



Contextualising Cholera in Nigeria: Contemporary Epidemiology, Determinants and Recommendations

Olusola Bamidele Ojo¹, Abideen M. Gbolahan²

¹Medical Registrar, Health Care Agency, Ministry of Health, Seychelles

²Family Physician / Health System Specialist, Gbagada General Hospital, Lagos, Nigeria

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*Corresponding Author: Olusola Bamidele Ojo ¹

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Abstract

Original Research Article

In 2024, Nigeria reported the highest cholera mortalities among other African countries. From 1 January to 24 November, Nigeria recorded 702 deaths out of 19,178 cholera cases and a case fatality rate of 3.7%. WHO recommends a case fatality rate of less than 1% for cholera management globally. In this light, we highlight the contemporary epidemiology of cholera in Nigeria and expose the determinants of recurrent outbreaks from geopolitical zone contexts. By deploying descriptive analysis of primary data from the Nigerian Center for Disease and Control Prevention (NCDC), we computed an average case fatality ratio of 2.9 % for cholera between 2017 and 2 March 2025. We discovered that the northwest and northeast geopolitical zones had the highest incidences of cholera outbreaks due to disproportionate poverty and religious conflicts. Lagos constituted roughly 46 % of the cases in 2024 due to overstretching water, sanitation, and hygiene (WASH) amenities and flagrant disregard for sanitary practices, which enhance frequent flooding. As of 2 March 2025, the south-south geopolitical zone had the highest incidences of cholera infections. Most of their areas are low-lying and proximal to many river channels and the Atlantic Ocean, predisposing them to recurrent flooding. Hence, we maintain that the main determinants of cholera in Nigeria are poverty, religious conflicts, incessant flooding, and inadequacy of WASH amenities. A study of this caliber would enhance targeted intervention against the menace of cholera based on regional peculiarities. We believe this is a viable step in stemming recurrent cholera epidemics in Nigeria.

Keywords: Nigeria, Cholera, WASH, Case Fatality Ratio, Epidemiology, Geopolitical Zone, Sanitation.

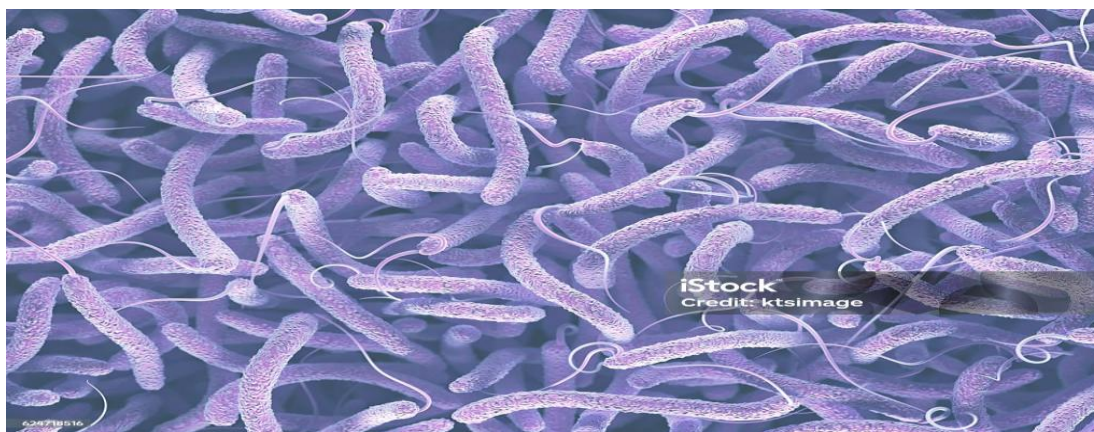
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INTRODUCTION

In the 21st century, there is a growing threat of recurrent cholera epidemics with resultant fatalities in the African sub-region, which includes Nigeria. This severe gastrointestinal disease results from exposure to a bacterium called *Vibrio cholerae* in contaminated water, fruits, foods, and beverages. Despite having hundreds of serotypes, only two known strains of the bacterium cause epidemics, 01 and 0139 [1]. *Vibrio cholerae* appears in the feces between one

