



Cholera Overview – National , Regional and Global : A Narrative Review

Mohammed Amood Al Kamarany ^{1,2 *}, Abdullah Zuhairy ²¹ Center of Tropical Medicine and Epidemiology Studies of Hodeidah University (CTMES-HU), Hodeidah, Yemen² Center of Tropical Medicine and Infectious Diseases (CTMID) , Authority of Public AL Thawara Hospital, Hodeidah, Yemen*Corresponding author E-mail: alkamarany@gmail.com ; alkamarany2022@hoduniv.net.ye

Received: 01 January 2025. Accepted: 28 June 2025. Published: 30 June 2025.

Abstract

This narrative review aims to provide an updated overview of cholera and describe its situation in Yemen at the national level, in Arab countries at the regional level, and globally at the continental level. Cholera is a bacterial infection of the small intestine caused by *Vibrio cholerae* (*V. cholerae*). Initially confined to Asia, the disease spread globally in 1817, triggering the first pandemic from India. In 1854, a cholera outbreak in Soho, London, was investigated by English physician John Snow (1813–1858), whose findings contributed to understanding disease transmission. The causative agent of cholera was identified twice—first by Italian physician Filippo Pacini during an outbreak in Florence, Italy, in 1854, and later, independently, by Robert Koch in India in 1883. In Yemen, cholera was first reported in 1971, with smaller outbreaks occurring in 2010. Since 2015, the country has faced an ongoing humanitarian crisis, compounded by the worst global cholera epidemic since 2016. The outbreak spread to 92% of the country, affecting 305 districts and 22 of 23 governorates, with Hodeidah experiencing the highest burden. Cholera is primarily transmitted through the fecal-oral route via contaminated food or water, often due to poor sanitation. In healthy adults, an infectious dose of approximately 100 million bacteria is required to cause illness, though this threshold is lower in individuals with reduced gastric acidity. Children, particularly those aged two to four, are especially vulnerable. The infection leads to the rapid loss of large volumes of watery stool due to cholera toxin, resulting in severe dehydration and shock. Symptoms vary from asymptomatic to mild, moderate, or severe cases. The hallmark symptom is profuse watery diarrhea lasting several days, often accompanied by vomiting and muscle cramps. Severe diarrhea can cause life-threatening dehydration, electrolyte imbalances, and acute renal failure. Other signs include sunken eyes, cold skin, decreased skin elasticity, and wrinkled hands and feet. In extreme cases, dehydration may lead to a bluish skin tone. Symptoms typically appear between two hours and five days after infection. A rapid dipstick test can detect *V. cholerae*, and clinical diagnosis is based on patient history and examination. Stool and swab samples collected during the acute phase, before antibiotic treatment, are crucial for laboratory confirmation. The most common strains responsible for outbreaks are *V. cholerae* O1 and O139. Treatment primarily involves fluid replacement therapy, which reduces the mortality rate from over 50% to below 0.2%. Antibiotic therapy is recommended for moderate to severe dehydration, as it can decrease both the volume and duration of diarrhea by 50%. Preventative measures include ensuring access to clean water, improved sanitation, and oral cholera vaccines (OCVs).

Keywords: Cholera , Overview , Globally , Regionally , Nationally , Yemen

1. Introduction

1.1. History

Cholera is an acute infectious disease affecting the digestive system, caused by the bacterium *Vibrio cholerae* (*V. cholerae*). Initially confined to Asia, cholera began spreading globally in 1817 during the first recorded pandemic, originating in India. In 1854, a cholera outbreak in Soho, London, was investigated by English physician John Snow (1813–1858), who made significant contributions to understanding its transmission. The causative agent of cholera was independently identified twice: first by Italian physician Filippo Pacini during an outbreak in Florence, Italy, in 1854, and later by Robert Koch in India in 1883 [1-10].

1.2. Causative agent

Cholera is caused by the gram-negative bacterium *V. cholerae*. The disease is considered laboratory-confirmed when *V. cholerae* O1 or O139 is detected in a patient's stool or vomit. [11] (Table 2).

Table 1. History of cholera

Pandemic	Country	Date
• First	India	1817 – 1824
• Second	North America and Europe	1826 to 1837
• Third	North Africa	1846 – 1860
• Fourth	India and Spain	1863 – 1875
• Fifth	India	1881 – 1889
• Sixth	India	1899 - 1923
• Seventh	Indonesia	1961 – present

1.3. Mode of cholera transmission

Table 2. Mode of cholera transmission [12-18]

Mode of transmission	Fecal-oral route
	• Water – borne transmitted disease
	• Transmission by food
	• From one person to another
	• Transmission within a group of people
	• Role of the cholera carriers

1.4. Risk factors and determinants

Table 3. Risk factors and determinants of cholera

Risk factors and determinants of cholera	1.4.1. Biological factors Cholera and age : The relationship between the cholera and age were reported by previous studies in Asia [19,20] (1948) , Europe (1973) [12] , Africa (1970 to 197) reported that the association between age and cholera attack is rather weak. Cholera and sex : Several previous studies have reported a relationship between cholera and gender, indicating that women were most affected due to their responsibility for water and sanitation tasks at home, including washing clothes and caring for children [20,21].
	1.4.2. Socio-economic Cholera and socio-economic factors: Cholera is more likely to attack low income earners [22].
	1.4.3. Behavioral factors Informed behavior toward cholera : A previous study found that key behavioral factors contributing to cholera risk included drinking untreated water (37.2%). School-based messages accounted for 24.6% of prevention efforts, while media sources (print, audio, and visual) contributed 17.6%. Informal sources played a smaller role at 13.6%, with community campaigns being the least influential at 7%. Overall, public health information promoters effectively targeted their audiences with appropriate messages, leading to improved coverage [23].
	1.4.4. Environmental factors Water, sanitation and hygiene (WASH): Africa and Asia, in particular, face challenges with compromised sanitation conditions. While maintaining a clean physical environment is the responsibility of local communities, ensuring adequate sanitation remains a pressing concern. [22]. Controversies regarding role of the climate factors : Season and climate did not affect the spreading of the cholera infection , but lack of clean water did [23,24].

1.5. Clinical profile of cholera

1.5.1. Infectious dose in humans

The infectious dose of *V. cholerae* in humans varies significantly based on the bacterial strain and the host. A previous study on healthy North American volunteers found that doses ranging from 10^8 to 10^{11} cells were needed for consistent colonization. However, when a bicarbonate buffer was administered to neutralize stomach acid before inoculation, the required dose decreased to 10^4 – 10^8 cells, resulting in an infection rate of 90%.

