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CHOLERA RESEARCH LANDSCAPE IN NIGERIA, 2010-2025: A SCOPING REVIEW

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ABSTRACT

Nigeria is one of the countries most affected by cholera in sub-Saharan Africa, experiencing recurrent outbreaks despite ongoing prevention and control efforts. Although numerous studies have examined various aspects of cholera in Nigeria, no study has systematically examined the characteristics, evolution, and gaps in the national cholera research landscape. This research aimed to fill this gap. A scoping review was conducted using the Arksey and O'Malley framework and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews guidelines. Literature searches were performed across Web of Science, CINAHL, PsycINFO, Embase, Medline, PubMed and African Journals Online (AJOL) between January 2010 and July 2025. Eligibility was defined as a primary focus on cholera or *Vibrio cholerae* in Nigeria. Data extraction was performed in Covidence and analysed descriptively. One hundred and fifty-two (152) records met the predefined inclusion criteria. Of these, the majority were original research articles (83.6%), and over half (57.6%) were published between 2020 and 2025, suggesting significant growth in cholera research activity. Epidemiology (surveillance and laboratory) (11.8%; 18/152), bacteriology/molecular/genomics (5.9%; 9/152), and cross-cutting (61.8%; 94/152) were the most frequently represented thematic areas. However, descriptive and cross-sectional studies dominated the evidence-base. Nearly half of the included studies did not report funding sources. In conclusion, cholera research in Nigeria has expanded considerably over the past 15 years, reflecting national research capacity and scientific attention to the disease; however, there is a dearth of evidence in intervention, implementation, and policy-relevant research. Therefore, strengthening investment in a locally led research agenda and implementation strategy is critical to achieving evidence-based policies and public health interventions to control and possibly eliminate cholera in Nigeria.

Keywords: Cholera; *Vibrio cholerae*; research landscape; surveillance; WASH; Nigeria.

INTRODUCTION

Cholera is still one of the most important epidemic-prone infectious diseases worldwide, disproportionately affecting low- and middle-income countries (LMICs). It is caused by toxigenic strains of *Vibrio cholerae* and is characterised by acute watery diarrhoea that can rapidly lead to severe dehydration and death if untreated (World Health Organization, 2019). Although the disease is both preventable and treatable, it continues to cause recurrent outbreaks in many parts of the world, indicating perpetual inequalities in access to safe water, sanitation, hygiene (WASH), healthcare services, and comprehensive surveillance systems (Ali *et al*., 2015). Notably, Africa bears a disproportionate share of the global cholera health and socioeconomic burden, with the continent consistently accounting for most reported cases and deaths worldwide(Mengel *et al*., 2014). Recently, there has been a substantial increase in cholera cases reported across many African countries, including Nigeria, the Democratic Republic of Congo, Zambia, Zimbabwe, Malawi, Mozambique, Ethiopia, Sudan, and South Sudan (European Centre for Disease Prevention and Control, 2026). This persistent transmission of cholera across the continent highlights the complex interplay among environmental, social, political, and infrastructural determinants (Siamalube *et al*., 2025). Rapid population growth, informal urban settlements, inadequate water and sanitation infrastructure, climate-related flooding, conflict, displacement, and limited access to healthcare continue to create conditions conducive to cholera transmission (Rebaudet *et al*., 2013).