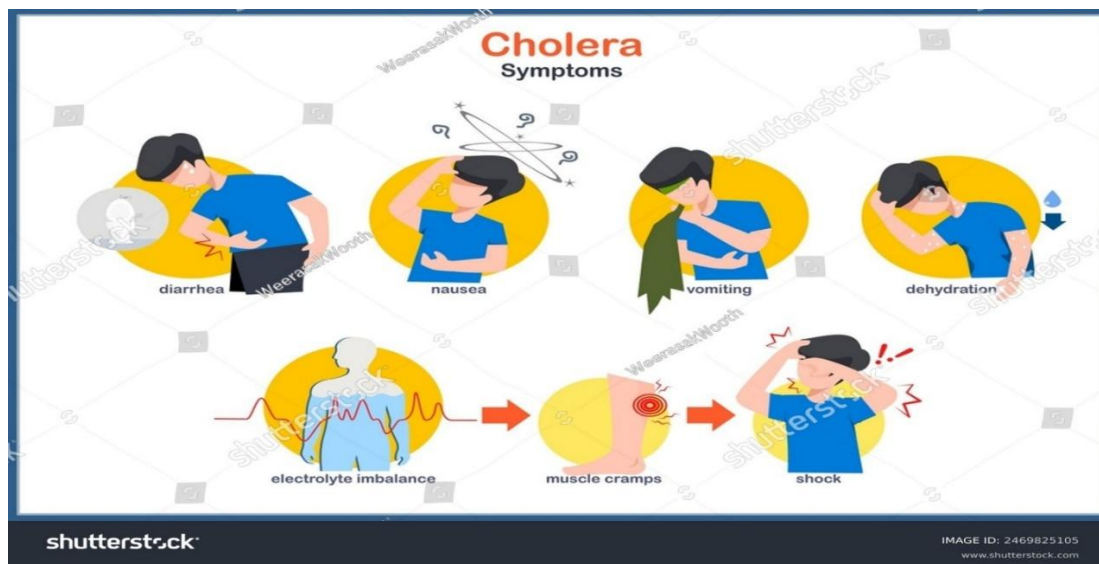
and 10 days, and most sufferers do not manifest its features immediately. They usually exhibit symptoms after some days. [2]. Consequently, the organisms are released into the environment to infect other people. Typically, symptoms occur between 12 hours and 5 days after eating polluted food or drinking contaminated water or beverages. Patients usually present with severe vomiting, diarrhea, concomitant dehydration, and hypovolemic shock that often leads to death within hours if left untreated [1].

Illustration of Vibrio Cholerei with Flagella (A Gram-Negative Bacteria)



Adapted from IStock by Getty images. <https://www.istockphoto.com/photo/vibrio-cholerae-bacteria-gm624718516-109852915>

Illustrating clinical symptoms and signs of Cholera



Adapted from Shutterstock images . <https://www.shutterstock.com/image-vector/medical-vector-illustration-flat-style-cholera-2469825105>

Cholera is regarded as a disease of poverty, illiteracy, and inequalities. It is prevalent where populations lack basic water supply, waste disposal, and sanitation infrastructures. Cholera has ravaged and continues to pose significant public health threats in lower- and middle-income countries (LMICs) in the African, Eastern Mediterranean and Southeast Asian regions. Across the three regions in 23 countries, 70, 488 cases were recorded with 808 cholera-related mortalities between 1 January and 23 February 2025. Within this period, the African region had the highest proportion of 37,406 cases and highest mortalities of 667 across 15 countries [3]. As of 20 February 2025, the most afflicted countries remained South Sudan, Afghanistan, Angola, Yemen, and DR Congo. However, Afghanistan, Angola, the Democratic Republic of the Congo, Ethiopia, Ghana, Malawi, Niger, Nigeria, Somalia, South Sudan, Sudan, Togo, Uganda, the United Republic of Tanzania, Yemen, Zambia, and Zimbabwe are encountering

new cholera and acute watery diarrhea (AWD) related deaths [4]. Given the peculiarities of political conflicts, wars, economic sabotage, and widespread corruption, which plague most sub-Saharan African economies including Nigeria, the threats of cholera could not be over-emphasized.

In Nigeria, between 1 January to 23 February 2025, there were 1,113 cases of cholera including 28 deaths and a case fatality ratio (CFR) of 2.5 %. Roughly a month before February 23, 2025, Nigeria reported 14 deaths from 327 cases with a CFR of 4.3%, which surpassed the death rates of over 90 percent of countries in the African sub-region [3]. Recently, as of 2 March 2025, the Nigerian Centre for Disease Control and Prevention (NCDC) reported 1,149 cases including 28 deaths and a CFR of 2.4% in 25 states [5]. By deconstructing these gross values, the top three affected states are Bayelsa with 763 cases (66%), Rivers with 107 cases (9%) , and Abia with 44 cases (4%) [5]. A notable outbreak among the epidemics

occurred in early January 2025 in Rivers state where nine lives were lost to cholera. State health officials confirmed three mortalities in Andoni and six in Akuku-Toru local government areas [6]. Much more devastating, Lagos state, the commercial hub of the country and the sixth largest economy in Africa [7], encountered the largest cholera catastrophe in 2024. By 6 July 2024, 54 Lagos inhabitants had succumbed to the deadly fangs of cholera out of 1,661 suspected patients including 70 laboratory-confirmed cases [8]. Amid the tumultuous socio-economic and humanitarian crises wrought by the deadly Boko Haram group and other splinter renegades in North East Nigeria, Borno state suffered a devastating flood displacing roughly 2 million people in early October 2024 [9]. The resulting contamination of water bodies and disruption of sanitation infrastructures triggered cholera outbreaks with untoward social and health consequences on local populations. On the national front, given the idiosyncratic social, economic, and political turmoil bedeviling its healthcare sector, Nigeria continues to harbor poverty-related infectious diseases including cholera in the fourth industrial revolution era. Unfortunately, it continues to grapple with the containment of common diseases, which have been eradicated in the contexts of high-income countries (HICs). They are replete and equipped with effective water, sanitation, and hygiene (WASH) infrastructures as opposed to most LMICs. As of 21 July 2024, Nigeria reported 156 deaths out of over 4, 809 suspected cholera sufferers with a CFR of 3.2 % in 192 local government areas across 35 states [10]. There are 36 states altogether in the country [11]. Cholera outbreaks affecting over 95 percent of the geographical space assert anecdotally the threat of the contagion and its endemic status in the whole country. There is a WHO global roadmap and initiative that directs all cholera-prone countries to reduce cholera fatalities by 90 percent by 2030 [12,13]. To achieve this lofty feat, we need to holistically and comprehensively focus on the control and eradication efforts to avert preventable deaths occasioned by cholera in Nigeria. Therefore, this research article intends to illuminate the epidemiology of contemporary cholera outbreaks in Nigeria. This would enhance research-based recommendations to mitigate future outbreaks.