1.5.2. Pathophysiology

V. cholerae produces a toxin that strongly stimulates adenylate cyclase, prompting the intestine to secrete large volumes of watery fluid rich in sodium, bicarbonate, and potassium. This secretion far exceeds the intestine's absorptive capacity, leading to profuse watery diarrhea. The resulting fluid loss can cause severe dehydration and shock, progressing rapidly. Without proper medical intervention, particularly rehydration therapy, severe cholera has a fatality rate of approximately 50% in affected individuals.

1.5.3. Symptoms and signs

The most *V. cholerae* symptoms are sudden, painless and profuse watery diarrhea, dehydration and abdominal pain. Also, may experience occasional vomiting. Other symptoms such as excretion of large volumes of non-bloody rice-watery stools, muscle cramps and signs of shock are not uncommon [18]. The degree of infection is classified depending on its severity. This grouping varies from mild, moderate to severe. If the case is severe, dehydration, metabolic acidosis, renal and/or circulatory collapse may occur leading to sudden death [25].

Table 4. Severity of cholera

Severity of cholera	Mild case : No thirst, skin goes back normally when pinched , passing urine is good , pulse is normal
	Moderate case : Restlessness and irritability , sunken eyes, dry mouth and tongue , increased thirst , skin goes back slowly when pinched, decreased urine , decreased tears ,
	Severe case: Lethargy , unconsciousness , very dry mouth and tongue, skin goes back very slowly when pinched , weak or absent pulse , low blood pressure , minimal or no urine
	Critical case : Organs failure such as acute renal failure

1.5.4. Complications

The most common complications of *V. cholerae* are severe and rapid dehydration within hours, leading to hypovolemic shock and metabolic acidosis, which can potentially be fatal [25].

Table 5. Complications of cholera

Complication of cholera	Dehydration (Electrolytes imbalance)
	Acute Renal failure
	Shock (Hypotension)
	Hypoglycemia
	Blue death

1.5.4. Cholera case management

1.5.4.1. Diagnosis

The cholera is diagnosed of cholera clinically with direct treatment to control on the dehydration. On the other hand , the cholera is diagnosed in laboratory based rapid test and confirmed using golden microbiological [26]

Table 6. Diagnosis of cholera

Diagnosis of cholera	Clinically - Acute watery diphtheria - Dehydration assessment
	Laboratory - Rapid test - Microbiological assay
	Other test - Electrolytes assay - Renal function test

1.4.3.2. Treatment

Patient management for cholera primarily involves fluid replacement, which significantly reduces the mortality rate from over 50% to less than 0.2%. Effective antibiotic treatment can also decrease the volume and duration of diarrhea by 50% and is recommended for cases with moderate to severe dehydration. The majority of cholera cases are treated using oral rehydration solution (ORS), a glucose and electrolyte solution that helps replenish lost fluids and electrolytes. Approximately 80–90% of mild to moderate cases can be managed with ORS alone, while around 20% of patients with severe dehydration require intravenous fluids, such as Ringer's lactate, until diarrhea subsides. In cases of hypoglycemia, particularly in pediatric patients, glucose supplementation may be necessary. Although antibiotic prophylaxis is not a standard intervention, antimicrobial agents are used to shorten the duration of symptoms [27-30].

Table 7. Treatment of cholera

Treatment of cholera	• Dehydration assessment
	• Rehydration therapy
	• Monitoring
	• Antibiotic
	• Nutrition

1.6. Prevention measures of cholera

Table 8. Prevention of cholera

6. Prevention measures of cholera	6.1. Water, Sanitation and Hygiene (WASH): Previous studies have concluded that promoting soap use and hand washing can lead to a 26% to 62% reduction in diarrhea incidence in developing countries [31].
	6.2 Cholera vaccine The World Health Organization (WHO) recommends the implementation of cholera immunization alongside other prevention and control measures in areas where cholera is endemic, and potentially in regions at risk of outbreaks [32,33]. Notably, cholera vaccines are not recommended for children under the age of two. There are two types of cholera vaccines available: an oral vaccine and a live attenuated vaccine [18]. However, most studies indicate that the current cholera vaccines offer protection for a relatively short period, typically around six months [18]. Vaccination may still be beneficial for individuals at higher risk, such as elderly people and children over the age of two, especially if they are traveling to areas where cholera risk is heightened. While vaccines can protect individuals from illness, they do not prevent the spread of cholera in endemic populations [34].
	6.3. Health promotion strategies to reduce the susceptibility to cholera infection
	1.6.1. Health education Health education, including practices like hand washing, can reduce diarrheal incidences by at least 33% [35].
	1.6.2. Meeting minimum water requirement standards Travelers are advised to carry safe bottled or boiled water. It's also recommended to avoid high-risk foods and drinks, particularly seafood and items from street vendors [18].

1.6.3. Personal hygiene
Cholera infections are more likely to spread due to poor sanitation and inadequate personal hygiene practices. The community needs to adopt proper hygiene habits, with hand washing stations, soap, and towels readily accessible for use after using the toilet [21].

2. Cholera epidemiology

2.1 Global epidemiology

Despite efforts to control cholera, it remains an emerging and re-emerging infectious disease and continues to pose a significant public health threat, particularly in developing countries. Its rapid spread and potential to cause large-scale epidemics impose a heavy economic burden on endemic regions [16,36].

- Since 1996, Africa has reported the highest number of cholera cases globally [1].
- In recent years, major cholera outbreaks have occurred in Haiti, Vietnam, Zimbabwe, Angola, Ethiopia, Somalia, and Sudan [37 - 40].
- The 2008 outbreak in Zimbabwe lasted over a year, resulting in more than 98,000 cases and over 4,000 deaths. Similarly, in 2011, Haiti experienced a cholera epidemic with 522,335 reported cases and 7,001 deaths [16,41-43].
- Cholera remains a leading cause of mortality worldwide among children under five and a significant contributor to morbidity [44].
- Cholera is now secluded to the tropical and subtropical. The disease is now largely confined to tropical and sub-

tropical regions where poor sanitation persists. As a result, outbreaks are rare in developed countries with proper water, sanitation, and food hygiene standards. Unfortunately, cholera continues to affect less developed nations, where the majority of the population resides.[45].

- The risk of cholera in the United States and other developed nations is minimal, making it a predominant issue in Africa, Asia, and South America. Between 1995 and 2005, approximately 88% of cholera cases occurred in Sub-Saharan Africa, followed by Southeast Asia. [38].

2.2. Recent cholera outbreaks in the region

Large, high-mortality cholera outbreaks are regularly reported in East Africa and the Middle East, highlighting the persistent presence of the disease in both regions surrounding Yemen. In Somalia, annual outbreaks occurred from 2011 (77,636 cases, 1,130 deaths, CFR=1.46%) to 2016 (15,619 cases, 534 deaths, CFR=3.5%) [47]. Iraq experiences outbreaks approximately every two years. Factors such as conflict, famine, acute malnutrition, inadequate WASH infrastructure, poor hygiene practices, and displacement contribute to the rapid spread of cholera in both countries.

