

**INVESTIGATING THE INCIDENCE OF TYPHOID FEVER IN KWARA STATE
UNIVERSITY TEACHING HOSPITAL ILORIN KWARA STATE FROM JANUARY
2019 TO DECEMBER 2023**

BY

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**FACULTY OF NURSING SCIENCES
THOMAS ADEWUMI UNIVERSITY, OKO-IRESE
KWARA STATE.**

AUGUST, 2025

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**IN PARTIAL FULFILMENT OF THE REQUIREMENTS OF THOMAS ADEWUMI
UNIVERSITY FOR THE AWARD OF BACHELOR OF NURSING SCIENCE
CERTIFICATE.**

AUGUST, 2025

Declaration Page

This is to declare that this research topic titled “**Investigating The Incidence Of Typhoid Fever In Kwara State University Teaching Hospital Ilorin Kwara State Between January 2019 To December 2023**” was carried out by **Aladeloye Oluwapelumi Peace** is solely the result of my work except where acknowledged as being derived from other person or resources.

Matric Number: 20/05NSS006

In the Faculty of Nursing, Thomas Adewumi University, Oko-Irese, Kwara State

Signature



Date: 07-08-2025


Certification Page

This is to certify that this research project by **Aladeloye Oluwapelumi Peace** with matriculation number **20/05NSS006** has been examined and approved for the award of bachelor of nursing science Certificate.

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Abstract

Typhoid fever remains a significant public health concern, particularly in low-resource communities where sanitation and access to clean water are limited. This study investigates the incidence of typhoid fever in Kwara State University Teaching Hospital, Ilorin, Kwara State, from January 2019 to December 2023, focusing on the influence of age, gender, seasonal variations, and educational level of patients. The aim of the study was to assess the demographic and environmental factors contributing to the incidence of typhoid fever and to test the hypotheses that both age and gender significantly influence its occurrence. A retrospective study design was employed, analyzing medical records of 464 confirmed typhoid fever cases. Data were categorized by age, gender, and year of diagnosis. Statistical analyses, including t-tests and chi-square tests, were used to evaluate the relationship between demographic factors and the incidence of typhoid fever. The results revealed that there is a significant relationship between age and the incidence of typhoid fever, with middle-aged adults (41-50 years) showing the highest prevalence ($p = 0.013$). Gender also plays a significant role, as females were more affected than males, particularly in 2023, where females accounted for 90 cases compared to 54 in males ($p = 0.000$). Seasonal variations and educational levels were not found to be significant factors in this study. In conclusion, this study highlights the importance of demographic factors, particularly age and gender, in understanding the incidence of typhoid fever. It recommends targeted public health interventions, including vaccination campaigns and gender-sensitive health education, to mitigate the spread of the disease. Improved sanitation and access to clean water are also critical to reducing the incidence of typhoid fever in affected populations.

Keywords: Typhoid fever, Incidence, Age, Gender, Public health

Dedication

This research project is dedicated to God Almighty, my beloved parents and wonderful brothers who stood by me physically, spiritually and financially, supporting me in all the aspects that led to the success of this research work.

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CHAPTER ONE

1.0 Introduction

This chapter consists of the background to the study, statement of problem, objectives of the study, research questions/Hypotheses, significance of the study, scope of study, and operational definition of terms

1.1 Background of the study

Typhoid fever is also called enteric fever. It is a prospectively, multisystemic illness that has been a public health problem, especially in the developing world. It is caused by *Salmonella typhi* and *Salmonella para typhi*. Enteric fever is a cumulative term that illustrates both typhoid and paratyphoid fever. Paratyphoid is clinically indistinct from typhoid fever; thus, enteric and typhoid fever are used mutually. Typhoid fever is one of the major causes of mortality and morbidity in overcrowded and unhygienic areas though comprehensive research and public health interventions have decreased the occurrence. The disease course ranges from early gastrointestinal distress to nonspecific systemic illness but ultimately may lead to multiple complications. Salmonella is said to spread by the 'four Fs" (flies, fingers, feces, fomites). Fever characteristically comes in a step-wise pattern (i.e., rises and falls alternatively) followed by headache and abdominal pain. (Bhandari et al., 2022)

Typhoid fever is an acute infectious disease of the digestive system caused by the bacteria *Salmonella typhi* or *Salmonella paratyphi*. Typhoid fever is a global infectious disease in which an estimated 26.9 million cases of typhoid fever are found worldwide. Typhoid fever is especially common in developing countries because it is associated with poor sanitation. Clinical manifestations of typhoid fever that arise can vary from mild to severe symptoms. Symptoms of

typhoid fever that are often found are fever, malaise, abdominal pain and constipation. Culture examination is a gold standard examination in establishing the diagnosis of typhoid fever. But this examination is rarely done. The first-line treatment option for typhoid fever is chloramphenicol. However, as the bacterial resistance to chloramphenicol increases, the main therapeutic choice for typhoid fever is the fluoroquinolone antibiotic. (Yelvi & Aldo., 2020)

In Sub-Saharan Africa, typhoid fever is estimated to have caused 14 million cases in 2010 and 11 million cases in 2017 globally (Jong-Hoon et al 2024) However, with improvement of sanitation and safe food and water, endemic enteric fever declined dramatically in developing countries. Enteric fever continues to remain a serious problem in many low-income countries, impacting both the endemic population and international travelers. Pleomorphic clinical presentations, rise of *Salmonella Paratyphi* as a dominant pathogen in some areas, need of a better early diagnostic test and widespread resistance to antibiotics pose a problem despite the overall decreasing global burden. Imported travel-related infection is now the leading form of enteric fever in most industrialized countries. The ever-growing number of international travelers now well over a billion annually worldwide has inadvertently created a global ‘surveillance system’ for enteric fever epidemiology. Lack of reliable vaccines that cover both *Salmonella Typhi* and *Salmonella Paratyphi* further contributes to the problem of travel-related enteric fever. In addition, rising multidrug resistance in enteric fever has led to treatment challenges as well (Journal of Travel medicine 2021)

Typhoid is a bacterial infection caused by the Gram-negative bacterium *Salmonella enterica* subspecies *enterica* serovar *Typhi* (*S. Typhi*). Typhoid fever is usually contracted by ingestion of food or water contaminated by faecal or urinary carriers excreting *S. Typhi* . The predominant symptom of infection is high fever, with other symptoms including nausea, abdominal pain and

abnormal bowel movements . Once prevalent worldwide, improvements in the provision of clean water and sewerage systems has led to a dramatic decrease in the incidence of typhoid fever with the burden of disease now predominantly residing in low- and middle-income countries where sanitary conditions may be poor (Cristina & Atouguia., 2021)

Enteric fever, due to Salmonella enterica serotype Typhi (S Typhi) and Para typhi (S Para typhi) A, B, and C, is a preventable disease causing an estimated 14 million illnesses and 136 000 deaths worldwide in 2017.

Nigeria experienced at least 291,909 typhoid cases (136 cases per 100,000) and 3,584 typhoid deaths. Illness is caused by ingesting faecally contaminated food or water. Although enteric fever is largely controlled in high-income countries through sanitation infrastructure improvements, in low-income and middle income countries the disease is largely managed with antibiotics. The spread of antimicrobial resistance is undermining this management approach, however, as increasing drug resistance makes enteric fever more difficult and expensive to treat. In 2018, WHO recommended the use of the first typhoid conjugate vaccine (TCV) for children as young as 6 months in typhoid-endemic areas. Policy makers in typhoid-affected countries must now decide whether, and how, to introduce TCV into routine immunization schedules, including the optimal age, target population, and delivery strategies. To make these decisions, timely and accurate information on enteric fever disease burden is required, including incidence and disease outcome data and local geographical and demographic distribution of typhoid. Previous typhoid burden estimates were generated using active facility-based or passive augmented household-based studies. Recent blood culture sentinel surveillance studies are generating important data on the burden of disease in select countries in Asia and sub-Saharan Africa. (Denise et al., 2022)\

1.2 Statement of Problem

The incidence of typhoid fever remains a significant public health concern in many regions around the world. It is estimated to have caused 14 million cases in 2010 and 11 million cases in 2017 globally (Jong-Hoon et al., 2024). In Africa, as of 2019 estimates, there are 9 million cases of typhoid fever annually, resulting in about 110, 000 deaths per year (WHO., 2023).

The Global Burden of Disease 2019 study estimated that Nigeria experienced at least 291,909 typhoid cases (136 cases per 100,000) and 3,584 typhoid deaths

Significant progress has been made in reducing the global burden of typhoid fever, but the disease still remains endemic in many regions like Kwara State. While on clinical rotation during the researcher's program in school, she has witnessed people lose their life to typhoid fever which could have been prevented or even treated if it had been diagnosed promptly. Also, it was noted that there are no available statistical record on the incidence of typhoid fever in Kwara State. This prompted the researcher to carry out this study which aims to investigate the incidence of typhoid fever in Kwara State University Teaching Hospital Ilorin Kwara State, examining factors such as transmission routes, demographic patterns, and the effectiveness of preventive strategies.

1.3 Objectives Of the Study

1.3.1 Broad Objective:

To investigate the incidence rate of typhoid fever in Kwara State University Teaching Hospital Ilorin (KWASUTH) Kwara State

1.3.2 Specific Objectives:

1. To identify demographic and socio-economic factors associated with increased risk of typhoid infection;
2. To encourage the populace on the importance of environmental sanitation as a prime factor in disease prevention.

1.4 Research Questions

1. Will the age of the patient influence the incidence of typhoid fever disease?
2. Will the gender of the patient influence the incidence of typhoid fever disease?
3. Will seasonal variation influence the incidence of typhoid fever?
4. Will educational level of the patient influence the incidence of typhoid fever disease?

1.5 Research Hypotheses

1. H0: There is no significant relationship between the age of patient and the incidence of typhoid fever.

H1: There is significant relationship between the age of patient and the incidence of typhoid fever.

2. H0: There is no significant relationship between the gender of patient and the incidence of typhoid fever.

3. H1: There is significant relationship between the gender of patient and the incidence of typhoid fever.

4. 1.6 Significance Of the Study

- The study will contribute to reduction in the incidence and burden of typhoid fever in the population studied, by identifying factors that influence the spread of the disease.
- The study will inform targeted interventions and strategies to improve sanitation, access to clean water, and vaccination efforts.
- It will guide public health policy and resource allocation, by providing data on the patterns and trends of typhoid incidence, therefore help policymakers prioritize areas in need of interventions and support.
- To raise awareness about typhoid among the general public and healthcare providers. This can lead to better recognition and reporting of cases, as well as more proactive measures to prevent the spread of the disease.
- Enhance the knowledge of medical personnel on the causes and management of typhoid fever.

1.7 Scope Of Study

This study is carried out in Kwara State University Teaching Hospital Ilorin Kwara State, to assess the incidence of typhoid disease as seen between January 2019 to December 2023.