Nigeria offers an interesting opportunity to elucidate cholera epidemiology and control in Africa. As the continent's most populous nation, with an estimated population of over 200 million people, Nigeria experiences recurrent cholera outbreaks that contribute substantially to regional and global disease burden (Ogunniyi *et al*., 2025). Cholera has been reported across all geopolitical zones of the country, although transmission intensity and outbreak frequency vary considerably across states and communities (Ogunniyi *et al*., 2025). Cholera epidemiology in Nigeria is often driven by multiple interacting factors, including inadequate access to improved WASH services, rapid urbanisation, seasonal flooding, particularly in riverine and flood-prone communities, and persistent insecurity and population displacement (Elimian *et al*., 2020; Ngwa *et al*., 2020). Nigeria has recorded several major cholera outbreaks over the past two decades. The 2010 outbreak affected numerous states and highlighted weaknesses in surveillance and response systems (Dalhat *et al*., 2014). More recently, the country experienced one of its largest recorded outbreaks in 2021, with tens of thousands of suspected cases reported across multiple states (Elimian *et al*., 2022). Subsequent outbreaks have continued to occur, demonstrating the endemicity of cholera transmission and the challenges associated with achieving sustained control. Importantly, these recurring outbreaks have reinforced the need for evidence-informed interventions and long-term investments in prevention, preparedness, surveillance, and health system strengthening.

Despite the growing number of studies on cholera in Nigeria, critical questions remain about the overall structure, evolution, and characteristics of cholera research in the country. Besides helping researchers and stakeholders to better understand how the Nigerian cholera research landscape has evolved, a systematic profiling of the literature will highlight which technical pillars have received the

greatest attention, where critical knowledge gaps exist, who is responsible for the evidence generation, how research is funded, and whether current research priorities align with national and global cholera research agendas. Understanding the cholera research landscape is particularly important at this time. The Global Task Force on Cholera Control (GTFCC) Global Roadmap to 2030 aims to reduce cholera deaths by 90% and eliminate cholera in at least 20 countries by 2030 (Ending Cholera: A Global Roadmap to 2030, 2017). This will require not only the effective implementation of interventions but also policies and practices that are informed by context-specific evidence. Profiling cholera research in Nigeria can help identify strengths in the existing evidence base while highlighting areas that require additional investment, collaboration, and methodological innovation.

To our knowledge, no systematic review of the literature has been conducted to achieve the aforementioned goals in the Nigerian context. Existing reviews have generally focused on specific aspects of cholera, such as outbreak dynamics and transmission, the factors underpinning recurrent outbreaks, temporal trends and contributing determinants, and health system preparedness and public health response strategies (Adebajo *et al*., 2025; Elimian *et al*., 2020; Mike-Ogburia *et al*., 2024; Ogunniyi *et al*., 2025; Onwunta *et al*., 2025). Consequently, there remains a critical gap in understanding the scope and evolution of cholera-related research conducted in Nigeria over time, especially as the country makes concerted efforts towards cholera control by 2030 in accordance with the global roadmap strategic goals. Therefore, this study aimed to map and characterise systematically cholera research conducted in Nigeria since the emergence of recurrent cholera transmission.

MATERIALS AND METHODS

Study Design

This was a scoping review of the research landscape in Nigeria between 2010 and 2025. The review adopted the methodological framework proposed by (Arksey & O'Malley, 2005) and subsequently refined by (Levac *et al*., 2010); it was reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR).

Search Strategy

A comprehensive literature search was conducted in Web of Science, CINAHL, PsycINFO, Embase, and Medline. An additional search was conducted in PubMed and African Journals Online (AJOL). Search terms included combinations of keywords related to "cholera", "*Vibrio cholerae*", and "Nigeria". Reference lists of eligible articles were also screened to identify potentially eligible studies.

Eligibility Criteria

Studies were eligible for inclusion if they focused on cholera or *Vibrio cholerae* in Nigeria and were published between 2010 and 2025. This covered original research articles, surveillance reports, and policy-related research. However, editorials, commentaries, conference abstracts, letters without primary data, and studies conducted outside Nigeria were deemed ineligible for this study.

Study Selection

All retrieved records were imported into Covidence for screening and duplicate removal. Two reviewers independently screened titles and abstracts, followed by full-text assessment of potentially eligible records. Disagreements were resolved through discussion and consensus. The entire record selection process was documented using a PRISMA flow diagram.

Data Extraction

Within Covidence, a predefined data extraction form was used to extract data on relevant variables, including publication year, journal, study location, study design, thematic focus, institutional affiliations, authorship characteristics, funding source, identified challenges to study implementation, and key findings.