Table 9. Cholera in the region

Outbreak	Incidence	CFR (%)	Date
Somalia	77636	1.46	2011
Iraq	15619	3.5	2016

2.3. Cholera outbreaks in Yemen

Between 2009 and 2011, Yemen experienced multiple cholera outbreaks following a 15-year interepidemic period. Small outbreaks of 55 to 300 cases were reported in 2009 and 2010, while a larger outbreak in 2011 resulted in approximately 30,000 acute watery diarrhea (AWD) or suspected cholera cases (attack rate: 1.4%) and 134 deaths, "case fatality rate (CFR) <1%". This outbreak primarily affected the southern governorates of Aden, Abyan, and Al-Dhale'e, with fewer cases in Lahj and Ibb, largely due to the deterioration of WASH infrastructure and healthcare services caused by conflict [48]. The most severe cholera outbreak began in October 2016, with 1,423,700 suspected cases and 4,510 laboratory-confirmed cases reported across 306 of 333 districts by January 2019. This outbreak resulted in 2,767 deaths, with a CFR of 0.2% [49]. It remains the largest recorded cholera outbreak in recent history, likely driven by the collapse of public services, including hygiene and sanitation, due to the ongoing war. Beyond the humanitarian crisis, Yemen faces additional challenges such as population displacement, shortages of essential goods and services, and the overall breakdown of public infrastructure. Over the past decade, the country has experienced multiple cholera outbreaks, with smaller ones in 2009, 2010, and 2011, showing CFRs of 5.5%, 1.3%, and 0.4%, respectively. Since 2016, the epidemic has spread extensively, affecting nearly the entire country [50-52].

Table 10. Cholera in Yemen [49-52]

Epidemic	Incidence	CFR (%)
Yemen		
2009	55	5.5
2010	300	1.3
2011	30000	0.4
2016	1,423,700	0.2
2017	1,009,554	0.24

How cholera affects the body

Cholera is an acute intestinal infection that causes severe diarrhea, dehydration and, if not treated promptly, death.

How it spreads

- People ingest water or food contaminated with cholera bacteria
- In epidemic, feces of diseased person is source of contamination

Treatment

- Salt solution, intravenous fluids, antibiotics
- In unprepared communities, death rates can be as high as 50 percent

In the large intestine

- 1 Bacteria multiply rapidly

- 2 Toxin from bacteria penetrates cells of intestinal wall

- 3 Toxin prevents intestine from absorbing water from digested food; diarrhea, dehydration result

© 2010 MCT
Source: World Health Organization

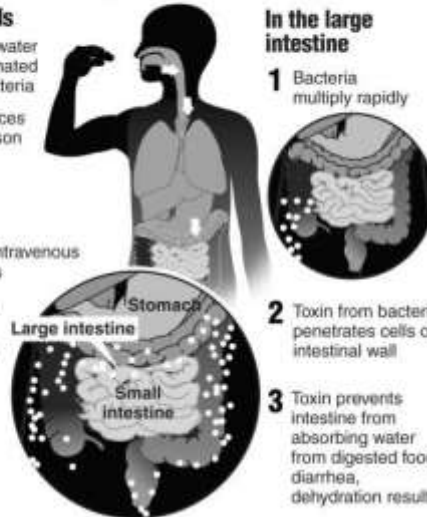


Figure 1. Pathogenesis of toxigenic *V. cholerae*. (A) Toxigenic *V. cholerae* produces several virulence factors that contribute to its pathogenesis [53]. https://www.researchgate.net/publication/310603313_A_Case_Study_Cholera

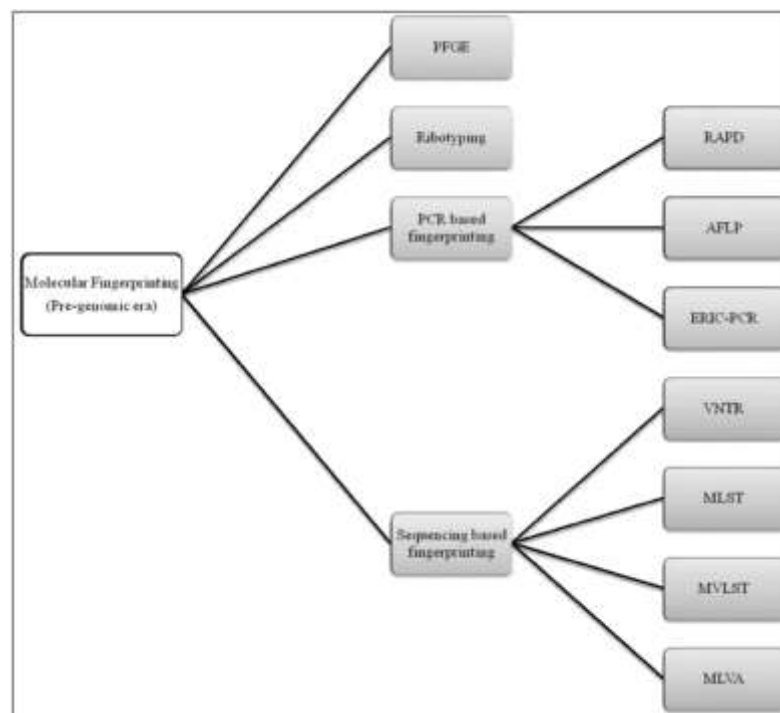


Figure 2. A chart of molecular fingerprinting strategies used in epidemiological investigations of *V. cholerae* [55]