1.8 Operational Definition of Terms

- **INCIDENCE:** the number of cases of typhoid fever diagnosed at Kwara State University Teaching Hospital Ilorin among patients.
- **TYPHOID FEVER:** bacterial infection caused by *Salmonella enterica* serotype Typhi, characterized by symptoms such as prolonged fever, fatigue, headache, abdominal pain, and diarrhea or constipation.
- **FEVER:** body temperature of 38C (100.4F) or higher, measured using a clinical thermometer, in patients presenting to KWASUTH.

CHAPTER TWO

REVIEW OF RELATED LITERATURE.

2.0 Introduction

This chapter reviewed related literature on the following headings. Causes of typhoid fever, risk factors for contracting typhoid fever, age group at risk, gender group at risk, awareness of mode of transmission in relation to educational status, incidence of typhoid fever, prevention of typhoid fever, seasonal patterns in the occurrence of typhoid fever, antimicrobial resistance and co-infection and complications, awareness.

Concept Of Typhoid Fever

Typhoid fever, or enteric fever, is a potentially fatal multisystemic infection produced primarily by *Salmonella enterica* serotype typhi and to a lesser extent *Salmonella enterica* serotypes and paratyphi A, B, and C. *Salmonella* are motile entero bacteriaceae that can produce a variety of gastrointestinal infections. The most serious of these is typhoid that is primarily produced by *Salmonella enterica* serotype typhi and, to a lesser extent, *S enterica* serotypes *paratyphi* A, B, and C. It presents in a wide variety of ways ranging from an overwhelming septic illness to minor cases of diarrhea with low-grade fever. The classic presentation is one of fever, malaise, diffuse abdominal pain, and constipation. Untreated typhoid fever may progress to delirium, obtundation, intestinal hemorrhage, bowel perforation, and death within 1 month of onset. Survivors may be left with long-term or permanent neuropsychiatric complications. The term typhoid derived from the ancient Greek word for cloud, was chosen to emphasize the severity and long lasting neuropsychiatric effects among the untreated. (Brusch., 2022)

2.1 Causes of Typhoid Fever

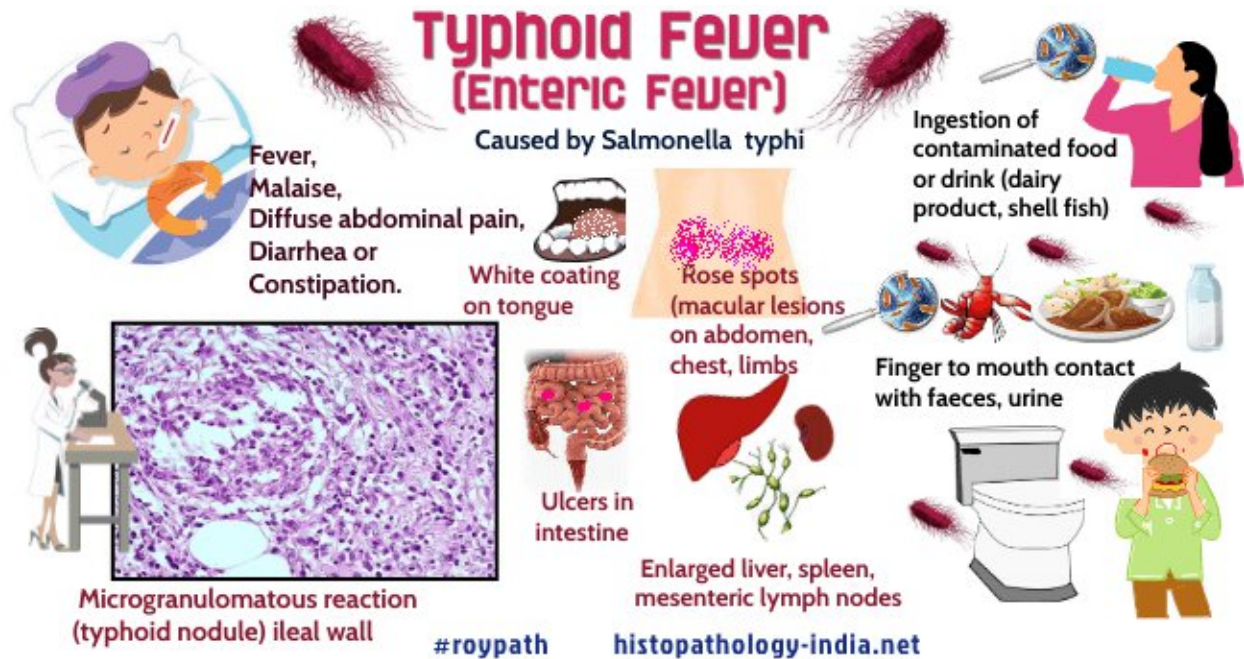
(Mayor Clinic 2023) posited that a bacteria strain called *Salmonella enterica* serotype typhi causes typhoid fever. Other strains of salmonella bacteria cause a similar disease called paratyphoid fever. People pick up the bacteria most often in places where outbreaks are common. The bacteria passes out of the body in the stool and urine of people who are carrying the bacteria. Without careful hand-washing after going to the bathroom, the bacteria can move from the hands to objects or other people.

The bacteria also can spread from a person who carries the bacteria. It can spread on food that isn't cooked, such as raw fruits without a peel. In places where water isn't treated to kill germs, you can pick up the bacteria from that source. This includes drinking water, using ice made from untreated water, or by drinking unpasteurized milk or juice.

S typhi is spread through contaminated food, drink, or water. If you eat or drink something that is contaminated with the bacteria, the bacteria enter your body. They travel into your intestines, and then into your blood. In the blood, they travel to your lymph nodes, gallbladder, liver, spleen, and other parts of the body. (Penn medicine., 2022)

Humans are the only source of the bacteria that cause enteric fever; no animal or environmental reservoirs have been identified. Typhoid and paratyphoid fever are acquired through consumption of water or food contaminated by feces of an acutely infected or convalescent person, or a person with chronic, asymptomatic carriage. Risk for infection is high in low- and middle-income countries with endemic disease and poor access to safe food and water, and poor sanitation. Sexual contact, particularly among men who have sex with men, has been documented as a rare route of transmission. (CDC., 2024)

Food and water with the bacteria in it cause typhoid fever. Close contact with a person who is carrying the salmonella bacteria also can cause typhoid fever.



From: www.histopathology-india.net

2.1.1 Clinical Features of Typhoid Fever:

Following an incubation period of 6 to 30 days, enteric fever presents insidiously with the gradual onset of fever with fatigue, anorexia, headache, malaise, and abdominal symptoms. If treatment is delayed or inadequate, meningitis, sepsis, or intestinal perforation can occur (Jenish et al., 2024).

As typhoid is an enteric infection, it affects the intestine and hence, the typhoid symptoms one experiences are related to digestion. Generally, the signs and symptoms of typhoid fever start showing up gradually over a period of 10-14 days after exposure to the bacteria. The duration of the typhoid illness is **about 3-4 weeks (Metropolis., 2023)**

Chronic carriers are responsible for much of the transmission of the organism. While asymptomatic, they may continue to

shed bacteria in their stool for decades. The organisms sequester themselves either as a biofilm on gallstones or gallbladder epithelium or, perhaps, intracellularly, within the epithelium itself. The bacteria excreted by a single carrier may have multiple genotypes, making it difficult to trace an outbreak to its origin. (Brusch., 2022)

Clinical Illness

Increasing fever begins with the persistent secondary bacteremia of established infection. The gallbladder is colonized through hematogenous or local spread, more commonly if gallstones or structural abnormalities are present. Lymphoid tissue within Peyer patches is a site of primary infection, reinfection, and chronic infection, becoming a secondary source for fecal excretion and transmission. The proliferation of lymphoid tissue may cause constipation. Endotoxin-mediated necrosis may occur, resulting in intestinal bleeding, perforation, or tertiary bacteremia with enteric microorganisms. The total white count, lymphocytes, platelets, and neutrophils begin to drop with the onset of symptoms. Immunoglobulin (Ig) IgG, IgM, and IgA antibodies develop against flagellin and lipopolysaccharide in those who develop clinical disease but not against Vi. (Jenish et al., 2024)

2.1.2 Portal of Entry and Host

The portal of entry for *Salmonella* Typhi infection is the mouth, usually through ingestion of fecally contaminated water or food. Infection occurs in a susceptible human host. The incubation

period shortens and the risk for infection and disease increases with the ingested dose (Hornicks et al., 2019).

Gastric acid provides an important barrier to *Salmonella Typhi* accessing the small intestinal mucosa and, in turn, the reticuloendothelial system. Natural and vaccine-induced immunity provide partial protection against typhoid fever (Wain J et al., 2019)

2.2 Risk Factors for Contacting Typhoid

Typhoid fever is a serious worldwide threat and affects millions of people each year. Places with the highest number of cases or with regular outbreaks are in Africa and South Asia. But cases are recorded worldwide, often due to travelers to and from these areas (Mayor clinic., 2024)

Typhoidal salmonella have no nonhuman vectors. An inoculum as small as 100,000 organisms of *typhi* causes infection in more than 50% of healthy volunteers. *Paratyphi* requires a much higher inoculum to infect, and it is less endemic in rural areas. Hence, the patterns of transmission are slightly different.

The following are modes of transmission of typhoidal salmonella:

- Oral transmission via food or beverages handled by an often-asymptomatic individual—a carrier—who chronically sheds the bacteria through stool or, less commonly, urine
- Hand-to-mouth transmission after using a contaminated toilet and neglecting hand hygiene
- Oral transmission via sewage-contaminated water or shellfish (especially in the developing world).

Paratyphi is more commonly transmitted in food from street vendors. It is believed that some such foods provide a friendly environment for the microbe.

Paratyphi is more common among newcomers to urban areas, probably because they tend to be immunologically naïve to it. Also, travellers get little or no protection against *paratyphi* from the current typhoid vaccines, all of which target *typhi* (Brusch., 2022)

Typhoidal salmonella are able to survive a stomach pH as low as 1.5. Antacids, histamine-2 receptor antagonists (H2 blockers), proton pump inhibitors, gastrectomy, and achlorhydria decrease stomach acidity and facilitate *S typhi* infection.

HIV/AIDS is clearly associated with an increased risk of nontyphoidal *Salmonella* infection; however, the data and opinions in the literature as to whether this is true for *S typhi* or paratyphi infection are conflicting. If an association exists, it is probably minor.

Other risk factors for typhoid fever include various genetic polymorphisms. These risk factors often also predispose to other intracellular pathogens. For instance, *PARK2* and *PACGR* code for a protein aggregate that is essential for breaking down the bacterial signaling molecules that dampen the macrophage response. Polymorphisms in their shared regulatory region are found disproportionately in persons infected with *Mycobacterium leprae* and *S typhi*. (Brusch., 2022)

Different factors determine the risk of enteric fever in endemic versus non-endemic countries.

