \(SWS\)?](#)

[Why was the SWS developed?](#)

[Who is the SWS for?](#)

[Where has the Safe Water System \(SWS\) been used?](#)

[How is a SWS implemented?](#)

REPORTS & STUDIES

[Handbook for SWS Implementation](#)

[Applications & Contracts](#)

ADDITIONAL INFORMATION

[Related Links](#)

[Safe Water Video](#)

[Contact Us](#)

Safe Water System



The Safe Water System is a water quality intervention that employs simple, inexpensive and robust technologies appropriate for the developing world. The objective is to make water safe through disinfection and safe storage at the point of use. The basis of the intervention is:

Point-of-use treatment of contaminated water using sodium hypochlorite solution purchased locally and produced in the community from water and salt using an electrolytic cell;



Sodium hypochlorite solution
Left to right: Madagascar, Peru, Zambia, Bolivia.
(Point-of-use treatment)

Safe water storage containers produced and distributed in rural Haiti by a CDC and USAID partner Deep Springs International, since 2001





**Centers for Disease Control and Prevention
Atlanta, Georgia**

Thank you for joining!

Please email us questions at coca@cdc.gov

What CDC Is Doing

What You Can Do

Blog: Public Health Matters

What's New

Date: Wednesday, December 15, 2010
Time: 12:00 PM – 1:00 PM (Eastern Time)

Presenter(s):



David L. Swerdlow, MD

CAPT U.S. Public Health Service
Incident Manager, CDC Haiti Cholera Response (Nov 15-Dec 8),
Senior Advisor for Epidemiology,
National Center for Immunization and Respiratory Diseases,
CDC

Overview:

Since October 2010 Haiti has experienced a severe outbreak of cholera- the first in more than 100 years. Since then cases of cholera have been imported into the Dominican Republic and the United States. Although cholera is unlikely to spread significantly in the United States, more imported cases are likely to occur. Since treatment of cholera may be life saving, clinicians in the United States should be able to recognize and treat cases of cholera. Please join us for this informative COCA conference call where an update on the current cholera situation in Haiti, and the epidemiology, diagnosis, and treatment of cholera will be discussed.

Participate by Phone: 800-857-1754

Passcode: 5676778

[Subscribe to RSS](#)

[Get email updates](#)

[Sign up](#) for COCA email updates.

Contact Us:

- Centers for Disease Control and Prevention
1600 Clifton Rd
Atlanta, GA 30333
- 800-CDC-INFO
(800-232-4636)
TTY: (888) 232-6348
24 Hours/Every Day
- cdcinfo@cdc.gov

[REPORT AN EMERGENCY](#)

[Tell us what you think](#)