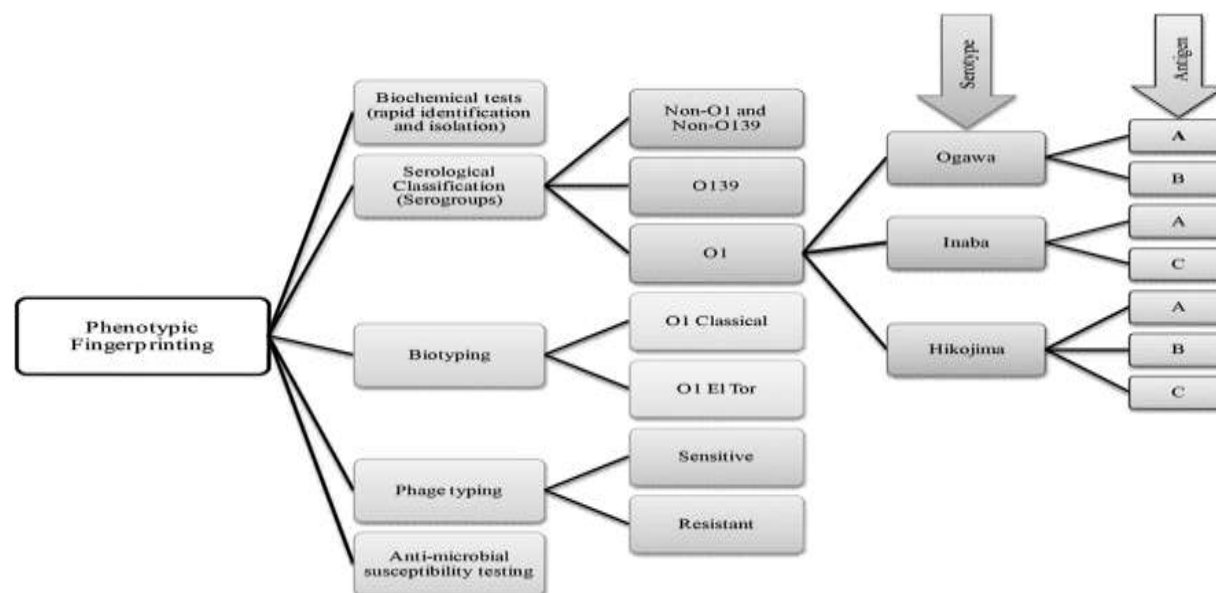


Figure 3. Molecular tools in understanding the evolution of *V. cholerae* [54]

- In 1854, a cholera outbreak in Soho, London, was investigated by the English physician John Snow .
- Germ responsible for cholera was discovered twice: first by the Italian physician Filippo Pacini during an outbreak in Florence, Italy, in 1854, and –
- then independently by Robert Koch in India in 1883

- Serological classification established (1916)
- Phage type developed (1923)

- Biotype established (1959)

Ribotyping began (1986)
PFGE, RAPD (1990)
AFLP (1995)
MLST (1998)
- WGS 2000
- VNTR 2002
- MLVA 2009
- MVLST 2011

Year	1810	1820	1830	1840	1850	1860	1870	1880	1890	1900	1910	1920	1930	1940	1950	1960	1970	1980	1999	2000	2010	---
Fast five pandemic classic Biotype											6 th pandemic 1989 – 1923 Classic Biotype	Pandemic free period (1923-1961) El Tor				7 th pandemic (1961 – present) El Tor Biotype						

Figure 4. Molecular tools in understanding the evolution of *V. cholerae* [55]

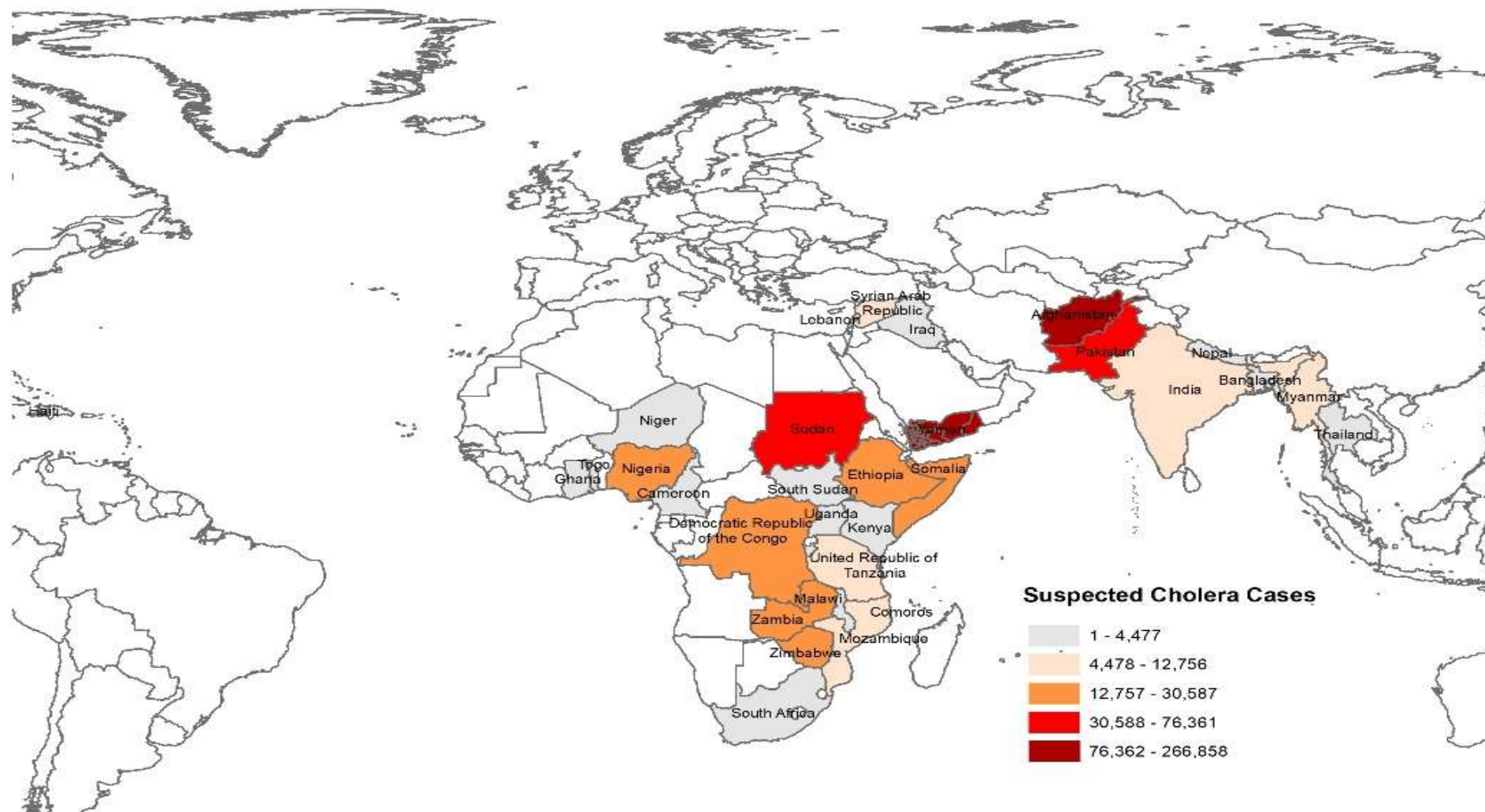


Figure 5. World Health Organization. (2022, December 16). Cholera – Global situation [Disease Outbreak News]. World Health Organization. <https://www.who.int/emergencies/disease-outbreak-news/item/2022-DON426> [56]

