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Haiti resurging epidemics: Its potential to transition to endemic status

Abstract

The island nation of Haiti had been Cholera free for over a century prior to the 2010 earthquake which left over 1 million inhabitants homeless, when a key community water source became inadvertently contaminated with the causative organism, V. cholerae (El Toro strain 01) soon after the earthquake. The infectious organism was apparently transmitted via well intentioned Nepalese aid workers visiting the Island. During the 2010-2018 outbreak, over 819,000 people were treated for cholera, resulting in nearly 10,000 deaths. With assistance from the CDC, the U.S. Agency for International Development, and implementing partners including the Pan American Health Organization to further expand epidemiologic and public health initiatives, Haiti was once again declared cholera free in February 2022, having no new cases for over 3 years; however, by Sept 2022 new cases were once again reported, ultimately affecting over 20,000 additional mostly Haitian residents, geographically centered around the Port au Prince area, and in 285 additional deaths from the second wave of the Cholera epidemic. This was followed by over 1150 additional deaths by mid-December 2023 and the designation as a Grade 3 Emergency Hazard Status by the WHO. Because of the high potential for asymptomatic carriers of cholera to develop following a widespread epidemic, additional public health strategies must be vigorously employed including widespread immunization to control and minimize the continued impact of the endemic on community, regional and global wellbeing and hopefully prevent the next epidemic from occurring in Haiti or from spreading to surrounding islands and distant jurisdictions.

Keywords: cholera, endemic, epidemic, pandemic, Haiti

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Introduction

Cholera has been described as a scourge and causation of often fatal illness that has plagued much of human populations from early times; no era of recorded history has been exempt at different times in history, and the mere mention of Cholera continues to cause panic among susceptible populations.[1–5] Now with the 2021 level 7.2 magnitude earthquake in Haiti[6] the question emerges: will Haiti's cholera epidemic return with a new vengeance considering the extensive earthquake damage that has recently occurred, and will Cholera now become and remain endemic in Haiti? Haiti is highly prone to earthquakes, due to its strategic geographic location along a fault line.[1,2,6] Over the centuries Haiti has encountered numerous earthquakes, some including the 2010 and 2021 earthquakes of 7.0 or greater magnitude.[1] Cholera has been around for centuries, and in the last century has caused at least 7 devastating global outbreaks each claiming thousands of innocent human lives.[3,5–7] Cholera infects 1.3 to 4 million people around the world annually with over 20,000 deaths per year according to the World Health Organization (WHO) statistics.[5–9] Cholera is a microbial disease of multicausal origin and fecal-oral transmission, where various biological, environmental, social, political and cultural factors often intervene, thereby presenting complex solutions for what often becomes a public health issue in the broader community.[10,11]

The immediate effects of the January 2010 earthquake left approximately 1,000,000 inhabitants of the greater Port-au-Prince area virtually homeless and approximately 220,000 immediate deaths due to the massive destruction of roads and buildings and their inadvertent casualties. The earthquake caused an almost total loss of availability of viable and adequate community and emergency services in 2010, and effectively stretched the healthcare resources well beyond their limits.[1,2] Subsequently, over 819,000 Haitians became ill with cholera during the 8 years following the 2010 earthquake, with nearly 10,000 deaths reported as a result of one of Haiti's main waterways accidentally becoming contaminated with the highly infectious El Toro strain of the cholera organism.[1-3,12,13] After a brief cholera-free hiatus from 2018-2021, a resurgence of cholera cases emerged, resulting in over 1100 additional fatalities by late December 2023 and the designation of Haiti as a Grade 3 hazard area, similar to that also occurring in the African nation of Malawi.[14]

Considering the severe damages now being reported from the August 2021 earthquake, which was followed by severe seasonal annual weather outlooks, the potential for a re-emergence of the cholera epidemic became a serious public health reality to the island Nation and her neighbors.[6–9] This potential threat extended far beyond the borders of Haiti due to the ease of international travel, including the potential risks to other nearby Island nations in the Caribbean basin and beyond. Should infected carriers relocate to non-earthquake prone localities, Cholera could easily become introduced to new and unsuspecting distant locales. With epidemiologic assistance from the WHO, PAHO and others, Haiti was declared Cholera fee in February 2022 as the result of expansive improvements in public health measures, and having seen no new cases reported for over 3 years.[15–17] However, by September 2022, new cases began to be reported, ultimately resulting in over 20,000 new cases and 285 deaths resulting from the reemergence of cholera by January 2023.[17] In addition, by mid-December of 2023 an additional 1156 deaths had been reported, resulting in the WHO designating Haiti as a grade 3 emergency hazard due to the increasing numbers of cholera cases and deaths.[14,18] Cholera endemics have occurred previously in underdeveloped areas of South and Central America, emphasizing the importance of prompt attention to implementation of adequate control measures.[18–20] Thus, the continued implementation of effective hygiene measures, including public information and education initiatives, timely medical monitoring, cholera immunization, and strategic intervention where indicated will be essential to prevent a resurgence of cholera or other

