PREVALENCE AND MANAGEMENT BEHAVIOUR OF INDIVIDUALS WITH PEPTIC ULCER DUE TO *HELICOBACTER PYLORI* IN OWERRI WEST LOCAL GOVERNMENT AREA, IMO STATE, NIGERIA

BY

ACHUGWO, ANTHONY IHEMEBIGE

REG NO: 20204249688

A THESIS SUBMITTED TO THE

DEPARTMENT OF PUBLIC HEALTH,

SCHOOL OF HEALTH TECHNOLOGY,

FEDERAL UNIVERSITY OF TECHNOLOGY, OWERRI

AUGUST, 2024

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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF PUBLIC HEALTH (MPH) DEGREE

AUGUST, 2024

CERTIFICATION

; research on Prevalence and management behaviour of individuals with peptic ulcer due to *icobacter pylori* in Owerri West Local Government Area, Imo State, Nigeria written by ugwo, Anthony I. (Reg. No: 20204249688) has been certified as meeting the requirements for ster's Degree thesis in Public Health, in Post Graduate School, Federal University of hnology, Owerri.

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DEDICATION

This work is dedicated to my wife- Lolo Stella Achugwo and my children.

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I am grateful to the Almighty God for His grace, guidance and inspiration. I am grateful to my supervisor Dr. U.M. Chukwuocha for his encouragement; his indefatigable devotion to every stage of the work and also my Co-Supervisor Dr. Mrs Akanazu C. for her contributions to the success of the work.

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ABSTRACT

Background: Peptic ulcer disease (PUD) caused by Helicobacter pylori (H. pylori) infection is a significant health issue globally. This study aims to determine the prevalence of H. pyloriassociated peptic ulcers and to assess the management behavior among individuals in Owerri West Local Government Area (LGA), Imo State, Nigeria. Materials and Methods: A descriptive cross-sectional design was employed, targeting individuals aged 18 years and above in Owerri West LGA. A sample size of 439 respondents was determined using the Yammane formula and selected through a multi-stage sampling method. Data collection involved a combination of serological tests for H. pylori and structured questionnaires covering sociodemographic details, health information, lifestyle and dietary habits, access to healthcare, and management behavior of peptic ulcers. The validity and reliability of the instruments were ensured through expert review and a test-retest method with a reliability coefficient of 0.8. Ethical approval and informed consent were obtained before the study commenced. Results: The study revealed a high prevalence of H. pylori infection among individuals diagnosed with peptic ulcer disease, with 82.5% testing positive for H. pylori. The demographic analysis showed a diverse population with the largest age group being 3140 years old and a slight majority of female respondents. Healthcare providers in the study included doctors, nurses, and other healthcare professionals with varying years of experience. Civil servants and traders were the predominant occupational groups among the patient respondents. The Urea breath test was identified as the most widely available and accessible diagnostic method, considered highly effective by a majority of respondents. The management behavior for peptic ulcers varied, the predominant forms of management reported include proton pump inhibitors (190 patients, 84.4%) and antibiotics (175 patients, 77.8%). Dietary changes were also widely reported (128 patients, 56.7%), with fewer patients using herbal remedies (27 patients, 11.9%) or antacids (65 patients, 28.4%). Conclusion: The high prevalence of H. pylori infection among individuals with peptic ulcers in Owerri West LGA highlights the need for effective diagnostic and management strategies. The study underscores the importance of accessible and reliable diagnostic methods, as well as comprehensive management approaches, to address the burden of H. pylori-associated peptic ulcers in the region.

Keyword: peptic ulcer, helicobacter pylori, diagnostic methods, empirical studies, data collection

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Peptic ulcer disease (PUD) is a prevalent health issue globally, particularly in developing countries like Nigeria, where it is exacerbated by poor sanitation and limited healthcare access. The primary cause of PUD is *Helicobacter pylori* (H. pylori), a bacterium discovered in 1982, which has significantly altered the understanding and management of peptic ulcers (Sule, 2020).

In Nigeria, the prevalence of *H. pylori* infection among individuals with peptic ulcers varies significantly, with rates between 50% to 90% (Smith & Eke, 2019). Owerri West Local Government Area (LGA) in Imo State, Nigeria, exemplifies the semi-urban regions where the disease's prevalence is influenced by socioeconomic factors, lifestyle, and healthcare accessibility (Umeh, 2018).

H. pylori contribute to ulcer formation through colonization and mucosal damage, triggering an inflammatory response and altering gastric secretions (Okeke & Ogbonna, 2021). Clinically, peptic ulcer disease manifests through symptoms such as epigastric pain, bloating, nausea, and, in severe cases, complications like bleeding and perforation (Ibe & Nwosu, 2020).

Accurate diagnosis of *H. pylori* is essential, utilizing non-invasive tests (urea breath test, stool antigen test) and invasive methods (endoscopy with biopsy) (Adiele & Chukwu, 2017). The treatment involves antimicrobial therapy, typically a combination of antibiotics (clarithromycin, amoxicillin) and proton pump inhibitors (PPIs) to reduce gastric acid production (Eze & Ugochukwu, 2016).

Public health efforts are crucial in addressing the high prevalence of *H. pylori* infection in Owerri West LGA. Improving sanitation, strengthening healthcare infrastructure, enhancing public health education, and conducting surveillance and research are key strategies (Ndubuisi & Eze, 2020). By addressing these factors, the burden of peptic ulcer disease can be significantly reduced, improving health outcomes for the population. To this end, conducting a study on the prevalence and management of peptic ulcers due to *H. pylori* in Owerri West LGA, Imo State, Nigeria, is crucial to address the lack of data in the region, understand the burden of the disease, and develop effective strategies for prevention and treatment. By filling this knowledge gap, the study will contribute to improving the overall healthcare provision and outcomes for individuals affected by *H. pylori*-related peptic ulcers in the local community.

1.2 Statement of the Problem

Peptic ulcer disease (PUD) due to *Helicobacter pylori* (*H. pylori*) infection is a significant public health challenge in Nigeria. Despite advances in medical science, the prevalence of *H. pylori* infection and the associated burden of peptic ulcer disease remain high in this region (Smith & Eke, 2019). Factors such as poor sanitation, inadequate healthcare infrastructure, limited access to diagnostic and treatment facilities, and low public awareness contribute to the persistence of this problem (Umeh, 2018).

The high prevalence of *H. pylori* infection in Owerri West LGA exacerbates the morbidity and mortality associated with peptic ulcer disease. In this semi-urban area, the combination of urbanization and inadequate public health measures creates an environment conducive to the spread of H. pylori (Okeke & Ogbonna, 2021). This situation is further compounded by the lack of comprehensive data on the prevalence and management of peptic ulcer disease in the region,

making it challenging to develop effective public health interventions (Adiele & Chukwu, 2017).

Moreover, the diagnosis and treatment of H. pylori-related peptic ulcer disease are hampered by limited resources and healthcare personnel. Many residents are unable to access or afford proper diagnostic tests and treatment regimens, leading to prolonged suffering and complications such as bleeding, perforation, and gastric cancer (Eze & Ugochukwu, 2016). The absence of widespread public health education on the risk factors, symptoms, and preventive measures for peptic ulcer disease further aggravates the problem (Ndubuisi & Eze, 2020).

Given these challenges, there is an urgent need to address the prevalence and management of peptic ulcer disease due to *H. pylori* infection in Owerri West LGA. This study aims to provide a comprehensive understanding of the epidemiology of *H. pylori* infection, the effectiveness of current management strategies, and the public health implications. By identifying gaps in knowledge and practice, the study seeks to inform the development of targeted interventions that can reduce the burden of peptic ulcer disease in this community and improve overall health outcomes.

1.3 General Objective

The general objective of this study is to determine the Prevalence and management behaviour of individuals with peptic ulcer due to *Helicobacter pylori* in Owerri West Local Government Area, Imo State, Nigeria

Specific Objectives

1. To determine the prevalence of *Helicobacter pylori* infection among individuals diagnosed with peptic ulcer disease in Owerri West Local Government Area, Imo State, Nigeria.
2 To determine the availability, accessibility, and effectiveness of various diagnostic methods used for detecting *H. pylori* infection in Owerri West LGA.

3 To determine the adequacy of healthcare infrastructure, including the availability of diagnostic facilities, trained healthcare professionals, and treatment options for managing peptic ulcer disease in Owerri West LGA.

4 To determine the effectiveness of current antibiotic and proton pump inhibitor regimens in eradicating *H. pylori*

5 To determine the practices and protocols of healthcare providers in managing *H. pylori* induced peptic ulcer disease.

6 To determine the management behaviour of peptic ulcer due to *Helicobacter pylori* among individuals

1.4 Research Questions

1. What is the prevalence of *Helicobacter pylori* infection among individuals diagnosed with peptic ulcer disease in Owerri West Local Government Area, Imo State, Nigeria?

2. How available, accessible, and effective are the various diagnostic methods used for detecting *H. pylori* infection in Owerri West LGA?

3. How adequate is the healthcare infrastructure in Owerri West LGA, including the availability of diagnostic facilities, trained healthcare professionals, and treatment options for managing peptic ulcer disease?