In non-endemic countries, the acquisition of enteric fever is related to travel, contact with a traveler from an endemic country, or exposure to food prepared by a chronic carrier. In contrast, risk factors in endemic countries include individual host factors, environmental exposures, and climate and geographic factors. (Jenish et al., 2024)

Typhoid risk is higher in populations that lack access to safe water and adequate sanitation, and children are at highest risk (WHO., 2023)

2.3 Age Group at Risk

On average, the incidence of enteric fever peaks between the ages of 5 and 9. However, this masks great variability in the age of onset in different locations, with a younger peak age incidence correlating to a higher prevalence of enteric fever. In very high prevalence areas, peak incidence may occur in infants due to increased exposures and the greater accumulated immunity acquired with repeat clinical, subclinical, or asymptomatic infections as people age. Reinfections demonstrate that only a moderate level of protection is conferred by clinical infection. (Jenish et al., 2024)

Despite decades of worldwide effort to improve water quality, hygiene, and sanitation, the global burden of typhoid fever, caused by *Salmonella enterica* serovar Typhi (S Typhi), remains high. Analyses have estimated that more than 9 million cases and 110 000 deaths occur per year, with the burden concentrated among the poor residing in low-income and middle-income countries. Although typhoid was traditionally believed to be a disease of school-aged children, it is now known that preschool-aged children (aged 0–5 years) have a high incidence in areas of high overall typhoid incidence, such as urban slums in the developing world. Augmenting this burden are growing levels of antimicrobial resistance among clinical isolates of S. Typhi

For these reasons, development and deployment of safe and effective typhoid vaccines that can protect young children are a global priority. Studies done in the urban slums of Dhaka city in Bangladesh, which is an area with high typhoid endemicity, have shown that the highest incidence

is in children younger than 5 years and studies in hospitalized children in Dhaka city have shown a higher detection rate in children 2 years of age and younger. (Firdausi et al., 2021)

Most documented typhoid fever cases involve school-aged children and young adults. However, the true incidence among very young children and infants is thought to be higher. The presentations in these age groups may be atypical, ranging from a mild febrile illness to severe convulsions, and the *S typhi* infection may go unrecognized. This may account for conflicting reports in the literature that this group has either a very high or a very low rate of morbidity and mortality. (Brusch., 2022)

2.4 Gender Group at Risk of Contacting Typhoid Fever

According to (Brusch., 2021) 54% of typhoid fever cases in the United State reported between 1999 and 2006 involved males.

Analysis by sex showed that the proportion of males with positive culture was far higher than that of females. This result is in line with the study carried out by Smith *et al*, in Nigeria but contrary to what was observed by Mohammad *et al*, in Dhaka and Ramyil *et al*, in Jos Metropolis, Plateau State, Nigeria who found that more females were affected than the males. *Salmonella* in the stool occurs only when one becomes a potential carrier of the infection as explained by Ramyil *et al*. (Heasla et al., 2021)

According to a study carried out by Fu-Huang et al., (2021), they compared the number of typhoid and paratyphoid cases from 2011 to 2020. Sex was not found to be a risk factor for enteric fever; nevertheless, the attack rate was found to be a little greater in women (58.4% for typhoid cases and 63.9% for paratyphoid cases) than in men. A previous study indicated that the sex-specific

burden of salmonellosis varies by age 20–39 years female-to-male incidence rate ratio of 1.09, 40–59 years female-to-male incidence rate ratio of 1.23, and over 60 years female-to-male incidence rate ratio of 1.08), with the result being similar to that of this study. There was, however, a significant difference in the age of patients. Both typhoid cases and paratyphoid cases primarily occurred in individuals who were 20–39 years old.

Environmental exposures

A meta-analysis demonstrated that having an improved water source with a protected well can reduce the risk of culture-confirmed typhoid infection by half. (Perry et al., 2023) Having surface water as a water source doubles the risk of typhoid fever compared to other unimproved water sources, such as an unprotected well or spring. Using any household water treatment reduces the risk compared to no treatment. Using metal lids and keeping water containers covered is associated with 80% lower odds of typhoid infection than keeping water in open containers, while using dirty containers doubles the risk.

People using unimproved pit latrines had 50 times the risk of enteric fever than those having limited, basic, or safely managed sanitation facilities. Those defecating in the open had 1.2 times the risk. A lack of a handwashing facility with soap and water at home increases the odds by 2.3 compared to those without such facilities. (Perry et al., 2023) Independent of vaccination, living in a house with better WASH facilities significantly decreases the risk of enteric fever. (Jenish et al., 2024)

2.5 Knowledge Of Patients On Modes Of Transmission Of Typhoid Fever

A cross-sectional descriptive study was conducted at the Saint Elisabeth General Hospital Shisong, from March 1st, 2017 to May 31st, 2017. Patients who visited the hospital, presenting with clinical signs and symptoms of typhoid fever and from whom a stool culture was requested to be done by the medical doctor throughout the study period. a questionnaire designed to capture information on the Knowledge/awareness, attitude, and practices of typhoid fever was administered to all consenting participants. About 1g of stool samples was collected from the same patient in a labeled universal (plastic) disposable tube with a screw cap and transported for culture

Serial number	Level of Education	Number	Percentage (%)
1	Higher education	25	14.5
2	Secondary education	57	33.0
3	Primary education	45	26.0
4	No formal education	46	26.5

From: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8607955/>

Serial number	Education level (N)	Awareness of typhoid fever (%)	Means of contamination	
			Contaminated food (%)	Contaminated water (%)
1	Higher	25 (100.0)	23(92.0)	23(92.0)

Serial number	Education level (N)	Awareness of typhoid fever (%)	Means of contamination	
			Contaminated food (%)	Contaminated water (%)
	education (26)			
2	Secondary education (57)	54(94.7)	44(77.2)	41(71.9)
3	Primary education (45)	39 (86.7)	26(57.8)	21(46.7)
4	No formal education (46)	27(58.7)	12(26.1)	11(23.9)

From: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8607955/>

Awareness of patients on typhoid fever: while typhoid fever remains a serious problem in sub-Saharan Africa many people from this study remain uninformed about the disease and this unawareness is greatly correlated with the level of education of patients. Patients with no formal education were shown to have less information on typhoid fever (27, 58.7%) compared to those with a higher level of education (25, 100.0%)

Awareness of typhoid fever being contracted through the consumption of contaminated water and food was shown to be positively correlated with the level of education among patients. Twenty-three (92.0%) of the patients who had attained a higher level of education responded that typhoid

fever can be contracted through contaminated water, followed by 21 (46.7%) for those who had attained primary education and 11 (23.9%) for patients with no formal education.

The level of education turns out to have a high impact on the mastery of the disease but fairly affected the rate at which the disease is contracted.

Some of the risks factors identified by this study included a low level of education, poor hand hygiene, and poor knowledge about the disease, especially among the less educated patients. Corrective measures include increasing the awareness of *Salmonella* infections through education with an emphasis on the modes of contraction, preventive measures as well as water sanitation.

A high prevalence of typhoid fever was observed in this study. The unawareness of the patients on typhoid fever and its contraction through contaminated water and food was positively correlated to the level of educations of the patients (Heasla et al., 2021)

2.6 Seasonal Patterns in The Occurrence of Typhoid Fever

Seasonal patterns of typhoid fever vary geographically but generally show distinct trends influenced by climate, sanitation, and socioeconomic factors. In endemic regions, typhoid fever often exhibits a seasonal peak during certain times of the year, correlating with environmental conditions conducive to bacterial transmission (Khan et al., 2022).

In subtropical and tropical regions, where typhoid fever is endemic, seasonal patterns often coincide with the rainy season. For instance, in South Asia, studies have shown a peak in typhoid cases following monsoon rains, which can create conditions favorable for the spread of *Salmonella* Typhi, the bacterium responsible for the disease (Khan et al., 2022). The increase in cases during

these periods is attributed to contaminated water sources and poor sanitation exacerbated by heavy rainfall and flooding (Khan et al., 2022).

Conversely, in temperate regions, typhoid fever may exhibit a different seasonal pattern. In areas with distinct seasons, such as parts of North America and Europe, cases might peak during the warmer months when outdoor activities increase and food handling practices can lead to *Salmonella Typhi* transmission (Smith et al., 2021).

Similarly, research from Pakistan indicated a higher incidence of typhoid fever in the summer months, possibly due to increased bacterial survival and transmission in warmer temperatures (Khan et al., 2019). These findings are consistent with other studies in endemic regions of Africa and Southeast Asia, where seasonal peaks coincide with periods of higher temperature and precipitation (Sinha et al., 2020)

Understanding these seasonal patterns is crucial for public health interventions, such as vaccination campaigns and improvements in water and sanitation infrastructure. By targeting interventions during high-risk periods, public health officials can mitigate the impact of typhoid fever outbreaks and reduce transmission rates effectively (Smith et al., 2021).

2.7 Incidence of Typhoid Fever

An estimated 11–21 million cases of typhoid fever and 5 million cases of paratyphoid fever occur worldwide each year, causing an estimated 135,000–230,000 deaths. In the United States during 2016–2018, 400 culture-confirmed cases of typhoid fever and 50–100 cases of paratyphoid fever caused by Paratyphi A were reported each year; paratyphoid fever caused by Paratyphi B and Paratyphi C is rarely reported. Approximately 85% of typhoid fever and 92% of paratyphoid fever

cases in the United States occur among international travelers; most are in travelers returning from South Asia, primarily Bangladesh, India, and Pakistan. Other high-risk regions for infection include Africa, Latin America, and Southeast Asia; lower-risk regions include East Asia and the Caribbean (CDC., 2024)

Travelers visiting friends and relatives are at increased risk because they might be less careful with food and water while abroad than other travelers and might not seek pretravel health consultation or typhoid vaccination. Although the risk of acquiring illness increases with the duration of stay, travelers have acquired typhoid fever even during visits of <1 week to countries where the disease is highly endemic (e.g., Bangladesh, India, Pakistan). (CDC., 2024)

Improved living conditions and the introduction of antibiotics resulted in a drastic reduction of typhoid fever morbidity and mortality in industrialized countries. However, the disease continues to be a public health problem in many developing areas of the WHO African, Eastern Mediterranean, South-East Asia and Western Pacific Regions.

As of 2019 estimates, there are 9 million cases of typhoid fever annually, resulting in about 110 000 deaths per year (WHO., 2023)

International

Typhoid fever occurs worldwide, primarily in developing nations whose sanitary conditions are poor. Typhoid fever is endemic in Asia, Africa, Latin America, the Caribbean, and Oceania, but 80% of cases come from Bangladesh, China, India, Indonesia, Laos, Nepal, Pakistan, or Vietnam. Within those countries, typhoid fever is most common in underdeveloped areas. Typhoid

fever infects roughly 21.6 million people (incidence of 3.6 per 1,000 population) and kills an estimated 200,000 people every year.

