Knowledge and Preventive Practices Regarding Typhoid Fever among Adults in Nigeria: A Systematic Review

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ABSTRACT

Background. Typhoid fever, caused by *Salmonella* Typhi, is spread through food and water contaminated with faeces. The Global Burden of Disease Study 2017 estimated about 14.3 million cases of typhoid and paratyphoid fever and about 135,900 deaths worldwide.

Methods. A systematic review of 71 supplied records, reported in line with PRISMA 2020 where applicable (Page et al., 2021). We screened records against eligibility criteria (typhoid as the main subject; burden, risk factors, knowledge, practices or prevention; published 2017–2026). One reviewer screened and extracted data; no formal risk-of-bias tool was applied, and findings were synthesized narratively.

Results. We removed one duplicate and 11 records on other diseases, leaving 59 included records, 25 of which were Nigerian studies. In a preprint survey of 443 adults in Kano, 71.4% had heard of typhoid fever, but only 31.1% were aware of the vaccine. Only 53.7% of 300 respondents in Gyadi-Gyadi agreed that not washing hands contributes to infection (Aliyu et al., 2019). Unsafe drinking water carried a pooled odds ratio of 2.44 (95% CI 1.65–3.59) for typhoid in a published meta-analysis (Mogasale et al., 2018).

Conclusions. Knowledge of typhoid among Nigerian adults is partial, vaccine awareness is low and preventive practices are inconsistent. We recommend community health education, safe water and sanitation, broader vaccine awareness and stronger surveillance. The evidence is mostly cross-sectional, partly from non-peer-reviewed sources, and was not formally appraised for bias.

Keywords*:* systematic review; typhoid fever; knowledge; preventive practices; adults; Nigeria

INTRODUCTION

Background

Typhoid fever is an infection of the blood and gut caused by *Salmonella* Typhi. This bacterium lives only in humans and passes from one person to another through food and water contaminated with faeces. It begins with a prolonged fever, headache and abdominal discomfort, and in the worst cases it leads to intestinal bleeding, perforation and death. Because the same germ spreads wherever sanitation is poor and hands are not washed, typhoid has been called a disease of poverty and crowded settlements (Radhakrishnan et al., 2018; Obaro et al., 2017). The Global Burden of Disease Study 2017 estimated about 14.3 million cases of typhoid and paratyphoid fever and about 135,900 deaths worldwide in that year, with *S.* Typhi causing 76.3% of cases and a case fatality of about 0.95%. The burden had fallen by around 45% since 1990, yet it still amounted to 9.8 million healthy life years lost (Stanaway et al., 2019).

The burden is not shared equally. Reviews of African data show that enteric fever is endemic across much of the continent, that surveillance is thin, and that the true burden is probably undercounted (Adesegun et al., 2020; Obaro et al., 2017; Park et al., 2019). Systematic reviews repeatedly identify the same set of risk factors.

A review of 109 studies found that demographic and socioeconomic factors were examined in 50.5% of studies, foodborne transmission in 44.0%, waterborne transmission in 41.3% and sanitation and hygiene practices in 31.2% (Boakye Okyere et al., 2025). People who drink unimproved or unsafe water have about 2.5 times the odds of typhoid (pooled odds ratio 2.44; Mogasale et al., 2018). Outbreak investigations elsewhere show how fast water and sanitation interventions are needed once typhoid appears (Bennett et al., 2018; Prasad et al., 2018; Watson et al., 2017).

In Nigeria, typhoid is a familiar illness and a frequent diagnosis in clinics and pharmacies. Hospital records from Lagos covering 1993 to 2015 showed that more than 80% of *S.* Typhi isolates were resistant to several antibiotics, while access to improved sanitation in the country had fallen (Akinyemi et al., 2018). In Gombe metropolis, incidence from hospital records was above 100 cases per 100,000 people every year from 2015 to 2019 (Tawfiq et al., 2022b). In Niger State, 57.1% of tap-water users and 25.6% of borehole users were infected, and isolates showed 96.8% resistance to chloramphenicol, 79.5% to tetracycline, and 100% to amoxicillin (Musa et al., 2025, as reported by NAN News, 2025). Studies from Kebbi, Nasarawa, Bauchi, Rivers, Delta, Ebonyi and Enugu add local prevalence and risk factor data (Acha et al., 2025; Enwe et al., 2026; Faruku et al., 2024; Hassan et al., 2024; Odikamnoro et al., 2018; Osu et al., 2024; Samuel & Eleke, 2024), and an outbreak linked to contaminated drinking water has been described in Borno State (Ubachukwu et al., 2026).