Quality Assessment

The study quality was appraised using an 18-item checklist that covered design clarity, methodological rigour, reporting transparency, and policy relevance. The items assessed were: clarity of aim; stated study period; stated study design; explicit inclusion/exclusion criteria (including for reviews); description of data/sample collection (stool, water, or food, where relevant); sampling approach (participants, locations, or samples); reported sample size; identification of data sources (e.g., surveillance, hospital, laboratory, bibliographic databases); description of analytical methods; reporting of missingness or data coverage; clarity of results presentation; concordance of findings with the stated aim; provision of key statistics/results (or themes for qualitative work); ethical approval/informed consent where applicable; acknowledgement of limitations or bias; disclosure of funding and conflicts of interest; practical usefulness for cholera policy, prevention, preparedness/response, or research in Nigeria; and contextual relevance to local or regional determinants. Each criterion was scored once as 1 (yes), 0.5 (partly), 0 (no), or not applicable. For each article, the scores were summed across applicable items and expressed quality as a percentage:

$$\text{Quality score (\%)} = \frac{\sum \text{item scores}}{\text{number of applicable items}} \times 100 \quad (1)$$

Non-applicable items were excluded from the denominator. For illustration, an article with 8.5 points across 16 applicable items (two items were not applicable) received a score of 53.1%. For interpretability, percentage scores were categorised as follows: A (≥70%), B (60–69%), C (50–59%), D (40–49%), E (30–39%), and F (<30%). This framework preserves comparability across heterogeneous designs while avoiding penalisation for legitimately non-applicable criteria.

Data Analysis

Descriptive analyses were conducted to characterise publication trends, study designs, thematic areas, geographical distribution, funding, and authorship characteristics. Frequencies, associated percentages, and temporal trends were summarised using descriptive statistics. Findings were synthesised narratively to identify research strengths, trends, and knowledge gaps within the Nigerian cholera research landscape. All analyses were performed in Stata V16.

RESULTS AND DISCUSSION

Selection of Articles

The scoping review identified 8,858 records, of which 152 met the predefined inclusion criteria. See details of the selection process in Figure 1.