In the United States, most cases of typhoid fever arise in international travelers. The average yearly incidence of typhoid fever per million travelers from 1999-2006 by county or region of departure was as follows:

- Western Hemisphere outside Canada/United States - 1.3
- Africa - 7.6
- Asia - 10.5
- India - 89 (122 in 2006)

United States

- Since 1900, improved sanitation and successful antibiotic treatment have steadily decreased the incidence of typhoid fever in the United States. In 1920, 35,994 cases of typhoid fever were reported. In 2006, there were 314.
- Between 1999 and 2006, 79% of typhoid fever cases occurred in patients who had been outside of the country within the preceding 30 days. Two thirds of these individuals had just journeyed from the Indian subcontinent. The 3 known outbreaks of typhoid fever within the United States were traced to imported food or to a food handler from an endemic region. Remarkably, only 17% of cases acquired domestically were traced to a carrier. (Jong-Hoon et al., 2024)

Africa

Typhoid fever continues to be a major public health problem in low- and middle-income countries (LMICs). While being the cornerstone for control of typhoid fever, improving water, sanitation, and hygiene (WASH) and food safety is generally a resource-intensive and long-term goal. Other

control strategies such as vaccination, that may protect unvaccinated people as well as vaccine recipients, and antimicrobials, that may reduce morbidity and mortality among those with typhoid fever while also reducing fecal carriage and onward transmission, may facilitate more immediate impact and near-term control. Limited resources for health mean that global and national policy makers need to identify efficient ways to implement these control strategies, which demands detailed understanding of the distribution of disease. (Joon-hong et al., 2024)

Typhoid fever is estimated to have caused 14 million cases in 2010 and 11 million cases in 2017 globally. Earlier studies reported somewhat varying estimates:

- 21 million cases worldwide in 2000
- 27 million (interquartile range: 18–36 million) cases in 2010
- 12 million (95% confidence interval: 10–15 million) or slightly higher in 2010
- 17.8 million cases in 2015 but with much wider uncertainty intervals (95% credible interval: 6.9–48.4 million) (Jong-Hoon et al., 2024)

Nigeria

Nigeria is a typhoid-endemic country. The Global Burden of Disease 2019 study estimated that Nigeria experienced at least

- ❖ 291,909 typhoid cases (136 cases per 100,000)
- ❖ 3,584 typhoid deaths
- ❖ 273,473 disability-adjusted life-years lost to typhoid

While typhoid is rarely fatal, the recovery is long and difficult. The disease steals time, money, and productivity from those infected and their families and is associated with numerous long-term complications (Institute for Health Metrics and Evaluation 2022)

2.7.1 Outbreak of Typhoid Fever

Outbreaks of typhoid fever were reported in 15 countries since 1950 (in 17 countries since 1900 and the majority have occurred in the southeastern part of the African continent. The frequency of reported outbreaks of typhoid fever and the number of people affected appear to have increased over time. The earliest reports were outbreaks during the Anglo-Boer War in South Africa between 1899 and 1902, and the most recent record was in January 2018 when a sudden increase in typhoid fever cases ($n > 200$) was observed in Harare, Zimbabwe. The largest outbreak was in Kampala, Uganda, between February and June 2015, where a total of 10 230 suspected cases were associated with a typhoid-confirmed breakout , although the magnitude of the outbreak in South Africa in 1900 might have been larger. Recent outbreaks have occurred mostly in East Africa: Moyale, Kenya (December 2014–January 2015); Kampala, Uganda (February–June 2015); Kigoma, Tanzania (May 2015); and Kirehe, Rwanda (October 2015–January 2016) (Jong-Hoon et al., 2019)

Mortality/Morbidity

With prompt and appropriate antibiotic therapy, typhoid fever is typically a short-term febrile illness requiring a median of 6 days of hospitalization. Treated, it has few long-term sequelae and a 0.2% risk of mortality. Untreated typhoid fever is a life-threatening illness of several weeks' duration with long-term morbidity often involving the central nervous system. The case fatality rate in the United States in the pre-antibiotic era was 9%-13% (Brusch., 2022)

2.7.2 Drivers of Typhoid Fever Incidence

Perhaps not surprisingly, given predominant modes of *Salmonella Typhi* transmission, early 20th century data from large cities in Europe and North America repeatedly demonstrated a reduction in typhoid fever illnesses and deaths ecologically associated with measures to improve the microbiologic quality of drinking water. It is likely that similar health gains could be achieved in typhoid-endemic countries if human feces could reliably be excluded from drinking water and food. In 1990, the regions of sub-Saharan Africa, South and Southeast Asia, and Oceania had the lowest population coverage with improved water and sanitation facilities. By 2015, water and sanitation coverage had increased markedly in South and Southeast Asia, and less so in sub-Saharan Africa. However, during the same period Oceania made little progress in either category and is now thought to experience the highest incidence of typhoid fever of any global region (Crump., 2019)

2.8 Prevention of Typhoid Fever

Typhoid fever is common in places with poor sanitation and a lack of safe drinking water. Access to safe water and adequate sanitation, hygiene among food handlers and typhoid vaccination are all effective in preventing typhoid fever. (WHO., 2023)

People using unimproved pit latrines had 50 times the risk of enteric fever than those having limited, basic, or safely managed sanitation facilities. Those defecating in the open had 1.2 times the risk. A lack of a handwashing facility with soap and water at home increases the odds by 2.3 compared to those without such facilities. Independent of vaccination, living in a house with better WASH facilities significantly decreases the risk of enteric fever (Jenish et al., 2024)

The disease is not transmitted from animals and only spreads between humans. The primary preventive measures for typhoid are therefore ensuring clean drinking water and maintaining good hygiene and sanitation standards (Sally., 2023)

Vaccines

In many developing countries goals that may prevent the spread of typhoid fever such as safe drinking water, improved sanitation and adequate medical care may be challenging to reach and some experts believe that the best way to control the infection is to vaccinate high risk populations. A vaccine is also recommended for people travelling to nations where typhoid is widespread (Sally., 2023)

At present, there are two vaccines against typhoid fever that have been approved by the World Health Organization for the prevention of typhoid. These include:

- Ty21a – One capsule is taken orally every other day until 4 doses have been received. Children need to be at least 6 years of age to receive this vaccine and then require boosters every five years.
- ViCPS – This is administered as a single injection. This is given to children of at least 2 years of age and requires a booster every 2 years (Sally., 2023)

VACCINE	APPROVED AGES FOR USE	DOSE & ROUTE OF ADMINISTRATION	NUMBER OF DOSES	DOSING INTERVAL	REPEAT DOSES
VI Capsular Polysaccharide Vaccine (ViCPS)—Typhim Vi					
Primary series	≥2 years	0.5 mL, IM injection	1	NA	NA
Booster	≥2 years	0.5 mL, IM injection	1	NA	Every 2 years
Live Attenuated Ty21a Vaccine—Vivotif[®]					
Primary series	≥6 years	1 capsule, orally every other day ²	4	48 hours	NA
Booster	≥6 years	1 capsule, orally every other day ²	4	48 hours	Every 5 years

FROM: CDC (2024) <https://wwwnc.cdc.gov>

Neither of these vaccines can offer complete effectiveness against typhoid fever and other guidelines should therefore also be followed when people are travelling to high risk areas. These hygiene guidelines are described below

Preventing Infecting Yourself

- Wash hands frequently in hot, soapy water before eating or preparing food, as well as after using the toilet. Alcohol-based sanitizer can be used in the absence of hot water.
- Avoid drinking contaminated water by ensuring water is bottled or boiled. Carbonated bottled water is safer to drink than uncarbonated.
- Wash teeth using bottled water and avoid swallowing shower water.
- Avoid ordering drinks with ice, unless you know the ice is made from boiled or bottled water. Also avoid flavored ices that could have been made with water that is contaminated.
- Only eat foods that have been thoroughly cooked and served steaming hot and avoid foods that have been stored or served at room temperature.
- Only eat raw vegetables if they can be peeled. Items such as lettuce are particularly at risk of contamination and are very difficult to clean properly.
- Avoid food and drink being sold by street vendors as it is difficult to keep food clean in the street. (Sally., 2023)

Preventing Infecting Others

If a person is recovering from infection with typhoid fever, they can take the following measures to prevent infecting others:

- Follow the doctor's instructions for taking antibiotics and be sure to complete the whole course.
- Avoid preparing food for others until it is confirmed that you are no longer contagious. It will not be possible to return to a job in the food service industry until tests have confirmed there is no risk of you passing typhoid bacteria.
- Frequently wash hands using hot, soapy water before preparing or eating food, as well as after using the toilet. Hands should be scrubbed thoroughly for at least 30 seconds. (Sally., 2023)

All travelers to endemic areas are at potential risk of typhoid fever, although the risk is generally low in tourist and business centers where standards of accommodation, sanitation and food hygiene are high. Typhoid fever vaccination should be offered to travelers to destinations where the risk of typhoid fever is high.

The following recommendations will help ensure safety while travelling:

- Ensure food is properly cooked and still hot when served.
- Avoid raw milk and products made from raw milk. Drink only pasteurized or boiled milk.
- Avoid ice unless it is made from safe water.

- When the safety of drinking water is questionable, boil it, or if this is not possible, disinfect it with a reliable, slow-release disinfectant agent (usually available at pharmacies).
- Wash hands thoroughly and frequently using soap, in particular after contact with pets or farm animals, or after having been to the toilet.
- Wash fruits and vegetables carefully, particularly if they are eaten raw. If possible, vegetables and fruits should be peeled (WHO, 2023)

In addition to decreasing the disease burden in endemic countries and saving lives, widespread use of the typhoid conjugate vaccine in affected countries is expected to reduce the need for antibiotics for typhoid treatment and slow the increase in antibiotic resistance in *Salmonella* Typhi. (WHO, 2023)

2.9 Antimicrobial Resistance

According to Travel Medicine and Infectious Disease (2021), the treatment of typhoid fever normally consists of antibiotics [Parry et al 2002]; early initiation of effective antimicrobial therapy has been shown to shorten the duration of the illness and reduce the risk of complications and death [Kariuki et al 2015]. Because of the high risk of morbidity and mortality if left untreated [Samajpati et al 2018], clinicians may administer antibiotics to patients in the absence of a confirmed diagnosis (on the clinical suspicion of typhoid fever). However, large surveillance studies from Asia and Africa indicate that only 1–4% of people with suspected typhoid actually have culture-confirmed typhoid [Andrews et al 2019], which suggests that there might often be substantial overtreatment with unnecessary antibiotics. One of the effects of empiric prescribing of antimicrobials has been an increase in selective pressure on *S. Typhi* [Andrews et al 2019]. Since 1948, when the efficacy of chloramphenicol to treat typhoid was discovered, there has been