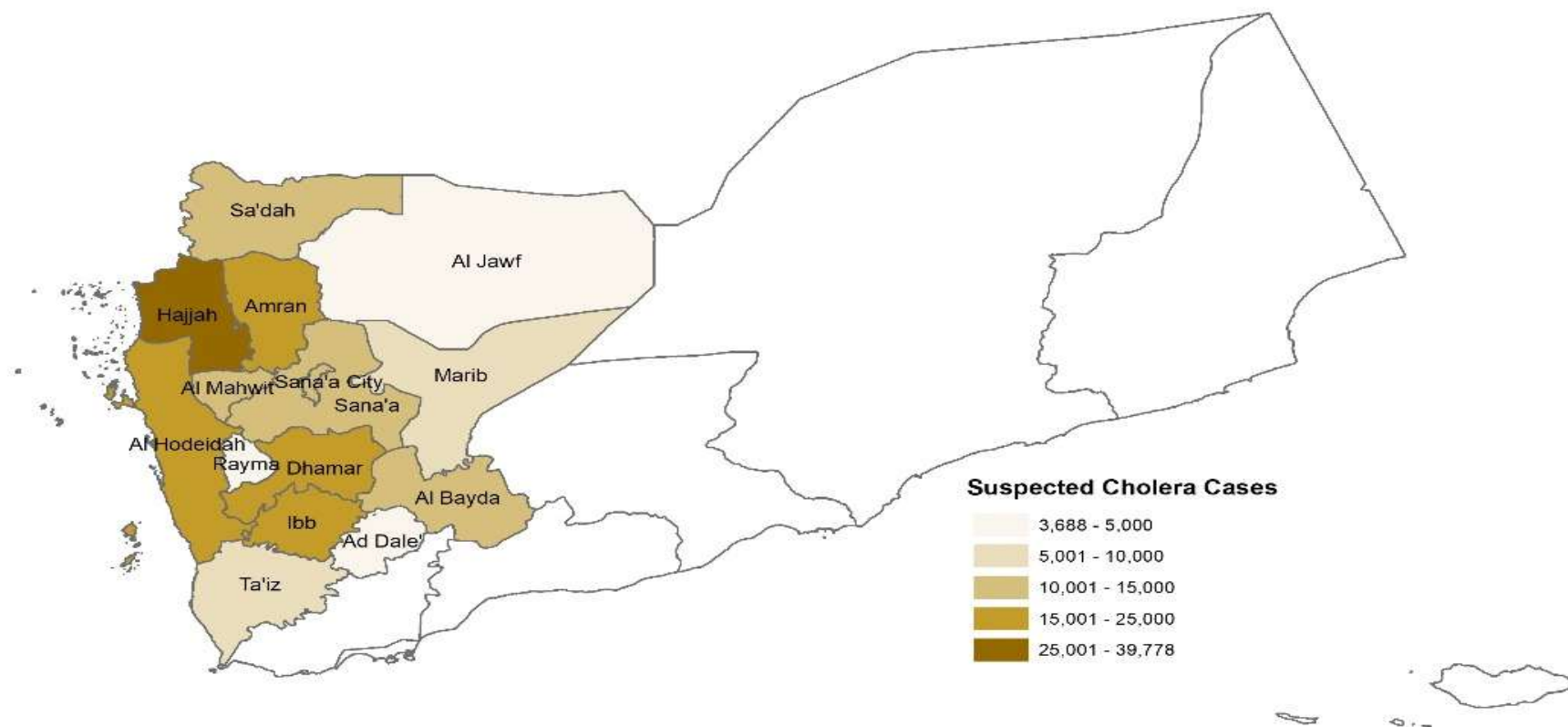


Figure 6. WHO Yemen. (2024, December 23). WHO Yemen: Yemen reports the highest burden of cholera globally. *United Nations in Yemen*. <https://yemen.un.org/en/286445-who-yemen-yemen-reports-highest-burden-cholera-globally> [57]

Table 11. Reported cholera and AWD cases and deaths by WHO region, as of 24 November 2024

WHO Region	Country, area, territory	1 January to 24 November 2024				Last 28 days				
		Cases	Deaths	Cases per 100 000	CFR (%)	Cases	Deaths	CFR (%)	Monthly cases % change	Monthly deaths % change
African Region	Burundi	835	3	7	0.4	12	0	0	33	
	Cameroon	81	50	0	61.7	32	1	3.1		
	Comoros [§]	10 549	152	1 283	1.4					
	Democratic Republic of the Congo	28 804	409	24	1.4	1 783	20	1.1	-3	-33
	Ethiopia	26 718	263	36	1	276	8	2.9	-46	-27
	Ghana	2 244	18	7	0.8	2 233	18	0.8	24 711	
	Kenya [§]	613	5	1	0.8					
	Malawi	386	11	2	2.8	41	7	17.1	-2	250
	Mozambique	8 299	22	29	0.3	145	4	2.8	559	
	Niger	1 064	23	5	2.2	37	2	5.4	-89	-50
	Nigeria	19 178	702	9	3.7	2 039	99	4.9	-53	14
	South Africa [§]	11	0	0	0					
	South Sudan	697	7	6	1.0	646	7	1.1	1 192	
	Togo	167	12	2	7.2	96	4	4.2	45	-43
	Uganda	96	5	0	5.2	7	0	0		
	United Republic of Tanzania	10 061	134	16	1.3	2 695	19	0.7	120	27
	Zambia [§]	20 219	637	103	3.2					
	Zimbabwe	20 135	400	133	2	102	1	1		
Eastern Mediterranean Region	Afghanistan**	165 629	84	506	0.1	10246	7	0.1	-17	-12
	Iraq [§]	571	1	1	0.2					
	Lebanon [§]	1	0	0	0					
	Pakistan***	72 832	0	31	0	3 529	0	0	-48	
	Somalia [§]	20 159	138	123	0.7					
	Sudan	38 903	1 009	93	2.6	13199	266	2	32	4
	Syrian Arab Republic [§]	10 563	0	48	0					
	Yemen [¥]	245 776	861	729	0.4	21082	71	0.3	9	20
European Region	Mayotte [§]	221	2	69	0.9					
Region of the Americas	Haiti	10 556	162	91	1.5	100	4	4	-58	-69
South-East Asia Region	Bangladesh	376	0	42	0	116	0	0	170	
	India ^{§#}	10 615	52	1	0.5					
	Myanmar	7 498	0	14	0	333	0	0	-74	
	Nepal [§]	95	0	0	0					
	Thailand [§]	5	0	0	0					

* Case and death numbers presented are not directly comparable due to differences in case definitions, reporting systems, and general underreporting. All data are subject to verification and change due to data availability and accessibility. Respective figures and numbers will be updated as more information becomes available. The data in Table 1 includes suspected, rapid diagnostic test (RDT) positive, and culture-confirmed cholera cases. ** Afghanistan and Myanmar report AWD cases. *** The reported number of suspected cholera and AWD cases is based on the available [Public Health Bulletin published by the National Institute of Health of Pakistan](#). . § Countries which did not report cholera cases between 1 and 24 November 2024. ¥ Includes all reported suspected cholera and AWD cases from Yemen. # Among the total of 10 615 cases reported from India, 481 cases were confirmed [56].

