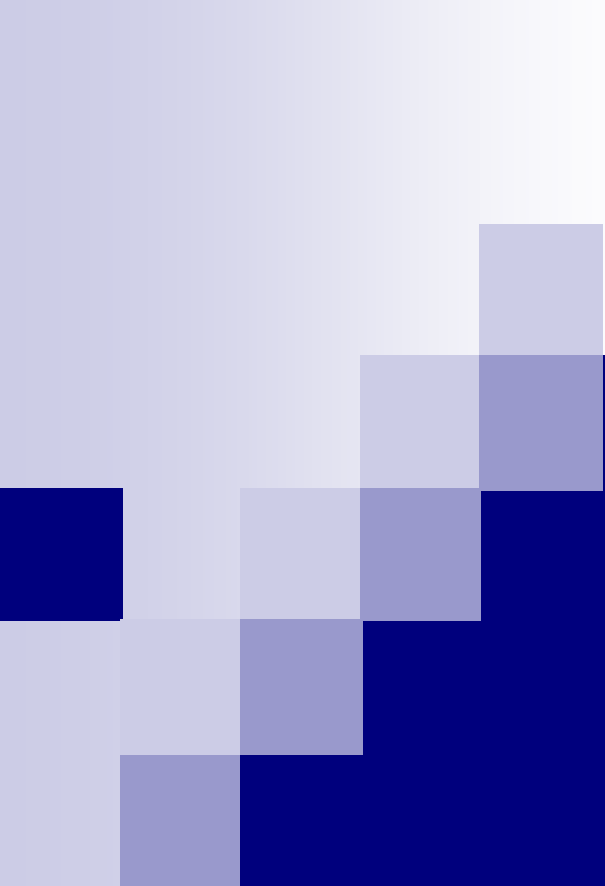




Infectious diseases regulated by the International health regulations. Cholera

V.Bodnar

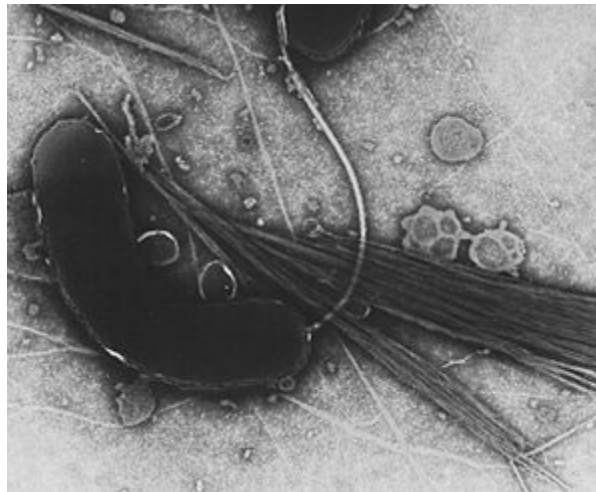
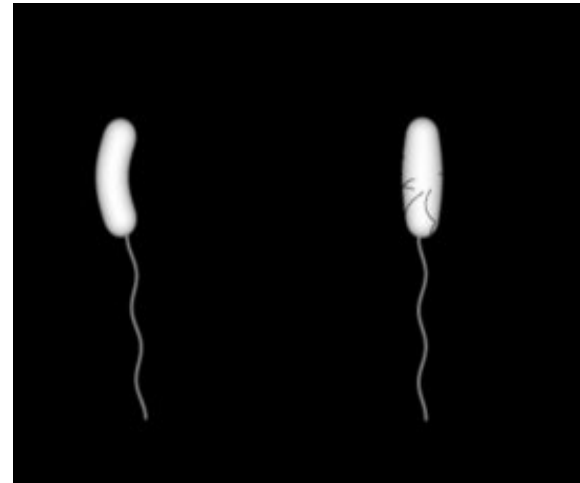
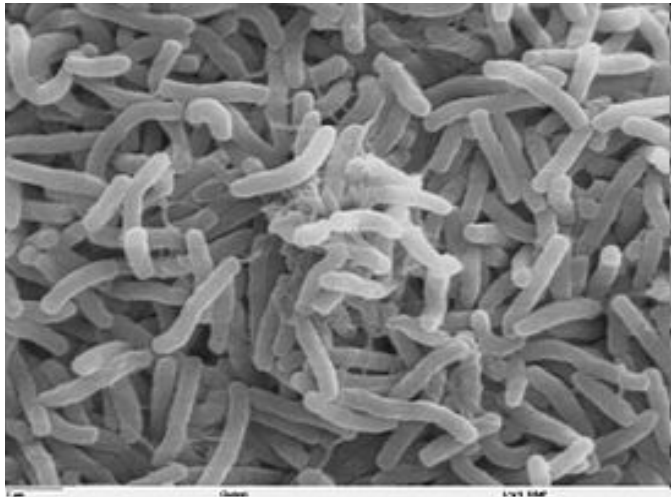
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- Cholera is an infection in the small intestine caused by the bacterium *Vibrio cholerae*.
 - The main symptoms are profuse, watery diarrhea and vomiting.
 - Transmission occurs primarily by drinking water or eating food that has been contaminated by the feces of an infected person, including one with no apparent symptoms.
 - The severity of the diarrhea and vomiting can lead to rapid dehydration and electrolyte imbalance, and death in some cases. The primary treatment is oral rehydration therapy, typically with oral rehydration solution (ORS), to replace water and electrolytes.