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public health issues in the coming weeks and months aftermath of the destruction of the roads, structures and public health resources resulting from the recent earthquake and ongoing seasonal Caribbean weather disturbances in Haiti.[1,2,20]

A brief historical review of Cholera epidemics

The off-shore Haiti earthquake of 2021 struck at 8:29:09 a.m. EDT on 14 August 2021. The earthquake registered with a seismic magnitude of 7.2, followed by tsunami warnings in Haiti.[6] This proved to be the second serious earthquake in just over a decade.[1,2] The earthquake struck with a 10-km deep hypocenter in Petit-Trou-de-Nippes, near the coastal village of Les Cayes, approximately 150 km West of the capital city of Port-au-Prince. The number of casualties increased rapidly, with the final numbers of deaths exceeding 1400 within the first few days and were estimated to be in the thousands when all casualties were finally found and counted. Thus the 2021 earthquake was ranked among the most devastating earthquakes of 2021. With ongoing new seasonal tropical storms approaching only days after the earthquake, the seriousness of the disaster including the threats to human health became magnified to an even greater extent than initially estimated, as much experience was gained, and protocols implemented following the 2010 earthquake disaster. The recent earthquake in 2021 continues to rank among the deadliest such disasters worldwide since the 2018 Sulawesi earthquake occurred in a mountainous area of Indonesia, also followed by a tsunami warning due to the offshore epicenter of the earthquake.[21]

When cholera first broke out in Haiti for the very first time, in just 8 months after the devastating January 12th, 2010, earthquake, it displaced over 1 million inhalants and had resulted in over 220,000 immediate deaths, and their already struggling healthcare system was literally pressed to or beyond the brink, and physically unable to fully cope with the magnitude of mass casualties.[1–3] The extraordinary events and actions that followed that earthquake could offer an opportunity to develop strategies in dealing with a public health crisis and disaster management, and emphasizes the need for early interventional plans and measures to prevent or minimize the adversity that may occur in the absence of such early planning.[20] In the years that followed the 2010 earthquake, Haiti encountered its first ever cholera epidemic in over 150 years of recorded history, during which entire prior time the small Caribbean nation was believed to be free of cholera, having never previously recorded a single case or suspected incident of the illness.[1–4] With serious disasters such as the Haiti earthquake and looming seasonal tropical storm forecasts throughout the Caribbean. Eager to assist and well-meaning foreign aid may often appear welcome when arriving on site from afar, but unseen risks may emerge and well-intentioned but unscreened aid workers arrival. These risks may be introduced by the incoming aid workers who may be potentially carrying with them previously unencountered infectious germs from abroad.[3–5,9,12,13]

In so doing, the well-meaning external support may unwittingly transport the new risks to the disaster area with the assistance teams, thus adding further insult to the magnitude of the disaster.[5,6] Such appears to have been the case for Haiti in 2010 and considering the extent of the devastation caused by the recent earthquake of August 14, 2021, the risks and benefits of well-intentioned foreign aid may soon re-emerge due to undetected carriers who may travel with the non-resident aid-workers. Haiti ranks among the poorest nations of the globe, and among the poorest Caribbean Island nations in the Caricom region.[3,7] Accordingly, Haiti likely continues to have only a limited financial and medical capacity to respond to the disaster. The much needed and already strained public health and other governmental resources to accommodate or minimize the devastating fiscal and public health impact of a severe natural disaster as had occurred, once again placing the health and well-being of the nation's population at further risk.[3,7] Sadly, while the second earthquake of 2021 was not associated with an immediate resurgence of cholera, by September 2022 new cases began to emerge from unknown sources, consistent with an unidentified carrier, and would result in over 20,000 new cases and 285 additional deaths had been reported by January 2023.[17, 20]