There is no paucity of research on cholera in Nigerian clime. Some studies have highlighted the epidemiological patterns and exacerbating factors for cholera in Nigeria [13, 14, 15, 16, 17]. They have attributed factors such as inequality, poverty, poor water supply, and sanitation as the main drivers of the contagion in Nigeria. Other scholars have ascribed the escalations and recurrence of cholera outbreaks in Northern Nigeria to religious conflicts [18,19,20]. According to them the militancy, insurgency and terrorism pervasive in the Northern parts of the country has led to displacement of millions. The concomitant contamination of water sources and disruption of sanitary systems led to an increased frequency of cholera outbreaks. Some research highlighted that cholera infections are more prevalent in the rainy seasons when some parts of the country are prone to flooding [21,22]. Others explored the role of poor environmental sanitation as a driver of a resurgence of the scourge in recent times [23,24]. They found out blocked wastewater drainages, open defecation, and inadequate waste disposal leading to fecal contamination of

water sources are important risk factors for the spread of cholera in Nigeria.

In a related vein, some studies have related the recent recurrence of cholera in some parts of Nigeria to the dynamics of seasonal changes and climatic factors [25,26]. They further described the predilection of cholera for the rainy seasons and highlighted the role of climatic change in heightened cholera outbreaks in sub-Saharan Africa. The El-Nino phenomenon led to heightened temperatures in sub-Saharan Africa and other parts of the world. It is causing increased rainfall leading to flooding and contamination of water sources which promotes cholera among other water-borne diseases [21]. Aside from enhanced sanitation and strengthening of healthcare system, some advocated for adequate quantities and increased access to cholera vaccines for local populations [27,28]. They underscored the essentiality of vaccines in the fight against cholera in Nigeria.

Nevertheless, only a handful of research has attempted to estimate the average CFR and delineate the drivers of cholera outbreaks along sub-national lines. This scholastic adventure would illuminate our understanding regarding the determinants of cholera on geo-political zone basis rather than the national outlook of other studies. For instance, recent studies showed geographical distribution of cholera in Nigeria to offer recommendations for tackling the infectious disease, without a detailed analysis of the average and the component mortality rates along regional lines [12, 29]. In this light, this research article will highlight the fundamental determinants of cholera along a sub-national angle. Then, to compute a total average CFR for cholera epidemics in contemporary Nigeria to highlight the threat of the contagion in the most populous black nation. It would enhance our understanding regarding the true picture of cholera in Nigeria to ensure research-based recommendations based on regional peculiarities.

METHODOLOGY

This research article deployed mainly descriptive analysis using tables and average values such as mean, median, and mode to derive our epidemiological values before subsequent narrative analysis and discussions. Specifically, we deployed primary data from the Nigerian Centre for Disease Control and Prevention, 2024-2025. We calculated the case fatality ratio for cholera in contemporary Nigeria. It would ensure an appraisal of the existing cholera guidelines and offer research-based recommendations to enhance future approaches.

Contemporary Epidemiology of Cholera 2017-2025

Since the 1970s, Nigeria has been having sporadic cases of cholera with major epidemics. Recently, there have been outbreaks in 2018, 2022 and 2024. According to recent data, as of 2 March 2025, Nigeria has recorded 1,149 cases including 28 deaths with a CFR of 2.4% in 25 states of the federation [5]. If the trend continues, this year might witness another widespread epidemics in more states. There has been a consistent rise in cholera cases and geographical spread since 2017. Hence, it is expedient to estimate the CFR of present-day cholera epidemics in Nigeria between 2017 and 2025. It

would ensure adequate evaluation of cholera trends in contemporary Nigeria and give research-based recommendations to stem recurrent outbreaks. In this light,

Table 1 shows key epidemiological attributes of cholera in Nigeria from 2017 to 2025.