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- If this is not tolerated or does not provide improvement fast enough, intravenous fluids can also be used.
 - Antibacterial drugs are beneficial in those with severe disease to shorten its duration and severity.
 - Worldwide, it affects 3–5 million people and causes 100,000–130,000 deaths a year as of 2010.
 - Cholera was one of the earliest infections to be studied by epidemiological methods.

Cause

- *Vibrio cholerae*
- *Vibrio cholerae* is a Gram-negative, comma-shaped bacterium.
- Some strains of *V. cholerae* cause the disease cholera.
- *V. cholerae* is facultatively anaerobic and has a flagellum at one cell pole.
- *V. cholerae* was first isolated as the cause of cholera by Italian anatomist Filippo Pacini in 1854, but his discovery was not widely known until Robert Koch, working independently 30 years later, publicized the knowledge and the means of fighting the disease

Vibrio cholerae



Susceptibility

- About 100 million bacteria must typically be ingested to cause cholera in a normal healthy adult.
- This dose, however, is less in those with lowered gastric acidity (for instance those using proton pump inhibitors).
- Children are also more susceptible, with two- to four-year-olds having the highest rates of infection.
- Individuals' susceptibility to cholera is also affected by their blood type, with those with type O blood being the most susceptible.
- Persons with lowered immunity, such as persons with AIDS or children who are malnourished, are more likely to experience a severe case if they become infected.
- However, it should be noted that any individual, even a healthy adult in middle age, can experience a severe case, and each person's case should be measured by the loss of fluids, preferably in consultation with a doctor or other health worker.

Susceptibility

- The cystic fibrosis genetic mutation in humans has been said to maintain a selective advantage: heterozygous carriers of the mutation (who are thus not affected by cystic fibrosis) are more resistant to *V. cholerae* infections.
- In this model, the genetic deficiency in the cystic fibrosis transmembrane conductance regulator channel proteins interferes with bacteria binding to the gastrointestinal epithelium, thus reducing the effects of an infection.