4. How effective are the current antibiotic and proton pump inhibitor regimens in eradicating *H. pylori* among individuals with peptic ulcer disease in Owerri West LGA?
5. What are the practices and protocols of healthcare providers in managing *H. pylori* induced peptic ulcer disease in Owerri West LGA?

6. What is the management behaviour of peptic ulcer due to *Helicobacter pylori* among individuals

1.5 Research Hypotheses

1. Hypothesis on Prevalence of *Helicobacter pylori* Infection:

Null Hypothesis (H_0): There is no significant prevalence of *Helicobacter pylori* infection among individuals diagnosed with peptic ulcer disease in Owerri West Local Government Area, Imo State, Nigeria.

Alternative Hypothesis (H_1): There is a significant prevalence of *Helicobacter pylori* infection among individuals diagnosed with peptic ulcer disease in Owerri West Local Government Area, Imo State, Nigeria.

2. Hypothesis on Effectiveness of Treatment Regimens

H0: There is no significant current antibiotic and proton pump inhibitor regimens effective in eradicating *Helicobacter pylori* among individuals with peptic ulcer disease in Owerri West Local Government Area.

H1: There is a significant current antibiotic and proton pump inhibitor regimens effective in eradicating *Helicobacter pylori* among individuals with peptic ulcer disease in Owerri West Local Government Area.

3. Hypothesis on Availability and Accessibility of Diagnostic Methods

H0: There is no significant diagnostic method for detecting *Helicobacter pylori* infection adequately available and accessible to individuals in Owerri West Local Government Area.

H1: There is a significant diagnostic method for detecting *Helicobacter pylori* infection adequately available and accessible to individuals in Owerri West Local

Government Area.

4. Hypothesis on Adequacy of Healthcare Infrastructure

H0: There is no significant healthcare infrastructure, including diagnostic facilities, trained healthcare professionals, and treatment options for managing peptic ulcer disease, is not adequate in Owerri West Local Government Area.

H1: There is a significant healthcare infrastructure, including diagnostic facilities, trained healthcare professionals, and treatment options for managing peptic ulcer disease, is adequate in Owerri West Local Government Area.

5. Hypothesis on Healthcare Provider Practices

H0: There is no significant healthcare providers in Owerri West Local Government Area that follow effective practices and protocols in managing *Helicobacter pylori* induced peptic ulcer disease.

H1: There is a significant healthcare provider in Owerri West Local Government Area that follows effective practices and protocols in managing *Helicobacter pylori* induced peptic ulcer disease.

1.6 Significance of the Study

The prevalence of *H. pylori* related peptic ulcers in Owerri West Local Government Area (LGA) remains unknown, and this information is crucial for public health planning and resource allocation. Understanding the extent of the problem will help healthcare providers and policymakers prioritize prevention and treatment interventions, allocate appropriate resources, and implement targeted educational campaigns to raise awareness about *H. pylori* infection and its association with peptic ulcers.

Investigating the management of peptic ulcers due to *H. pylori* in Owerri West LGA is important to identify current treatment practices and evaluate their effectiveness. This knowledge will assist in identifying gaps in healthcare delivery and inform the development of evidence-based treatment guidelines specific to the local population. It will also enable healthcare professionals to implement appropriate treatment strategies to improve patient outcomes and reduce the morbidity associated with peptic ulcers.

The significance of this study extends to several key stakeholders:

1. Healthcare Providers and Policymakers:

The findings will help in prioritizing prevention and treatment interventions, ensuring appropriate resource allocation, and raising awareness through targeted educational campaigns about *H. pylori* infection and peptic ulcers.

2. Researchers

This study will add to the existing literature on *H. pylori* related peptic ulcers, providing a valuable resource for further research and academic inquiry.

3. Government and Related Organizations:

The results will provide necessary information to the government and concerned organizations, enabling them to identify weak points in healthcare delivery and areas in need of intervention. The government can utilize the findings to implement effective public health strategies and allocate resources efficiently.

4. Healthcare Professionals:

Insights from this study will assist healthcare professionals in adopting appropriate treatment strategies, ultimately improving patient outcomes and reducing the morbidity associated with peptic ulcers in the local population.

Overall, this study will contribute significantly to understanding the prevalence and management of *H. pylori* related peptic ulcers in Owerri West LGA, guiding future public health interventions and enhancing healthcare delivery.

1.7 Scope of the Study

This study focuses on the prevalence and management of peptic ulcer disease (PUD) due to *Helicobacter pylori* (H. pylori) among individuals in Owerri West Local Government Area (LGA), Imo State, Nigeria. The study is geographically confined to Owerri West LGA, Imo State, Nigeria. This area includes both urban and semi-urban communities, providing a diverse demographic and socio-economic backdrop for the research. The study targets individuals diagnosed with peptic ulcer disease within the selected geographical area. Both male and female participants, across various age groups and socio-economic statuses, will be included to ensure a comprehensive analysis. The study aims to determine the prevalence of *H. pylori* infection among individuals diagnosed with peptic ulcer disease in Owerri West LGA. This will involve collecting and analyzing data on the incidence and distribution of the infection.

The study will evaluate the current management practices for peptic ulcer disease due to *H. pylori*. This includes an examination of the diagnostic methods used, the treatment regimens prescribed, and the protocols followed by healthcare providers in the area. An assessment of the healthcare infrastructure in Owerri West LGA will be conducted. This includes evaluating the availability and accessibility of diagnostic facilities, the presence of trained healthcare professionals, and the adequacy of treatment options. The effectiveness, availability, and accessibility of various diagnostic methods for detecting *H. pylori* infection will be examined. This encompasses laboratory tests, endoscopic procedures, and noninvasive diagnostic techniques. The study will analyze the effectiveness of current antibiotic and proton pump inhibitor regimens in eradicating *H. pylori* and promoting ulcer healing. This includes assessing patient adherence to treatment and monitoring outcomes. The study will investigate the level of public awareness and understanding of *H. pylori* infection and peptic ulcer disease. This involves evaluating the effectiveness of existing educational campaigns and identifying areas where further education is needed. Data will be collected through a combination of quantitative and qualitative methods, including surveys, interviews, medical record reviews, and laboratory

tests. The study will employ rigorous statistical analysis to ensure the validity and reliability of the findings. The study will cover a specific time frame, typically spanning several months, to allow for the comprehensive collection and analysis of data. This period will be sufficient to capture the prevalence of the infection and the outcomes of various management practices. By delineating these boundaries, the study aims to provide a detailed and focused examination of the prevalence and management of peptic ulcer disease due to *H. pylori* in Owerri West LGA.

1.8 Operational definition of terms

1. **Peptic Ulcer Disease (PUD):** A condition characterized by open sores or ulcers on the lining of the stomach, duodenum, or esophagus.
2. ***Helicobacter pylori* (H. pylori):** A spiral-shaped bacterium that colonizes the stomach, contributing to peptic ulcers and other gastrointestinal conditions.
3. **Proton Pump Inhibitors (PPIs):** Medications that reduce gastric acid production, used in treating peptic ulcers.
4. **Antibiotics:** Drugs used to treat bacterial infections, such as H. pylori-related peptic ulcers.
5. **Non-invasive Tests:** Diagnostic methods like urea breath tests and stool antigen tests that do not require tissue samples.
6. **Invasive Tests:** Diagnostic methods involving tissue samples, such as endoscopy and biopsy.

7. **Socioeconomic Status (SES):** The social and economic position of individuals, influencing health outcomes.

8. **Prevalence:** The proportion of a population found to have a condition.
9. **Epidemiology:** The study of the distribution and determinants of diseases in populations.

10. **Morbidity and Mortality:** Measures of illness and death rates within a population.
11. **NSAIDs:** Non-steroidal anti-inflammatory drugs known to irritate the stomach lining, potentially contributing to ulcers.

12. **Eradication Therapy:** A combination of antibiotics and acid suppressors used to eliminate H. pylori infection.

1.9 Abbreviations

1. PUD: Peptic Ulcer Disease
2. H. pylori: *Helicobacter pylori*
3. PPIs: Proton Pump Inhibitors
4. NSAIDs: Non-Steroidal Anti-Inflammatory Drugs
5. SES: Socioeconomic Status
6. LGA: Local Government Area
7. FOB: Fecal Occult Blood
8. DALY: Disability-Adjusted Life Year

CHAPTER TWO

LITERATURE REVIEW

This research involves a comprehensive review of related literature conducted by other researchers, including an array of sources such as journals, articles, periodicals, and books.

The review is structured to present a detailed examination through various frameworks. Firstly, conceptual frameworks will be used to provide a clear explanation of each component of the research, ensuring a thorough understanding of the key concepts and their interrelations. Secondly, related theoretical frameworks will be explored to contextualize the study within existing theories and to highlight the foundational principles that underpin the research. Lastly, empirical studies will be reviewed to draw on evidence-based findings from previous research, offering insights and data that support and inform the current investigation. This multifaceted

literature review aims to establish a solid foundation for the study, situate it within the broader academic discourse, and ensure a robust and well-supported research approach.