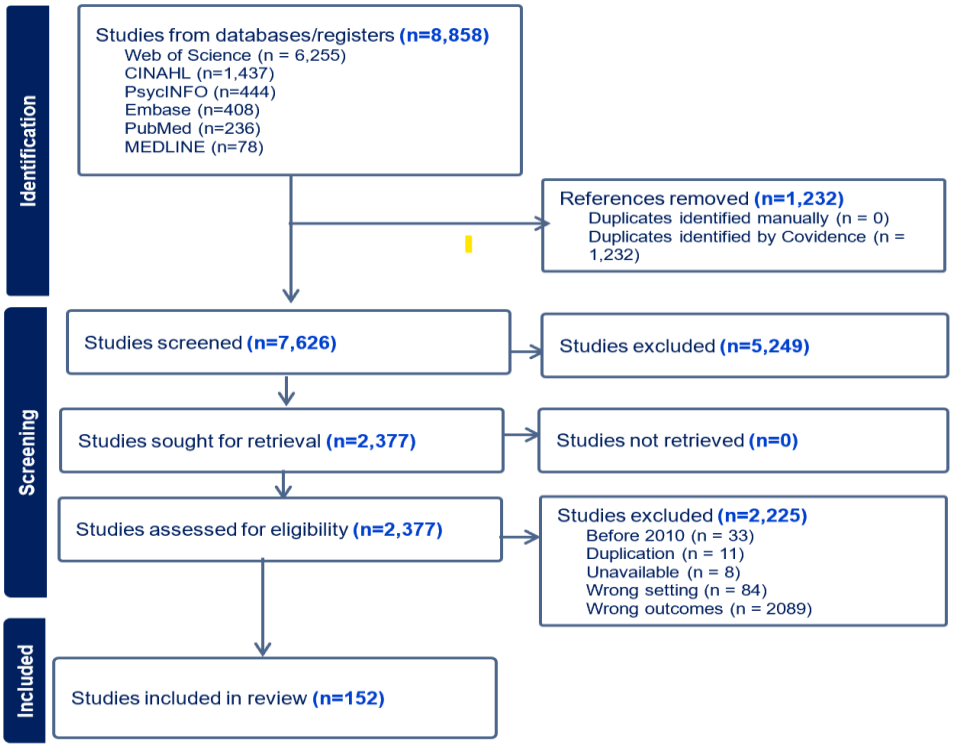

Figure 1: PRISMA chart showing the selection of documents for the review

Description of Included Records

Table 1 characterises the included records for this review. Most of the 152 included records were original research (127, 83.6%) (not shown). Cholera publications were more frequent in 2020–2025 (57.6%; 87/152) than in 2010–2019 (42.4%; 64/152). The study quality was high overall, with those categorised as A or excellent accounting for slightly over half (54.0%) and B at 19.1%. The majority of the identified studies adopted a cross-sectional design (31.5%; 46/152). The proportions of studies conducted during cholera outbreaks and non-outbreaks were similar. The dominant thematic focus was cross-cutting (61.8%; 94/152), while epidemiology (surveillance and laboratory) (11.8%; 18/152) was the most common among single domains. Editorial timelines averaged 198.3 days from submission to publication.

Table 1: Characteristics of Included Articles on Cholera in Nigeria (N=152)

Variable	Frequency (%)
Publication year	
2010-2019	64 (42.4)
2020-2025	87 (57.6)
Article quality	
E	10 (6.7)
D	10 (6.7)
C	21 (13.8)
B	29 (19.1)
A	82 (54.0)
Average quality score (%)	70.6
Study domain	
Epidemiology (surveillance and laboratory)	18 (11.8)
Bacteriology/molecular/genomics	9 (5.9)
Community engagement and risk communication	7 (4.6)
Infection prevention and control	6 (4.0)
Environment/ecology/climate	6 (4.0)
WASH	2 (1.3)
Healthcare systems and policy	4 (2.6)
Case management	2 (1.3)
Logistics and planning	4 (2.6)
Cross-cutting	94 (61.8)
Indigeneity of authors	
Indigenous	97 (63.8)
Partially indigenous	20 (13.2)
Non-indigenous	35 (23.0)
Average number of collaborating institutions (SD)	3.5 (2.9)

Variable	Frequency (%)
Average number of authors (SD)	6.6 (6.1)
Funding status	
Funded	42 (27.6)
Unfunded	38 (25.0)
Unspecified	72 (47.4)
Study design	
Antimicrobial resistance assessment	5 (3.4)
Bacteriology/genomics/cellular biology	6 (4.1)
Case series/report	5 (3.4)
Case-control	12 (8.2)
Cross-sectional	46 (31.5)
Ecological	1 (0.7)
Environmental assessment	4 (2.7)
Prospective cohort	2 (1.4)
Mathematical modelling	11 (7.5)
Mixed-methods study	13 (8.9)
Perspective	1 (0.7)
Qualitative	6 (4.1)
Quasi-experimental	2 (1.4)
Retrospective cohort	9 (6.2)
Review (systematic or scoping)	22 (15.1)
Time series	1 (0.7)
Study context	
Outbreak	77 (50.7)
Non-outbreak	71 (46.7)
Not applicable	1 (0.7)
Missing	3 (2.0)
Mean time from article submission to acceptance (SD)Ƀ	140.0 (115.5)
Mean time from article acceptance to publication (SD)Ⱨ	47.6 (73.4)
Mean total time from submission to publication*	198.3 (225.7)

ɃBased on 97 records; ⱧBased on 92 records; *Based on 90 records

Temporal Trends in Publications

The number of cholera articles was generally low and sporadic between 2010 and 2011; however, it increased sharply in 2012–2014 and stabilised at modest levels in 2015–2019. A sustained increase in the publication output followed until 2023. Thereafter, publication output gradually decreased between 2024 and 2025. Overall, the observed trajectory suggests a step change in cholera research intensity from 2020 onward, with a recent decrease that may reflect the timing of the search for the review, conducted in July 2025.