Epidemiological attributes of Cholera Epidemics in Nigeria, 2017-2025

Year of Outbreaks	Total Cases	Total Mortalities	Case Fatality Ratio (%)	Most Affected States	Management and Control Measures
2025(January 1 to March 2)	1149	28	2.4	Bayelsa (763) Rivers (107) Abia (44) Niger (33) Delta (33)	Coordination: National multi-sectoral TWG, EOC activation. Surveillance: IDSR, EBS, data validation. Case Management: Technical support, cholera kits, training. WASH: Hygiene promotion, water chlorination. Vaccination: Epidemiological monitoring for ICG requests. Risk Communication: Cholera jingles, media engagement
2024 (January to September)	10837	359	3.3	Lagos (4,667) Jigawa (870) Kano (809) Borno (588) Katsina (559) Total (States affected): 36 Total (LGAs affected): 339	Coordination: National multi-sectoral TWG, EOC activation, NRRT deployment. Surveillance: IDSR, EBS, active case search. Case Management: Technical support, cholera kits, training. WASH: Hygiene promotion, water chlorination, borehole construction. Vaccination: Ongoing in Borno and Adamawa. Risk Communication: Cholera jingles, community sensitization.
2023	3683	128	3.5	Zamfara (914) Cross Rivers (718) Katsina (343) Bayelsa (319) Ogun (295) Total (States affected): 3 Total (LGAs affected): 166	Coordination: National multi-sectoral TWG, EOC activation. Surveillance: IDSR, EBS, data validation. Case Management: Technical support, cholera kits, training. WASH: Hygiene promotion, water chlorination. Vaccination: Epidemiological monitoring for ICG requests. Risk Communication: Cholera jingles, media engagement.
2022	23763	592	2.5	Borno (12,465) Yobe (1,888) Katsina (1,639) Gombe (1,407) Taraba (1,153) Kano (1,131) Total (States affected): 33	Coordination: National multi-sectoral TWG, EOC activation. Surveillance: IDSR, EBS, data validation. Case Management: Technical support, cholera kits, training. WASH: Hygiene promotion, water chlorination. Vaccination: Epidemiological monitoring for ICG requests. Risk Communication: Cholera jingles,

				Total (LGAs affected): 271	media engagement.
2021	111062	3604	3.2	Bauchi (19,558) Jigawa (15,141) Kano (12,116) Zamfara (11,931) Total (States affected): 34 Total (LGAs affected): 435	Coordination: National multi-sectoral TWG, RRT deployment. Surveillance: IDSR, EBS, data validation. Case Management: Technical support, cholera kits, training. WASH: Hygiene promotion, water chlorination. Vaccination: Reactive OCV campaigns in Benue, Bauchi, Jigawa, and Yobe. Risk Communication: Cholera jingles, media engagement.
2019	1583	22	1.38	Adamawa Bayelsa Kano Plateau Ebonyi Total (States affected): 7 Total (LGAs affected): 33	No detailed actions were recorded.
2018	42466	830	1.95	Adamawa Anambra Bauchi Borno Ebonyi Total (States affected): 20 Total (LGAs affected): 206	No detailed actions were recorded.
2017	5264	140	2.7	Borno Zamfara Lagos Kano Yobe Total (States affected): 16 Total (LGAs affected): Not Specified	Coordination: NCDC, WHO, CDC, AFENET collaboration. Case Management: Cholera Treatment Centers (CTC), Oral Rehydration Points (ORP). Surveillance: Line listing, risk assessment. Logistics: ICG request for OCV, RDT kits distribution. Prevention: Water chlorination, handwashing stations, health education
Total	199,807	5703			

CFR: Case Fatality Rate; TWG: Technical Working Group; EOC: Emergency Operations Center; NRRT: National Rapid Response Team; IDSR: Integrated Disease Surveillance and Response; EBS: Event-Based Surveillance; WASH: Water, Sanitation, and Hygiene; OCV: Oral Cholera Vaccine; ICG: International Coordinating Group; RDT: Rapid Diagnostic Test; CDC: Centers for Disease Control and Prevention; AFENET: African Field Epidemiology Network; FCT: Federal Capital Territory.

Adapted from Nigeria Centre for disease control and prevention.

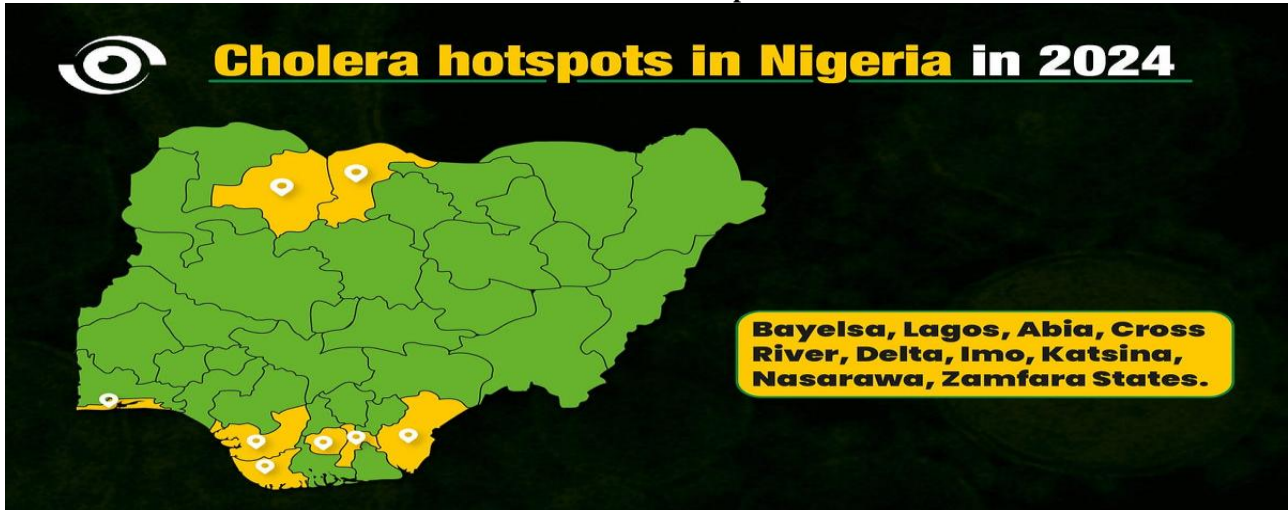
<https://ncdc.gov.ng/diseases/sitreps/?cat=7&name=An%20update%20of%20Cholera%20outbreak%20in%20Nigeria>. Accessed April 12 25, 2025., NCDC (2025) Cholera Situation Report. Epidemiological Week 9 (3rd February to 2nd March 2025) Accessed April 20 , 2025