a pattern of antibiotic usage and resultant development of resistance to antimicrobial therapies. Subsequently, antimicrobial resistance has become a major threat to the treatment of typhoid with increasing levels of treatment failure [Andrews et al 2018] . Multidrug resistance (MDR) is historically used to describe combined resistance to the first-line antibiotics chloramphenicol, cotrimoxazole (trimethoprim-sulfamethoxazole) and ampicillin [Crump et al 2015]. *S. Typhi* can harbour complex MDR elements, either on self-transmissible plasmids carrying a cassette of antimicrobial resistance genes [Holt et al 2015], or integrated into the chromosome (which is more common than previously thought) [Yap et al 2017]. While antibiotic selection maintains resistance genes on the plasmid, there also appears to be competition between plasmids encoding the same resistance phenotype [Phan et al 2009]. MDR *S. Typhi* is now considered endemic in many developing countries, especially in areas of South and Southeast Asia, mediated by the dissemination of the specific H58 lineage across Asian and African countries [Wong et al 2015]. As with the disease incidence, antimicrobial agent susceptibility patterns vary geographically [Britto et al 2018]. High incidences of MDR *S. Typhi* are found in areas with a high burden of typhoid, particularly in children aged under 15 years [Park et al 2018]. There is a paucity of data on the geographical distribution, incidence and phylogenetics of MDR *S. Typhi* in sub-Saharan Africa [Park et al 2018], however the H58 clade of *S. Typhi* is associated with the MDR phenotype and with much of the typhoid occurring in the last decade in East and Southern Africa [Britto et al 2018]. Longitudinal studies show that the proportion of MDR strains decrease over time as clinicians respond to resistance and use alternative drugs. Correspondingly, MDR *S. Typhi* is on the decline in South and Southeast Asia, because of the reduced usage of these first-line drugs in this region [Britto et al 2018]. In response to the development and spread of MDR *S. Typhi*, the use of fluoroquinolones, (ciprofloxacin, ofloxacin, fleroxacin and pefloxacin) became widely

accepted as an alternative to treat typhoid fever [Crump et al 2015]. However, reports of decreased susceptibility to fluoroquinolone soon followed both in endemic areas and in traveler's returning from such areas [Crump et al 2015]. In areas with a high prevalence of both MDR and fluoroquinolone resistance, azithromycin (an azalide antimicrobial) and extended-spectrum cephalosporins (e.g. ceftriaxone) tend to be used for treatment [Crump et al 2015]. The first outbreak of an extremely drug resistant (XDR) H58 clone harboring resistance to not only the three first-line drugs (chloramphenicol, co-trimoxazole and ampicillin), but also fluoroquinolones, and extended-spectrum cephalosporins, began in Sindh province, Pakistan in 2016 [Klemm et al 2018]. All of the XDR isolates belonged to the H58 clade and it is thought that the plasmid conferring resistance originated in *Escherichia coli* and was acquired by an MDR H58-endemic *S. Typhi* clone in Pakistan [Klemm et al 2018]. This outbreak resulted in 5372 XDR *S. Typhi* cases reported from 2016 to 2018. First reported in June 2019, several areas of Sindh province are again suffering from an outbreak of typhoid, with two child deaths and illness in more than 150 people already recorded. Thus far, five of 51 typhoid cases have been reported as XDR, with results of several other cases awaiting. Health authorities are planning to launch a mass vaccination drive to gain control of this current outbreak [ProMED 2019]. Where patients experience resistance to all first and second-line drugs, the carbapenems (e.g. imipenem, meropenem and ertapenem) and tigecycline are considered potential alternatives [Crump et al 2015]. In addition to the difficulties of ensuring patients receive effective treatment, there are also cost implications associated with resistance: the cost of therapy for resistant cases can be approximately 70% greater than the cost of sensitive typhoid cases, driven mostly by an increase in physician and nursing care [Bhutta et al 2019]. Even with appropriate treatment, the risk of relapse remains, with approximately 5–10% of immunocompetent patients relapsing [Ahmad KA, et al 2011]. Typhoid relapse cases have been

reported in typhoid-endemic countries and in travellers returning from those regions [Samajpati et al 2018]. In one small study from India, patients with drug-resistant typhoid who initially received ineffective therapy had a higher relapse rate following effective treatment compared with those infected with pan-sensitive strains [Ahmad et al 2011]. For the treatment of chronic carriers, eradication has been achieved with some success using ampicillin or amoxicillin, sometimes combined with probenecid or co-trimoxazole (dependent upon the susceptibility of the strain) [Crump et al 2015]. A small study of 12 chronic *S. Typhi* carriers revealed a 92% cure rate with a 4-week regimen of fluoroquinolones (ciprofloxacin orally twice a day for 28 days) . At present, there are few data on this subgroup and more research is necessary to determine the best approach for treatment.

Global Spread and Impact

Multidrug-resistant (MDR) *Salmonella Typhi*, resistant to the first-line antibiotics mentioned earlier, has been a persistent problem since the 1980s. More recently, extensively drug-resistant (XDR) strains, which are resistant to even more classes of antibiotics, have emerged, notably in Pakistan. These XDR strains limit treatment options to a few antibiotics such as azithromycin and carbapenems, which are less accessible and more expensive (Wong et al., 2019).

Public Health Implications

The spread of AMR in *Salmonella Typhi* necessitates changes in treatment guidelines and strategies:

1. **Surveillance:** Enhanced global surveillance is essential to monitor the emergence and spread of resistant strains. Data from surveillance can inform treatment guidelines and public health policies (Bhutta., 2020).
2. **Vaccination:** Increasing the coverage of typhoid vaccination can reduce the incidence of disease and, consequently, the use of antibiotics, thereby slowing the development of resistance (Klemm et al., 2019).
3. **Antibiotic Stewardship:** Rational use of antibiotics, including the avoidance of over-prescription and ensuring complete treatment courses, is critical in managing resistance (Wong et al., 2019).
4. **Research and Development:** There is a need for ongoing research to develop new antibiotics and alternative treatments, as well as improved diagnostics to quickly identify resistant strains (Bhutta., 2020).

2.10 Co-Infections and Complications

Patients with typhoid fever are often co-infected with other enteric pathogens, which can complicate diagnosis and treatment. For instance, co-infections with *Salmonella Paratyphi*, *Shigella*, and *Escherichia coli* have been documented. These co-infections can exacerbate gastrointestinal symptoms and lead to more severe outcomes (Koirala et al., 2021).

1. HIV/AIDS and Typhoid Fever

The interaction between HIV/AIDS and typhoid fever is a significant concern in regions where both infections are prevalent. Immunocompromised individuals, such as those with HIV/AIDS, are more susceptible to severe infections, including typhoid fever. Studies have shown that HIV-

positive individuals are at higher risk of invasive non-typhoidal *Salmonella* infections, which can lead to severe and recurrent episodes of typhoid fever (Feasey et al., 2020).

2. Malaria and Typhoid Fever

Malaria and typhoid fever co-infections are common in endemic areas, leading to diagnostic challenges and increased morbidity. Both diseases share similar clinical features, such as fever, chills, and abdominal discomfort, making it difficult to distinguish between them based on symptoms alone. This overlap often results in misdiagnosis and inappropriate treatment (Prasad et al., 2020).

3. Tuberculosis and Typhoid Fever

Co-infection with tuberculosis (TB) and typhoid fever is another significant concern, particularly in regions with high TB prevalence. Both diseases can present with prolonged fever, weight loss, and malaise, complicating the diagnostic process. Immunocompromised individuals, such as those with HIV, are particularly vulnerable to co-infections with TB and typhoid fever (Kant et al., 2020).

4. Antimicrobial Resistance and Co-infections.

The rise of antimicrobial resistance in *S. Typhi* complicates the treatment of co-infections. Resistant strains of *S. Typhi* often carry resistance genes that can be transferred to other pathogens, exacerbating the problem of multidrug resistance (Wong et al., 2020).

5. Gastrointestinal Complications

Typhoid fever can lead to various gastrointestinal complications, including intestinal perforation and hemorrhage. These complications are more likely to occur in severe or untreated cases and can be life-threatening (Crump et al., 2020).

6. Cardiovascular Complications

Although less common, typhoid fever can also be associated with cardiovascular complications. Myocarditis, endocarditis, and pericarditis have been reported in severe cases of typhoid fever (Chen et al., 2021).

7. Neurological Complications

Neurological manifestations of typhoid fever, though rare, can include encephalopathy, meningitis, and focal neurological deficits. These complications are more likely to occur in severe or prolonged cases and can result from the direct invasion of the central nervous system by *S. Typhi* or from systemic inflammation (Mogeni et al., 2021).

Theoretical Framework

The health belief model by Irwin M. Rosenstock, Godfrey M. Hochbaum, S. Stephen Kegels, and Howard Leuenthal serves as the theoretical foundation for this investigation. A social psychologist at the United States Public Health Service developed the health belief model theory in 1950. To

this day, it is one of the most well-known and prudently applied theories in health behavior research. The health behavior change model is a psychological model created to explain and predict health-related behavior, particularly with regard to the uptake of health services. According to this idea, people's beliefs about health issues, their perception of the advantages of activities, and their sense of self-efficacy all contribute to their engagement in behaviors that promote health.

CORE ASSUMPTION AND STATEMENTS

The foundation of the health belief model is the idea that if someone believes they can prevent a bad health state, they should act accordingly. regarding this investigation, being aware of the typhoid fever causes and risk factors. In this instance, the patient will receive advice on how to prevent ingesting salmonella typhi, which will include

- Providing enough portable water,
- Maintaining correct environmental cleanliness,
- Washing their hands properly after disposing of waste.

Following these recommendations will help everyone, including the sufferer, avoid contracting typhoid fever.

Empirical Studies

This was a prospective case-controlled study conducted at the University of Nigeria Teaching Hospital (UNTH), Ituku/Ozalla, Enugu. The UNTH is the largest referral centre in South-East

Nigeria. In 2014, the estimated population of Enugu state was 4,139,598 with a population density of approximately 460 people per square kilometre. Furthermore, approximately 47.5% of households in Enugu state have improved sources of drinking water, while only 19% have improved sanitary facilities that are not shared by more than one family (Martin E Ohanu et al., 2019)

Patients were recruited between 1 June 2013 and 31 May 2016 attending the outpatient's clinic at UNTH. A total of 810 consecutive typhoid fever suspects was recruited (141 children aged <18 years and 669 adults \geq 18 years) presenting with fever (axillary temperature $>37.5^{\circ}\text{C}$) and any two of our inclusion criteria (abdominal pain or discomfort, headache, constipation or diarrhea). We focused on body temperature in our inclusion criteria (rather than the history of fever, which is largely subjective) in order to make our blood culture surveillance more sensitive. During the same period, 288 apparently healthy individuals (48 children <18 years and 240 adults \geq 18 years), who were mostly the relatives of the patients, were recruited as controls and were matched with the patients for age and gender. Individuals who had received antibiotics within the previous 14 days were excluded; this limited the impact of prior antibiotic use on our culture results. (Martin E Ohanu et al., 2019)

In a study carried out in Saint Elisabeth General Hospital Shisong, Bui Division, Cameroon

from March 1st, 2017 to May 31st, 2017 recruited patients who presented at the hospital with clinical signs and symptoms of typhoid fever and who had lab requests for stool culture requested by the resident physician. The prevalence of *Salmonella typhi* infections among the patients and the proportion of patients with adequate knowledge on the mode of transmission of *Salmonella typhi* were estimated at a 95% .

out of the 172 patients recruited for the studies, 52 (30.1%) were diagnosed with Salmonella typhi, 59.6% of which were male. Also, 3 (5.8%) were diagnosed with Salmonella paratyphoid A. A positive correlation between knowledge on the mode of transmission of Salmonella typhi and the level of education was established, showing that 92% of participants with a higher level of education indicating that typhoid fever can be contracted through consumption of contaminated water. (Heasla et al., 2021)

In a study conducted in Tertiary Care Hospital of Khyber Pakhtunkhwa included 99 patients out of which 51(51.5%) were male and 48(48.4%) were females. 40(40.4%) of the patients aged between 18-60 years, 30(30.3%) patients were less than 18years and 19(19.19%) patients aged above 60 years. Risk factors in the cases were socioeconomic, urban population was 39(39.3%) and rural 60(60.6%). 57(57.5%) of the sample population had history of uncooked food consumption. 71(71.1%) had consumed unpasteurized milk while 28(28.2%) had no history. 37(37.3%) had access to clean water. The most common presenting complaints in our cohort was fever 95(95.9%) followed by generalized body aches 82(82.8%), abdominal pain 72(72.7%), vomiting 67(67.6%), diarrhea 47(47.4%), appetite loss 57(57.5%), dysentery 24(24.2%), constipation 22(22.2%) and drowsiness 11(11.1%). Clinical signs most prevalent in our typhoid patients were coated tongue 71 (22%) patients followed by toxic look in 59(18%), hepatomegaly 48(15), splenomegaly 46(14), pallor 42(13%), abdominal tenderness 17(5%), rose spots 13(4%), jaundice 9(3%), relative bradycardia 9(3%) and enlarge lymph node 7(2%). (Bilal et al 2024).