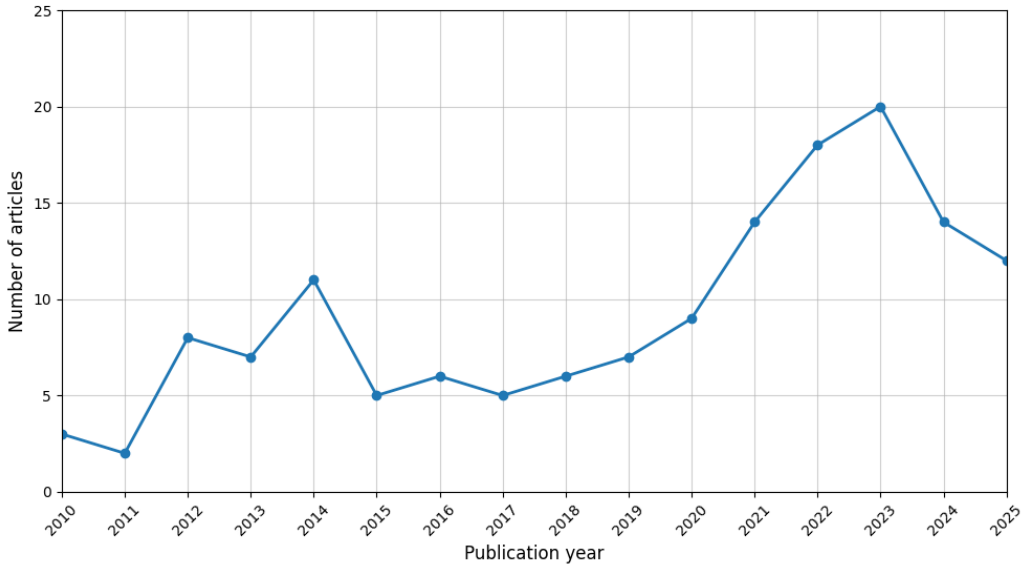

Figure 2: Annual number of included publications on cholera in Nigeria, 2003–2025

Funding Status

Of the 152 articles, funding statements were unspecified in 47.4% (72/152), reported funding in 27.6% (42/152), and were unfunded in 25.0% (38/152) (Figure 2). This translates to less than one in three studies declaring funding to support the research, while nearly half did not report funding status. However, these patterns should be interpreted with caution, as "unspecified" does not necessarily mean "unfunded."