2.1 Conceptual Framework

2.1.1 Concept of Peptic Ulcers

Peptic ulcers are open sores that develop on the lining of the stomach, upper small intestine (duodenum), or esophagus. They are primarily caused by the erosion of the protective mucous layer in the gastrointestinal tract, which allows stomach acid and digestive enzymes to damage the underlying tissues. One of the major contributing factors to the development of peptic ulcers is the infection with a bacterium called *Helicobacter pylori* (*H. pylori*). Peptic ulcers are common condition affecting millions of people worldwide. According to a study by

Søreide et al., (2016), the global prevalence of peptic ulcer disease (PUD) was estimated to be around 4% in the general population. Peptic ulcers can cause symptoms such as abdominal pain, bloating, nausea, and vomiting (Lanza et al., 2019). If left untreated, they can lead to complications like bleeding, perforation, or obstruction of the gastrointestinal tract (Malfertheiner et al., 2017).

The association between *H. pylori* infection and peptic ulcers has been extensively studied. *H. pylori* is a spiral-shaped bacterium that colonizes the stomach and contributes to the pathogenesis of peptic ulcers (Kusters et al., 2006). It produces various enzymes and toxins that disrupt the protective mechanisms of the gastric mucosa, leading to inflammation and ulceration (Graham et al., 2016). Studies have shown that the prevalence of *H. pylori* infection is significantly higher in individuals with peptic ulcers compared to those without ulcers (Chey et al., 2017).

Management of peptic ulcers focuses on two main aspects: eradicating *H. pylori* infection and reducing gastric acid secretion. The standard treatment for *H. pylori*-associated ulcers involves a combination of antibiotics (such as amoxicillin and clarithromycin) and proton pump inhibitors (PPIs) to eradicate the bacteria and promote ulcer healing (Malfertheiner et al., 2017). PPIs are medications that reduce the production of stomach acid, allowing the ulcer to heal and preventing its recurrence.

Peptic ulcers are commonly associated with the bacterium *Helicobacter pylori* (*H. pylori*). *H. pylori* is a Gram-negative, spiral-shaped bacterium that colonizes the stomach and can cause chronic inflammation, leading to the development of peptic ulcers (Chey et al., 2017). The following discussion will provide an overview of the relationship between peptic ulcers and *H. pylori*, incorporating Harvard citations.

H. pylori is considered a major risk factor for the development of peptic ulcers. Epidemiological studies have consistently demonstrated a strong association between *H. pylori* infection and the presence of peptic ulcers. For example, a meta-analysis conducted by Chey et al. (2017) found that individuals infected with *H. pylori* were at a significantly higher risk of developing peptic ulcers compared to those without the infection.

The pathogenesis of peptic ulcers due to *H. pylori* involves various mechanisms. *H. pylori* possesses unique virulence factors that contribute to the disruption of the gastric mucosal barrier and the induction of inflammation. These factors include the production of urease, which facilitates the survival of the bacterium in the acidic environment of the stomach, as well as adhesins and toxins that promote bacterial colonization and damage to the gastric epithelium (Kusters et al., 2006).

To diagnose *H. pylori* infection and assess its role in peptic ulcer disease, several diagnostic methods are available. These include serological tests, urea breath tests, stool antigen tests, and endoscopic biopsies for histological examination (Liou et al., 2019). These tests detect the presence of *H. pylori*-specific antibodies, urease activity, bacterial antigens, or direct visualization of the bacteria, respectively. The diagnosis of *H. pylori* infection in patients with peptic ulcers can be achieved through various methods. These include serological tests, urea breath tests, stool antigen tests, and endoscopic biopsy for histological examination. Serological tests detect antibodies against *H. pylori* in the blood, while urea breath. *H. pylori* infection is a major cause of peptic ulcers, and its eradication can lead to complete healing of these ulcers. Proper diagnosis and treatment of *H. pylori* infection are essential in managing and preventing the development of peptic ulcers and other gastrointestinal diseases.

There is a lot of research on the connection between *H. pylori* infection and peptic ulcers. According to Kusters et al. (2006), the spiral-shaped *H. pylori* bacteria colonizes the stomach and has a role in the etiology of peptic ulcers. It generates a number of enzymes and poisons that interfere with the stomach mucosa's defenses, causing inflammation and ulceration (Graham et al., 2016). According to studies, people with peptic ulcers have a much greater frequency of *H. pylori* infection than those without ulcers (Chey et al., 2017). There are numerous diagnostic techniques available to identify *H. pylori* infection and determine how it contributes to peptic ulcer disease. These consist of endoscopic biopsies for histological analysis, stool antigen testing, urea breath tests, and serological tests (Liou et al., 2019). These tests, in turn, look for bacterial antigens, urease activity, *H. pylori*-specific antibodies, or direct imaging of the germs. Eliminating *H. pylori* infection and lowering stomach acid output are the two basic goals of treating peptic ulcers. Proton pump inhibitors (PPIs) are often used in conjunction with antibiotics (such as amoxicillin and clarithromycin) to treat *H. pylori*-related ulcers. This combination kills the bacteria and speeds up ulcer healing (Malfertheiner et al.,

2017). PPIs are drugs that lower stomach acid production, enabling an ulcer to heal and avoiding a recurrence.

2.1.2 *Helicobacter pylori* Cause of Peptic Ulcer

Once the bacteria reach the mucus that coats the stomach or duodenal lining, they use their flagella to corkscrew through the mucus to the epithelia cells. In this location, the pH of mucus is nearly neutral and the bacteria attach to the mucus-secreting epithelium or multiply adjacent to it. Bacteria products incite an inflammatory response in the wall of the stomach and mucus production decreases. Once infection occurs it persists for years, often for life. From 10% to 20% of infected persons develop ulcers, 65% to 80% of patients with gastric ulcers and 95% of those with duodenal ulcers are infected with *H. pylori* (Nwozor, 2013). The thinning of the protective mucus layer at the site of infection probably accounts for the development of peptic ulcers of the stomach and duodenum.

H. pylori weaken the protective mucous coating of the stomach and duodenum, which allows acid to get through to the sensitive lining beneath. Both the acid and the bacteria irritate the lining and cause a sore, or ulcer. *H. pylori* is able to survive in stomach acid because it secretes enzymes that neutralize the acid. This mechanism allows *H. pylori* to make its way to the "safe" area—the protective mucous lining. Once there,the bacterium's spiral shape helps it burrow through the lining (NDDIC, 2004). A small percentage of individuals infected with *H. pylori* develop cancer of the stomach but more than 90% of those with stomach cancer are infected by the bacterium (Nester et al., 2004).

2.1.3 Transmission and Sources of *H. pylori* Infection

The exact mechanisms whereby *H. pylori* is acquired are largely unknown. *H. pylori* has a narrow host range and is found almost exclusively in humans and some nonhuman

primates. *H. pylori* has on rare occasions been isolated from pet animals; thus, the presence of pets may be a risk factor for *H. pylori* infection (Kusters & Kuipers, 2006). As conclusive evidence for zoonotic transmission of *H. pylori* is not yet available, new infections are thought to occur as a consequence of direct human-to-human transmission, via either an oraloral or faecal-oral route or both. *H. pylori* has been detected in saliva, vomitus, gastric refluxate, and faeces (Allaker et al., 2002), but there is no conclusive evidence for predominant transmission via any of these products. This may be due to the fact that most research on transmission has focused on adults. It appeared that there was no clear increased risk for being a carrier of *H. pylori* among dentists, gastroenterologists, nurses, partners of an *H. pylori*-positive spouse, or visitors to a clinic for sexually transmitted diseases (Kusters & Kuipers, 2006). As a result of these and other investigations, it is generally believed that acquisition mostly occurs in early childhood, most likely from close family members.

Premastication of food by the parent is an uncertain risk factor for transmission of *H. pylori*. Childhood crowding in and outside the family are all positively associated with *H. pylori* prevalence, whereas among adults crowding appears less important, with the exception of certain circumstances, such as among army recruits. Several studies have reported the presence of *H. pylori* DNA in environmental water sources but this probably reflects contamination with either naked DNA or dead *H. pylori* organisms. To our knowledge there is only a single report of *H. pylori* being successfully cultured from water, but this involved wastewater and as such may well represent faecal contamination of the water source. Spread via fecal contaminants is supported by the occurrence of *H. pylori* infections among institutionalized young people during

outbreaks of gastroenteritis. Other possible sources include contaminated food, as *H. pylori* may survive briefly on refrigerated food. Coupled with the extreme sensitivity of *H. pylori* to atmospheric oxygen pressure, lack of nutrients, and temperatures outside the 34 to 40°C range (Kusters & Kuipers, 2006), direct person-toperson transmission remains the most likely transmission route.

2.1.4 Pathogenesis of *H. pylori* and Virulence Factors

H. pylori cause chronic active gastritis in humans and is the cause of most cases of duodenal and gastric ulcers that are not associated with administration of non-steroidal antiinflammatory agents (Shamsuddeen et al., 2009). In addition *H. pylori* is associated with primary mucosaassociated lymphoid tissue, gastric lymphoma and some types of gastric adenocarcinoma.

The primary disorder, which occurs after colonization with *H. pylori*, is chronic active gastritis. This condition can be observed in all *H. pylori*-positive subjects. The intragastric distribution and severity of this chronic inflammatory process depend on a variety of factors, such as characteristics of the colonizing strain, host genetics and immune response, diet, andthe level of acid production. *H. pylori*-induced ulcer disease, gastric cancer, and lymphoma are all complications of this chronic inflammation; ulcer disease and gastric cancer in particular occur in those individuals and at those sites with the most severe inflammation (Kusters et al., 2006). Understanding of these factors is thus crucial for the recognition of the role of *H. pylori* in the etiology of upper gastrointestinal pathology.