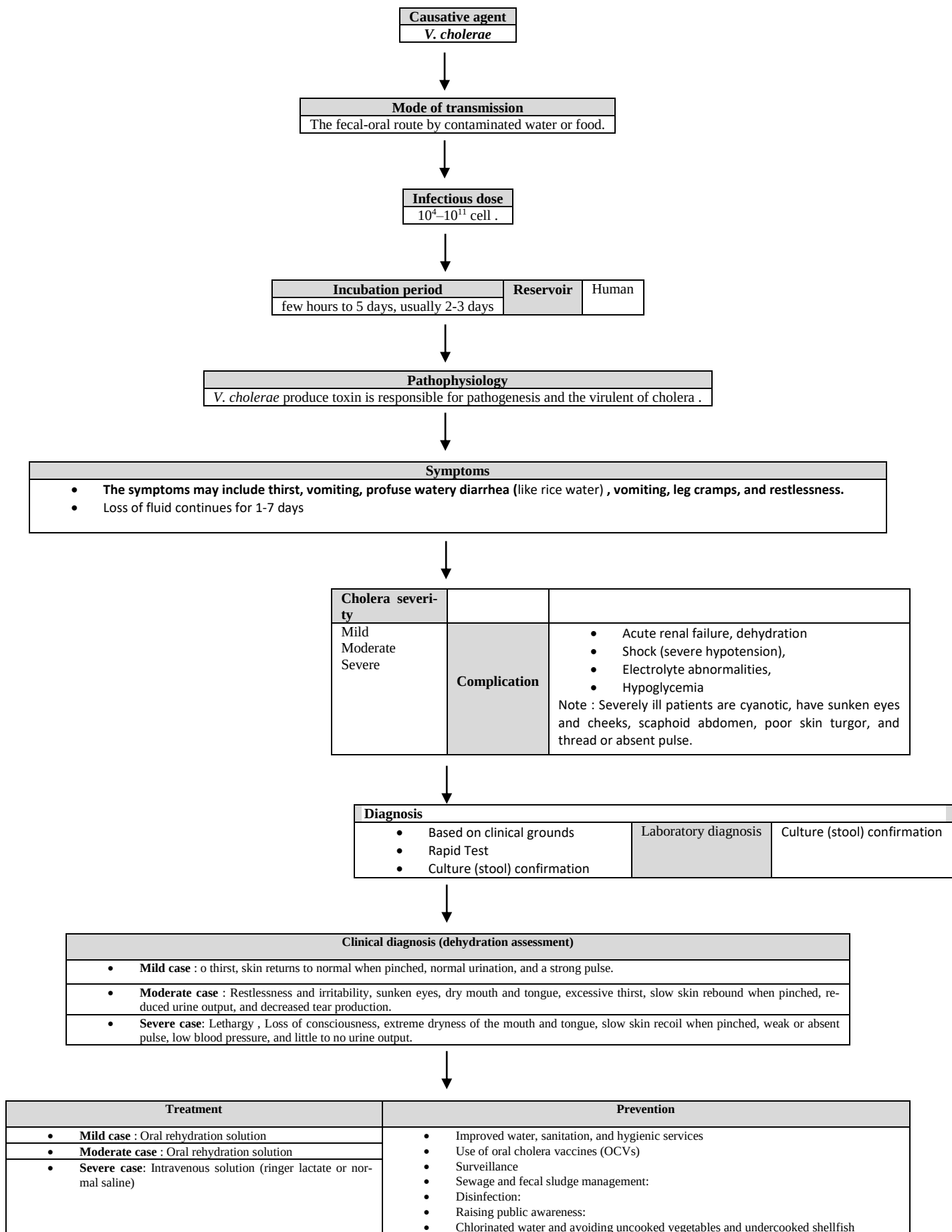


Figure 7. Schematic of cholera infection – pathogenesis – diagnosis – treatment and prevention [58]

3. Conclusion

Cholera is a bacterial infection of the small intestine caused by *V. cholerae*, spreading primarily through contaminated food and water. It originated in Asia and began spreading globally in 1817. A key breakthrough in understanding its transmission came in 1854 when John Snow investigated an outbreak in London. Yemen first reported cholera in 1971, with major outbreaks since 2016. The disease causes profuse watery diarrhea, vomiting, and muscle cramps, leading to severe dehydration and complications like acute renal failure. Symptoms range from mild to severe, appearing within hours to days after infection.

Data Availability

No data were used to support this study.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

This work was conducted during our work at CTMID – Al Thawara Public Hospital Authority, Hodeidah, Yemen.

Ethical Approval

The studies involving human participants were reviewed and approved by Ethics Committee of Tropical Medicine and Epidemiology Studies of Hodeidah University (CTMES-HU) Hodeidah, Yemen.

How to Cite : Amod Al Kamarany, M., & Zuhairy, A. (2025). The Cholera in Overview – National, Regional and Global : A Narrative Review. *Abhath Journal of Basic and Applied Sciences*, 4(1), 1–11.