<https://efaidnbmnnnibpcajpcglclefindmkaj/https://ncdc.gov.ng/themes/common/files/sitreps/2bfd8db1fdd6d05a6f341a0dc71e5.pdf>

Table (1) displays that the highest number of cholera cases occurred (111,062) in Bauchi state, in 2021. Bauchi's value constituted 55.5 percent of the total cases encountered in Nigeria between 2017 and 2025. This corresponds with the highest cholera mortalities of 3,604 and the second-highest CFR of 3.2 % within the period. The highest CFR of cholera in Nigeria was 3.5%. It was recorded in the 2023 cholera outbreaks with 128 deaths out of 3683 cholera sufferers. The lowest frequency of cholera cases occurred in 2019 (discountenancing 2025 values because our data ended on March 2). Only 1583 cases were recorded in 2019 and it correspondingly has the lowest death rate, and the lowest CFR of 1.38% from 2017 to March 2 2025. There was a total number of 199,807 cases including 5703 deaths with an average CFR of 2.85% between 2017 and 2 March 2025. Regarding the geographical spread of cholera, Table (1) shows widespread dispersal of cholera outbreaks across all geopolitical zones in the country. It could be deduced that cholera epidemics have pervaded the six regions that constitute the country. Concerning the top affected states, the outbreaks occurred in at least two states in each geopolitical region from 2017 to 2 March 2025. The Northwest and the Northeast region had the highest frequency and spread of cholera epidemics from 2017 to 2025 while the Northcentral had the lowest, closely followed by the Southwest geopolitical region. In the northwestern region, Kano, Jigawa, and Zamfara had the highest cases and mortalities due to cholera between 2017 and 2025. Kano featured among the most afflicted states by cholera outbreaks on five occasions between 2017 and 2025. However, it was second to Jigawa state regarding affectionation, Kano had a total 14, 056 sufferers out of 150, 494

cases from 2021 to 2 March 2025 (9.3 percent). Jigawa recorded 16,011 cases out of a total 150,494 cases between 2021 and 2 March 2025(10.6 percent). In 2021, in the north eastern region, Bauchi reported 19, 558 cholera cases from 110, 062 cases for the year (17.1 percent). It therefore remained the single most cholera-afflicted state in contemporary Nigeria. However, Borno state had a higher spread of the scourge featuring among the top afflicted states, three times from 2017 to 2 March 2025. Between 2021 and 2 March, 2025 Borno State had 13,053 cholera cases from 150, 494 total cases (8.7 percent). In the southern geopolitical zones, the southwest geopolitical zone is the least infected region. However, because of its social, political, economic, and geographical dynamics, Lagos state remains the affected state in the southwest geopolitical zone. It was amongst the most afflicted states in 2017 and 2024. The latter was the largest epidemic of the contagion in contemporary Lagos. The commercial epicenter of the country reported 4,667 cholera cases from 10,837cases for 2024 between January and September (43 percent). In the south-south geopolitical zone, Bayelsa is among the most afflicted state in 2019 and 2025. As of 2 March 2025, Bayelsa was the most cholera-afflicted state in Nigeria with 763 cases from 1,149 sufferers (66.4 percent). It was closely followed by River State with 107 cases (9.3 percent) and Delta State with 33 cases (2.8 percent) from 1,149 cases as of March 2 2025. Regarding the southeast geopolitical zone, Abia state was among the most cholera-affected as of March 2 2025 with 44 cases from 1,149 (3.8percent). Ebonyi State featured among the top cholera-afflicted states in 2018 and 2019 and Anambra state was among the most infected states in 2018.

Illustration of Cholera Hotspots in 2024.



Adapted from Nigeria Health Watch. <https://articles.nigeriahealthwatch.com/cholera-and-climate-change-in-nigeria-an-old-enemy-in-a-modern-world/>

To adequately compare the recent mortality values of Cholera in Nigeria with other African countries, a table displaying recent cholera epidemiology is expedient going forward. In

Africa, Table (2) highlights cholera cases and deaths between 1 January and 24 November, 2024.