What adults know, believe and do about typhoid decides whether such figures fall. In a survey of 443 adults in Kano, 71.4% had heard of typhoid fever; almost all knew it could be cured, but only 31.1% were aware of the typhoid vaccine, and 43.4% said they were not (Ravi & Ayando, 2024). In Gyadi-Gyadi, Kano, 95.7% of 300 respondents identified headache as a sign of typhoid, yet only 53.7% agreed that not washing hands contributes to infection, and risk perception was judged poor (Aliyu et al., 2019). In Nimo village, interviewed adults had a limited understanding of the causes and risk factors of typhoid, and a lack of water and sanitation shaped their hygiene practices (Ilouno, 2020). Awareness and preventive measures have also been studied among residents of Epinmi Akoko in Ondo State (Bolaji et al., 2026) and Isiala Mbano in Imo State (John, 2025), and the effect of disease education has been tested among nursing mothers in Oyo State (Famuyiwa et al., 2022) and patent medicine vendors in Ebonyi State (Udeh et al., 2026).

Nigerian adults are also often confused about typhoid and malaria. The two illnesses overlap, both are treated at the same clinics, and co-infection has been reported among adults (Odikamnoro et al., 2018) and in a hospital in Ibadan, where co-infection reached 9.7% in May and was highest at 18.5% in children aged 6 to 12 years (Olowolafe et al., 2024). The belief that malaria and typhoid always occur together has been described as a myth that health promotion needs to dislodge (Uzochukwu et al., 2025). Treatment choices are shaped by social and environmental factors, including among secondary school students in Ikenne (Ozakpo & Olugasa, 2020) and rural dwellers in Ekiti State (Asenowo & Adeoye, 2025).

Studies from other countries show how widespread the knowledge–practice gap is. In Pakistan, 93.3% of respondents knew about typhoid and 94.7% knew that handwashing reduces food contamination, but only 35.7% used a sanitiser when washing fruit, and 21.2% drank raw milk (Tariq et al., 2025). In Ethiopia, 65.4% of febrile patients had good knowledge and 67.5% good practice, while 25.7% had evidence of infection (Mulu et al., 2021). Bangladeshi university students had a mean knowledge score of 80.05 but a mean practice score of only 60.93 (Parvin et al., 2026). Similar surveys have been done in Ghana (Delali et al., 2026), Malawi (Lubanga et al., 2026), Cameroon (Njoya et al., 2021), Iraq (Sadeq & Jabar, 2017), India (Abraham et al., 2025) and among food handlers in Ethiopia and Ghana (Akabanda et al., 2017; Gizaw et al., 2024).

Prevention rests on safe water, sanitation, hygiene, safe food handling, vaccination and early treatment. A typhoid conjugate vaccine had an efficacy of 54.6% in a controlled human infection trial (Jin et al., 2017), and India's experience shows both the progress and the challenges of control (Mukhopadhyay et al., 2019). Even so, a vaccine can protect only adults who know about it and can access it. Ceftriaxone-resistant typhoid has already spread across Pakistan (Nizamuddin et al., 2021), while multidrug-resistant enteric fever has become an unmet need in South Asia (Parry et al., 2019b). Nigeria cannot afford to wait for this threat to grow before strengthening preventive behaviour.

Understanding what adults know matters for a practical reason. Typhoid spreads through ordinary daily acts: the water a household drinks, the way food is washed and stored, whether hands are cleaned after using the toilet and before eating, and where a person buys street food. Adults decide these things for themselves and for the children in their care, so their knowledge and habits sit at the centre of prevention. Knowledge alone does not guarantee safe behaviour, as the contrast between high awareness and weak practice in several of the studies above shows. However, without it, people cannot recognise early symptoms, seek a proper diagnosis or accept vaccination when it is offered.

Diagnosis and treatment add another layer. Studies in Nigeria report typhoid by different methods, and the results do not always agree: among 125 Bingham University students, stool culture was positive in 75.2% while the Widal test was positive in 80 students (Joshua et al., 2017), which shows how the choice of test can change a reported prevalence. Treatment choices are also shaped by social and environmental factors (Ozakpo & Olugasa, 2020), and the high antibiotic resistance already described (Akinyemi et al., 2018) makes inappropriate treatment especially costly. Better public knowledge of causes, symptoms, correct care-seeking and prevention is therefore one of the few measures that can be strengthened quickly alongside the longer work of improving water and sanitation.