References

- Kindhauser, Mary Kay & World Health Organization. (2003). Communicable diseases 2002 : global defence against the infectious disease threat / edited by Mary Kay Kindhauser. World Health Organization. <https://iris.who.int/handle/10665/42572>
- Harris, J. B., LaRocque, R. C., Qadri, F., Ryan, E. T., & Calderwood, S. B. (2012). Cholera. *Lancet* (London, England), 379(9835), 2466–2476. [https://doi.org/10.1016/S0140-6736\(12\)60436-X](https://doi.org/10.1016/S0140-6736(12)60436-X)
- Winkelstein W., Jr (1995). A new perspective on John Snow's communicable disease theory. *American journal of epidemiology*, 142(9 Suppl), S3–S9. https://doi.org/10.1093/aje/142.supplement_9.s3
- Koch, R. An address on cholera and its bacillus. *Br. Med. J.* (1884) <https://doi.org/10.1136/bmj.2.1235.403>
- Finkelstein, R. A. (1996). Cholera, *Vibrio cholerae* O1 and O139, and Other Pathogenic Vibrios. In S. Baron (Ed.), *Medical Microbiology*. (4th ed). University of Texas Medical Branch at Galveston.
- De, S. N., & Chatterje, D. N. (2010). An experimental study of the mechanism of action of vibrio cholerae on the intestinal mucous membrane. 1953. *Bulletin of the World Health Organization*, 88(3), 239–240.
- Jump, R. L. P., Crnich, C. J., Mody, L., Bradley, S. F., Nicolle, L. E., & Yoshikawa, T. T. (2018). Infectious Diseases in Older Adults of Long-Term Care Facilities: Update on Approach to Diagnosis and Management. *Journal of the American Geriatrics Society*, 66(4), 789–803. <https://doi.org/10.1111/jgs.15248>
- Griffith, D. C., Kelly-Hope, L. A., & Miller, M. A. (2006). Review of reported cholera outbreaks worldwide, 1995–2005. *The American journal of tropical medicine and hygiene*, 75(5), 973–977.
- O'Grady, N. P., Barie, P. S., Bartlett, J. G., Bleck, T., Carroll, K., Kalil, A. C., Linden, P., Maki, D. G., Nierman, D., Pasculle, W., Masur, H., American College of Critical Care Medicine, & Infectious Diseases Society of America (2008). Guidelines for evaluation of new fever in critically ill adult patients: 2008 update from the American College of Critical Care Medicine and the Infectious Diseases Society of America. *Critical care medicine*, 36(4), 1330–1349. <https://doi.org/10.1097/CCM.0b013e318169eda9>
- Cholera in 1994. Part I. (1995). Releve epidemiologique hebdomadaire, 70(28), 201–208.
- Tulchinsky T. H. (2018). John Snow, Cholera, the Broad Street Pump; Waterborne Diseases Then and Now. Case Studies in Public Health, 77–99. <https://doi.org/10.1016/B978-0-12-804571-8.00017-2>
- Christie, A. B. (1987). Andrew B. Infectious diseases : epidemiology and clinical practice. (Churchill Livingstone).
- Health, W. & Geneva, O. (1997). Health and Environment in Sustainable Development: Five Years after the Earth Summit EXECUTIVE SUMMARY Programmes on Health and Environment. (1997).
- Chipare, T. (2008). STRATEGIES TO COPE WITH THE IMPACT OF CHOLERA ON ZIMBABWE FROM A CASE STUDY OF BUDIRO HIGH DENSITY SUBURB, CITY OF HARARE. THESIS MASTER'S IN DISASTER MANAGEMENT
- Robert F. Betts, Stanley W. Chapman, Robert L. Penn. (2002). Reese and Betts' A Practical Approach to Infectious Diseases (Practical Approach to Infectious Diseases (Betts)) 5th Edition
- Al Kamarany, M., & Ghouth, A. S. B. (2024). The Ice Berge of Cholera in Hodeidah, Yemen: The Contact Exposure. *Studies in Medical and Health Sciences*, 1(1), 32–35. <https://doi.org/10.48185/smhs.v1i1.1169>
- World Health Organization (WHO). (2004) .The, A., Response, O. & Preparedness, I. Assessing the Outbreak Response Assessing the Outbreak Response. Technical Document .
- Selgelid, M. J. (2012). Infectious Diseases. In Encyclopedia of Applied Ethics [Doi:10.1016/B978-0-12-373932-2.00114-9](https://doi.org/10.1016/B978-0-12-373932-2.00114-9)
- DNA Blueprint of Cholera. (2000). *Journal of Environmental Health*, 63(4), Online Research Library: Questia.
- Felsenfeld O. (1966). A review of recent trends in cholera research and control. With an annex on the isolation and identification of cholera vibrios. *Bulletin of the World Health Organization*, 34(2), 161–195.
- Inter-Agency Standing Committee (IASC).(2018). The Gender Handbook for Humanitarian Action. Yemaya (2018).
- Debas T. Haile, Richard Gosselin, Colin mccord, and A. T. Surgery. In: Jamison TL, Breman JG, Measham AR et al (eds). (2006). Disease control priorities in developing countries 2nd edition. In *Oxford University Press, New York*, pp 1245–1261 1293–1307 (The International Bank for Reconstruction and Development / The World Bank).
- Mbohwa, C. (2010). Humanitarian logistics: Review and case study of Zimbabwean experiences. *J. Transp. Supply Chain Manag.* (2010) <https://doi.org/10.4102/jtscm.v4i1.67>
- The New Humanitarian. (2006). Cholera is not going away anytime soon. *Water and Sanitation News* .
- Ojeda Rodriguez, J. A., Hashmi, M. F., & Kahwaji, C. I. (2024). *Vibrio cholerae* Infection. In StatPearls. StatPearls Publishing.
- Montero, D. A., Vidal, R. M., Velasco, J., George, S., Lucero, Y., Gómez, L. A., Carreño, L. J., García-Betancourt, R., & O'Ryan, M. (2023). *Vibrio cholerae*, classification, pathogenesis, immune response, and trends in vaccine development. *Frontiers in medicine*, 10, 1155751. <https://doi.org/10.3389/fmed.2023.1155751>
- Harris, J. B., LaRocque, R. C., Qadri, F., Ryan, E. T., & Calderwood, S. B. (2012). Cholera. *Lancet* (London, England), 379(9835), 2466–2476. [https://doi.org/10.1016/S0140-6736\(12\)60436-X](https://doi.org/10.1016/S0140-6736(12)60436-X)
- Sarkar K. (2003). Role of oral rehydration therapy in controlling epidemic of cholera and watery diarrhoea. *Journal of the Indian Medical Association*, 101(6), 379–386.
- Sack, D. A., Sack, R. B., & Chaignat, C. L. (2006). Getting serious about cholera. *The New England journal of medicine*, 355(7), 649–651. <https://doi.org/10.1056/NEJMp068144>
- Saha, D., Karim, M. M., Khan, W. A., Ahmed, S., Salam, M. A., & Bennis, M. L. (2006). Single-dose azithromycin for the treatment of cholera in adults. *The New England journal of medicine*, 354(23), 2452–2462. <https://doi.org/10.1056/NEJMoa054493>
- Shahid, N. S., Greenough, W. B., 3rd, Samadi, A. R., Huq, M. I., & Rahman, N. (1996). Hand washing with soap reduces diarrhoea and spread of bacterial pathogens in a Bangladesh village. *Journal of diarrhoeal diseases research*, 14(2), 85–89.
- World Health Organization (WHO). (2010). Cholera vaccines: WHO position paper. *Wkly. Epidemiol. Rec.*
- Von Seidlein, L. (2006). Editorial: A small step for WHO, a big step for cholera control. *Tropical Medicine and International Health* doi:10.1111/j.1365-3156.2006.01771.x.
- The Sphere Project.(2011). *Humanitarian Charter and Minimum Standards in Humanitarian Response*. Doi:10.3362/9781908176202.