Table 2: Reported Cholera cases and deaths from 1 January to 24 November in Africa

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Country	Cases	Deaths	Case Fatality Ratio (%)
Burundi	835	3	0.4
Cameroon	81	50	61.7
Comoros	10, 549	152	1.4
DR Congo	28,804	409	1.4
Ethiopia	26,718	263	1
Ghana	2,244	18	0.8
Kenya	613	5	0.8
Malawi	386	11	2.8
Mozambique	8,299	22	0.3
Niger	1,064	23	2.2
Nigeria	19,178	702	3.7
South Africa	11	0	0
South Sudan	697	7	1.0
Togo	167	12	7.2
Uganda	96	5	5.2
Tanzania	10, 061	134	1.3
Zambia	20, 219	637	3.2
Zimbabwe	20,135	400	2

Adapted from WHO (2025) . Multi-country outbreak of cholera. External Situation Report .

<https://www.who.int/publications/m/item/multi-country-cholera-outbreak--external-situation-report--24--20-march-2025>

Table (2) highlights that in Africa, Nigeria recorded the highest mortalities due to cholera between 1 January and 24 November 2024. This is despite having the fifth largest number of cases behind DR Congo, Zambia and Zimbabwe. Nigeria reported 702 deaths from cholera and a CFR of 3.7%, indicating the fourth highest value among other African countries. It surpassed the highest recorded CFR of 3.5% recorded in 2023 in Nigeria (Table 1).

DISCUSSIONS

According to our study, in Nigeria, cholera CFR ranged from 1.38 % and 3.5% with average cholera CFR of 2.85%, roughly 3.0 % between 2017 and 2 March 2025. This value is roughly consistent with WHO's latest data on cholera, which records a CFR of 3.7% for Nigeria between 1 January and 24 November 2024 (Table 2). This is far higher than the WHO-recommended value of CFR for treated cholera cases. It stipulates a CFR of less than 1 %. [30]. The reasons are not far-fetched. As of October 20, 2024, the World Bank reports that 56 percent of the Nigerian population are wallowing in multidimensional poverty [31]. Thus, many inhabitants lack potable water, sanitary and hygiene (WASH) amenities and other health infrastructure. Unfortunately, the trend is not

different in comparable geographical contexts due to analogous political, economic, and healthcare dynamics. Between 1 January and 24 November 2024, Cameroon recorded a cholera CFR of 61.7%, Togo had a CFR of 7.2%, Uganda's CFR was 5.2% and Malawi reported 2.8% (Table 2). In contrast, some countries like South Africa (0), Burundi (0.4), Mozambique (0.3), Ghana (0.8), and Kenya (0.8) had a considerably low CFR below 1% within the same period (Table 2). In this light, they met WHO's benchmark for cholera management. In these countries, the low cholera death rates might be due to heightened improvement in community engagement, and WASH facilities or due to poor surveillance and reportage resulting in missed cases and mortalities. Deconstructing the gross Nigerian values along the sub-national lines exposes the main determinants of high cholera outbreaks and resultant mortalities. Expectedly, the highest prevalence of cholera in Nigeria coincided with the most impoverished regions with an abysmally low Human Development Index (HDI). Jigawa and Zamfara are among the top ten poorest states in Nigeria with poverty rates of 87.02 percent and 73.98 respectively [32]. Hence, they had disproportionate low per capita income, literacy rate, average life expectancy, and infrastructure compared with southwest and southeast geopolitical zones [33]. Consequently, in

considerable areas, there is a dearth of potable water supply and, an inadequacy of sanitary and waste disposal systems leading sizable populations to open defecation [20]. Hence it is not a coincidence that the two states are witnessing huge incidences of cholera among other states in the northwest geopolitical zones. Armed conflicts have been recognized as a significant driver of cholera in sub-Saharan Africa [34]. The rising wave of banditry, insurgency, arms proliferation, and illicit drug abuse in Zamfara and other surrounding states is positively correlated with the recent increasing frequency of outbreaks [34,35]. The consequence of this is wanton human displacement with concomitant destruction of WASH facilities and consequent vulnerability of people to poor hygiene practices. Kano state has a slightly different dynamic. As of 2024, recent data shows that Kano State is the most populous state in Nigeria after Lagos state with over 16 million inhabitants [36]. The consequent high population density promotes the emergence of more slums with poor housing facilities. The overall consequences are inadequate sanitary, waste disposal systems and ineffective WASH facilities, which trigger frequent cholera outbreaks.

In the northeastern geopolitical zone, Borno among other states is among the most economically disadvantaged states in Nigeria [37]. Therefore, most inhabitants live with an abject lack of necessities of life and infrastructure, hence predisposing them to infectious diseases including cholera. Apart from this, the religion-centric insurgency, militancy and terrorism have decimated significant geographical space of Borno state. Since 2009, when the menace of Boko Haram emerged, the northern parts of the country have encountered an upsurge of cholera outbreaks [38]. From 2009 to 2018, the Boko Haram conflicts had claimed over 30,000 souls with devastating destruction of properties worth over 16 billion Naira [39]. So far, it has occasioned unwarranted displacement and destitution of over 2 million people [40]. It portends catastrophic social and health consequences. This religious-political hostility has occasioned the depletion of the health workforce and infrastructure, contamination of water bodies and destruction of many WASH facilities [20]. As a result, their health systems are largely unable to cope with common diseases including cholera epidemics without external intervention.