Epidemiology

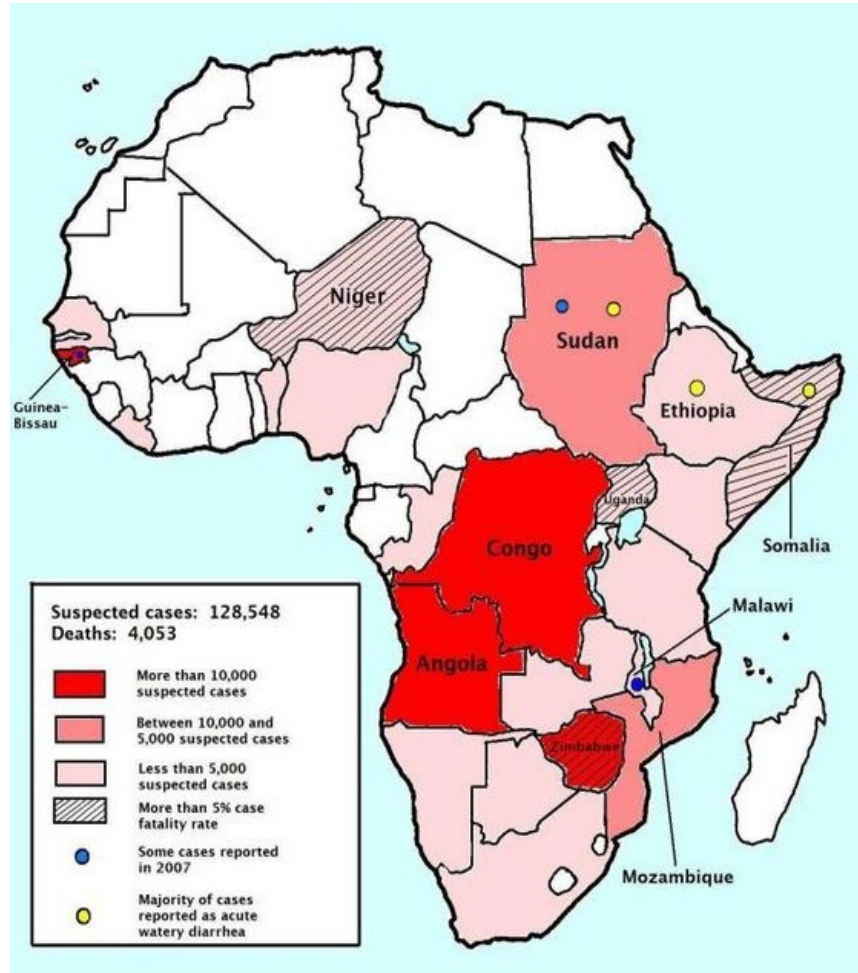
- Cholera affects an estimated 3-5 million people worldwide, and causes 100,000-130,000 deaths a year as of 2010.
- This occurs mainly in the developing world.
- In the early 1980s, death rates are believed to have been greater than 3 million a year.
- It is difficult to calculate exact numbers of cases, as many go unreported due to concerns that an outbreak may have a negative impact on the tourism of a country.
- Cholera remains both epidemic and endemic in many areas of the world.



Epidemiology

- Although much is known about the mechanisms behind the spread of cholera, this has not led to a full understanding of what makes cholera outbreaks happen some places and not others.
- Lack of treatment of human feces and lack of treatment of drinking water greatly facilitate its spread, but bodies of water can serve as a reservoir, and seafood shipped long distances can spread the disease.

Map of the 2008–2009 cholera outbreak in sub-Saharan Africa showing the statistics as of 12 February 2009





Transmission

- Cholera is typically transmitted by either contaminated food or water. In the developed world, seafood is the usual cause, while in the developing world it is more often water. Cholera has been found in only two other animal populations: shellfish and plankton.
- People infected with cholera often have diarrhea, and if this highly liquid stool, colloquially referred to as "rice-water", contaminates water used by others, disease transmission may occur.

Transmission

- The source of the contamination is typically other cholera sufferers when their untreated diarrheal discharge is allowed to get into waterways, groundwater or drinking water supplies.
- Drinking any infected water and eating any foods washed in the water, as well as shellfish living in the affected waterway, can cause a person to contract an infection.
- Cholera is rarely spread directly from person to person.
- Both toxic and nontoxic strains exist. Nontoxic strains can acquire toxicity through a temperate bacteriophage.
- Coastal cholera outbreaks typically follow zooplankton blooms, thus making cholera a zoonotic disease.