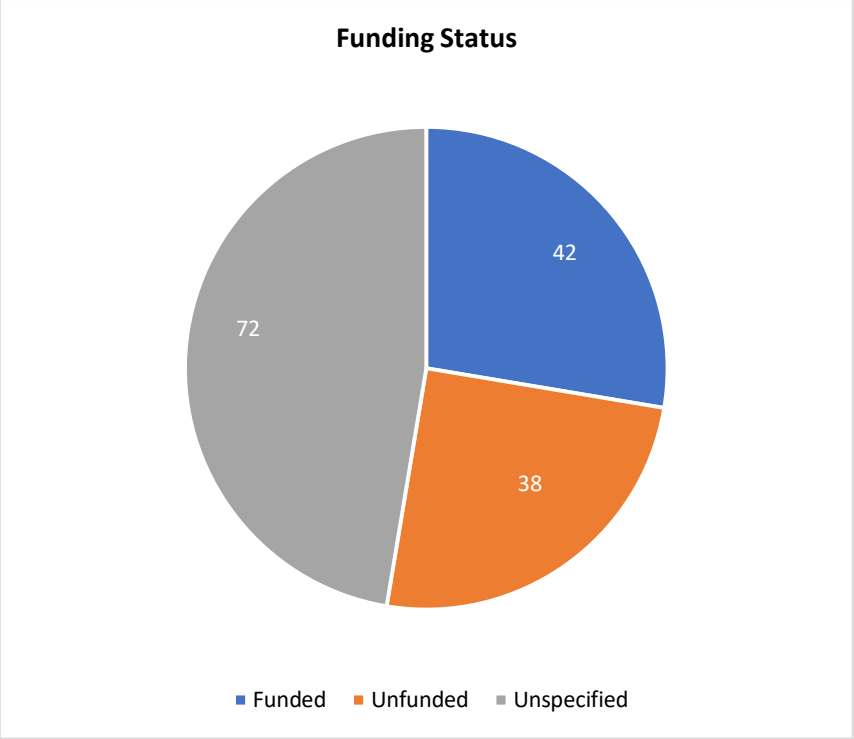

Figure 3: Funding status of included articles on cholera in Nigeria (N=152)

Comparison of Key Findings with Existing Evidence

This review provides a timely overview of the cholera research landscape in Nigeria between 2010 and 2025. In summary, the findings indicate a substantial growth in cholera research, with over half of the included studies published recently between 2020 and 2025. This growth is consistent with the growing advocacy for the public health benefits of investing in cholera prevention and control in Nigeria, particularly following recurrent large outbreaks in recent years (Elimian et al., 2022; Elimian *et al*., 2019). However, it appears that the growth in publication output has not been matched by a proportional increase in public health interventions, as would be expected in studies using trial and quasi-experimental designs. Another key finding is the dominance of cross-cutting studies, which accounted for nearly two-thirds of the included records. This could be interpreted in two ways. On the one hand, it suggests that Nigerian cholera research is multidisciplinary by targeting multiple technical areas concurrently, such as epidemiology (surveillance and laboratory), WASH, and case management. This is a strength because cholera is inherently multisectoral and requires integrated evidence to inform interventions that can make a sustainable impact. On the other hand, the high prevalence of cross-cutting studies may indicate insufficient depth within individual domains. For example, case management was comparatively under-represented as a primary thematic area, despite its centrality to cholera control. These contrasting implications of the finding underscore the need for a nationally-led cholera research agenda. The review also found the predominance of descriptive and cross-sectional designs across the evidence base. These studies are useful for describing cholera outbreaks, identifying risk factors, and documenting epidemiological patterns; however, they lack the methodological credibility to evaluate which interventions work, for whom, under what conditions, and at what cost. This can be addressed by promoting the design and implementation of more quasi-experimental studies, cohort studies (prospective and retrospective), implementation research, health economic evaluation, operational research, and policy translation studies. Further, the lack of a retrospective cohort study may indicate weaknesses in the country's surveillance data, despite its broad geographical coverage.

The funding status of the identified articles is another important finding: nearly half do not specify a funding source, and only about one-quarter report funding. This finding should be interpreted with caution, as the absence of a funding statement does not necessarily imply the absence of funding. However, poor funding disclosure has serious implications for transparency, as it makes it difficult to assess whether the national cholera research landscape is being shaped by local priorities, donor priorities, institutional capacity, or outbreak-driven urgency; it also points to the need for stronger local and international collaboration and investment in cholera research, particularly one that aligns with Nigeria's public health priorities outlined in a nationally-owned research agenda. The quality assessment suggests that the overall quality of included studies was relatively strong, with slightly over half categorised as excellent. This indicates that Nigeria has a credible and growing cholera research ecosystem. However, the classification of a few studies in lower-quality categories also highlights persistent weaknesses in the criteria used for the quality assessment.

