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Cholera: Outbreak Preparedness, Prevention and Control in Northern Nigeria

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Abstract
Cholera remains a seasonal epidemic in Nigeria, and the northern region is most affected. Poor sanitary and hygiene practices due to adverse socioeconomic, sociopolitical, and climatic conditions have led to recurrent and new outbreaks in many rural communities, especially in the northern region. Seasonal outbreaks are compounded by seasonal floods, nomadic culture of herders, illicit mining activities, and population displacement by banditry and environmental hazards. Other complicit factors include lack of waste and sewage management facilities, overcrowded refugee and internally displaced persons' camps, prisons and schools, and unsafe drinking water. Despite successive efforts by the government, through the Nigerian Centre for Disease Control and its partners, towards preparedness, prevention, control and elimination of cholera outbreaks over the years, seasonal outbreaks in many northern communities remain a recurring challenge. A review of recent outbreak management strategy reveals systemic challenges such inadequate preparedness and response plan resulting from poor surveillance and early warning, constitution and coordination of the response team, poor mapping of resources and required logistical supports, and poor implementation of preventive actions such as the WaSH protocol. Addressing the recurrent cholera outbreaks in northern Nigeria requires adequate and strategic proactive preparedness planning and response measures, including community education and sensitization for good sanitary and cultural practices, pre-outbreak training of health personnel, and inventory management optimization for relevant health commodities. The author discusses implications and solutions to identified gaps in the existing operational approach to preventing cholera outbreaks in northern Nigeria.

Keywords: Cholera, Outbreak Response, Preparedness, Prevention, Control, Northern Nigeria

1. Introduction

1.1. History and Prevalence

Cholera is believed to have spread across the world during the 19th century from the Ganges-Brahmaputra delta in India. Since then, about seven pandemics have resulted in the death of millions across the globe, including the pandemic of 1961 in South Asia. The cholera pandemic reached the African continent in 1971, followed by the Americas around 1991. Although cholera has been eradicated in most high-income countries, it is endemic in many low-income countries with suboptimal water, sanitation, and hygiene (WaSH) systems (WHO, 2022). Early epidemiological data estimates an annual cholera incidence of 2.8 million cases with a fatality of 91,000 (Ali et al., 2012 as cited in Ali et al., 2015, p.2). More evidence has shown that about 18% of the world population is at

risk, with about 1.3 to 4.0 million cases and 21,000 to 143,000 cholera-related deaths annually in endemic countries (Ali et al., 2015). Cholera is an indicator of low social-infrastructural development and a high level of inequity and inequality (Elimian et al., 2022; Gidado et al., 2018).

Cholera is endemic to Nigeria although its' incident appears to be on the decline with a case fatality ratio (CFR) of 3.2% reported for 2021 by the Nigeria Centre for Disease Control (NCDC, 2022), which is lower than previously reported 5.10% in 2018, 4.98% in 2010 (Ngwa et al., 2021), and 3.8% in 1996 (Ali et al., 2015). According to NCDC, the case definition of cholera for suspected cases in a patient age ≥5 years is severe dehydration or death from acute watery diarrhoea (AWD); but if there is a cholera epidemic, a suspected case is any person age ≥ 5 years with AWD, with or without vomiting. A confirmed case is a suspected case in which *Vibrio cholerae* O1 or O139 serotype has been isolated from the stool (NCDC, n.d.). The World Health Organisation (WHO) defines AWD as an illness characterized by ≥3 loose or watery (non-bloody) stools within a twenty-four hour period (GTFCC, 2017).