This review therefore brings together the evidence supplied in the reference list on the burden of typhoid, adults' knowledge and risk perception, the risk factors that shape exposure, and the preventive practices and measures that have been tested. It sets out the review methods, a flow diagram of study selection, and nine tables; compares Nigerian results with surveys from other countries; and closes with recommendations for community health workers, health educators, and policy makers in Nigeria. Typhoid fever remains endemic in Nigeria with rising antibiotic resistance. However, adults' knowledge is uneven, awareness of the vaccine is low, and preventive practices such as handwashing, safe water use and safe food handling are poorly documented and often weak. This review therefore examines the burden of typhoid fever, summarises what Nigerian adults know about it, describes their preventive practices and the risk factors that sustain transmission, and recommends prevention measures. This is a systematic review of the 71 records supplied as the reference set for this review. Each record was screened against stated eligibility criteria; 59 were included, and 12 were removed as duplicates or as papers about other diseases. Scrub typhus (Kore & Mahajan, 2022; Xu et al., 2017) and fowl typhoid in poultry (Berhanu & Fulasa, 2020) are different diseases from typhoid fever and were excluded for that reason. Where a paper reported numbers, they are used as reported by the authors, and where the full text could not be examined, only abstract figures are reported. Typhoid fever continues to cause illness and death on a very large scale, with an estimated 14.3 million cases and about 135,900 deaths worldwide in 2017 (Stanaway et al., 2019). In Nigeria, incidence in Gombe exceeded 100 cases per 100,000 people per year (Tawfiq et al., 2022), resistance of *S.* Typhi to first-line antibiotics is very high (Akinyemi et al., 2018; Musa et al., 2025), and access to improved sanitation has declined (Akinyemi et al., 2018).

Adults are central to this problem because they prepare food, collect and store water, seek treatment, and decide whether children are protected. Nevertheless, awareness of the vaccine was only 31.1% in one Kano survey (Ravi & Ayando, 2024), risk perception was judged poor in another (Aliyu et al., 2019), and village residents had limited understanding of how typhoid is caused (Ilouno, 2020). Knowing about handwashing does not guarantee that it happens, as surveys elsewhere show (Parvin et al., 2026; Tariq et al., 2025). Without a clear picture of adult knowledge and practice, prevention programmes risk being aimed at the wrong things. This review is justified on four grounds. First, the burden is large, and the risk factors are largely preventable. Unsafe water, poor sanitation, unsafe food and poor hygiene dominate the research (Boakye Okyere et al., 2025; Mogasale et al., 2018), and each can be changed through community action. Second, antibiotic treatment is failing. When chloramphenicol resistance reaches 96.8% and amoxicillin resistance 100% (Musa et al., 2025), prevention becomes more important than ever, because cure can no longer be taken for granted.

Third, Nigerian evidence on knowledge and practice is scattered across theses, local journals, and preprints, and much of it is hard to find. A single synthesis helps students and practitioners to see the whole picture. Fourth, the topic is central to community health practice. Health education, water and sanitation promotion,

and vaccination campaigns are delivered by community health workers and environmental health officers, and education has been assessed in Nigerian settings among patent medicine vendors and nursing mothers (Famuyiwa et al., 2022; Udeh et al., 2026).

REVIEW OF RELATED LITERATURE

Epidemiology and risk factors. Global estimates place typhoid among the leading enteric infections (Stanaway et al., 2019), with an unrecognised burden in Africa (Obaro et al., 2017) and an ongoing effort to build surveillance (Barkume et al., 2018; Park et al., 2019). Reviews of African enteric fever describe changing resistance and diagnostic limits (Adesegun et al., 2020; Saha et al., 2023). Water is the most consistent risk factor (Mogasale et al., 2018), alongside food, sanitation and socioeconomic factors (Boakye Okyere et al., 2025; Twumasi-Ankrah et al., 2025). Studies in Fiji, Samoa, India, Chile and the United States describe how typhoid behaves in other settings (Gauld et al., 2018; McAteer et al., 2021; Parry et al., 2019a; Prasad et al., 2018; Sikorski et al., 2020; Sur et al., 2018; Watson et al., 2017), and travel-related typhoid has its own literature (Amicizia et al., 2019; Forster & Leder, 2021; Muresu et al., 2020).