Most *H. pylori* bacteria found in the stomach are in the layer of mucus overlying the epithelium. Some penetrate the mucous layer and adhere to the gastric epithelial cells with formation of a

pedestal, as is seen with enteropathogenic E. coli strain, which require cytoskeletal rearrangements (Smoot and Resau, 1993). A few *H. pylori* are seen between adjacent cells in proximity to tight junctions. *H. pylori* urease appears to be necessary for the establishment of gastric mucosal colonization according to animal experimental studies with urease negative mutants and urease inhibitors. Urease may serve to protect the organism from gastric acid by converting urea to ammonia and carbon dioxide, thus surrounding the bacterium with an alkaline layer that neutralizes the acid. Urease may also be an important cause of the inflammation seen in the lamina propria that is the hallmark of chronic *H. pylori* infections, as it is a phlogistic and cytotoxic agent (Mai and Prez-Prez, 1992). Bacterial motility is also important for the colonization of mucous layer, as non-motile mutants do not colonize the stomachs of gnotobiotic piglets. Several *H. pylori* adhesins have been described that bind to Lewis b antigens with terminal fucose residues (found in humans with blood group O), to sialic acid-lactose residues and to phosphatidylethanolamine, a glycolipid receptor on the gastric antral mucosa. The adhesin binding to blood group O-specific antigens may help explain the predisposition of people with blood group O to peptic ulcer disease and gastric adenocarcinoma. Apart from urease which may cause damage to host cells, CagA, a high molecular weight protein product of a cytotoxin associated gene (cag A), is produced by about 60% of *H. pylori* strains and is associated with the expression of vacA. CagA-positive strains are also associated with the presence of duodenal ulceration, although it is unclear whether cagA ha an independent pathogenic role (Shamsuddeen et al., 2009).Virulent *H. pylori* strains produce a protein CagA, which they inject into host cells resulting in changes in shape and surface characteristics of the cells. These changes represent a prelude to malignancy. Another bacterial product, VacA, acts on mucosal cells to promote flow of urea into the stomach (Nwozor, 2013).

2.1.5 Helicobacter-induced Gastric Pathology in Humans

Chronic *H. pylori* infection is strongly linked to various gastric diseases, including chronic active gastritis, peptic ulcers, gastric adenocarcinoma, and gastric extranodal marginal zone lymphoma of the mucosa-associated lymphoid tissue type (MALT lymphoma). Among these, gastric adenocarcinoma poses the most significant mortality risk. Recent meta-analyses have indicated that individuals infected with *H. pylori* have a 2- to 3-fold higher relative risk of developing gastric cancer compared to those without the infection (Burkitt, et al., 2017). Understanding these diverse pathological conditions is vital for assessing the accuracy of available models in mirroring clinical aspects of *H. pylori*-related pathology.

The most common consequence of *H. pylori* infection is gastritis. While acute gastritis is rarely observed in humans, it has been documented in cases of individuals unintentionally exposed to *H. pylori* (Sobala et al., 1991) or deliberately exposed to induce gastric pathology (Morris et al., 1991). In these instances, infected individuals displayed symptoms and underwent endoscopic evaluations with biopsies of inflamed gastric mucosa. Early disease stages are characterized by a presence of polymorphonuclear leukocytes in the gastric mucosa and a transient decrease in gastric acid production.

Marshall et al. (1985) administered *H. pylori* eradication therapy, effectively eliminating *H. pylori* from the gastric mucosa and leading to the complete resolution of symptoms and histological abnormalities. In Sobala et al.'s (1991) case, symptoms and signs spontaneously resolved, with subsequent endoscopy revealing low levels of Helicobacter in the gastric antrum and increased lymphocytes within the gastric mucosa. These histological changes correlated with IgM and Ig Gseroconversion for *H. pylori*, typical of chronic, superficial *H. pylori* gastritis,

which is the most widespread *H. pylori*-induced gastric pathology globally (Campbell et al., 2001).

Individuals colonized with *H. pylori* have a 6.8-fold increased risk of developing peptic ulcer disease (PUD) compared to those unexposed to the infection (Li et al., 2010). This is consistent with the decline in *H. pylori* infection worldwide, which has coincided with a reduction in PUD cases. Unlike the 1980s when the *H. pylori*-PUD connection was first established (Graham,

1989), individuals presenting with PUD are now less likely to have *H. pylori* colonization. Instead, their condition is often linked to non-steroidal anti-inflammatory drug use or low-dose aspirin (Musumba et al., 2012).

H. pylori-induced peptic ulcers develop in the context of pre-existing chronic superficial gastritis but are associated with increased gastric acid secretion and a T helper 1 (Th1) polarized immune response compared to individuals with isolated superficial gastritis (Burkitt, et al., 2017).

In many PUD cases, individuals exhibit antral-predominant gastritis, leading to heightened gastrin secretion, which stimulates parietal cells in the gastric corpus to produce more acid, resulting in mucosal ulceration. Eradicating *H. pylori* is known to suppress excess gastrin secretion (Burkitt, et al., 2017), an essential component of the healing process for *H. pylori*associated peptic ulcers.

In 2012, gastric cancer ranked as the fifth most common malignancy worldwide and the third leading cause of cancer-related deaths, with over 720,000 global fatalities attributed to the disease. *H. pylori* colonization remains the most substantial risk factor for gastric cancer,

implicated in at least 80% of cases (Burkitt, et al., 2017). However, only a small percentage of *H. pylori*-infected individuals progress to gastric cancer, prompting further research to understand why this happens.

Additional risk factors for gastric cancer can be categorized into two groups. The first group includes potentially modifiable external factors such as dietary salt and nitrosamine intake (Burkitt, et al., 2017), *H. pylori* virulence factors, non-Helicobacter gastric microbiota. The second group comprises unalterable host genetic or intrinsic risk factors, which encompass polymorphisms at loci encoding cytokines and their receptors (Persson et al., 2011), stromalremodeling proteins like matrix metalloproteinases (Tang et al., 2008), and prostate stem cell antigen (PSCA), acting as a tumor suppressor gene in the context of gastric pathology (Burkitt, et al., 2017).

The development of gastric cancer follows a well-established pathological pathway proposed before the discovery of *H. pylori* (Burkitt, et al., 2017). Over decades, some individuals with chronic superficial gastritis progress to gastric atrophy, marked by the patchy loss of parietal cells in the gastric corpus mucosa. This reduces gastric acid production, raising intraluminal pH, decreasing somatostatin secretion, and increasing gastrin production. Gastrin not only stimulates acid secretion but also enhances epithelial cell turnover in the gastric epithelial stem cell zone (Burkitt et al., 2009).

A portion of individuals with established gastric atrophy eventually develop intestinal-type metaplasia of the gastric mucosa, where oxyntic glands are replaced by CDX2-expressing glandular units morphologically similar to intestinal crypts. This condition is associated with gastric dysplasia, and up to 20% of individuals with intestinal metaplasia also have concurrent dysplasia. Gastric epithelial dysplasia is linked to a tenfold or more increased risk of developing

gastric cancer (Burkitt, et al., 2017), though accurately representing this risk from populationbased studies has proven challenging.

Numerous studies have explored the strategy of testing for and eradicating *H. pylori* in highrisk populations for gastric cancer. Unfortunately, a recent well-designed meta-analysis found this approach to have relatively limited success. Eradicating *H. pylori* reduced the risk of developing gastric cancer by about one-third (Burkitt, et al., 2017). However, when individuals with pre-existing pre-neoplastic gastric conditions (gastric atrophy, intestinal metaplasia, or dysplasia) were considered, there was no evidence that *H. pylori* eradication decreased the risk of gastric cancer in this highest-risk group.

Gastricextranodal marginal zone lymphomas of mucosa-associated lymphoid tissue (MALT lymphomas) are B-cell lymphomas that originate within the stomach's mucosa-associated lymphoid tissue. The incidence of gastric MALT lymphoma in the USA was estimated to be 3.8 cases per million people between 2001 and 2009. In the only published systematic review of this condition, 79% of 1844 reported MALT lymphoma cases were associated with *H. pylori* infection (Burkitt, et al., 2017).

Similar to other hematological malignancies, MALT lymphoma exhibits characteristic cytogenetic profiles. One of the most well-characterized is the formation of the MALT1-API2 fusion oncogene through the t (11:18) translocation, leading to API2 (cellular inhibitor of apoptosis 2) expression under the MALT1 promoter's control (Burkitt, et al., 2017). MALT1 encodes mucosa-associated lymphoid tissue lymphoma translocation protein 1, crucial for T- and B-lymphocyte activation and proliferation, and pivotal in NF-κB activation. This fusion protein enhances NIK (NF-κB-inducing kinase) cleavage, a critical regulator of the alternative pathway of NF-κBsignaling (Burkitt, et al., 2017).