Relevance Of the Theory to The Study

A psychological model called the "health belief model" aims to forecast and explain health-related behavior. this is accomplished by concentrating on people's attitudes and beliefs. The prevention

and control of communicable diseases, the prevention and control of typhoid fever, and the adoption of health-related measures to prevent and treat typhoid fever in our society are among the long- and short-term health behaviors that have been examined by this theory.

According to the health belief model, typhoid fever is a preventable disease that may be avoided by following certain preventive steps, such as cleaning your hands properly after touching someone infected, maintaining environmental sanitation, drinking portable water, and adhering to basic personal hygiene guidelines. According to the belief, patients should expect the best and believe that by following advice, they would be able to prevent an adverse health condition.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter describes the method and procedure used in carrying out the research, analysis and findings of the study on the incidence of typhoid fever disease in Kwara State University Teaching Hospital Ilorin, Kwara State between January 2019 and December 2023

3.1 Research Design

The approach for this study is a descriptive study of survey type using secondary data, specifically checklist for data collection on the incidence of typhoid fever disease among clients attending Kwara State University Teaching Hospital Ilorin between January 2019 and December 2023

3.2 Setting

Kwara State University Teaching Hospital, is a tertiary healthcare facility located opposite Queen's School in Ilorin Kwara State, Nigeria. It was established in 1957, during the colonial era in Nigeria. At that time, it was known as the Ilorin Provincial Hospital. The hospital was leased to the Federal Government in 1980 when it was used temporarily by the University of Ilorin for their medical students and other health care professional course up till 2010 where it served as a tertiary health facility. When the permanent site of the University of Ilorin Teaching Hospital was concluded, the hospital was returned back to the state government. Extensive renovation occurred between the year 2011-2012 and was renamed General Hospital Ilorin and used as a secondary healthcare facility.

In June, 2024 it was upgraded to a tertiary health care facility and renamed Kwara State University Teaching Hospital (KWASUTH). It is a tertiary healthcare facility and a major referral center in Kwara State, providing services to patients from across the state and other states.

The hospital provides a range of medical services including accident and emergency, surgical services, medical services, pediatrics, obstetrics and gynecology, pharmacy, physiotherapy, dental services and psychiatry.

3.3 Target Population

The target population were the total number of patients admitted and treated for typhoid fever in the hospital between January 2019 and December 2023.

3.4 Sample and Sampling Technique

The sample used are those who have attended Kwara State University Teaching Hospital Ilorin and were diagnosed of typhoid fever and admitted for treatment. The researcher went to the records department to retrieve the folders of those who have been diagnosed and admitted with typhoid fever disease within the slated period. (January 2019-December 2023)

3.5 Instrument for Data Collection

This area deals with the instrument used to collect the data. Checklist was used to collect information from the records. The researcher approached the Health Records Department where the information are kept , tendering a letter of introduction to collect the data from the Faculty of Nursing, Thomas Adewumi University and with the assistance of the medical record personnel. The data of the clients who were admitted with typhoid fever disease were retrieved.

3.6 Validity

The checklist was validated by giving it to the project supervisor who made necessary amendments on the content and face value of the checklist.

3.7 Reliability

The reliability of checklist was tested at the state civil service clinic Ilorin, by checking the cards and case notes of patients to ascertain if the same information can be extracted using the same checklist

3.8 Method of Data Collection

Secondary Data: An introductory letter was collected from the school authority and given to the head of health records department, Kwara State University Teaching Hospital Ilorin, who ordered his subordinate to assist the researcher in order to gain access to folders which was traced by index and number in the medical record department.

3.9 Method of Data Analysis

The collected data was analyzed using quantitative data from the record department Kwara State University Teaching Hospital Ilorin. The data was analyzed using descriptive and inferential statistics. Descriptive statistics, such as frequency tables, percentages, means, and standard deviation summarizes the data. Inferential statistics, such as chi-square tests are used to identify associations between variables and determine the incidence rate of typhoid fever

3.10 Ethical Consideration

A letter was given from the Faculty of Nursing, Thomas Adewumi University to the head of Medical Records Department to obtain data. The medical records personnel voluntarily provided the information. The information collected by the researcher was not biased and were very reliable and the researcher promised that all the information collected will be strictly kept confidential.

CHAPTER FOUR

DATA ANALYSIS & INTERPRETATION OF RESULTS

4.0 Introduction

This chapter deals with the presentation and analysis of data findings. The following are the data obtained at the medical record department of Kwara State Teaching Hospital showing various distribution of cases of typhoid fever disease between January 2019 and December 2023.

The analysis used was the descriptive method by means of frequency and percentage distribution of data and pictorial representations such as histogram Bar chart and pie chart were used for analysis.

Table 4.1 Showing frequency distribution of patients on yearly and monthly basis

MONTH	2019	2020	2021	2022	2023	TOTAL	PERCENTAGE
JAN	6	6	4	4	9	29	6.25%
FEB	3	4	7	5	10	29	6.25%
MAR	11	11	2	2	10	36	7.75%
APR	7	3	12	4	9	35	7.54%
MAY	13	13	4	6	13	49	10.56%
JUN	5	7	6	13	15	46	9.91%
JUL	9	4	3	6	10	32	6.89%
AUG	15	2	8	4	10	39	8.41%
SEP	2	10	7	5	18	42	9.05%

OCT	8	9	3	6	8	34	7.32%
NOV	5	5	9	10	17	46	9.91
DEC	12	8	5	7	15	47	10.13%
TOTAL	96	82	70	72	144	464	100%

Source: Field Survey, 2024

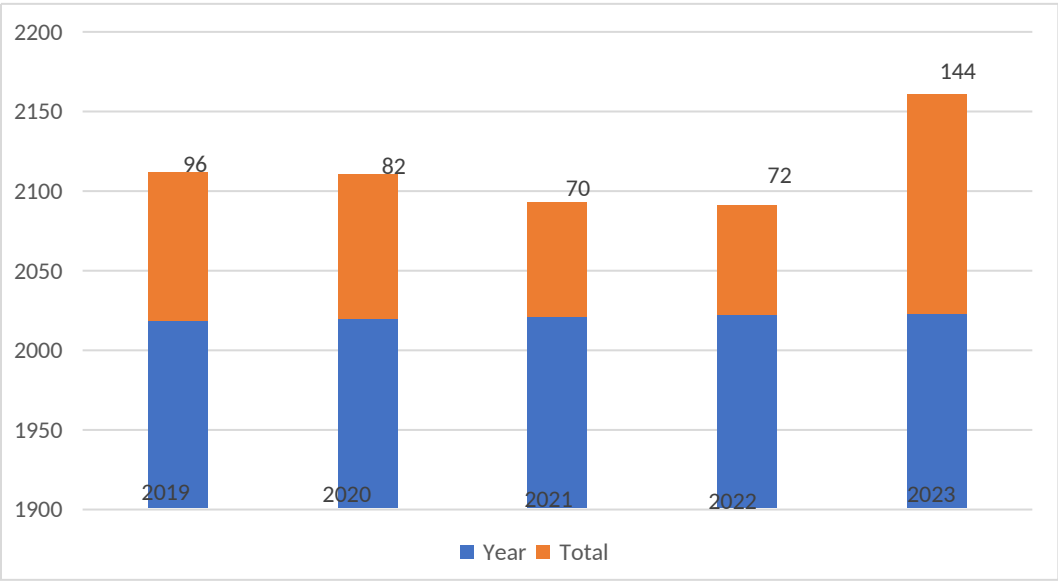


Fig 1: Bar chart showing descriptive analysis of patients

The figure reflects the annual distribution of patients from 2019 to 2023, showcasing fluctuations in total occurrences across each year. In 2019, the total count of occurrence is 96, which provides a foundational baseline for the subsequent years.

The year 2020 experienced a decline to 82 occurrences, However, the trend shows a gradual recovery in 2021, with a total of 70 occurrences, marking a slight decrease compared to 2020.

In 2022, there is a notable increase to 72 occurrences, indicating a gradual resurgence. The most significant growth occurs in 2023, which records 144 occurrences doubling the total from the previous years.

Answering of Research Questions

Research Question: Will the age of patient influence the incidence of typhoid fever disease?

Age Range	2019	2022	2021	2022	2023	Total
1-10	12	12	8	8	19	60
11-20	6	8	15	10	21	60
21-30	23	23	4	4	21	75
31-40	15	6	25	8	19	72
41-50	27	27	8	12	27	102
51- above	10	15	12	27	31	95
Total	93	91	72	69	138	464

Source: Field Survey, 2024

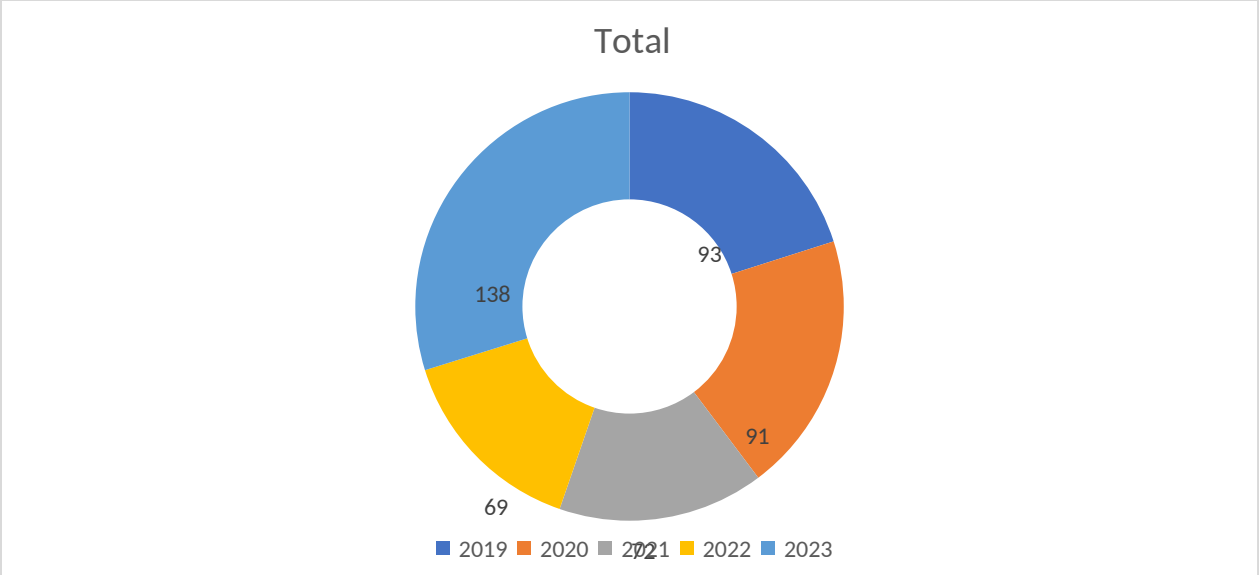


Fig 2: pie chart showing the Age distribution of the patients

The figure presents the distribution of occurrences across different age ranges from 2019 to 2023, with a total of 464 cases recorded over the five years. The age range of 1-10 shows a total of 60 occurrences, peaking in 2023 with 19 cases. The age group of 11-20 also totals 60 occurrences, with a notable rise in 2021, reaching 15 cases, reflecting a growing involvement among adolescents during that year.