This review has some strengths and limitations worth acknowledging. In terms of strengths, this is the first systematic mapping of the cholera research landscape in Nigeria over 15 years, using a transparent scoping review methodology and conducting a quality appraisal for heterogeneous study designs. By mapping study designs, funding patterns, thematic focus, and publication trends, the review goes beyond disease epidemiology to examine the research ecosystem itself. The review also has limitations. First, although the review involved searching multiple databases, relevant grey literature, government reports, theses and non-indexed institutional outputs may have been omitted. Second, the review included only published studies, which

may introduce publication bias. Third, the classification of thematic domains involved judgement, especially for cross-cutting studies. Finally, the quality appraisal tool was developed for this review and, while useful for comparing heterogeneous studies, may not capture all design-specific quality dimensions.

The findings have important implications. Nigeria needs a coordinated cholera research agenda that moves from descriptive outbreak documentation towards implementation, intervention and policy research. Priority areas should, however, be developed in collaboration with relevant cholera stakeholders at both the national and subnational levels, rather than relying solely on expert judgement. Future research should also strengthen collaboration among universities, the NCDC, state ministries of health, WASH agencies, communities, and international partners.

CONCLUSION

Cholera research in Nigeria has grown substantially, particularly since 2020, and is increasingly characterised by diverse thematic coverage; however, the current evidence base remains heavily descriptive and insufficiently oriented towards implementation, intervention evaluation and policy translation. To support Nigeria's cholera control ambitions and contribute to the global roadmap goals by 2030, future investment should prioritise locally led and methodologically robust research that directly informs prevention, preparedness, response and long-term elimination strategies.

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REFERENCES

Adebajo, G. O., Alabi, G. J., Oladele, O. C., Ayowole, D. J., Ogedengbe, I. T., & Abati, S. O. (2025). Review of public health preparedness and response to cholera; lessons from Nigeria's 2024 outbreak. *Discover Public Health 2025 22:1*, *22*(1), 184-. https://doi.org/10.1186/S12982-025-00583-W

Ali, M., Nelson, A. R., Lopez, A. L., & Sack, D. A. (2015). Updated global burden of cholera in endemic countries. *PLoS Neglected Tropical Diseases*, *9*(6), e0003832. https://doi.org/https://dx.doi.org/10.1371/journal.pntd.0003832

Arksey, H., & O'Malley, L. (2005). Scoping studies: towards a methodological framework. *International Journal of Social Research Methodology*, *8*(1), 19–32. https://doi.org/10.1080/1364557032000119616

Dalhat, M. M., Isa, A. N., Nguku, P., Nasir, S.-G., Urban, K., Abdulaziz, M., Dankoli, R. S., Nsubuga, P., & Poggensee, G. (2014). Descriptive characterisation of the 2010 cholera outbreak in Nigeria. *BMC Public Health*, *14*(1), 1167. https://doi.org/10.1186/1471-2458-14-1167

Elimian, K. O., Mezue, S., Musah, A., Oyebanji, O., Fall, I. S., Yennan, S., Yao, M., Abok, P. O., Williams, N., Omar, L. H., Balde, T., Ampah, K., Okudo, I., Ibrahim, L., Jinadu, A., Alemu, W., Peter, C., & Ihekweazu, C. (2020). What are the drivers of recurrent cholera transmission in Nigeria? Evidence from a scoping review. *BMC Public Health*, *20*(1), 1–13. https://doi.org/10.1186/s12889-020-08521-y

Elimian, K. O., Musah, A., Mezue, S., Oyebanji, O., Yennan, S., Jinadu, A., Williams, N., Ogunleye, A., Fall, I. S., Yao, M., Eteng, W.-E., Abok, P., Popoola, M., Chukwuji, M., Omar, L. H., Ekeng, E., Balde, T., Mamadu, I., Adeyemo, A., & Ihekweazu, C. (2019). Descriptive epidemiology of cholera outbreak in Nigeria, January-November, 2018: implications for the global roadmap strategy. *BMC Public Health*, *19*(1), 1264. https://doi.org/https://dx.doi.org/10.1186/s12889-019-7559-6

