Cholera: with a Focus on Haiti

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http://www.youtube.com/watch?feature=player_embedded&v=6jXkiX-f3jY
IMAGINE LIFE WITHOUT A TOILET

2.6 billion people don’t have to imagine

40% of the world’s population do not have access to adequate sanitation. That’s 2.6 billion people having to practice open defecation, creating environments which lead to waterborne diseases such as acute diarrhea, cholera and dysentery. The lack of toilets is one of the greatest killers of children. Everyone should have the right to have an access to a toilet anytime and anywhere. No one should die from not having a toilet.

19 November is World Toilet Day. Celebrate the day together with the rest of the world and share your thoughts to give 2.6 billion people the hope to survive. www.worldtoiletday.com
Pre-Test Question 1

1. There are an estimated __-__ million cholera cases and ____-______ deaths due to cholera every year.
   
   a. 1 – 2 million cases; 100,000 – 200,000 deaths
   b. 3 – 5 million cases; 100,000 – 120,000 deaths
   c. 8 – 9 million cases; 100,000 – 120,000 deaths
   d. 3 – 5 million cases; 400,000 – 420,000 deaths
   e. 4 – 5 million cases; 50,000 – 100,000 deaths
Pre-Test Question 2

2. About ___% of people infected with *V. cholerae* do not develop any symptoms, although they may shed the bacteria for ___-___ days after infection.

a. 25%; 1 – 3 days
b. 35%; 5 – 7 days
c. 95%; 7 – 14 days
d. 75%; 7 – 14 days
e. 85%; 14 – 28 days
Pre-Test Question 3

3. Potential control measures for *V. cholerae* infections include all of the following EXCEPT:

a. preparedness
b. response
c. prevention
d. vaccination
e. rehydration
Pre-Test Question 4

4. Cholera epidemics have been associated with all of the following EXCEPT:

a. disruption of sanitation systems
b. displacement of populations
c. overcrowding
d. decaying corpses
e. global warming
The Bathers (2006) by George Desarmes b. 1915

Life in the Artibonite River communities in Haiti pre-cholera

Potter P. “Persistence of Memory and the Comma Bacillus”. EID 2011; 17: 2181-2
History of Cholera

- Recognized by Hippocrates and Galen – epidemics associated with the Ganges River
- Robert Koch identified the Ganges Delta as the source
- John Snow implicated water and the Broad Street pump
- 1965 named *Vibrio cholerae*

Potter P. “Persistence of Memory and the Bacillus”. EID 2011; 17: 2181-2
Cholera Taxonomy

- > 70 serogroups, - O antigen
- O1 and toxigenic produce epidemic cholera
- Strains that agglutinate in antiserum; others are "not toxigenic"
- Strains in serogroup O1 or O139 are further characterized by biotype, serotype, and cholera toxin production
- 2 biotypes, El Tor (1961) & Classical biotype
- 2 serotypes, Inaba and Ogawa
- Current Haiti strain - toxigenic, Vibrio cholerae O1, serotype Ogawa, biotype El Tor
### Modes of Transmission of Cholera

<table>
<thead>
<tr>
<th>Waters</th>
<th>Seafood</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Municipal</td>
<td>Raw mussels</td>
<td>Millet gruel</td>
</tr>
<tr>
<td>Shallow wells</td>
<td>Raw oysters</td>
<td>Leftover rice</td>
</tr>
<tr>
<td>River water</td>
<td>Raw conch (&quot;concha&quot;)</td>
<td>Rice with peanut sauce</td>
</tr>
<tr>
<td>Bottled water</td>
<td>Raw clams</td>
<td>Leftover peas</td>
</tr>
<tr>
<td>Ice</td>
<td>Raw fish</td>
<td>Frozen coconut milk</td>
</tr>
<tr>
<td></td>
<td>Partly dried fish</td>
<td>Raw vegetables</td>
</tr>
<tr>
<td></td>
<td>Undercooked crab</td>
<td>Leftover corn porridge</td>
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<td></td>
<td>Street-vended squid</td>
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Burden of Cholera Disease

• Estimated 3-5 million cholera cases and 100,000-120,000 deaths due to cholera each year
• 2004 – 2008: cases increased by 24% compared with 2000 to 2004
• 2008: 190,130 cases and 5,143 deaths from 56 countries
Geographic Distribution of Cholera, 2009

Countries reporting cholera in 2009

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement. © WHO 2010. All rights reserved.
Pathophysiology of Cholera Toxin

- Signs and symptoms produced by cholera toxin
  - Profound loss of fluid and electrolytes
- Incubation period 1–3 days
- Vibrios ingested → pass through gastric acid → produce cholera toxin → binds to epithelial surface of the bowel
- Active portion of the toxin (subunit A), enters mucosal cells and activates cAMP → active secretion of chloride, and blocks absorptive function → H₂O, potassium, and bicarbonate follow chloride into lumen → less sodium is absorbed, producing secretory diarrhea
Symptoms of Cholera

- Loss of sodium, chloride, and water → dehydration and vascular collapse
- Acute tubular necrosis → transient renal failure occurs as result of shock
- Hypokalemia → painful muscle cramps, arrhythmias and focal myocardial necrosis
- Loss of bicarbonate → acidosis → hyperventilation, vomiting, and altered mental status
Clinical Features of Cholera Infection