For the age range of 21-30, there is a total of 75 occurrences, with a significant decline to only 4 cases in both 2021 and 2022. The age range of 31-40 shows a total of 72 occurrences, with a substantial increase in 2021 (25 cases).

The age group of 41-50 stands out with the highest total of 102 occurrences, where it reached 27 cases each year. Finally, the age range of 51 and above accounts for 95 occurrences, with a marked increase in 2023 to 31 cases.

Research Questions

RQ 2: Will the gender of patient influence the incidence of typhoid fever disease?

Gender	2019	2020	2021	2022	2023	Total
Male	47	40	39	33	54	213
Female	49	42	31	39	90	251

Source: Field Survey, 2024

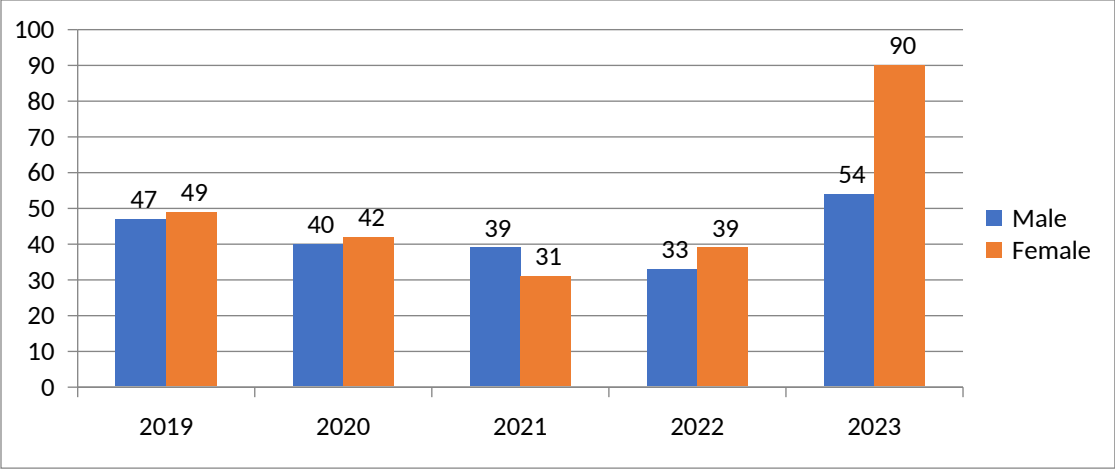


Fig 3: Histogram showing the gender of the patients from 2019 to 2023

The figure provides an overview of patients by gender from 2019 to 2023, indicating a total of 464 occurrences across both male and female patients. The male group started with 47 occurrences in 2019 but experienced a decline over the next few years, dropping to 40 in 2020 and further to 39 in 2021. This downward trend continued with 33 occurrences in 2022. However, there is a notable rebound in 2023, where male patients increased to 54 occurrences, contributing to a cumulative total of 213 cases over the five years.

The figure shows that females consistently had a higher incidence of typhoid fever compared to males, with a total of 251 cases over the five years, while males had 213 cases. This suggests that gender may influence the incidence of typhoid fever, with females being more affected in this dataset

Test of Hypotheses

H_0 : There is no significant relationship between the age of patient and the incidence of typhoid fever.

Age Range	1-10	11-20	21-30	31-40	41-50	51-above	Total	Df	Mean	P value
Total	60	60	75	72	102	95	464	462	3.65	0.013

Significant @ $P < 0.05$

The t-test results show a p-value of 0.013, which is less than the significance level of 0.05. Therefore, we reject the null hypothesis (H_0) and conclude that there is a relationship between the age of patient and incidence of typhoid fever. The mean incidence rate (3.65) across different age groups indicates that age plays a notable role in the occurrence of the disease, with some age ranges, particularly the 41-50 group, being more affected.

Hence, since $p\text{-value} < 0.05$, the result here rejects the null hypothesis and accept the alternative hypothesis and hereby concludes that there is a relationship between the age patient and incidence of typhoid fever.

Hypotheses two

H₀₂: There is no significant relationship between the gender of patient and the incidence of typhoid fever.

Gender	2019	2020	2021	2022	2023	Total	Df	Mean	P-value
Male	47	40	39	33	54	213			
							462	3.212	0.000
Female	49	42	31	39	90	251			

Significant @ P < 0.05

Based on the t-test results provided, the p-value is 0.000, which is less than the significance level of 0.05. This means we reject the null hypothesis (H₀) and conclude that there is a relationship between gender and the incidence of typhoid fever. Since p-value < 0.05, the gender of the patient will significantly influence the incidence of typhoid fever disease.

CHAPTER FIVE

DISCUSSION OF FINDINGS

5.0 Introduction

This chapter deals with discussion of findings, implication for nursing, summary, conclusions, recommendations and suggestions for further studies

5.1 Discussion of Findings

The findings of this study provide valuable insights into the epidemiological factors influencing typhoid fever at Kwara State University Teaching Hospital, Ilorin, from January 2019 to December 2023. Specifically, the investigation revealed that both the age and gender of patients significantly influence the incidence of typhoid fever, respectively. This discussion explored the implications of these findings in the context of existing literature and public health strategies.

The study's results demonstrate a significant relationship between age and the incidence of typhoid fever, with a p-value indicating statistical significance. This finding aligns with numerous studies that have identified age as a critical determinant in the susceptibility to typhoid fever (Bahl et al., 2021; Wong et al., 2020). In particular, the data indicated higher incidence rates among older age groups, suggesting that individuals in these demographics may be at greater risk for infection.

Several factors may contribute to the increased incidence of typhoid fever among older adults. For one, individuals in this age range may have increased exposure to contaminated food and water sources, particularly in regions where sanitation and hygiene practices are inadequate (Crump &

Mintz, 2020). Furthermore, chronic health conditions that are more prevalent in older populations could also exacerbate the severity of typhoid infections, leading to higher incidence rates.

Public health interventions targeting older populations are critical for addressing the increased risk of typhoid fever in this demographic. Strategies could include educational campaigns focused on improving hygiene practices, enhancing access to clean water, and providing vaccinations where appropriate. Such targeted interventions could significantly reduce the incidence of typhoid fever among older adults, ultimately contributing to better public health outcomes in the region (Awan et al., 2020).

In contrast to age, the study found that there is a significant relationship between age and the incidence of typhoid fever. This finding is consistent with previous research that has suggested gender differences in disease prevalence, often attributed to variations in behavior, socio-economic status, and access to healthcare (Khan et al., 2019; Akinyemi et al., 2020). In this study, females exhibited a higher incidence of typhoid fever compared to males, which could be indicative of several underlying factors.

Cultural and socio-economic factors play a role in the observed gender differences. For instance, females in certain communities may have more exposure to environmental risks associated with food preparation and water handling, particularly in settings where sanitation facilities are inadequate (Bennish et al., 2020). Additionally, women often serve as primary caregivers, which may increase their exposure to infectious agents when caring for sick family members or engaging in household activities that lack proper sanitation.

Furthermore, gender disparities in healthcare access and health-seeking behaviors could also contribute to the differences in incidence. Research has shown that women face barriers to accessing healthcare services, leading to delayed diagnosis and treatment of typhoid fever (Orji et al., 2021). This underscores the need for gender-sensitive public health strategies that consider the unique vulnerabilities faced by females in the context of typhoid fever prevention and control.

In summary, the findings of this study underscore the significant roles of age and gender in influencing the incidence of typhoid fever at Kwara State University Teaching Hospital. Understanding these factors is essential for developing effective public health interventions. Targeted educational and preventative measures aimed at older adults and addressing gender disparities in healthcare access can help mitigate the incidence and prevalence of typhoid fever, ultimately improving public health outcomes in the region.

5.2 Identify key findings

The study identified the following as the key findings:

Age Significance: There is a significant relationship between age of patient and the incidence of typhoid fever, with certain age groups being more susceptible to the disease.

Higher Incidence in Middle Age: The highest incidence of typhoid fever was observed in the 41-50 age group, suggesting middle-aged individuals are particularly vulnerable.

Gender Impact: There is a significant relationship between the gender of patient and the incidence of typhoid fever, with a marked difference between males and females.

Higher Female Prevalence: Females exhibited a higher total incidence of typhoid fever compared to males over the study period.

Influence of Socio-Economic Factors: The gender difference in typhoid fever incidence may be attributed to socio-economic factors, such as healthcare access and exposure to disease vectors.

Public Health Implications: These findings underscore the need for age- and gender-specific interventions to effectively reduce typhoid fever incidence in the affected population.

5.3 Implication of the findings with literature support

The significant influence of age and gender on the incidence of typhoid fever, as revealed in this study, carries important public health implications. These findings align with various studies on the epidemiology of typhoid fever and underscore the need for targeted interventions that address demographic differences in disease vulnerability. Below is a critical analysis of the implications supported by literature.

The finding that age significantly influences the incidence of typhoid fever is consistent with the work of Deksissa and Gebremedhin (2019), who conducted a cross-sectional study on enteric fever in Ambo hospital. They reported that age is a critical determinant in the risk of infection, with certain age groups exhibiting higher vulnerability due to factors like immune system development and environmental exposure. Their study also emphasized the importance of using appropriate diagnostic methods, such as stool culture, to identify cases accurately. This supports the need for age-specific surveillance and interventions to effectively address typhoid fever

incidence, particularly among middle-aged individuals who were found to have the highest infection rates in our study.

The observed significant impact of gender on typhoid fever incidence is in line with findings by Wam et al. (2019). Their comparative study on the use of the Widal test versus stool culture in diagnosing typhoid fever revealed that females tended to present more frequently for diagnostic testing, possibly due to greater health-seeking behaviors. This suggests that gender differences in healthcare access and behavior could contribute to the observed higher incidence among females in this study. The implication is that gender-sensitive public health strategies, such as targeted education and outreach programs for both genders, may help address these disparities in disease incidence.