Elimian, K., Yennan, S., Musah, A., Cheshi, I. D., King, C., Dunkwu, L., Mohammed, A. L., Ekeng, E., Akande, O. W., Ayres, S., Gandi, B., Pembi, E., Saleh, F., Omar, A. N., Crawford, E., Olopha, O. O., Nnaji, R., Muhammad, B., Luka-Lawal, R., & Adetifa, I. (2022). Epidemiology, diagnostics and factors associated with mortality during a cholera epidemic in Nigeria, October 2020-October 2021: a retrospective analysis of national surveillance data. *BMJ Open*, *12*(9). https://doi.org/10.1136/bmjopen-2022-063703

Ending Cholera: A Global Roadmap to 2030, 32 (2017). https://www.who.int/cholera/publications/global-roadmap.pdf

European Centre for Disease Prevention and Control. (2026). *Geographical distribution of cholera cases reported worldwide from February 2025 to February 2026*. ECDC. https://www.ecdc.europa.eu/en/publications-data/geographical-distribution-cholera-cases-reported-worldwide-february-2025-february

Levac, D., Colquhoun, H., & O'Brien, K. K. (2010). Scoping studies: advancing the methodology. *Implementation Science 2010 5:1*, *5*(1), 1–9. https://doi.org/10.1186/1748-5908-5-69

Mengel, M. A., Delrieu, I., Heyerdahl, L., & Gessner, B. D. (2014). Cholera outbreaks in Africa. *Current Topics in Microbiology and Immunology*, *379*, 117–144. https://doi.org/10.1007/82_2014_369

Mike-Ogburia, M. I., Eze, C. C., Okoli, M. O., Ekada, I., Uhegbu, C. U., Ugwu, C., Ogbakiri, P. A., Alozie, F. C., Ideozu, N. O., Amesi, A. W., & Ifeanyi, M. A. (2024). Cholera in Nigeria: A review of outbreaks, trends, contributing factors, and public health responses. *Nigerian Medical Journal : Journal of the Nigeria Medical Association*, *65*(6), 824–843. https://doi.org/https://dx.doi.org/10.60787/nmj.v65i6.584

Ngwa, M. C., Wondimagegnehu, A., Okudo, I., Owili, C., Ugochukwu, U., Clement, P., Devaux, I., Pezzoli, L., Ihekweazu, C., Jimme, M. A., Winch, P., & Sack, D. A. (2020). The multi-sectorial emergency response to a cholera outbreak in Internally Displaced Persons camps in Borno State, Nigeria, 2017. *BMJ Global Health*, *5*(1), 2000. https://doi.org/10.1136/bmjgh-2019-002000

Ogunniyi, T. J., Muoneke, A. P., Nimo, F., Yisa, S. S., & Olorunfemi, O. A. (2025). Cholera in Nigeria: a five-decade review of outbreak dynamics and health system responses. *Journal of Health, Population and Nutrition 2025 44:1*, *44*(1), 329-. https://doi.org/10.1186/S41043-025-01096-7

Onwunta, I. E., Ozota, G. O., Eze, C. A., Obilom, I. F., Okoli, O. C., Azih, C. N., Okoye, C. O., & Agbo, E. L. (2025). Recurrent cholera outbreaks in Nigeria: A review of the underlying factors and redress. *Decoding Infection and Transmission*, *3*, 100042. https://doi.org/10.1016/J.DCIT.2025.100042

Rebaudet, S., Sudre, B., Faucher, B., & Piarroux, R. (2013). Environmental determinants of cholera outbreaks in inland Africa: a systematic review of main transmission foci and propagation routes. *The Journal of Infectious Diseases*, *208 Suppl 1*(SUPPL. 1). https://doi.org/10.1093/infdis/jit195

Siamalube, B., Ehinmitan, E., Runo, S., Ngotho, M., & Onguso, J. (2025). Cholera in Sub-Saharan Africa: Unveiling neglected drivers and pathways to elimination. *PLOS Neglected Tropical Diseases*, *19*(4), e0013029. https://doi.org/10.1371/JOURNAL.PNTD.0013029

World Health Organization. (2019). *Cholera: Key Facts*. WHO.