In the southwest, Lagos, the most important coastal city in Nigeria, had significant outbreaks in 2017 and 2024. The latter constituted 46 percent of cholera cases out of the total for the year. The peculiar nature of Lagos is an important factor in enhancing these outbreaks. Lagos city remains the most densely populated in Nigeria. As of 2024, over nine million people are estimated to live in Lagos city compared to over three million Kano city inhabitants [41]. Hence, Lagos is the most densely populated city in Africa [42]. In comparison with other large cities in Nigeria, another source states that over 15 million people reside in Lagos Metropolis as against about 5million in Kano, over 3.6 million in Ibadan, about 2.7 million in Abuja, and over 2 million people in Port-Harcourt [43].

Perspectively, Lagos state harbors over 22 million people [7], out of over 237 million estimated Nigerians as of 2025 [44]. However, Lagos has the least land space in the country. It has

just 3,354 square kilometers of land space to cater for over nine percent of Nigerian inhabitants [45]. Contrastingly, as of 2025, Niger state, the largest state regarding area size has a population of roughly 7.5 million on a landmass of 74,363square kilometers [46,47]. This huge population density causes a tremendous overstretch of basic WASH amenities in Lagos predisposing many to infectious diseases including cholera. Most parts of the mainland are extremely densely populated with poor or nonexistent toilets and sanitary facilities. Many areas are replete with blocked waste water drainages and putrefaction of gutters exposing populations to fecalith-infested water and foods.

From a geographical context, Lagos has predominantly low-lying areas but it is above the sea level. To dispel the original assertion by many, the flood map analysis for Lagos shows that the state is between one and 30 meters above sea level depending on the location [48]. Hence, it is not listed among major cities below sea level in Africa [49]. Thus, this is not a scientifically proven reason for recurrent flooding in Lagos. Nevertheless, the rising sea levels during rainy months contribute substantially to the backflow and sluggish emptying of the gabbage-filled drainage system into the Atlantic Ocean. Lagos is prone to recurrent flooding because of poor drainages predominantly occasioned by refuse deposition in drainage channels [50]. In some instances, occasional flooding of putrefying wastewater occurs on the mainland, but more severe flooding occurs on the Island triggering cholera outbreaks among other water-borne diseases [50,51]. In 2024, Lagos Island was the reported cholera hotspot in Lagos that extended to Ogun State during the wave. It is germane to highlight the role of flagrant disrespect for sanitary laws. Contextually, in overcrowded slums on Lagos Island, some structures are erected over drainage channels. Consequently, those houses empty their sewage directly into the drainage system.

Bayelsa, Rivers, and Cross Rivers states have usually witnessed recurrent cholera outbreaks in the rainy seasons due to flooding [5]. River and Bayelsa states have many areas that are low-lying, often below 20 meters above sea level, hence predisposing them to frequent flooding [52]. Therefore, most peasants residing in many riverine areas lack access to potable water in the south-south geopolitical zone of the country. Some often resort to consumption of poorly treated and contaminated water bodies around them for drinking and other essentialities, hence predisposing them to recurrent cholera outbreaks [5].

In Lagos and elsewhere in Nigeria, apart from the contributory role of poor sanitation and lack of WASH facilities, there is an economic factor. The impact of the nascent economic reforms resulting in the escalation of staple foods could not be overstated. In Nigeria, the whooping yearly 40 percent inflation rate in recent years has turned cooking foods into a luxury, as more people now resort to buying unsanitary cooked foods and unsafe sachet water from food vendors [53]. Most commercial food vendors prioritize pecuniary gains over sanitation in most instances. Hence, exposing some customers to gastrointestinal infections including cholera. Specifically in Lagos's metropolis, a drive through some dense suburbs would show many impoverished inhabitants with unsanitary

habits. Many individuals resort to consumption of unsanitary foods and water near open and foul-smelling gutters, predisposing them to cholera infections.

CONCLUSIONS AND RECOMMENDATIONS

Cholera continues to pose a threat to public health in contemporary Nigeria. According to our study, Nigeria recorded an average cholera CFR of 2.9% between 2017 and 2 March 2025. Moreover, recent data by WHO also showed Nigeria had 19,178 cases including 702 mortalities with a CFR of 3.7% from 1 January to November 24. These recent epidemiological values fail to meet WHO's standard of less than 1% CFR of cholera management across countries. Hence, we delved into the drivers and risk factors enhancing persistent cholera outbreaks in Nigeria.