1.2 Symptoms, Diagnosis, and Treatment

Many recent cholera outbreaks have been caused by *Vibrio cholerae* O1 (WHO, 2022). *Homo sapiens* are the primary hosts of the parasite but water, molluscs, fish and aquatic floras are feasible hosts. Cholera infection comes from the consumption of food or/and water which has come in contact with faeces infected by the *Vibrio cholerae* O1 or O139. Approximately 20% of infected individuals develop AWD within twelve hours to five days requiring immediate treatment. Symptoms are mild to moderate in about 80% of cases with symptoms, and vomiting may be an associated symptom in about 10-20% (Fagbamila et al., 2023; WHO, 2022). The diagnosis is confirmed by laboratory tests on stool samples to identify *V. cholerae* through organism culture or polymerase chain reaction (PCR) technique. However, rapid diagnostic tests (RDTs) may be used to accelerate testing for surveillance purposes (WHO, 2022). Untreated cases can lead to severe dehydration and death in a few hours due to acute loss of large amounts of body fluids and electrolytes (Fagbamila et al., 2023). Treatment involves rehydration with appropriate intravenous fluid and/or oral rehydration solution (ORS) to prevent shock, and treatment with antibiotics to eliminate the organisms. The use of zinc as an adjuvant in ORS treatment is important in children under-5 to reduce the duration of diarrhoea and its short-term reoccurrence. The CFR in untreated cases could be as high as 50%, while treatment can keep it as low as <1%.

1.3 Transmission

Cholera is transmitted through fecal–oral route and transmission can be facilitated by direct contact with feacally contaminated food or water, human-to-human contact, contact with dead body of infected persons, and by cholera treatment centres with inadequate sanitary and decontamination measures (FMOH-NCDC, 2017). Poor sanitary facilities, which may be due to adverse socioeconomic and socio-political factors, lead to recurrent and new outbreaks that often plague poor communities. Situations such as floods, overcrowded facilities (e.g. refugee camps, internally displaced persons' camps and prisons, etc), nomadic activities, poor waste and sewage management facilities, poor sanitary amenities, and unsafe drinking water often predispose the population to cholera outbreaks. Global warming as a result of climate change creates conducive habitats for the growth of gram-negative bacteria like *V. cholerae,* which are readily transmitted in aquatic ecosystems (Fagbamila et al., 2023; Ngwa et al., 2021).

The virulent nature of cholera increases its potential to spread internationally through food products and individuals, which can affect international trade. This adds to its public health relevance. Cholera control strategies have evolved as multifaceted/multisectoral frameworks encompassing effective surveillance, WaSH initiatives, social mobilization, treatment with antibiotics and intravenous fluid/ORS, and vaccination with oral cholera vaccines (OCVs). Successive governments of Nigeria have implemented strategies to prevent, control and eliminate cholera outbreaks over the years, but seasonal outbreaks reoccur in many communities, especially in northern Nigeria. This article discusses cholera prevention and control in northern Nigeria, with a focus on addressing identified gaps in the preparedness and response to the 2021 outbreak.

2. Discussion

2.1 Cholera in Northern Nigeria

Cholera incidents in Nigeria vary across States with the northern region mostly affected. For the year 2021, there were 111,062 suspected cases and 3,604 deaths across Nigeria (NCDC, 2022). The Federal Capital Territory (FCT) and 33 out of the 36 states were affected (Elimian et al., 2022; NCDC, 2022). The northern region accounted for 89% of all the suspected cholera cases. Four states in the region, including Bauchi, Jigawa, Kano, and Zamfara accounted for nearly 53% of the cumulative suspected cases (NCDC, 2022). The outbreak of cholera in this region and many other parts of the country has been associated with the rainy season. This is because of the seasonal floods that wash sewage into open wells, ponds, and rivers, which usually serve as sources of water for domestic and agricultural use (Adagbada et al., 2012; Fagbamila et al., 2023).

2.2 Prevention and Control in Nigeria

Cholera is reportable as AWD disease under the national Integrated Disease Surveillance and Response (IDSR) system. The Nigerian Manual for Infection Prevention and Control (IPC) and guidelines for preparedness and response to AWD outbreaks apply to the prevention and control of cholera in Nigeria (FMOH-NCDC, 2017, 2021). The NCDC is statutorily mandated to coordinate infectious disease prevention and control across the country using the "one health" principles. The NCDC undertakes these activities in collaboration with multisectoral team and the state's emergency response mechanism, usually the multi-sectoral state-level Emergency Operation Centre (EOC). The EOC is the constituted structure that coordinates emergency response actions and determines the next line of action during an outbreak (NCDC, 2022). The AWD outbreaks response guidelines classify an AWD outbreak as a public health emergency, requiring a swift response and the immediate deployment of WaSH (water, sanitation, and hygiene) resources and public health responses. Response follows an escalation process from the community at the local government area level to the state level, and then to the national level. The framework for AWD outbreak response includes:

1. **Preparedness Plan and Coordination**: All levels of government (local, state and national) are required to undertake advance planning for AWD outbreak prevention, response and coordination. This encompasses routine cholera surveillance, assessments of outbreak risk factors and the WaSH protocol. The preparedness plan articulates the structure of command, communication, and reporting, including escalation of suspected outbreak and response processes. During an outbreak, the NCDC coordinates national response and provides support to the affected state(s) by activating the incident management system (IMS) in collaboration with the Federal Ministry of Health (FMOH), the Federal Ministry of Water Resources (FMWR), the Federal Ministry of Environment (FMEnvrt), and strategic partners. The IMS is responsible for the coordination of surveillance, laboratory tests, case management, risk advisory/community engagement, implementation of the WaSH protocol, activation of reactive OCV campaigns, and reporting/review. The activities of the IMS at the state and local level are undertaken bythe EOCs of the specific state/local government (FMOH-NCDC, 2017, 2021).
2. **Surveillance and outbreak investigation**: NCDC works with hospitals and designated laboratories to conduct routine IDSR and Event-Based Surveillance (EBS) for early detection of outbreaks. This involves effective surveillance data collection and analysis.
3. **Laboratory investigation**: NCDC identifies public health laboratories with capacities for stool testing and water analysis; coordinates requests and delivery of test-kits and medium for specimen transfer to cholera endemic/prone areas; and builds capacity of identified laboratory staff. The National Reference Laboratory (NRL) at NCDC Abuja receives and conducts confirmatory tests on samples collected by the states.
4. **Case Management**: This includes the review of existing cholera IPC and AWD protocols; selection of designated treatment centres, and constitution and training of the case management team on harmonized protocols and SOPs.
5. **Logistics and supplies**: This involves mapping essential health commodities such as intravenous fluids, ORS, antibiotics, OCVs, personal protective equipment (PPE), WaSH kits etc in the affected areas, and

available infrastructure and human resources to distribute the items to the last mile or households for treatment and prevention.

6. **Promotion of WaSH initiatives**: The response teams work with WaSH sector partners to support the promotion of the activities involved in WaSH initiatives in cholera hotspots.
7. **Risk Communication**: The IMS/EOC develops risk communication strategies for pre-, during and post-outbreak period, and also design media tools and strategies for engaging targeted stakeholders.

2.3 Prevention and control measures for recent outbreaks in northern Nigeria

The outbreaks in northern Nigeria between 2019 and 2021, were probably moderated by the COVID-19 pandemic in no certain way. On one hand, the pandemic and lockdown era prevented health-seeking behaviours and access to quality healthcare, weakened the focus on strengthened laboratory capacity for cholera testing, and diminished resources for cholera IPC including OCV campaigns. On the other hand, the COVID-19 IPC measures, such as frequent handwashing and hygiene, social distancing, and use of PPE may have improved general hygiene in hospitals and households, while the city lockdowns and travel restrictions may have helped decrease cholera transmission (Elimian et al., 2022). In spite of the foregoing, the challenges observed in the prevention and control of the 2021 outbreaks were systemic, infrastructural, and operational (Elimian et al., 2022; NCDC, 2022). The systemic challenges were inadequate preparedness and response plans for many of the states in the region. This resulted in poor surveillance and early warning; delays in proper constitution, integration, and coordination of the response team; improper mapping of resources and poor evaluation of required logistical supports; and poor preventive actions such as implementation of the WaSH protocol (NCDC, 2022). The lack of pre-outbreak evaluation and validation of diagnostic kits, poor diagnostics coverage, and timeliness were unfortunate outcomes of logistics failure (Elimian et al., 2022). Another systemic challenge was the community lifestyle of open defecation and poor sanitation and hygiene practices (Elimian et al., 2022). Infrastructural challenges such as lack of effective drainage for flood control, lack of access roads to communities, lack of access to safe water, and inadequate health facilities/diagnostic capacities affected the response time, coverage, and prevention of transmission. Some communities lacked access to basic amenities for WaSH (Elimian et al., 2022; NCDC, 2022). Operational challenges included inadequate health commodities such as vaccines, antibiotics, ORS, and intravenous fluids, PPE and qualified personnel to cover all the affected communities and settlements (NCDC, 2022).