2.1.6 Clinical manifestation of *H. pylori* associated diseases

Colonization with *H. pylori* is not a disease in itself but a condition that affects the relative risk of developing various clinical disorders of the upper gastrointestinal tract and possibly the hepatobiliary tract. Testing for *H. pylori* therefore has no relevance by itself but should be performed to find the cause of an underlying condition, such as peptic ulcer disease, or for the purpose of disease prevention, such as in subjects with familial gastric cancer. In these cases, a positive test result justifies treatment and a negative test result may indicate the need to search for other etiologic factors or preventive measures. For these reasons, a correct understanding of the clinical course of *H. pylori*-associated disorders and the effect of *H. pylori* eradication is needed (Johannes *et al.*, 2006).

Although gastric colonization with *H. pylori* induces histologic gastritis in all infected individuals, only a minority develop any apparent clinical signs of this colonization. It is estimated that *H. pylori*-positive patients have a 10 to 20% lifetime risk of developing ulcer disease and a 1 to 2% risk of developing distal gastric cancer (Ernst and Gold,2000). The risk

of development of these disorders in the presence of *H. pylori* infection depends on a variety of bacterial, host, and environmental factors that mostly relate to the pattern and severity of

Source: Ernst and Gold (2000)

The above fig.1 shows the colonization with *H. pylori* virtually leads to infiltration of the gastric mucosa in both antrum and corpus with neutrophilic and mononuclear cells. This chronic active gastritis.

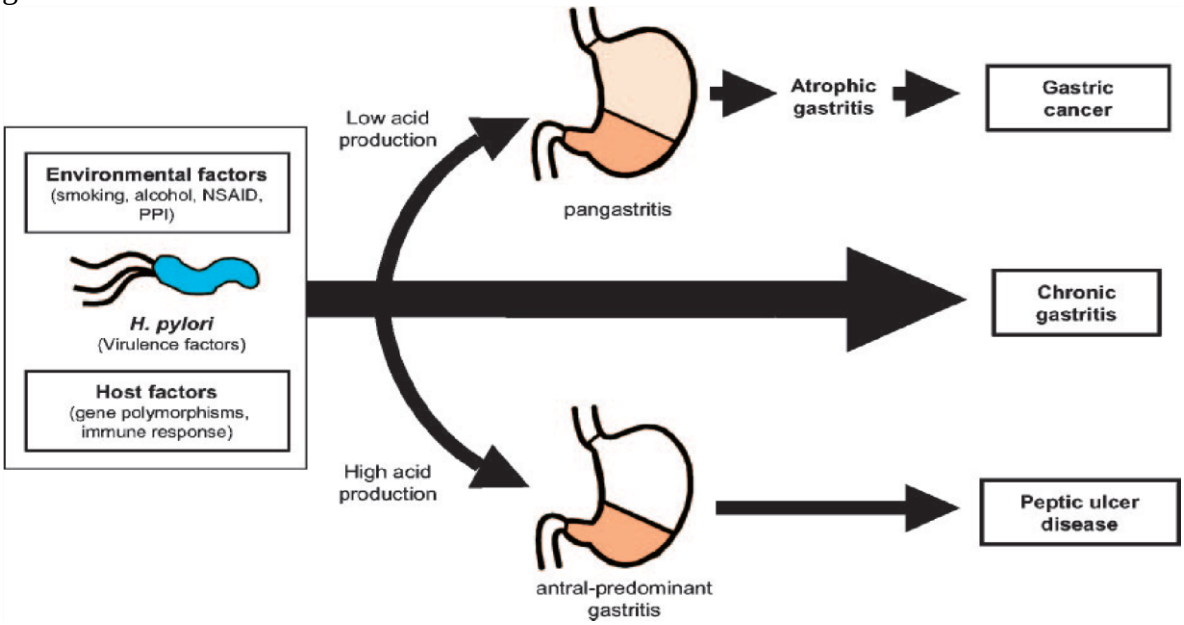


Fig. 1: Schematic representation of the factors contributing to gastric pathology and disease outcome in *H. pylori* infection

gastritis is the primary condition related to *H. pylori* colonization, and other *H. pylori*associated disorders in particular result from this chronic inflammatory process.

Data on the acute phase of infection are scarce and largely come from reports of subjects who deliberately or inadvertently ingested *H. pylori* or underwent procedures with contaminated material (Johannes *et al.*, 2006). Recently, a human challenge model for *H. pylori* infection was introduced; it allowed controlled studies of the acute phase of infection with deliberate infection of healthy volunteers with a well-characterized laboratory strain of *H. pylori*. Together, these reports showed that the acute phase of colonization with *H. pylori* may be associated with

transient nonspecific dyspeptic symptoms, such as fullness, nausea, and vomiting, and with considerable inflammation of both the proximal and distal stomach mucosa, orpangastritis. This phase is often associated with hypochlorhydria, which can last for months. It is unclear whether this initial colonization can be followed by spontaneous clearance and resolution of gastritis and, if so, how often this occurs. Follow-up studies of young children with serology or breath tests suggested that infection may spontaneously disappear in some patients in this age group (Perez-Perez et al., 2003); this has not been observed in adults other than under specific circumstances, such as development of atrophic gastritis. However, studies of homozygotic twins showed a concordance in their *H. pylori* status irrespective of whether they had grown up together or apart (Johannes *et al.*, 2006). Such a concordance was not observed among heterozygotic twins. This suggests that some individuals are prone to *H. pylori* colonization while others may be able to prevent colonization or clear an established infection. This hypothesis is also supported by the observation that in many developing countries the level of exposure to *H. pylori* is very high (i.e., _90%) at young ages and yet some individuals never develop persistent *H. pylori* infection.

When colonization does become persistent, a close correlation exists between the level of acid secretion and the distribution of gastritis. This correlation results from the counteractive effects of acid on bacterial growth versus those of bacterial growth and associated mucosal inflammation on acid secretion and regulation. This interaction is crucial in the determination of outcomes of *H. pylori* infection.

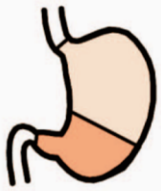
Pattern of gastritis	Gastric histology	Duodenal histology	Acid secretion	Clinical condition
 Pan-gastritis	• Chronic inflammation • Atrophy • Intestinal metaplasia	• Normal	• Reduced	• Gastric ulcer • Gastric cancer
 Antral-predominant	• Chronic inflammation • Polymorph activity	• Gastric metaplasia • Active chronic inflammation	• Increased	• Duodenal ulcer

Fig. 2. Acid secretion and the associated pattern of gastritis play an important role in disease outcome in *H. pylori* infection. The figure displays the correlations between the pattern of *H. pylori* colonization, inflammation, acid secretion, gastric and duodenal histology, and clinical outcome.

In subjects with intact acid secretion, *H. pylori* in particular colonizes the gastric antrum, where few acid-secretory parietal cells are present. This colonization pattern is associated with an antrum-predominant gastritis. Histological evaluation of gastric corpus specimens in these cases reveals limited chronic inactive inflammation and low numbers of superficially colonizing *H. pylori* bacteria. Subjects in whom acid secretion is impaired, due to whatever mechanism, have a more even distribution of bacteria in antrum and corpus, and bacteria in the corpus are in closer contact with the mucosa, leading to a corpus-predominant pangastritis (Kuipers *et al.*, 1995). The reduction in acid secretion can be due to a loss of parietal cells as a result of atrophic gastritis, but it can also occur when acid secretory capacity is intact but parietal cell function is inhibited by vagotomy or acid-suppressive drugs, in particular, proton pump inhibitors (PPIs) (Johannes *et al.*, 2006). The resulting active inflammation of the corpus mucosa further augments hypochlorhydria, paralleling the acute phase of infection, as local inflammatory factors such as cytokines, including interleukin-1_ (IL-1_), have a strong suppressive effect on parietal cell function. This is illustrated by various observations. Firstly, *H. pylori*corpus

gastritis is often associated with hypochlorhydria, and eradication therapy leads to increased acid secretion in these subjects. Secondly, *H. pylori* corpus gastritis augments the acid-suppressive effects of PPIs. As a result, *H. pylori* positive patients with gastroesophageal reflux disease (GERD) may respond somewhat faster to PPI treatment both with respect to symptom resolution and with healing of esophagitis, but this effect is minimal and largely irrelevant in daily clinical practice. This means that there is no general need to take *H. pylori* status into account when decisions on the dose of PPI treatment for GERD must be made. A third observation in support of the acid-suppressive effects of active corpus gastritis comes from more recent, important research showing that subjects with proinflammatory genotypes have a higher risk of corpus-predominant pangastritis, predisposing them to atrophic gastritis, intestinal metaplasia, and gastric cancer. Although colonization with *H. pylori*is almost invariably associated with the presence of gastritis, and gastritis is mostly due to *H. pylori* colonization, other causes of gastritis include infections such as cytomegalovirus, chronic idiopathic inflammatory and autoimmune disorders such as

Crohn's disease and pernicious anemia, and chemical damage due to alcohol abuse or nonsteroidal anti-inflammatory drug (NSAID) use (Johannes *et al.*, 2006).