We therefore highlighted the deadly role of poverty, lack of appropriate WASH facilities, and prolonged conflicts as the main determinants of unrelenting cholera outbreaks across all geo-political regions of the country. Specifically, we apportioned peculiar exacerbating factors in identified cholera hotspots across the main geopolitical zones. In the southwest geopolitical zone, mainly Lagos, we described the influence of high population density, the overstretching of WASH facilities, recurrent flooding, and flagrant disrespect for basic sanitary regulations. Hence, promoting incessant cholera epidemics in the sixth largest economy in Africa. In the northwest region, overwhelming poverty and armed banditry were recognized as the main risk factors for cholera outbreaks. In Kano, the overstretching of WASH facilities resulting from high population density and poor housing planning in some suburbs were identified as the main drivers of cholera. In the northeastern geopolitical zone, particularly, Borno, the recurring and persistent menace of religious conflicts coupled with the prevailing poverty of the region were identified as the foremost reasons why cholera continues to fester in the area. In the south-south geopolitical zone, predominantly Bayelsa and Rivers state, they are proximal to several river channels and the Atlantic Ocean. This geographical peculiarity makes them susceptible to recurrent flooding with a concomitant lack of potable water. Therefore, they are vulnerable to incessant waterborne diseases including cholera.

To redress the devastating trends of cholera requires a multifaceted approach and inter-sectoral collaboration. The existing approaches do not seem to achieve much success in stemming cholera incidences and fatalities in Nigeria. The state, local, and Federal governments must collaborate effectively to mitigate cholera mortalities. There is a need for a concerted and collaborative effort across boards. In 2017, the Global Task Force on Cholera Control (GTFCC) set a global roadmap, which stipulates a reduction of cholera mortality by 90 percent by 2030 [13]. Therefore, all hands must be on deck to achieve this lofty objective. To achieve this aim, the Federal Government of Nigeria launched National Strategic Plan on Cholera Control on 4 February 2025 [54]. They are meant to strengthen the existing modalities of combating cholera through enhanced Integrated Disease Surveillance and Response (IDSR) and Event based

surveillance (EBS). The main objectives are to identify the flash points of cholera, carry out mass community education, and provide WASH amenities and cholera vaccines. Their activities would be evaluated later based on future cholera epidemiological values. Generally, the significance of adequate sanitation, community education and engagement, improved surveillance, and strengthening of health systems could not be overstated, especially in prone areas. In Nigeria and most LMICs, the impoverished people are prone to consumption of unclean water. The provision of clean water is pivotal to redress frequent cholera epidemics. The Ministry of Environment and Water resources of each state should enforce strict regulations regarding drilling of boreholes and wells. The National Agency for Food and Drug Administration and Control (NAFDAC) should improve their statutory responsibilities including regulation of packaged water. Cholera is a reportable disease in Nigeria and treatment is free in all government institutions. But in some instances, the severity of cholera cases might not opportune some patients to get to government facilities. In this regard, to reduce fatalities during outbreaks, national and state health insurance agencies should provide reimbursements for the management of cholera patients in non-governmental facilities. The shortage of oral cholera vaccine (OCV) is another cog in the wheels of successful management of cholera, especially during outbreaks. The government should address the issue of limited vaccines supplied by donors and implementing partners, and seek for improved technical support from WHO/GAVI. The significance of potable water, hygiene, and sanitary facilities in curbing cholera could not be overstated. The government should promptly address this pertinent issue, especially in impoverished communities.

More specifically, in Lagos and other large cities, we advocate for weekly or bi-weekly environmental sanitation, especially in large markets and large urban centers. This would ensure frequent cleaning of drainages, gutters and channels, whose blockages lead to flooding and fecal contamination of foods and water. Moreover, to further improve sanitation and sanitary disposal of waste, we also advocate for a heightened role and reintroduction of the Sanitary inspectors across the nation. They inspect homes, offices, and facilities to ensure appropriate waste disposal amenities. They inspect each house for an efficient water facility and storage system, and they check for toilet facilities to prevent open defecation. They monitor water quality and enforce sanitation laws as well as prosecution of violators of sanitary regulations. They have helped to maintain sanitation and curb the menace of infectious diseases in colonial and immediate post-colonial Nigeria. In the present era, although all 36 states are mandated by law to have sanitary inspectors, their performance remains hampered by a lack of manpower and judiciary bottlenecks preventing quick prosecution of offenders [55]. In this regard, the Abia state government has reintroduced a revamped sanitary inspecting system in all local governments in 2023 [56]. We enjoin more states to join this noble step towards improving the sanitation of the country as a whole to redress cholera epidemics. In Lagos and Kano, among other congested cities, government should endeavor to improve social amenities and infrastructures outside the metropolis. They can

build low-cost housing estates and construct or repair major roads leading out of the city centers to decongest and reduce their population densities. The recent reconstruction of the Ikorodu access road by the Lagos Government is a step in the right direction.

On the national front, the Federal government should seek holistic solutions to the persistent menace of armed conflicts in the northeastern and northwestern parts of the country. They should continue to engage communities, stakeholders and pursue both kinetic and non-kinetic means to put an end to the menace of terrorism and banditry in the northern parts and the whole country as a whole. In the south-south geopolitical zones, the onus lies on their respective governments to provide WASH facilities and enhance community engagement and education about the scourge of cholera. All efforts should also be made to prevent blocking drainages and channels to reduce the possibility of flash flooding. Lastly, the national government should pursue counter-economic reforms that would mitigate the galloping inflationary trends in the country. An effective pricing control for basic food commodities and other essential necessities would be a step in the right direction across the government strata.

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