Nigerian studies. Prevalence and risk factors have been described in Gombe (Kumo, 2025; Tawfiq et al., 2022a, 2022b), Kebbi (Faruku et al., 2024), Nasarawa (Osu et al., 2024), Bauchi (Hassan et al., 2024), Rivers (Samuel & Eleke, 2024), Delta (Acha et al., 2025), Niger (Musa et al., 2025) and a university campus (Joshua et al., 2017). Knowledge and risk perception were assessed in Kano (Aliyu et al., 2019; Ravi & Ayando, 2024), Nimo village (Ilouno, 2020), and Imo State (John, 2025), and awareness of preventive measures in Ondo State (Bolaji et al., 2026). Education interventions were evaluated among nursing mothers (Famuyiwa et al., 2022) and patent medicine vendors (Udeh et al., 2026). Nigerian work on other infections, such as Lassa fever, uses the same knowledge and practice framework (Aromolaran, 2021; Aromolaran et al., 2023).

Other countries and related topics. Knowledge, attitude and practice surveys on typhoid have been done in Pakistan (Tariq et al., 2025), Ethiopia (Mulu et al., 2021), Ghana (Delali et al., 2026), Malawi (Lubanga et al., 2026), Bangladesh (Parvin et al., 2026) and Iraq (Sadeq & Jabar, 2017), and awareness of transmission in Cameroon (Njoya et al., 2021). Studies of dengue knowledge and practice in Nigeria, Tanzania and Bangladesh use similar methods (Banik et al., 2023; Jesu-Oboh et al., 2026; Kazaura, 2020), as do studies of household water handling in Uganda (Ssemugabo et al., 2019) and preventive behaviour against COVID-19 in Ethiopia (Andarge et al., 2020). Malaria and typhoid have been studied together in Ghana and Nigeria (Anabire et al., 2018; Olowolafe et al., 2024).

Aim of the review

To systematically review the evidence on adults' knowledge and preventive practices regarding typhoid fever in Nigeria, and to identify practical, community-based measures for prevention.

Specific objectives

The specific objectives of this review are to:

1. Describe how the evidence was identified, screened and included and the global and Nigerian burden of typhoid fever using at least six quantitative indicators
2. State at least five findings on adults' knowledge, risk perception and vaccine awareness in Nigeria
3. Identify at least five risk factors for typhoid infection and recurrence, with the measures of association reported
4. Compare Nigerian findings with at least three knowledge, attitude and practice studies from other countries and explain the effect of co-infection on diagnosis
5. Appraise the evidence for at least four prevention measures and propose at least six recommendations
6.

METHODS

Design and reporting

This is a systematic review of a fixed evidence set: the 71 records supplied as the reference list for this review. It is reported following the PRISMA 2020 statement where applicable (Page et al., 2021). The reference list holds 74 entries: the 71 records, plus three supporting sources that are not counted among them (the PRISMA 2020 statement, a news report and a thesis on the same data as Tawfiq et al., 2022b). No protocol was registered. Because the records were supplied rather than found through a database search, the review did not run or report a search strategy, and this is stated as a limitation.

Review question

What is known about the burden of typhoid fever, the risk factors that sustain it, and adults' knowledge, perception and preventive practices regarding it in Nigeria, and what preventive measures are supported by evidence? The population was people living in Nigeria, with adults as the main interest, and studies of other groups were retained where adult data were not separated. Studies from other countries were kept as comparison evidence.

Eligibility criteria

A record was included if

1. typhoid fever or enteric fever was its main subject;
2. it reported at least one of burden (prevalence, incidence, resistance), risk factors, knowledge, attitudes or practices, or preventive measures;
3. it was a primary study, trial, surveillance report or review of any design; and
4. it was published in English between 2017 and 2026. Records were excluded if they concerned a different disease or an animal disease, if typhoid was not the focus, or if they duplicated another record.

Selection, data extraction and synthesis

One reviewer screened each record by title and abstract against the criteria and removed duplicates first. For each included record, the setting, population, focus and numerical results were extracted as reported by the authors into the tables, with a dash where a value was not reported. Where the full text was not accessible, only abstract values were extracted. No formal risk-of-bias tool was applied, and the certainty of evidence was not graded, so study design is discussed narratively. Results were synthesised narratively in tables, and no meta-analysis was done because outcomes, definitions and populations differed; the only pooled estimate quoted (odds ratio 2.44 for unsafe water) comes from a published meta-analysis (Mogasale et al., 2018).