The disease Cholera causes has been around for centuries and in our modern history there have been a resurgence of cholera epidemics seen to emerge, as when a devastating outbreak occurred in India.[9,11] There have been at least seven recent global pandemics of cholera worldwide claiming thousands of lives in past decades. Each year, cholera infects 1.3 to 4 million people around the world, causing between 21,000 to 143,000 deaths, according to the World Health Organization.[10–12] It is thus imperative to research this bacterial disease further, and to determine ways of shedding light on better and more effective methods of prevention and cure. Historically cholera epidemics have negatively impacted a number of nations and taken countless millions of lives in poor and developing countries alike. Cholera is a well-known and well characterized bacterial disease organism that is preventable and curable through adequate provision of public health and education measures, and which may become challenged following natural disasters.[8–12] Cholera is an acute intestinal infection caused by the ingestion of Vibrio cholerae, either type O1 or type O139, a bacterium that is often present in untreated or inadequately treated water and in food supplies inadvertently contaminated by feces.[13] Cholera is usually transmitted through this water linked fecal-oral vectors, and it continues to constitute a permanent risk in many countries. Outbreaks may occur sporadically anywhere in the world where water supply, sanitation, food safety, or hygiene becomes inadequate.[6,8–13] The greatest risks occur in overcrowded communities, refugee settings, and following natural disasters where sanitation is poor, drinking water becomes unhealthy, and where increases person-to-person transmission become prevalent. In 1817 the first documented pandemic occurred in Asia, which soon spread to Turkey and the Arab countries.[8,10] From that area, it has now spread to all the continents of the world as international travel has become possible and now more commonplace than in previous generations. The second recoded epidemic described between 1826 and 1851 affected the Americas for the first time.[13] It began in India and affected North, Central, and South America by 1832. Due to yearly death tolls of these epidemics, it is pertinent to carry out a review on the history, epidemiology, clinical picture, diagnosis, treatment, and prevention of this disease.[10]

The Haiti experience required international assistance to resolve the 2010 cholera epidemic. Following the earthquake of January 2010, Haiti sought international assistance from numerous potential sources, including calls to the United Nations, the WHO, the CDC in the USA and the Pan American Health Organization.[15–17] These organizations contributed to where the needs for outside support and assistance could be obtained, and assisted Haiti in reaching a worldwide appeal under the well-respected UN mantra.[11] In the weeks and months that followed, help arrived for public assistance and peacekeeping efforts from several counties, including a team from Nepal that established a working camp near the Artibonite river, a main river in Haiti that also served as a main agricultural and public water source for the surrounding farms and communities. Following the entrance of foreign support assistance teams with assistance from the WHO, they were observed to be dumping their human generated waste into the Artibonite river that doubled as a water source for the residents of

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the local community.[3,5] By October of 2010 the first cases of cholera in over 150 years were reported among residents who obtained their water for their rice farms and for their personal consumption from the now contaminated Artibonite river with the Nepalese El Toro strain.[3,16] Cholera would eventually sicken over 800,000 people, nearly 10% of Haiti's population, easily overwhelming the maximum capacity of their hospitals and healthcare resources, and result in the deaths of nearly 10,000 inhabitants in the months and years that followed.[3] It then became necessary for the government of Haiti to develop and implement a strong promotion of healthcare in their society in addition to mass immunizations in order to eradicate the disease, to guarantee quick attention to the sick and identify the contacts, and to impede the disorganization of the social and economic structure which had occurred following the earthquake in favor of the quality of the human life and their individual rights to healthcare. These goals were accomplished by establishing strong public health measures, including the establishment of effective community hygienic conditions and practices, water purification and testing measures, early medical intervention and supportive care for cholera patients, including greater access to antibiotics and therapeutic measures, and dissemination of individual protective measures to stem the spread of the disease.[3] By 2020, no new cases of cholera were reported in Haiti for the preceding 12 months, and the epidemic was considered to have been resolved.[3,16–18] Now 2024 poses a continuing challenge to Haiti, with the widespread structural and environmental destruction and damage to the area of Petit-Trou-de-Nippes and surrounding communities, and the likelihood of asymptomatic carriers remaining in the resident population.[1,3,4,22]