2.1.7 Risk Factors for Peptic Ulcer Disease

One of the primary risk factors for peptic ulcer disease is infection with *Helicobacter pylori* (*H. pylori*). This bacterium is known to colonize the gastric mucosa and cause chronic inflammation, leading to ulcer formation. Epidemiological studies have consistently identified

H. pylori infection as a significant risk factor for both gastric and duodenal ulcers (Chey et al., 2017). It is estimated that approximately 70-90% of patients with duodenal ulcers and 60-80% of patients with gastric ulcers are infected with *H. pylori* (Lanas et al., 2018). Another major risk factor for peptic ulcer disease is the use of non-steroidal antiinflammatory drugs (NSAIDs).

NSAIDs, including aspirin and ibuprofen, are widely used for pain relief and anti-inflammatory purposes. However, they can significantly increase the risk of developing peptic ulcers by disrupting the protective mechanisms of the gastrointestinal mucosa and promoting gastric acid secretion (Lanas et al., 2018). Studies have shown that long-term or high-dose NSAID use can increase the risk of both gastric and duodenal ulcers (Taha et al., 2018). Smoking has been identified as an independent risk factor for the development and recurrence of peptic ulcer disease. The harmful effects of smoking on the gastrointestinal tract, including reduced blood flow to the gastric mucosa and impaired healing processes, contribute to ulcer formation and delayed ulcer healing (Taha et al., 2018). Several studies have demonstrated a strong association between smoking and an increased risk of peptic ulcers (Chey et al., 2017). Excessive alcohol consumption has also been implicated as a risk factor for peptic ulcer disease. Alcohol can cause damage to the gastric mucosa and impair the production of protective mucus, leading to increased vulnerability to ulcer formation (Lanas et al., 2018). Studies have shown a dose-dependent relationship between alcohol consumption and the risk of peptic ulcers, with heavy drinkers having a higher risk compared to moderate or non-drinkers (Taha et al., 2018). Psychosocial factors, such as chronic stress and psychological disorders, have been suggested as potential risk factors for peptic ulcer disease. Stress can increase gastric acid secretion and impair the mucosal barrier, making the stomach more susceptible to ulcer formation (Taha et al., 2018). Studies have reported a higher prevalence of peptic ulcers in individuals with high levels of stress and those with psychiatric conditions like anxiety and depression (Chey et al., 2017).

2.1.8 Diagnostic Methods for *Helicobacter pylori* Infection

Accurate diagnosis of *Helicobacter pylori* (*H. pylori*) infection is crucial for effective management and treatment of associated gastrointestinal diseases. Various diagnostic methods are available, each with its advantages and limitations.

1. Invasive Methods:

- **Endoscopy with Biopsy:**

Endoscopy with biopsy is considered the gold standard for diagnosing *H. pylori* infection. During endoscopy, multiple biopsies are taken from the gastric mucosa, and these samples are subsequently examined using various techniques such as histology, rapid urease testing, and culture (Malfertheiner et al., 2017). Histology involves microscopic examination of the biopsy specimens for the presence of *H. pylori* bacteria and associated inflammation. Rapid urease testing detects the presence of *H. pylori* by measuring the urease activity in the biopsy samples, while culture involves growing *H. pylori* bacteria in a laboratory setting (Malfertheiner et al., 2017).

- **Urea Breath Test:**

The urea breath test is a non-invasive method used to detect *H. pylori* infection. In this test, the patient ingests a solution containing a stable isotope-labeled urea. If *H. pylori*is present in the stomach, it produces the enzyme urease, which breaks down the labeled urea, releasing labeled carbon dioxide. The labeled carbon dioxide is then measured in the patient's breath, indicating the presence of *H. pylori* infection (Gisbert & Pajares, 2018).

2. Non-Invasive Methods:

- **Serological Tests:**

Serological tests detect the presence of specific antibodies against *H. pylori*in the patient's blood. These tests are based on the immune response triggered by the infection. They are relatively simple and inexpensive, but they cannot distinguish between active and past infections, and their accuracy may be influenced by factors such as prior treatment or reinfection (Gisbert & Pajares, 2018).

- **Stool Antigen Test:**

The stool antigen test detects *H. pylori* antigens in the patient's stool. It is a non-invasive and relatively simple method that can be used to diagnose *H. pylori* infection. The test is based on the detection of *H. pylori*-specific antigens using immunoassay techniques. It has high sensitivity and specificity, making it a useful tool for both initial diagnosis and post-treatment assessment (Gisbert & Pajares, 2018).

2.1.9 Management of Peptic Ulcer Due to Helicobacter pylori

The management of peptic ulcer disease (PUD) primarily involves eradicating the underlying *Helicobacter pylori* (*H. pylori*) infection to promote ulcer healing and prevent recurrence. Various treatment regimens are available, including triple therapy, quadruple therapy, and sequential therapy.

Triple Therapy:

Triple therapy is the most commonly used regimen for *H. pylori*eradication and involves the combination of a proton pump inhibitor (PPI) with two antibiotics, typically clarithromycin and amoxicillin or metronidazole (Malfertheiner et al., 2017). This regimen is typically administered

for a duration of 7-14 days. The PPI reduces gastric acid production, while the antibiotics target and eliminate the *H. pylori*bacteria. Studies have shown that triple therapy can achieve eradication rates of approximately 80-90% (Chey et al., 2017).

Quadruple Therapy:

Quadruple therapy, also known as bismuth-based therapy, is an alternative treatment option for *H. pylori* eradication. It involves the combination of a PPI, bismuth subsalicylate, and two antibiotics (typically metronidazole and tetracycline or amoxicillin) (Malfertheiner et al., 2017). Quadruple therapy is particularly useful in areas with high clarithromycin resistance rates. Studies have shown that this regimen can achieve eradication rates of approximately 8595% (Chey et al., 2017).

Sequential Therapy:

Sequential therapy is a newer approach that involves the administration of a dual therapy regimen followed by a triple therapy regimen. In the initial phase, a PPI and amoxicillin are given for 5-7 days, followed by a subsequent phase of a PPI, clarithromycin, and metronidazole or tinidazole for another 5-7 days (Malfertheiner et al., 2017). Sequential therapy has shown promising results, with eradication rates comparable to triple therapy.

Reassessment and Rescue Therapy:

After completing the initial treatment regimen, reassessment of *H. pylori* eradication is essential. This can be done using non-invasive methods such as the urea breath test or stool antigen test (Gisbert & Pajares, 2018). In cases of treatment failure or persistent infection, rescue therapy with alternative antibiotic combinations may be necessary. These rescue regimens often involve

different antibiotics, such as levofloxacin or rifabutin, and should be tailored based on local antibiotic resistance patterns (Gisbert & Pajares, 2018).

Follow-up and Lifestyle Modifications:

Following successful eradication of *H. pylori*, regular follow-up is recommended to assess ulcer healing and monitor for any complications or disease recurrence. Lifestyle modifications, such as smoking cessation, reduction of alcohol consumption, and avoidance of non-steroidal antiinflammatory drugs, are crucial in preventing ulcer recurrence (Malfertheiner et al., 2017).

2.2 Theoretical Framework

2.2.1 Health Belief Model

Health behaviour theories provide valuable insights into understanding the factors that influence individuals' behavior in the context of *H. pylori* prevention and management. The HBM assumes that individuals take precautionary measures (risk reduction) when they perceive themselves susceptible to a disease or condition, acknowledge consequences of a condition as severe, accept that taking precautionary measures will be beneficial in reducing risk, and that benefits of taking action will overcome perceived barriers (Melkote & Steeves, 2001; Rosenstock, Strecher, & Becker, 1994). According to Maiman and Becker (1974), the basic components of the HBM are derived from a well-established body of psychological and behavioral theories whose models hypothesize that behaviors depend mainly upon two variables: the value placed by the individual on a particular goal and the individual's estimate of the goal. Here, we will explore two prominent theories: the Health Belief Model and Social

Cognitive Theory, and how they can be applied to this specific health issue.

Health Belief Model (HBM):

The Health Belief Model is a psychological theory that focuses on how individuals perceive health threats and the benefits of taking action to reduce those threats. In the context of *H. pylori* prevention and management, the HBM can be applied as follows:

Perceived Susceptibility: People's perception of their vulnerability to *H. pylori* infection and peptic ulcers plays a significant role. Individuals who believe they are at a higher risk due to factors like lifestyle, family history, or geographic location may be more motivated to prevent or manage the condition.

Perceived Severity: The perceived severity of *H. pylori*-related peptic ulcers, including knowledge of potential complications, can influence individuals' motivation to take preventive measures or adhere to treatment plans.

Perceived Benefits: Individuals will be more likely to engage in preventive behaviors (such as proper hygiene and dietary changes) or follow treatment regimens (such as taking antibiotics and acid-suppressing medications) if they believe these actions will lead to positive health outcomes.

Perceived Barriers: Recognizing and addressing barriers to preventive and management behaviors, such as the cost of treatment or fear of side effects, is essential for promoting adherence and behavior change.

Cues to Action: Health promotion campaigns, educational materials, and healthcare provider recommendations can serve as cues to action, prompting individuals to seek preventive measures or treatment.

Self-Efficacy: Self-efficacy, or an individual's belief in their ability to successfully carry out a behavior, plays a crucial role. Enhancing self-efficacy through education and support can improve adherence to recommended preventive and management strategies.