RESULTS

Study selection and characteristics of included studies

Of the 71 records supplied, one was a duplicate (the same JMIR review listed under two author orders), and 11 were removed because they were about other diseases or did not concern typhoid fever, leaving 59 records in the synthesis (Figure 1; Table 2). Twenty-five were Nigerian studies, and 34 were reviews, surveillance reports, vaccine trials, or knowledge surveys from other countries. The Nigerian studies came from hospitals, primary health centres, communities, schools, and a university in the north, west, east, and south of the country (Table 1). Most are recent: 16 of the 25 were published from 2024 onwards.

Figure 1: Flow of records through the review (PRISMA 2020 style)

Stage	Records	Detail
Records supplied	71	Reference file supplied for the review
Duplicates removed	1	Risk factors for typhoid fever: systematic review (JMIR 2025), listed twice
Records screened	70	Title and abstract checked against eligibility criteria
Records excluded	11	Other diseases or typhoid not the focus (Table 2)
Records included	59	Included in the narrative synthesis
Nigerian studies	25	Prevalence, risk factors, knowledge, practice, education (Table 1)
Reviews and burden syntheses	11	Global or regional reviews and risk-factor syntheses
Clinical, surveillance and outbreak reports	13	From other countries, including travel-related typhoid
Vaccine trial	1	Controlled human infection trial
Knowledge surveys outside Nigeria	9	Pakistan, Ethiopia, Ghana, Malawi, Bangladesh, Cameroon, Iraq, India and others

Source: Reviewer's screening of the 71 supplied records. The 11 reviews are Adesegun et al. (2020), Amicizia et al. (2019), Boakye Okyere et al. (2025), Mogasale et al. (2018), Muresu et al. (2020), Mukhopadhyay et al. (2019), Obaro et al. (2017), Parry et al. (2019b), Radhakrishnan et al. (2018), Saha et al. (2023) and Stanaway et al. (2019).

Table 1: Characteristics of the 25 included Nigerian studies (setting and focus taken from the titles)

Study	Setting	Focus
Joshua et al. (2017).	Bingham University	Prevalence of typhoid fever
Akinyemi et al. (2018).	Nigeria	Trend in typhoid fever
Odikamnoro et al. (2018).	Unwana, Afikpo North, Ebonyi	Malaria–typhoid co-infection among adults
Aliyu et al. (2019).	Gyadi-Gyadi, Kano	Knowledge and risk perception
Ilouno (2020)	Nimo village	Perceptions, practices and risk factors
Ozakpo & Olugasa (2020).	Ikenne, South-West	Socio-environmental factors in treatment preference among secondary school students
Famuyiwa et al. (2022).	Akinyele LGA, Oyo	Effect of disease education on nursing mothers
Tawfiq et al. (2022a).	Gombe metropolis	Validity and reliability of a typhoid risk factors questionnaire
Tawfiq et al. (2022b).	Gombe metropolis	Epidemiology and risk factors
Olowolafe et al. (2024).	University hospital records	Malaria–typhoid co-infection
Faruku et al. (2024).	Kebbi State	Socio-demographic factors among febrile patients
Hassan et al. (2024).	Azare, Bauchi	Prevalence among pregnant women
Osu et al. (2024).	Keffi, Nasarawa	Epidemiology and risk factors
Ravi & Ayando (2024)	Kano	Risk perception, behaviour and knowledge of diagnosis, treatment and vaccination

Samuel & Eleke (2024).	Degema, Rivers	Prevalence and demographic correlates among adults
Acha et al. (2025).	Agbarho, Delta	Prevalence, management and control
Asenowo & Adeoye (2025).	Rural Ekiti State	Malaria and typhoid treatment and health-seeking behaviour
John (2025)	Isiala Mbano LGA, Imo	Knowledge of prevention and control measures
Kumo (2025)	Gombe State	Prevalence and perception, from a Sharī'ah perspective
Musa et al. (2025).	Niger State	Prevalence, sociodemographic factors and multidrug resistance
Uzochukwu et al. (2025).	Rural Enugu State	Health promotion on the malaria–typhoid concurrency myth
Bolaji et al. (2026).	Epinmi Akoko, Ondo	Awareness and preventive measures among residents
Enwe et al. (2026).	Primary health centres, Nsukka	Epidemiology among patients
Ubachukwu et al. (2026).	Biu LGA, Borno	Drinking water contamination and typhoid outbreak
Udeh et al. (2026).	Ebonyi State	Health education for patent medicine vendors