Drawing of Death bringing cholera, in Le Petit Journal (1912)



Signs and symptoms

- The primary symptoms of cholera are profuse, painless diarrhea and vomiting of clear fluid.
- These symptoms usually start suddenly, one to five days after ingestion of the bacteria.
- The diarrhea is frequently described as "rice water" in nature and may have a fishy odor.
- An untreated person with cholera may produce 10 to 20 litres (3 to 5 US gal) of diarrhea a day with fatal results. For every symptomatic person, 3 to 100 people get the infection but remain asymptomatic.
- Cholera has been nicknamed the "blue death" due to a patient's skin turning a bluish-gray hue from extreme loss of fluids



Signs and symptoms

- If the severe diarrhea is not treated with intravenous rehydration, it can result in life-threatening dehydration and electrolyte imbalances.
- The typical symptoms of dehydration include low blood pressure, poor skin turgor (wrinkled hands), sunken eyes, and a rapid pulse

A person with severe dehydration due to cholera - note the sunken eyes and decreased skin turgor which produces wrinkled hands



Diagnosis

- A rapid dip-stick test is available to determine the presence of *V. cholerae*.
- In those samples that test positive, further testing should be done to determine antibiotic resistance.
- In epidemic situations, a clinical diagnosis may be made by taking a patient history and doing a brief examination.
- Treatment is usually started without or before confirmation by laboratory analysis.
- Stool and swab samples collected in the acute stage of the disease, before antibiotics have been administered, are the most useful specimens for laboratory diagnosis.
- If an epidemic of cholera is suspected, the most common causative agent is *V. cholerae* O1.
- If *V. cholerae* serogroup O1 is not isolated, the laboratory should test for *V. cholerae* O139.
- However, if neither of these organisms is isolated, it is necessary to send stool specimens to a reference laboratory. Infection with *V. cholerae* O139 should be reported and handled in the same manner as that caused by *V. cholerae* O1.

Diagnosis

A number of special media have been employed for the cultivation for cholera vibrios. They are classified as follows:

Enrichment media

- Alkaline peptone water at pH 8.6
- Monsur's taurocholate tellurite peptone water at pH 9.2

Plating media

- Alkaline bile salt agar (BSA): The colonies are very similar to those on nutrient agar.
- Monsur's gelatin Tauro cholate trypticase tellurite agar (GTТА) medium: Cholera vibrios produce small, translucent colonies with a greyish-black center.
- TCBS medium: This is the mostly widely used medium; it contains thiosulphate, citrate, bile salts and sucrose. Cholera vibrios produce flat, 2–3-mm-diameter, yellow-nucleated colonies.

Direct microscopy of stool is not recommended, as it is unreliable. Microscopy is preferred only after enrichment, as this process reveals the characteristic motility of *Vibrio* and its inhibition by appropriate antisera. Diagnosis can be confirmed, as well as serotyping done by agglutination with specific sera.

Treatment

Fluids

- In most cases, cholera can be successfully treated with oral rehydration therapy (ORT), which is highly effective, safe, and simple to administer. Rice-based solutions are preferred to glucose-based ones due to greater efficiency.
- In severe cases with significant dehydration, intravenous rehydration may be necessary.
- Ringer's lactate is the preferred solution, often with added potassium. Large volumes and continued replacement until diarrhea has subsided may be needed.
- Ten percent of a person's body weight in fluid may need to be given in the first two to four hours. This method was first tried on a mass scale during the Bangladesh Liberation War, and was found to have much success.
- If commercially produced oral rehydration solutions are too expensive or difficult to obtain, solutions can be made.
- One such recipe calls for 1 litre of boiled water, 1/2 teaspoon of salt, 6 teaspoons of sugar, and added mashed banana for potassium and to improve taste.