Results and conclusion

An endemic may occur when residual elements of an earlier endemic or pandemic has occurred, with the development of individuals who may remain within the population as asymptomatic carriers of the infectious disease. Among the most cited references is that of 'typhoid Mary' who as an asymptomatic carrier remained as a risk in her community.[1,8,22] Prior to 2010, Haiti had been widely considered cholera-free, having not recorded a single case of cholera recorded over the previous 150 years.[3] The first ever cases of cholera in Haiti were recorded in October 2010, just 10 months after experiencing a major 7.0 magnitude earthquake which caused major structural and environmental damage to the Island Nation, including disruption and contamination of a primary domestic and industrial water supply river that served as a primary water source for much of their population.[16] The total numbers of cholera cases and deaths from 2010-2019 totaled 819,000 and 9,789 deaths respectively. By 2020 no additional cases or deaths from cholera were reported, thereby signaling the end of the epidemic, and Haiti was once again declared Cholera-free by the WHO in February 2022. However, by September of 2022 new cases were once again being reported, which soon impacted over 20,000 suspected cases and 285 documented cholera deaths by January 2023. This return of cholera suggested that the resurgence of Cholera may now remain endemic should public health measures fail to completely eradicate the illness in the coming months and years. Intensive broad-spectrum efforts will be required if Haiti is ever to become completely risk free of cholera again.

Cholera was presumed to have become prevalent in Haiti following the arrival of foreign workers from Nepal, a cholera endemic region. The imported aid workers carried the disease from their previous locale, and inadvertently directly transmitted the infectious bacterium to a major water supply via improper waste disposal, since the serotype was consistent with the serotypes prevalent in the aid workers country of origin. While Haiti survived the first wave of the cholera epidemic following the tragic earthquake of January 2010 over the course of the following decade, the human cost of nearly 10,000 innocent lives lost out of some 850,000 ultimately infected represented a significant proportion of the Haiti population of ~11.4 million at the time. The epidemic became resolved by implementing improvements in public health education and preventive measures, widespread island wide immunizations, and by improving the safety and reliability of their water supply used for domestic and industrial uses. In addition, Haiti accomplished major strides in improving the delivery of responsible and effective healthcare and therapeutic measures to their population.[3] In August 2021, however, another earthquake of even greater magnitude (7.2 magnitudes) struck Haiti without warning and introduced a new threat to their capacity to deliver adequate humanitarian aid and to enforce effective public health measures. With the strong and unrelenting emphasis on public health measures and raising the standards of living, it was hoped to be able to enable the country to control the endemic, and to prevent another catastrophe as serious as that which had occurred previously following the 2010 earthquake, where the loss of life was unprecedented in Haiti.

The Republic of Haiti, with a population estimated at 11.4 million in a land area of 10,714 sq miles, is the third largest country in the Caribbean by land area, and its small relative size and large population makes it the most populous Caribbean country. The population density contributes additional challenges to maintain adequate public health measures during intense environmental events including earthquakes and seasonal weather disturbances common to the geographic area. Located on the Island of Hispaniola in the Greater Antilles archipelago in the Caribbean, Haiti occupies only the Western three-eighths of the island which it shares with the Dominican Republic which occupies the remaining five-eighths of the island. Because Haiti is located in close proximity to Hispaniola's other neighbors including the Dominican Republic and nearby Island nations of Turks and Caicos, Cuba, Jamaica, Puerto Rico and the Bahamas, potential transmission risks are not limited to local communities. Haiti's close proximity and inter-island and international travel destinations also places the broader international community at risk should another cholera epidemic or endemic occur. Educational efforts must be projected to all levels of the population, as the linguistic abilities if the younger often surpass the older generations, who may not have had the same opportunities for literacy education during their younger years. During the 1992 cholera epidemic in Peru, public education beginning at the primary school level was essential, as the youth were among the most literate in the population at that time.[23]

Haiti is currently also still experiencing the throes and community impact of the recent Coronavirus pandemic, which has placed additional strains on an already beleaguered healthcare system with the additional burden as the WHO designation as a Grade 3 hazard region.[14,16] Only time will reveal the success of their public health measures to alleviate or prevent and/or control the next epidemic and preserve the health of the nation and its peoples will remain successful.[16,21–28] Above all, when looking for a helping hand, the phrase 'be careful for what you wish for' may take on an entirely new meaning. Haitians are a demonstrated resilient population having survived numerous environmental disasters in the past century, and given the education and resources now made available, will ultimately endeavor to survive to become a leading industrial partner nation of the Caricom and the international community in the months and years to come.

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Conflicts of interest

The authors declare there is no conflict of interest.

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