3. Implications

Close to 40% of Nigerians live below the poverty line, i.e. $1.90 per day (Statista, 2023). The poverty rate in northern Nigeria is 57.9% with some of the states as high as 87.7% (World Bank, 2022). The WaSH survey of 2019/2020 indicates that the region has the lowest access to WaSH services in the country (Elimina et al., 2022, p. 10). Cholera is associated with poverty and poor communities, and some studies have shown that the current poverty level in Nigeria will make it difficult for the country to attain the target set in the Global Task Force on Cholera Control (GTFCC) roadmap-2030, which is to reduce cholera deaths by 90% and eliminate the disease in 20 out of the 47 endemic countries by 2030, due to a plethora of socioeconomic and social-political determinants (GTFCC, 2017; WHO, 2022). Some researchers, however, predict 2050 as a more realistic date for Nigeria if certain steps are taken to fast-track interventions and programmes aimed at strengthening WaSH initiatives, alleviating poverty, and promoting environmental hygiene through urban planning (Charnley et al., 2023).

Cholera susceptibility is moderated by the host immunity which could be a function of genetic makeup, hygiene, and nutrition. But the spread is moderated by demographic and socio-economic factors including age, gender, education, and income status, etc (Adagbada et al., 2012). The major determinants of cholera outbreak risks in northern Nigeria are seasonal flood, open defecation, and nomadic lifestyle. Recommended seasonal public health actions should include chlorination of wells and public water supply sources, distribution of WaSH kits to households, and community education on health-promoting behaviours about cholera prevention and control such as good sanitary and hygiene practices, especially during the rainy season. In addition, the government and its partners should improve access to sewage/waste management facilities and strengthen regulatory supervision/monitoring of environmental hygiene and food safety as part of cholera IPC measures (Charnley et

al., 2023). The idea of ranching for animal husbandry to control the nomadic lifestyle can help in controlling inter-community transmission. Adequate preemptive preparedness planning and measures, including pre-outbreak training, validation, and stockpiling of diagnostic kits and other relevant health commodities with longer shelf-life, should be undertaken. The challenge with case management due to the inability to handle the surge in cases at the healthcare facilities could be better managed if there is a timely early warning from the epidemiologic data and the hospitals were better equipped ahead of the outbreak. The use of the limited health facilities, which was worsened by the competing allocation of resources for the COVID-19 pandemic should be predictably and proactively planned for (Elimian et al., 2022).

4. Conclusion

Cholera is an endemic disease of public health importance in Nigeria. Its recurrence is seasonal, and the morbidity and mortality are higher in northern Nigeria where over 50% live in extreme poverty. Between 2019-2021 there has been a yearly outbreak, especially during the rainy season when seasonal flooding is inevitable (Fagbamila et al., 2023). The outbreaks are more in communities with inadequate sewage and waste management facilities, lack of access to safe water, and poor sanitary conditions. The four northern states of Bauchi, Jigawa, Kano and Zamfara led the 2021 outbreak data and accounted for about 89% of all suspected cases. Although the IMS and EOC framework for cholera prevention and control was activated in the region, there were gaps that could have been covered to reduce the cases and mortality. The period coincided with the COVID-19 pandemic, which may have also worsened the outcome.

The outbreak could have been better managed if there had been adequate state-level preparedness and response plans, data reporting and response, OCV campaigns across the region, increased funding for WaSH infrastructure, and sufficient logistic planning for pre-positioning of response commodities across the states. There was also gap in capacity for sample collection, transportation, and laboratory diagnosis (NCDC, 2022). Thus, the After-Action Review (AAR), and review of the National Strategic Plan of Action on Cholera Control (NSPACC) should consider solving these gaps in the revised preparedness and response plan. Specifically, the government at all levels should strengthen healthcare/laboratory infrastructure, sewage/waste handling facilities, climate and environmental impact control and management strategies, as well as risk communication strategies and tools across the northern states. Health promotion for health protective or health-seeking behaviours against cholera should be community-adaptable and driven, and may include off-/in-season media material to promote WaSH initiatives and OCV uptake, ranching, etc. Without prejudice to the foregoing, the government should step up current activities aimed at reducing poverty and strengthening the sociopolitical environment for improved security and social well-being of northern Nigerians to eliminate undesirable population displacement and migration.

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