

Understanding Cholera: Causes, transmission and History of Epidemiology

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Abstract

Cholera is a highly infectious diarrheal disease caused by the bacterium *Vibrio cholerae*, often transmitted through contaminated water or food. Characterized by rapid dehydration and potential death if untreated, cholera remains a major public health concern, especially in regions lacking clean water and proper sanitation. Understanding its causes and transmission pathways is crucial for controlling outbreaks and reducing mortality. This paper also explores the historical development of cholera epidemiology from early pandemics to John Snow's pioneering work in the 19th century highlighting how past discoveries have shaped modern public health responses to waterborne diseases.

Keywords: Cholera; *Vibrio cholerae*; Waterborne disease; Diarrheal illness; Cholera symptoms; Cholera causes; Cholera transmission; Cholera prevention; Cholera treatment; Oral rehydration therapy; Contaminated water; Sanitation and hygiene; Cholera vaccine; Public health; Endemic cholerae

Introduction

Cholera is a severe diarrheal disease caused by the bacterium *Vibrio cholerae*. It spreads through contaminated water and food, leading to acute dehydration and, if untreated, death. Despite being preventable and treatable, cholera remains a major public health issue in many parts of the world, particularly in regions with poor sanitation and limited access to clean drinking water [1]. Cholera is a highly contagious, acute diarrheal disease caused by the ingestion of food or water contaminated with the bacterium *Vibrio cholerae*. It remains a global health concern, particularly in areas where access to clean water, proper sanitation, and adequate healthcare is limited [2]. Although largely preventable and treatable, cholera continues to affect millions of people worldwide, particularly in parts of Africa, South Asia, and Latin America, where it can cause widespread outbreaks with high morbidity and mortality rates [3]. The disease is characterized by sudden onset of profuse watery diarrhea, which can lead to severe dehydration, electrolyte imbalances, and, if left untreated, death within hours [4]. Cholera thrives in environments lacking clean water infrastructure and is often triggered by natural disasters, refugee crises, and conflict zones where public health systems are overwhelmed or disrupted [5].

Understanding the causes, symptoms, methods of prevention, and treatment options for cholera is essential for individuals, healthcare providers, and governments alike [6]. Timely interventions such as oral rehydration therapy (ORT), intravenous fluids, antibiotics in severe cases, and public health measures including vaccination campaigns and improved sanitation can significantly reduce the impact of the disease [7]. Additionally, community education on hygiene practices and safe water usage plays a vital role in curbing its spread. Cholera has a long and devastating history. The first pandemic occurred in 1817 in the Indian subcontinent, spreading across Asia, Europe, and Africa. Since then, several cholera pandemics have swept the globe, with the most recent ongoing pandemic (the seventh) beginning in 1961, caused by the *Vibrio cholerae* El Tor strain [8].

According to the World Health Organization (WHO), cholera affects between 1.3 and 4 million people annually, resulting in 21,000 to 143,000 deaths. The disease is most prevalent in areas with poor sanitation infrastructure, including parts of Africa, South Asia, and Latin America.

Causes and transmission

Cholera is caused by the ingestion of *Vibrio cholerae* bacteria. The primary mode of transmission is through:

Contaminated water: Drinking or using water polluted with human feces containing the bacteria.

Contaminated food: Consuming raw or undercooked seafood, fruits, or vegetables washed with infected water.

Person-to-person transmission: Though rare, direct contact with infected individuals or contaminated surfaces can lead to infection.

Once ingested, the bacteria colonize the small intestine and produce a toxin called cholera toxin (CT). This toxin triggers the release of large amounts of water and electrolytes into the intestines, causing severe diarrhea.

Cholera symptoms range from mild to severe, with some individuals remaining asymptomatic. Common symptoms include:

Severe watery diarrhoea

Vomiting

Dehydration symptoms

Muscle cramps

Shock

The incubation period ranges from a few hours to five days, with symptoms typically appearing 12 to 72 hours after exposure.

Treatment

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Cholera treatment focuses on rapid rehydration and antibiotic therapy.

Oral rehydration solution (ORS), a mixture of salts and glucose dissolved in water, used to replace lost fluids and electrolytes.

Intravenous (IV) fluids, for severe cases where ORS is insufficient.

Doxycycline or azithromycin, recommended for moderate-to-severe cases to reduce the duration and severity of diarrhea.

Zinc supplementation, for children, as it reduces the severity and duration of diarrhea.

Cholera prevention strategies focus on improving water, sanitation, and hygiene (WASH) practices.

Safe water access, boiling, chlorinating, or filtering water.

Proper sanitation, safe disposal of feces to prevent water contamination.

Hand hygiene, regular handwashing with soap, especially before eating and after using the toilet.

Vaccination

There are three WHO-prequalified oral cholera vaccines (OCVs):

Dukoral- Provides protection for around two years.

Shanchol and euvichol-plus, provide protection for three years. Mass vaccination campaigns are conducted in outbreak-prone areas.

Avoid consuming raw or undercooked seafood.

Wash fruits and vegetables with safe water.

Eat food while it is still hot.

Cholera and global health

Cholera is both a public health and socio-economic issue. Outbreaks often occur in regions affected by:

Conflict and displacement, refugee camps with poor sanitation conditions are particularly vulnerable.

Natural disasters, floods and hurricanes can damage sanitation

infrastructure, increasing cholera risk.

Climate change, rising temperatures and flooding can exacerbate cholera outbreaks.

Conclusion

Cholera is a preventable and treatable disease, yet it continues to claim thousands of lives annually. Improved access to clean water, sanitation, and vaccines is key to controlling and eventually eradicating cholera. Public health efforts must focus on prevention strategies, rapid response to outbreaks, and long-term infrastructure improvements to reduce the global burden of cholera.

The historical evolution of cholera epidemiology from early misconceptions to modern scientific understanding illustrates the power of public health research in transforming disease control. With coordinated global action and community-based prevention strategies, cholera can be effectively managed and, ultimately, eliminated as a public health threat.

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