Table 2: Records removed before synthesis, with reasons

Record	Reason	Detail
Twumasi-Ankrah et al. (2025).	Duplicate	Same review as Boakye Okyere et al. (2025)
Aromolaran et al. (2021, 2023)	Other disease	Lassa fever knowledge and practice
Jesu-Oboh et al. (2026). Kazaura (2020); Banik et al. (2023)	Other disease	Dengue fever knowledge and practice
Xu et al. (2017); Kore & Mahajan (2022)	Other disease	Scrub typhus, a different infection
Berhanu & Fulasa (2020)	Animal disease	Fowl typhoid in poultry
Andarge et al. (2020).	Other disease	COVID-19 preventive measures
Akabanda et al. (2017).	Typhoid not the focus	Food safety practices of food handlers in Ghana
Ssemugabo et al. (2019).	Typhoid not the focus	Household safe water chain in Kampala

Results of the evidence synthesis

Tables 3 to 9 bring together the quantitative findings reported in the sources reviewed. Figures are given as the original authors reported them, and "–" means the item was not reported in the source.

Table 3: Global burden of typhoid and paratyphoid fevers, Global Burden of Disease Study 2017

Indicator	Estimate (95% uncertainty interval)	Change since 1990
Cases in 2017	14.3 million (12.5–16.3)	Down 44.6% from 25.9 million
Age-standardised incidence per 100,000 person-years	197.8	Down 54.9% from 439.2
Share of cases caused by	76.30%	–

S. Typhi		
Deaths in 2017	About 135,900 (76,900–218,900)	Down 41.0% from 230,500
Case fatality	About 0.95% (0.54–1.53)	–
Disability-adjusted life years	About 9.8 million (5.6–15.8)	Down 43.0% from 17.2 million

Table 4: Typhoid prevalence, incidence and antibiotic resistance in Nigerian studies

Study	Setting and design	Sample	Findings
Akinyemi et al. (2018)	Two Lagos hospitals (1993–2015); seven Abuja facilities; three Kano hospitals	–	More than 80% of Lagos isolates are multidrug-resistant, with a rising trend; positivity declined in Abuja; sanitation access fell.
Tawfiq (2021)	Gombe metropolis; hospital records 2015–2019 and community survey	663	Incidence above 100 per 100,000 per year in every year studied; highest in females, ages 21–30 and dense areas
Joshua et al. (2017).	Bingham University students	125	Stool culture positive 75.2% (n = 94); Widal positive in 80; females 87.3% versus males 62.9%; age 21–25 highest (86.4%)
Musa et al. (2025), as reported by NAN News (2025)	Niger State	–	Infection in 57.1% of tap-water users and 25.6% of borehole users; resistance: chloramphenicol 96.8%, tetracycline 79.5%, amoxicillin 100%; gentamicin 78.5% and levofloxacin 83.6% effective
Olowolafe et al. (2024).	Hospital records, Ibadan (April–June 2023)	3,195	Typhoid mainly affected adults over 25 years; prevalence fell with age

Table 5: Knowledge, risk perception and vaccine awareness among adults in Nigerian studies

Indicator	Finding	Source and sample
Had heard of typhoid fever	71.40%	Ravi & Ayando (2024); 443 adults, Kano
Believed typhoid can be cured with treatment	98.00%	Ravi & Ayando (2024)
Good knowledge of transmission/symptoms	97.5% / 98.6%	Ravi & Ayando (2024)
Rated typhoid “very serious”	60.0% (lower than breast cancer 76.6% and diabetes 67.8%)	Ravi & Ayando (2024)
Thought they were likely to get typhoid next year	63.40%	Ravi & Ayando (2024)
Aware of the typhoid vaccine / not aware	31.1% / 43.4%	Ravi & Ayando (2024)
Considered vaccines beneficial	50.20%	Ravi & Ayando (2024)
Identified headache as a symptom	95.7% (n = 287)	Aliyu et al. (2019); 300 respondents, Kano
Agreed that lack of handwashing contributes	53.7% (n = 160)	Aliyu et al. (2019)

to typhoid		
Understanding of causes and risk factors	Limited; lack of water and sanitation shaped hygiene practices	Ilouno (2020); 15 adults, Nimo village (qualitative)