- Dehydrating diarrheal illness → rapid loss of fluids and electrolytes
- Of total persons with infection, 75% asymptomatic
  - 25% with symptomatic infections have mild illness
  - ~2% of infected will have "cholera gravis"
  - 5% moderate illness requiring medical attention
- Develops watery diarrhea with flecks of mucus = "rice water stool"
- Severe diarrhea can be nearly continuous and can exceed 1 liter per hour
- Severity associated with ingestion of a high dose of organisms, decreased gastric acid production, blood group O, children, immunocompromised
Antimicrobial Therapy for Cholera

- Oral antibiotics reduce volume and duration of diarrhea

- Recommended for: 1) moderately and severely dehydrated persons, 2) persons who continue to pass large volume stools during rehydration treatment, and 3) all hospitalized patients

- Not recommended for asymptomatic persons

- Prophylactic use increases the risk of resistance and is not effective in preventing transmission

- Zinc given orally may reduce the duration of infectious diarrhea
Cholera Vaccines

• 2 oral available; whole-cell, killed; 50% protection years in endemic areas

• B-unit vaccine (Dukoral) WHO prequalified & licensed 60 countries; 85-90% protection *V. cholerae* O1 for 4-6 months; given in water

• Shanchol pending WHO prequalification, longer time protection against O1 and O139

• 2 doses between 7 days and 6 weeks apart

• Parenteral not recommended; WHO recommends oral cholera vaccines, CDC does not

• Vaccines used in conjunction with other methods
Use of Cholera Vaccines in Haiti

• 2 oral cholera vaccines – 90% short-term protection

• “Ring vaccination” is effective when infected are symptomatic

• Majority of cholera-infected are shedding but asymptomatic

• 2 doses in adults; 3 in children

• 3 weeks post-immunization for immunity

• Immunization focus reduces attention on other effective prevention measures
**Cholera in Haiti (1)**

- Epidemic cholera in Haiti in October 2010; not reported since 1800’s despite epidemics in Latin America
- rapid spread due to compromise from earthquake on January 2010
- Nations, multinational agencies, NGOs responded including USAID and CDC
- Poor health indices (life expectancy 61 years) and high IMR (64 / 1,000 live births)
- 87 / 1,000 children die by 5 years of age, >25% growth-stunted
Cholera in Haiti (2)

- Childhood immunization < 60%; high prevalence of HIV and TB; malaria is endemic
- 50% access to medical care; 1 MD and 1.8 RN / 10,000
- 63% access to clean water, 17% access to a latrine
Cholera in Haiti (3)

- 19 October 2010, MSPP notified of an increase in acute watery diarrhea in Artibonite Valley
- Stool cultures confirmed *V. cholerae* serogroup O1, biotype Ogawa
- Illness associated with drinking untreated river water

As of 31 July 2011, 419,511 cases, 222,359 hospitalized case-patients, 5,968 deaths reported
Cholera in Haiti (4)

- Educational materials advised to boil or chlorinate drinking water and bury human waste
- Priorities for control:
  1. Distribute supplies and trained personnel to health treatment facilities
  2. Supplying ORS to households
  3. Point-of-use water treatment
  4. Field investigations to prioritize prevention
  5. Establishment of a national cholera surveillance system
Cholera in Haiti and Beyond

• November 5-6 2010 – Hurricane Tomas
• November 19, laboratory confirmation of cholera in 10 administrative departments of Haiti, Dominican Republic, and Florida
• Less severe epidemic in DR due to increased resources
  • One large outbreak among wedding guests in DR including guests from Venezuela and the U.S.
2010 Alert # 3
Imported Cholera Cases in New York City

- Three cases of cholera have been confirmed in New York City (NYC)
- All three cases are linked to a confirmed cholera outbreak in the Dominican Republic
- Providers should include cholera in the differential diagnosis for patients presenting with gastrointestinal illness who have a history of recent travel to Haiti or the Dominican Republic.
- Report suspected and confirmed cases to the Bureau of Communicable Disease
- Submit all isolates of *Vibrio cholerae* to the Public Health Laboratory for confirmation and molecular typing, regardless of travel history.
The Future of Cholera in Haiti

- Seasonality of cholera on Hispaniola
- Immunity from natural infection
- Epidemic strains may result in endemic transmission
- Antimicrobial drug resistance
- Ships sailing from Haitian ports
- Introduction from Southeast Asia/ Nepal
- Education of healthcare workers and supply chain logistics
- Role for vaccines – costs, benefits, practicality
Approach to a Person with a Suspected Cholera Infection

- **ISOLATION**: Contact precautions for duration of illness for diapered and incontinent persons; standard precautions for others

- **REPORT**: Presumed or confirmed cases of *V. cholerae* O1 or O139 must be reported to local and state health departments immediately

- Request culture from laboratories for *Vibrio* organisms

- Oral and parenteral therapy for rehydration with electrolyte replacement are mainstays of therapy

- Oral doxycycline x 1, tetracycline x 3 doses, fluroquinolones, or TMP-SMZ for moderate to severe infections; chemoprophylaxis of contacts not recommended
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What is this crab doing in this suitcase?
“Cholera in Haiti” Emerging Infectious Diseases, [www.cdc.gov/eid](http://www.cdc.gov/eid), 17(11), November 2011. Contributions by JW Tappero, RV Taussig, JG Morris, KA Date et al.


Centers for Disease Control and Prevention, [http://www.cdc.gov/haiticholera/](http://www.cdc.gov/haiticholera/)