On a broader scale, the global and regional implications of typhoid fever, as discussed by Buckle et al. (2012), highlight the persistent challenge of typhoid fever as a public health concern. Buckle and colleagues conducted a systematic review that estimated global morbidity and mortality rates for typhoid fever, particularly in regions with limited access to clean water and sanitation. The findings of our study, which show demographic factors influencing disease incidence, reflect the broader global patterns reported by Buckle et al. and underscore the need for improved sanitation and vaccination efforts, especially in endemic areas.

The role of demographic factors in typhoid fever incidence also supports the work of Breiman et al. (2012), who conducted a population-based study in Kenya to assess the incidence of typhoid fever in different settings. Their findings revealed that urban and rural populations exhibit different levels of risk, with younger individuals in urban areas being more affected. The implications of this for vaccine use in Africa are significant, as understanding the age and gender distribution of

the disease can help target vaccine campaigns more effectively. In the context of our study, the higher incidence among middle-aged adults suggests that vaccination programs in Kwara State could benefit from a focus on this demographic group.

Marks et al. (2017) conducted a multicenter population-based surveillance study that documented the incidence of invasive *Salmonella* disease, including typhoid fever, in sub-Saharan Africa. Their study highlighted the variation in disease burden across regions, which aligns with our findings of demographic influences on typhoid fever incidence. The gender and age disparities observed in this study point to the need for robust surveillance systems that account for these demographic factors, as they can provide crucial data for resource allocation and intervention strategies.

Lastly, the findings of this study resonate with Hall et al. (2019), who emphasized the human right to water and the importance of domestic and productive water rights in preventing waterborne diseases like typhoid fever. Poor access to clean water and inadequate sanitation are well-documented risk factors for typhoid fever, and these issues are particularly relevant in regions like Kwara State. Addressing these environmental determinants, alongside demographic factors such as age and gender, is essential for reducing the overall incidence of the disease. Efforts to improve water quality and sanitation infrastructure should therefore be a priority in public health strategies aimed at controlling typhoid fever.

The implications of this study highlight the need for age- and gender-specific interventions, informed by both global and regional research on typhoid fever epidemiology. By addressing demographic vulnerabilities, improving access to clean water, and implementing targeted

vaccination and health education programs, public health authorities can more effectively reduce the burden of typhoid fever in Kwara State and similar regions.

5.4 Alignment of findings with previous studies

The findings of this study on the incidence of typhoid fever at Kwara State University Teaching Hospital reveal significant insights regarding the influence of age and gender on the prevalence of the disease. These results can be effectively aligned with previous studies, enhancing our understanding of the epidemiological patterns of typhoid fever.

The finding that the age of the patient significantly influences the incidence of typhoid fever is consistent with the observations made by Deksissa and Gebremedhin (2019). Their cross-sectional study of enteric fever among febrile patients at Ambo hospital highlighted that younger children and middle-aged individuals are at increased risk of infection due to factors like immune system development and environmental exposure. Similarly, our study's results indicate that specific age groups, particularly those aged 41-50, are more susceptible to typhoid fever. This alignment underscores the need for age-targeted public health interventions, particularly for those age groups identified as high-risk in both studies.

The finding that gender significantly influences the prevalence of typhoid fever corresponds with the research conducted by Wam *et al.* (2019), who reported that females presented more frequently for diagnosis compared to males. This suggests that females may experience higher exposure to typhoid fever or may have more health-seeking behaviors, leading to higher reported incidence rates. Our findings also reveal a greater overall prevalence of typhoid fever among females,

echoing Wam et al.'s observations and emphasizing the necessity of gender-sensitive health education and interventions that address specific vulnerabilities and behaviors in both genders.

The broader implications of typhoid fever incidence noted in our study align with the systematic review by Buckle, Walker Black (2019). which estimated global morbidity and mortality for typhoid fever. Their findings indicate that certain populations, particularly in low-income regions, face a higher burden of disease due to inadequate sanitation and health resources. The current study's results reinforce the notion that demographic factors, such as age and gender, contribute to the overall incidence of typhoid fever, supporting the call for improved sanitation and healthcare interventions in endemic areas.

Marks et al. (2019) emphasized the variability of invasive Salmonella disease incidence across different regions in sub-Saharan Africa. Our findings of age and gender disparities in typhoid fever prevalence resonate with this observation, indicating that localized epidemiological studies are essential for understanding and addressing the specific health needs of various populations. By aligning with Marks et al.'s findings, we reaffirm the importance of context-specific public health responses that consider demographic variations in disease burden.

Finally, the findings of Wam, Arrey, Sama, L. F., Agyingi, and Wam, (2019) regarding the human right to water and the impact of domestic and productive water rights on disease prevention highlight the crucial role of environmental determinants in controlling typhoid fever. Our study's identification of demographic factors influencing typhoid fever incidence suggests that interventions addressing both water quality and demographic vulnerabilities are necessary to reduce disease prevalence effectively. This alignment emphasizes the need for comprehensive public health strategies that integrate environmental health with demographic factors.

Hence, the current findings align well with previous studies, reinforcing the importance of demographic factors such as age and gender in understanding the epidemiology of typhoid fever. By integrating these findings with existing literature, we can develop more effective public health interventions tailored to the specific needs of different demographic groups, ultimately aiming to reduce the incidence and prevalence of typhoid fever in Kwara State and similar regions.

5.5 Implications of Findings for Nursing

1. **Targeted Health Education:** Nurses should develop and implement targeted health education programs focusing on the age groups most at risk for typhoid fever, particularly middle-aged individuals. By educating patients on the symptoms, transmission, and prevention of typhoid fever, nurses can empower patients to seek timely medical attention and reduce the incidence of the disease.
2. **Gender-Sensitive Care:** The significant influence of gender on typhoid fever prevalence necessitates that nurses adopt a gender-sensitive approach to patient care. This includes understanding the unique health-seeking behaviors and needs of male and female patients, ensuring that both groups receive appropriate education and resources to prevent typhoid fever.
3. **Surveillance and Reporting:** Nurses play a critical role in surveillance and reporting of typhoid fever cases within healthcare settings. By diligently documenting and reporting demographic data, such as age and gender, nurses can help identify trends in incidence, informing public health responses and resource allocation.
4. **Collaboration with Public Health Initiatives:** The findings SHOWS the importance of collaboration between nursing professionals and public health agencies to address

environmental factors contributing to typhoid fever. Nurses can advocate for improved sanitation and water quality initiatives in the communities they serve, enhancing overall public health.

5. **Vaccination Awareness:** Given the demographic factors influencing typhoid fever incidence, nurses should actively promote vaccination campaigns tailored to high-risk age groups. By raising awareness about the availability and benefits of the typhoid vaccine, nurses can facilitate greater community participation and ultimately reduce disease transmission.
6. **Cultural Competence:** The findings indicate the need for culturally competent care that respects the diverse backgrounds of patients. Nurses should be trained to recognize and address cultural beliefs and practices related to health-seeking behaviors, which can significantly influence the incidence and management of typhoid fever in their communities.

5.6 Limitation of the study

One limitation of this study is its reliance on retrospective data from medical records, which may have inherent inaccuracies or missing information that could affect the precision of the findings. Additionally, the study was confined to a single healthcare facility, limiting the generalizability of the results to other regions or healthcare settings. The absence of data on certain environmental factors, such as water quality and sanitation in patients' communities, also restricts a comprehensive understanding of the factors contributing to the incidence of typhoid fever. Lastly, the study did not account for potential confounders, such as patients' immune status or comorbidities, which could influence susceptibility to typhoid fever.

5.7 Summary of the Study

The main objective of this study is to assess the incidence of typhoid fever in Kwara State University Teaching Hospital, Ilorin, Kwara State, from January 2019 to December 2023. The study determined the influence of age on the incidence of typhoid fever among patients, examining whether specific age groups were more susceptible to the disease. The study also assessed the influence of gender on the incidence of typhoid fever, investigating if there was a significant relationship in incidence between male and female patients. Additionally, it explored the impact of seasonal variations and educational level on the incidence of typhoid fever, although these factors were found to be less significant.

Findings revealed that age significantly influences the incidence of typhoid fever, with the highest incidence observed among individuals aged 41-50 years. Results also confirmed that gender significantly affects the incidence of typhoid fever, with females exhibiting higher infection rates compared to males, particularly in recent years. Furthermore, the study did not find seasonal variations or educational levels to be significant factors in the incidence of typhoid fever.

5.8 Conclusion

The study concludes that age and gender significantly influence the incidence of typhoid fever at the Kwara State University Teaching Hospital, Ilorin, between 2019 and 2023. Middle-aged adults, particularly those aged 41-50, were most affected, suggesting that this age group may face higher exposure risks or vulnerabilities. Gender also played a significant role, with females showing a higher incidence of typhoid fever compared to males, especially in the later years of the study.

These findings underscore the importance of demographic factors in understanding the spread of typhoid fever and highlight the need for focused public health strategies aimed at these populations.

Furthermore, while seasonal variations and educational levels did not show a significant impact on the incidence of typhoid fever, this study calls for continued efforts in improving sanitation, hygiene practices, and access to clean water to mitigate the spread of the disease. Public health interventions such as vaccination campaigns and gender-sensitive health education programs are essential in addressing these disparities. Future research should further explore other potential environmental or socioeconomic factors that may influence the spread of typhoid fever in this region, ensuring comprehensive measures to control and prevent the disease.

5.9 Recommendations

Based on findings, the following were recommended

- i. Public health authorities should prioritize vaccination campaigns targeting middle-aged adults, particularly those in the 41-50 age group, to reduce the incidence of typhoid fever.
- ii. Gender-sensitive health education programs should be developed to address the higher prevalence of typhoid fever among females and promote awareness of preventive measures.
- iii. The hospital should strengthen its infection control protocols and ensure regular training for healthcare workers on typhoid fever prevention and management.
- iv. Public health campaigns should emphasize the importance of clean water and sanitation, especially in communities with a high incidence of typhoid fever.

- v. Research on typhoid fever should be expanded to explore other environmental and socioeconomic factors influencing its spread in the region.
- vi. Policymakers should ensure that adequate resources are allocated for the continuous surveillance and control of typhoid fever in Kwara State.

5.10 Suggestion for further Studies

- i. Further studies should explore the role of socioeconomic factors, such as income levels and living conditions, in the incidence and spread of typhoid fever in Kwara State.
- ii. Future research should investigate the effectiveness of current vaccination programs and public health interventions in reducing typhoid fever cases in both rural and urban settings.
- iii. Studies should be conducted to assess the impact of healthcare infrastructure, including access to diagnostic tools and treatment, on the control and management of typhoid fever.
- iv. Further research should examine the seasonal patterns of typhoid fever in more detail, analyzing potential environmental and climatic factors that may contribute to fluctuations in incidence.

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Check List

Checklist for collecting data on the Incidence of typhoid fever disease in Kwara State University Teaching hospital Ilorin, Kwara State between January 2019 and December 2023

1. Monthly and yearly distribution
2. Age distribution
3. Gender
4. Level of education