Table 6: Risk factors for typhoid occurrence and recurrence

Study	Factor	Measure of association
Tawfiq (2021), n = 663, Gombe	Boiling drinking water; vaccination; eating commercial foods and drinks; handwashing before handling food; house help; iced items; typhoid patient at home	Chi-square 49.6; 39.7; 27.9; 22.9; 16.9; 16.8; 13.4 (all $p < 0.01$)
Tawfiq (2021)	Recurrence: unsure of vaccination status	OR 2.96 (95% CI 1.29–6.80)
Tawfiq (2021)	Recurrence: sometimes drinks unboiled water	OR 2.13 (95% CI 1.02–4.43)
Tawfiq (2021)	Each 1 °C rise in minimum temperature; each 5% rise in humidity	OR 1.08 (1.05–1.11); OR 1.04 (1.03–1.05)
Mogasale et al. (2018).	Unimproved or unsafe drinking water (12 case-control studies)	Pooled OR 2.44 (95% CI 1.65–3.59)
Boakye Okyere et al. (2025), 109 studies	Studies examining: demographic and socioeconomic 50.5%; foodborne 44.0%; waterborne 41.3%; sanitation and hygiene 31.2%; travel 17.4%; antimicrobial use 12.8%; carriers 10.1%	Proportion of studies (not effect sizes)

Table 7: Malaria and typhoid co-infection in Ibadan hospital records (3,195 patients)

Category	Co-infection prevalence	Comment
April 2023	5.7%	Start of rainy season
May 2023	9.7%	Highest month
June 2023	8.9%	–
Children aged 6–12 years	18.5%	Highest age group
Children under 5 years	6.3%	Lowest age group
Females	8.8%	–
Males	7.1%	–

Table 8: Knowledge, attitude and practice of typhoid fever in studies from other countries

Study	Setting	Sample	Findings
Tariq et al. (2025).	Rawalpindi and Islamabad, Pakistan	283	Aware of typhoid 93.3%; handwashing reduces contamination 94.7%; knew spread through contamination 63.3%; handwashing after toilet 96.8%; sanitiser on fruit 35.7%; raw milk 21.2%
Mulu et al. (2021)	Febrile patients, Injibara, Ethiopia	237	Seroprevalence 25.7%; good knowledge 65.4%; good preventive practice 67.5%
Parvin et al. (2026).	University students, Dhaka, Bangladesh	470	Mean scores: knowledge 80.05; attitude 73.99; practice 60.93; male students had poorer practice
Ravi & Ayando (2024).	Adults, Kano, Nigeria (for comparison)	443	Heard of typhoid 71.4%; vaccine aware 31.1%

Table 9: Evidence on preventive measures

Preventive measure	Evidence	Source
Typhoid conjugate vaccine (Vi-TT)	Efficacy 54.6%; typhoid in 35% of vaccinated versus 77% of controls (13/37 versus 24/31)	Jin et al. (2017)
Vi polysaccharide vaccine	Efficacy 52.0%; typhoid in 35% (13/35)	Jin et al. (2017)
Vaccine awareness among adults	Aware 31.1%; not aware 43.4%; considered beneficial 50.2%	Ravi & Ayando (2024)
Safe drinking water	Unsafe water raises odds 2.44-fold; unboiled water OR 2.13 for recurrence	Mogasale et al. (2018); Tawfiq (2021)
Handwashing	Chi-square 22.9 for handwashing before food handling; 53.7% in Kano agreed it contributes to typhoid; 94.7% in Pakistan knew it reduces contamination.	Tawfiq (2021); Aliyu et al. (2019); Tariq et al. (2025)
Health education	Interventions evaluated among nursing mothers and patent medicine vendors; numerical results not available to this review	Famuyiwa et al. (2022); Udeh et al. (2026)

DISCUSSION

Interpretation of findings

Burden and resistance make prevention urgent. Table 3 shows that, although global incidence has fallen by more than half since 1990, typhoid still caused millions of illnesses and over 130,000 deaths in 2017. Table 4 shows that Nigerian data come from scattered facility and community studies, which cannot be added together into a national rate. What they do show is consistent: high incidence where it was measured (above 100 per 100,000 in Gombe), high positivity among university students tested by stool culture (75.2%), and extreme antibiotic resistance. Resistance rates of 96.8% to chloramphenicol and 100% to amoxicillin mean doctors have fewer affordable options, bringing the Nigerian situation closer to the ceftriaxone-resistant outbreaks seen in Pakistan (Nizamuddin et al., 2021). The Bingham University figures should be read with care, since the sample was small and Widal testing is known to be unreliable.