35. Ejemot-Nwadiaro, R. I., Ehiri, J. E., Arikpo, D., Meremikwu, M. M., & Critchley, J. A. (2021). Hand-washing promotion for preventing diarrhoea. *The Cochrane database of systematic reviews*, 12(1), CD004265. <https://doi.org/10.1002/14651858.CD004265.pub4>
36. Cash, R. A., & Narasimhan, V. (2000). Impediments to global surveillance of infectious diseases: consequences of open reporting in a global economy. *Bulletin of the World Health Organization*, 78(11), 1358–1367.
37. Chao, D. L., Halloran, M. E., & Longini, I. M., Jr (2011). Vaccination strategies for epidemic cholera in Haiti with implications for the developing world. *Proceedings of the National Academy of Sciences of the United States of America*, 108(17), 7081–7085. <https://doi.org/10.1073/pnas.1102149108>
38. Ali, M., Lopez, A. L., You, Y. A., Kim, Y. E., Sah, B., Maskery, B., & Clemens, J. (2012). The global burden of cholera. *Bulletin of the World Health Organization*, 90(3), 209–218A. <https://doi.org/10.2471/BLT.11.093427>
39. Office for the Coordination of Humanitarian Affairs (OCHA) - United Nations Zimbabwe: (2009). OCHA Cholera Update Situation Report No. 22, 15 Jul | reliefweb.
40. Harris, J. B., LaRocque, R. C., Qadri, F., Ryan, E. T., & Calderwood, S. B. (2012). Cholera. *Lancet (London, England)*, 379(9835), 2466–2476. [https://doi.org/10.1016/S0140-6736\(12\)60436-X](https://doi.org/10.1016/S0140-6736(12)60436-X)
41. Zuckerman, J. N., Rombo, L., & Fisch, A. (2007). The true burden and risk of cholera: implications for prevention and control. *The Lancet. Infectious diseases*, 7(8), 521–530. [https://doi.org/10.1016/S1473-3099\(07\)70138-X](https://doi.org/10.1016/S1473-3099(07)70138-X)
42. Das, R., Nasrin, S., Palit, P., Sobi, R. A., Sultana, A. A., Khan, S. H., Haque, M. A., Nuzhat, S., Ahmed, T., Faruque, A. S. G., & Chisti, M. J. (2023). *Vibrio cholerae* in rural and urban Bangladesh, findings from hospital-based surveillance, 2000–2021. *Scientific reports*, 13(1), 6411. <https://doi.org/10.1038/s41598-023-33576-3>
43. World Health Organization (WHO). (2004). *COMMUNICABLE DISEASE TOOLKIT LIBERIA CONTENTS*. https://iris.who.int/bitstream/handle/10665/68719/WHO_CDS_2004.24.pdf?sequence=1
44. Deen, J. L., von Seidlein, L., Sur, D., Agtini, M., Lucas, M. E., Lopez, A. L., Kim, D. R., Ali, M., & Clemens, J. D. (2008). The high burden of cholera in children: comparison of incidence from endemic areas in Asia and Africa. *PLoS neglected tropical diseases*, 2(2), e173. <https://doi.org/10.1371/journal.pntd.0000173>
45. Selgelid, M. J. (2012). Infectious Diseases. In *Encyclopedia of Applied Ethics*. <https://doi.org/10.1016/B978-0-12-373932-2.00114-9>
46. World Health Organization (WHO). (2022). Disease Outbreak News Cholera – Global situation <https://www.who.int/emergencies/disease-outbreak-news/item/2022-DON426>
47. Buliva, E., Elhakim, M., Tran Minh, N. N., Elkholy, A., Mala, P., Abubakar, A., & Malik, S. M. M. R. (2017). Emerging and Reemerging Diseases in the World Health Organization (WHO) Eastern Mediterranean Region-Progress, Challenges, and WHO Initiatives. *Frontiers in public health*, 5, 276. <https://doi.org/10.3389/fpubh.2017.00276>
48. Kakar, F., Ahmadzai, A. H., Habib, N., Taqdeer, A., & Hartman, A. F. (2008). A successful response to an outbreak of cholera in Afghanistan. *Tropical doctor*, 38(1), 17–20. <https://doi.org/10.1258/td.2006.006336>
49. World Health Organization (WHO). (2019). EMRO. Cholera in Yemen - Epidemic and Pandemic Diseases.
50. World Health Organization. (2010). Weekly Epidemiological Record, 2010, vol. 85, 40 [full issue]. *Weekly Epidemiological Record = Relevé épidémiologique hebdomadaire*, 85 (40), 385–400. <https://iris.who.int/handle/10665/241651>
51. Al Sheebani, S., Al-Kamarany, M. A., Ghouth, A. B., Kamal, A., & Alaq, M. (2018). Acute renal failure induced by cholera: outbreak of Hodeidah, Yemen, 2017. *European Journal of Pharmaceutical and Medical Research*, 5(8), 188–192. https://www.ejpmr.com/home/abstract_id/4065
52. Camacho, A., Bouhenia, M., Alyusfi, R., Alkohilani, A., Naji, M. A. M., de Radiguès, X., Abubakar, A. M., Almoalmi, A., Seguin, C., Sagrado, M. J., Poncin, M., McRae, M., Musoke, M., Rakesh, A., Porten, K., Haskew, C., Atkins, K. E., Eggo, R. M., Azman, A. S., Broekhuijsen, M., ... Luquero, F. J. (2018). Cholera epidemic in Yemen, 2016–18: an analysis of surveillance data. *The Lancet. Global health*, 6(6), e680–e690. [https://doi.org/10.1016/S2214-109X\(18\)30230-4](https://doi.org/10.1016/S2214-109X(18)30230-4)
53. Montero, D. A., Vidal, R. M., Velasco, J., George, S., Lucero, Y., Gómez, L. A., Carreño, L. J., García-Betancourt, R., & O’Ryan, M. (2023). *Vibrio cholerae*, classification, pathogenesis, immune response, and trends in vaccine development. *Frontiers in medicine*, 10, 1155751. <https://doi.org/10.3389/fmed.2023.1155751>
54. Hsiao, A., & Zhu, J. (2020). Pathogenicity and virulence regulation of *Vibrio cholerae* at the interface of host-gut microbiome interactions. *Virulence*, 11(1), 1582–1599. <https://doi.org/10.1080/21505594.2020.1845039>
55. Rahaman, M. H., Islam, T., Colwell, R. R., & Alam, M. (2015). Molecular tools in understanding the evolution of *Vibrio cholerae* [Review article]. *Frontiers in Microbiology*, 6, Article 1040. <https://doi.org/10.3389/fmicb.2015.01040>
56. World Health Organization (WHO). (2024). Multi-country outbreak of cholera. External Situation Report n. 21, published 18 December 2024 https://www.who.int/docs/default-source/coronaviruse/situation-reports/20241209-multi-country-outbreak-of-cholera-sitrep-21.pdf?sfvrsn=5dd738aa_3&download=true
57. World Health Organization (WHO). Yemen. (2024, December 23). WHO Yemen: Yemen reports the highest burden of cholera globally. United Nations in Yemen. <https://yemen.un.org/en/286445-who-yemen-yemen-reports-highest-burden-cholera-globally>
58. Mulugeta Alemayehu. (2004). LECTURE NOTES For Nursing Students Communicable Disease Control <https://www.cartercenter.org/resources/pdfs/health/ephti/librar y/lecture-notes/nursing-students/in-comm-disease-final.pdf>