Treatment

Electrolytes

- As there frequently is initially acidosis, the potassium level may be normal, even though large losses have occurred.
- As the dehydration is corrected, potassium levels may decrease rapidly, and thus need to be replaced.

Treatment

Antibiotics

- Antibiotic treatments for one to three days shorten the course of the disease and reduce the severity of the symptoms. People will recover without them, however, if sufficient hydration is maintained.
- Doxycycline is typically used first line, although some strains of *V. cholerae* have shown resistance. Testing for resistance during an outbreak can help determine appropriate future choices.
- Other antibiotics proven to be effective include cotrimoxazole, erythromycin, tetracycline, chloramphenicol, and furazolidone. Fluoroquinolones, such as norfloxacin, also may be used, but resistance has been reported.
- In many areas of the world, antibiotic resistance is increasing. In Bangladesh, for example, most cases are resistant to tetracycline, trimethoprim-sulfamethoxazole, and erythromycin.
- Rapid diagnostic assay methods are available for the identification of multiple drug-resistant cases.
- New generation antimicrobials have been discovered which are effective against in vitro studies.

Cholera hospital in Dhaka, showing typical "cholera beds"



Prognosis

- If people with cholera are treated quickly and properly, the mortality rate is less than 1%; however, with untreated cholera, the mortality rate rises to 50–60%.
- For certain genetic strains of cholera, such as the one present during the 2010 epidemic in Haiti and the 2004 outbreak in India, death can occur within two hours of becoming ill.



Prevention

- Although cholera may be life-threatening, prevention of the disease is normally straightforward if proper sanitation practices are followed. In developed countries, due to nearly universal advanced water treatment and sanitation practices, cholera is no longer a major health threat.
- Effective sanitation practices, if instituted and adhered to in time, are usually sufficient to stop an epidemic.

Hand bill from the New York City Board of Health, 1832 - the outdated public health advice demonstrates the lack of understanding of the disease and its actual causative factors.

NOTICE.

PREVENTIVES OF

CHOLERA!

Published by order of the Sanatory Committee, under the sanction of the Medical Counsel.

BE TEMPERATE IN EATING & DRINKING!

Avoid Raw Vegetables and Unripe Fruit !.

Abstain from COLD WATER, when heated, and above all from Ardent Spirits, and if habit have rendered them indispensable, take much less than usual.

Prevention

There are several points along the cholera transmission path at which its spread may be halted:

- **Sterilization:** Proper disposal and treatment of infected fecal waste water produced by cholera victims and all contaminated materials (e.g. clothing, bedding, etc.) are essential. All materials that come in contact with cholera patients should be sanitized by washing in hot water, using chlorine bleach if possible. Hands that touch cholera patients or their clothing, bedding, etc., should be thoroughly cleaned and disinfected with chlorinated water or other effective antimicrobial agents.
- **Sewage:** antibacterial treatment of general sewage by chlorine, ozone, ultraviolet light or other effective treatment before it enters the waterways or underground water supplies helps prevent undiagnosed patients from inadvertently spreading the disease.

Prevention

- **Sources:** Warnings about possible cholera contamination should be posted around contaminated water sources with directions on how to decontaminate the water (boiling, chlorination etc.) for possible use.
- **Water purification:** All water used for drinking, washing, or cooking should be sterilized by either boiling, chlorination, ozone water treatment, ultraviolet light sterilization (e.g. by solar water disinfection), or antimicrobial filtration in any area where cholera may be present. Chlorination and boiling are often the least expensive and most effective means of halting transmission. Cloth filters or sari filtration, though very basic, have significantly reduced the occurrence of cholera when used in poor villages in Bangladesh that rely on untreated surface water. Better antimicrobial filters, like those present in advanced individual water treatment hiking kits, are most effective. Public health education and adherence to appropriate sanitation practices are of primary importance to help prevent and control transmission of cholera and other diseases.