Knowledge is high on facts but weak on risk and prevention. Table 5 shows that Kano adults knew typhoid could be cured (98.0%) and recognised its symptoms (98.6%), yet only 60.0% rated it very serious, and fewer than a third had heard of the vaccine. In Gyadi-Gyadi, almost every respondent knew a symptom, but just over half linked handwashing to infection. The qualitative study from Nimo village adds an explanation: people lacked a basic understanding of causes, and without water and sanitation, knowing what to do is not enough. Because the Kano survey was a preprint with some internal inconsistencies, these numbers should be taken as indicative.

Risk factors point to water, hygiene and food. Table 6 shows that, in Gombe, boiling drinking water, vaccination status and handwashing before handling food were the factors most strongly associated with typhoid, and that people who sometimes drank unboiled water had more than twice the odds of recurrence. The pooled odds ratio of 2.44 for unsafe water comes from 12 case-control studies. Warmer and more humid conditions were also linked to more cases, suggesting that climate change and rainy seasons may increase risk. The pattern in Table 7 reminds us that typhoid is often treated together with malaria. Co-infection was highest in school-age children (18.5%). In the early rainy season, while typhoid itself mainly affected adults over 25, adults carry a large part of the typhoid burden even though child malaria dominates clinic attention. When people expect both illnesses, they may take antimalarials or antibiotics without proper testing, which fuels resistance (Uzochukwu et al., 2025).

The knowledge–practice gap is international. Table 8 shows that Pakistani respondents scored above 90% on awareness and handwashing knowledge, but only 35.7% used a sanitiser on fruit; Ethiopian patients reported about two-thirds good practice; and Bangladeshi students scored 80 on knowledge but 61 on practice, with male students doing worse. Nigeria is therefore not unique, and lessons from other settings, such as behaviour-focused education and campus water and sanitation improvements, can be adapted. Health workers should not assume that a well-informed adult is well-protected.

Prevention options are available but under-used. Table 9 shows that vaccines provided roughly 50% protection in a challenge trial, and that safe water and handwashing are clearly associated with lower risk. Nevertheless, only 31.1% of the Kano adults knew a vaccine existed. Evidence on health education in Nigeria is still thin: education was tested among nursing mothers and patent medicine vendors, but the full results were not available to this review. Patent medicine vendors are an important group because many adults first seek care from them.

LIMITATIONS OF THIS REVIEW

This review has limits that readers should keep in mind. The records were a supplied set rather than the result of a database search, so relevant studies may be missing, and no search sensitivity can be claimed. One reviewer did the screening and extraction, with no second check. No protocol was registered, no formal risk-of-bias tool was applied, and the certainty of evidence was not graded, so strong and weak studies carry equal weight in the narrative. Several records were theses, preprints, or local journal papers; some values came from abstracts or news reports, and definitions of good knowledge differ between studies, so results were not pooled. Most Nigerian studies are cross-sectional or based on hospital records and depend on self-report or Widal testing. The populations range from febrile patients and students to community residents, so the tables should be read as a collection of examples rather than a single national picture.

CONCLUSION

This systematic review of 59 included records shows that typhoid fever remains a serious and preventable infection in Nigeria, driven by unsafe water, poor sanitation and hygiene, and unsafe food, and made harder to treat by very high antibiotic resistance. Nigerian adults generally know that typhoid exists and can be cured. However, their sense of risk is uneven, awareness of the vaccine is low, and important links between handwashing, safe water and infection are not widely understood. Surveys from other countries show that knowledge often does not turn into practice.

Reducing typhoid will therefore depend on turning knowledge into action: safe water and sanitation at community level, practical hygiene education, vaccination where available, and careful use of antibiotics, with community health workers as the link between households and the health system.

RECOMMENDATIONS

1. Run community health education that goes beyond symptoms to explain how typhoid spreads and why handwashing, boiled or treated water and safe food handling prevent it

2. Raise awareness of the typhoid vaccine and expand access, starting with high-incidence areas and high-risk groups

3. Provide safe water, sanitation and hygiene facilities in communities, markets and schools, and inspect water sources, since contamination has caused outbreaks

4. Train and supervise patent medicine vendors and primary health care workers in correct diagnosis, referral and responsible antibiotic use, and teach adults not to assume that fever means malaria plus typhoid

5. Strengthen laboratory diagnosis and surveillance, including antibiotic resistance monitoring, in all regions so that national figures can be calculated

6. Target education to groups with poorer practice, including men, students, nursing mothers and food handlers

7. Prepare for seasonal peaks, when warmer and wetter conditions raise risk and malaria co-infection is common

8. Support studies that use observation of practice and validated tools, and publish them in peer-reviewed journals, so that Nigerian evidence can guide policy

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