2. Social Cognitive Theory (SCT):

The Social Cognitive Theory emphasizes the role of observational learning, social influence, and self-regulation in shaping health behaviors. In the context of *H. pylori* prevention and management, SCT can be applied as follows:

Observational Learning: Individuals learn from observing the behaviors of others. Positive role models, such as family members or peers who practice good hygiene or adhere to treatment regimens, can influence individuals to do the same.

Social Influence: Social support and peer pressure can significantly impact health behaviors. Encouragement and support from family and friends can motivate individuals to seek treatment or adopt preventive measures.

Self-Regulation: SCT emphasizes self-regulation, including goal setting, self-monitoring, and self-reflection. Encouraging individuals to set specific health-related goals and track their progress can enhance their ability to manage *H. pylori* infection and its complications

effectively.

Outcome Expectations: Understanding the expected outcomes of preventive and management behaviors is crucial. Providing individuals with accurate information about the benefits of prevention and treatment can positively influence their choices.

Self-Efficacy: Like in the HBM, self-efficacy is a central concept in SCT. Building individuals' confidence in their ability to manage their health and adhere to treatment plans is vital for effective behavior change.

In summary, both the Health Belief Model and Social Cognitive Theory offer valuable insights into the factors influencing individuals' behaviors regarding *H. pylori* prevention and management. These theories highlight the importance of perceived susceptibility, perceived severity, perceived benefits, and self-efficacy, while also recognizing the role of observational learning, social influence, and self-regulation in shaping health behaviors. Implementing strategies that align with these theories can help promote better *H. pylori*related health outcomes.

2.3 Empirical Studies

2.3.1 Prevalence, Distribution and Burden of *H. pylori* infection

Khalifa, Sharaf, and Aziz (2010) conducted a cross-sectional study to determine the prevalence of Helicobacter pylori infection among individuals with peptic ulcer disease. The study involved 500 participants who presented with symptoms of peptic ulcer at a gastrointestinal clinic in Cairo, Egypt. Gastric biopsies were taken from each participant, and *H. pylori* infection was confirmed using histological examination and rapid urease tests. The findings revealed a high prevalence of *H. pylori* infection (70%) among patients with peptic ulcer disease. The study also found that the prevalence was significantly higher among individuals with lower socioeconomic status, indicating that poor living conditions and hygiene practices might contribute to the spread of the infection.

Graham and Fischbach (2010) conducted a longitudinal study to assess the impact of antibiotic resistance on the treatment outcomes of Helicobacter pylori-associated peptic ulcer disease.

The study included 300 patients diagnosed with H. pylori infection and peptic ulcer disease. Patients were treated with a standard triple therapy regimen consisting of clarithromycin, amoxicillin, and a proton pump inhibitor. The study found that the eradication rate of H. pylori was significantly lower in patients with antibiotic-resistant strains (55%) compared to those with susceptible strains (85%). The authors suggest the use of alternative regimens, such as bismuth-containing quadruple therapy or levofloxacin-based therapy, in regions with high rates of antibiotic resistance. They also call for routine susceptibility testing to guide appropriate treatment choices.

Malfertheiner et al. (2017) presented comprehensive guidelines for the management of Helicobacter pylori infection, which is a major cause of peptic ulcer disease. The Maastricht

V/Florence Consensus Report was developed by a panel of experts based on a systematic review of the literature. The report recommends a combination of antibiotics (clarithromycin, amoxicillin, or metronidazole) and proton pump inhibitors (PPIs) as the first-line treatment for H. pylori infection. The study emphasizes the importance of tailored therapy based on antibiotic resistance patterns, as well as the need for follow-up testing to confirm eradication of the infection. The report also highlights the role of patient education in improving treatment adherence and outcomes.

Numerous studies have investigated the global prevalence of *H. pylori* infection. According to a systematic review and meta-analysis conducted by Sjomina et al. (2020), the global average prevalence of *H. pylori* infection was estimated to be approximately 44%. However, this prevalence varied significantly across different countries and regions. For example, in developed countries such as the United States and Canada, the prevalence was generally lower, ranging from 20% to 40% (Malfertheiner et al., 2017). In contrast, developing countries,

particularly those in Africa and parts of Asia, exhibited higher prevalence rates, often exceeding 70% (Miftahussurur et al., 2016). Certain populations are known to have a higher risk of *H. pylori* infection. For instance, studies have shown that individuals from low socioeconomic backgrounds, crowded living conditions, and poor sanitation facilities are more likely to be infected with *H. pylori* (Brown et al., 2019). Additionally, age is a significant factor, as *H. pylori* infection rates increase with advancing age. A study by Malfertheiner et al. (2017) found that the prevalence of *H. pylori* infection tends to be higher in older adults, with rates reaching over 50% in individuals aged 60 years and above. Geographic factors play a crucial role in the prevalence of *H. pylori* infection. Variations in regional prevalence can be attributed to differences in socioeconomic conditions, healthcare infrastructure, hygiene practices, and cultural factors. For example, studies have reported higher prevalence rates in developing countries with inadequate sanitation and hygiene facilities (Miftahussurur et al., 2016). In contrast, regions with better sanitation and higher standards of living tend to exhibit lower prevalence rates (Malfertheiner et al., 2017). Socioeconomic status has been identified as a significant determinant of *H. pylori* prevalence. Individuals from lower socioeconomic backgrounds, including those with limited access to education, proper healthcare, and hygienic living conditions, are at higher risk of *H. pylori* infection (Brown et al., 2019). This association can be attributed to factors such as overcrowding, poor sanitation, and limited resources for healthcare and disease prevention.

Xie *et al.* (2022) indicated that there were approximately 8.09 million (95% UI 6.79 to 9.58 million) prevalent cases of PUD in 2019, which represented an increase of 25.82% from 1990 [6.43 million (95% UI 5.41 to 7.63 million)]. Moreover, the age-standardized prevalence rate in 2019 was 99.40 per 100,000 (95% UI 83.86 to 117.55 per 100,000) population, which represented a decrease from 1990 [143.37 per 100,000 (95% UI 120.54 to 170.25 per 100,000) population]. Between 1990 and 2019, the number of incident cases of PUD increased from 2.82

million (95% UI 2.36 to 3.30 million) to more than 3.59 million (95% UI 3.03 to 4.22), representing an increase of 27.3% in the global incident cases of PUD (Scally*et al.*, 2018; Xie*et al.*, 2022). However, the global age-standardized incidence rate of PUD showed a decreasing trend, at 63.84 (95% UI 54.09 to 75.54) per 100,000 population in 1990 and 44.26 (95% UI 37.32 to 51.87) per 100,000 population in 2019. At the global level, nearly 6.03 (95% UI 5.59 to 6.64) million DALYs were attributable to PUD, with an agestandardized rate of 74.40 (95%

UI 68.96 to 81.95) DALYs per 100,000 population in 2019. The age-standardized rate of DALYs decreased by 60.64% from 1990. Similar trends were also found in PUD-related deaths (Scally *et al.*, 2018; Xie *et al.*, 2022).

Both the number of prevalent cases and age-standardized prevalence rate were higher in males than in females in all years from 1990 to 2019. However, the difference between the two groups decreased, mainly because the number of prevalent cases and age-standardized prevalence rate in males decreased faster than those in females. Overall, in 2019, 3.92 (95% UI 3.29 to 4.64) million prevalent cases occurred in females, whereas 4.17 (95% UI 3.49 to

4.97) million prevalent cases occurred in males (Collaborators GCoD, 2018, Xie*et al.*, 2022). The proportion of prevalent cases between males and females was 1:0.94. The agestandardized prevalence rate was 94.23 (95% UI 79.10 to 111.93) per 100,000 population in females and 104.98 (95% UI 88.26 to 124.10) per 100,000 population in males in 2019.

The report of Xie *et al.* (2022), has shown that from Jan.1st, 1990 to Dec 31st, 2019, the number of PUD-related deaths has shown a gradual, fluctuating decreasing trend in females and a relatively significant decreasing trend in males. Moreover, the age-standardized death rates in both groups showed downward trends. Among males, there were 127,522.08 (95%

UI 115,260.65 to 143,079.71) PUD-related deaths and 3.57 (95% UI 3.23 to 4.00) per 100,000 populations PUD related age-standardized deaths in 2019, whereas there were 164,933.87 (95% UI 146,881.12 to 180,422.89) deaths and 9.58 (95% UI 8.62 to 10.43) agestandardized deaths in 1990. Among females, there were 108,617.41 (95% UI 96,020.68 to

120,954.17) PUD-related deaths and 2.50 (95% UI 2.21 to 2.79) per 100,000 populations PUD related age-standardized deaths in 2019, whereas there were 114,044.63 (95% UI 99,995.18 to 128,749.67) death and 5.56 (95% UI 4.91 to 6.22) age-standardized deaths in 1990. The number of PUD-related deaths was lowest in 2012 [102,041.21 (95% UI 92,732.31 to 111,554.31)] (Xie*et al.*, 2022). This may be related to a variety of factors, such as the age distributions of the different sexes and the proportions of aging populations around the world (Fig. 4B). The patterns of incidence and DALYs by sex and year were relatively similar to those of prevalence and death, respectively.

2.3.2 Prevalence of *H. pylori* infection in Africa, Nigeria, Imo State, Owerri

In the study of Jemilohun et al. (2020), *H. pylori* was diagnosed in 64% of the patientswith dyspepsia in Ibadan, Nigeria. This was consistent with results of previous studies conducted Ndububa et al (2001) in Nigeria and other parts of West Africa (Aduful et al., 2007) which have consistently shown a high prevalence of *H. pylori* with the use of biopsy based methods.

Previous studiesconducted in various parts of South-Western Nigeria (including the University College Hospital, Ibadan) in which patients were investigated for *H. pylori* with the use of either histology or campylobacter-like organism (CLO) test showed prevalence rates of 60.5% to 73% (Ola et al., 2008) .

Seroprevalence studies conducted in the same region showed prevalence rates as high as 88% to 94.5% (Otegbayo et al., 2004). These are not unexpected in ahyper-endemic area like Nigeria

since serological tests cannot discriminate between previous and current infections. The sero-prevalence assay's IgG antibody lasts for up to 3 years or more in the serum even after the organism has been eradicated.

The most common identifiable lesion at endoscopy in this study was gastritis which had a frequency of 60.5%. This is comparable to a frequency of 60% obtained in a previous study conducted in the North-Eastern part of Nigeria (Mustapha et al., 2007). An earlier study conducted at the University College Hospital, Ibadan showed a frequency of 13.4% for gastritis while normal mucosal was the commonest finding with a frequency of 53% (Olubuyide et al., 1989). This disparity may be as a result of a change in the pattern of presentation of endoscopic lesions among patients with dyspepsia in more than two decades after the conduct of the previous study.

The study of Jemilohun et al. (2020) showed that despite the high prevalence of *H. pylori* infection in the South-Western part of Nigeria, the prevalence of serious gastroduodenal pathologies (GU, DU and gastric cancer) was low as these lesions were documented in only 14% of all the patients. In addition, the study showed that 63.5% of patients with endoscopic gastritis had *H. pylori* infection.

The study of Nwankwo et al. (2021) determined the seroprevalence of *H. pylori* among patients attending two Mission hospitals in Umuahia, Abia State. A high prevalence of 23.33% was observed in this study. Gender was not significantly associated with *H. pylori* infection (X2 =0.1517, p=0.3712). The highest incidence was observed in the age group 1626(38%) while the least was recorded with those of 49years and above 3(14.4%). There was no significant association of age with the prevalence of *H. pylori* infection (p=0.661). More cases of *H. pylori* infection was observed with patients from the rural area (16.67%). Out of the 90 participants

suspected of having peptic ulcer, 23.33% of them had ulcer that was caused by *H. pylori* Out of the 21 ulcer patients cause by *H. pylori* 16 (76.2%) were both seropositive and culture positive to *H. pylori* while 5 (23.4%) were only seropositive.

The sero-prevalence of *H. pylori* infection among individuals with peptic ulcer in Owerri, Imo State, Nigeria during 2020-2021was 72.4% (285/384) while the prevalence of ulcer by FOB test was 71.1% (273/384) as reported by Okoroiwu et al. (2022). A total of 78.4% (214/273) of those with ulcers were seropositive for *H. pylori* while 64.0% (71/111) of those without ulcers were sero-positive for *H. pylori*.

The prevalence of *Helicobacter pylori* and intestinal parasites amongst duodenal, gastric and peptic ulcer patients at Imo State University Teaching Hospital, Orlu was investigated by Obiajuru and Adogu (2013) between February and August, 2012. Out of 1,206 ulcer patients confirmed positive by faecal occult blood test, 703 (58%) were positive for *H. pylori* IgG antibody serological test, 407 (33.7%) were infected by *Entamoeba histolytica*, 113 (9.4%) were infected by *Cryptosporidium parvum*, 93 (7.7%) were infected by hookworm, 62 (5.1%) were infected by *Ascaris lumbricoides*, 31 (2.6%) were infected by *Strongyloides stercoralis*, 19 (1.6%) were infected by *Trichuris trichura* and 11 (0.9%) were infected by Giardia intestinalis. The study of Obiajuru and Adogu (2013) further showed that out of 409 non ulcer patients who were negative for faecal occult blood test, 7 (1.7%) were positive for *H. pylori* antibody serological test, 187 (45.7%) were positive for *Entamoeba histolytica*, 23 (5.6%) had hookworm, 11 (2.7%) had *Ascaris lumbricoides*, 6 (1.5%) had *Trichuris trichiura*, 5 (1.2%) had *Cryptosporidium parvum* and 3 (0.7%) had *Strongyloides stercoralis*.The study of Emerenini et al. (2021) reported the prevalence and risk factors for *Helicobacter pylori* infection among children in Owerri, Nigeria as 20.0%, increased with age and highest in the 10-15 years age

group (P = 0.001). Increasing age and low socioeconomic class (SEC) were found to be significant risk factors of *H. pylori* seropositivity among study subjects.

According to study by Lanas, and Chan (2017), the study reported that the rapidly declining prevalence of *Helicobacter pylori* infection and widespread use of potent anti-secretory drugs means peptic ulcer disease has become substantially less prevalent than it was two decades ago. Management has, however, become more challenging than ever because of the threat of increasing antimicrobial resistance worldwide and widespread use of complex antithrombotic therapy in the aging population. Peptic ulcers not associated with H pylori infection or the use of non-steroidal anti-inflammatory drugs are now also imposing substantial diagnostic and therapeutic challenges. This Seminar aims to provide a balanced overview of the latest advances in the pathogenetic mechanisms of peptic ulcers, guidelines on therapies targeting H pylori infection, approaches to treatment of peptic ulcer complications associated with antiinflammatory analgesics and anti-thrombotic agents, and the unmet needs in terms of our knowledge and management of this increasingly challenging condition.

Another study by Goderska et al. (2018) found that treatment of *Helicobacter pylori* infection is important for the management of gastrointestinal disorders such as peptic ulcer and gastric cancer. Due to the increase in the prevalence of *H. pylori* resistance to antibiotics, triple therapy with clarithromycin is no longer the best treatment for *H. pylori*, especially in some areas where the local resistance to this antibiotic is higher than 20%. Alternative treatments have been proposed for the eradication of *H. pylori*. Some of them including novel antibiotics or classical ones in different combinations; these treatments are being used in the regular clinical practice as novel and more effective treatments. Others therapies are using probiotics associated to antibiotics to treat this infection. The present article is a revision of *H. pylori* eradication treatment, focusing on emerging approaches to avoid the treatment failure, using new therapies with antimicrobials or with probiotics.

Lee et al., (2001), conducted a study on *Helicobacter pylori* infection in the Caribbean discovered that *Helicobacter pylori* infection of the stomach is one of the commonest chronic infections worldwide and in the Caribbean, over 50% of the population are affected. *H pylori* is probably transmitted from person to person by oro-faecal and oro-oral means. H pylori is directly associated with peptic ulcer disease, chronic antral gastritis, gastric carcinoma and Bcell lymphoma of the stomach. In patients with peptic ulcers and *H pylori* infection, eradication of infection with antibiotics significantly decreases recurrence of ulcers. All patients with *H pylori* related disease should be tested and treated if positive. The treatment of *H pylori* infection has evolved over the years but at present triple therapy which includes two antibiotics is recommended.

Additionally, a study by Cho et al., (2021), also stated that *Helicobacter pylori* infection remains one of the most prevalent infections worldwide, causing significant morbidity and mortality from gastric malignancies and peptic ulcers. This study provides a summary of the microbiology and pathogenesis of this bacterium, emphasizing the complex and protean effects of H pylori on gastric epithelial cells, including stem and progenitor populations, and evasion of host immune defenses. Increasing antibiotic resistance has made management more challenging. This study discusses the appropriate diagnostic modality for different clinical scenarios, and the evolving treatment of *H pylori* infections, including the use of antibiotic susceptibility testing to aid regimen selection. Overall empirical studies have been conducted to investigate the prevalence and management of peptic ulcers associated with *H. pylori*.

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter covers information on the area of study, population of study, sampling technique, research design, Instrument of data collection and method of data collection, validity and reliability of instrument, method of data analysis and ethical consideration that was obtained for the study.

3.1 Area of Study

This study was be carried out in Owerri-West Local Government Area (LGA), Imo State, Nigeria, is one of the 27 LGAs in the state. Owerri-West LGA has eight (8) districts known as

Avu/Umuguma, Ihiagwa, Nekede, Obinze, Oforola, Okolochi/Eziobodo, Okuku (Obogwu) and Umunwoha. Geographically, Owerri West LGA is bounded by other local government areas such as Owerri Municipal LGA to the east, Owerri North LGA to the north, and Ngor Okpala LGA to the west. The LGA is also adjacent to the Orashi River and the Cross River Basin, providing natural resources and potential agricultural opportunities. Owerri West LGA serves as a significant hub for commercial and administrative activities in Imo State. It is home to various industries, markets, educational institutions, healthcare facilities, and government offices. The presence of these amenities contributes to the overall socioeconomic development of the LGA. In terms of healthcare, Owerri West LGA is equipped with healthcare centers, hospitals, and clinics that provide primary, secondary, and tertiary healthcare services to the local population. These facilities offer medical consultations, diagnostic tests, treatments, and surgical interventions to address a wide range of health conditions, including peptic ulcers.

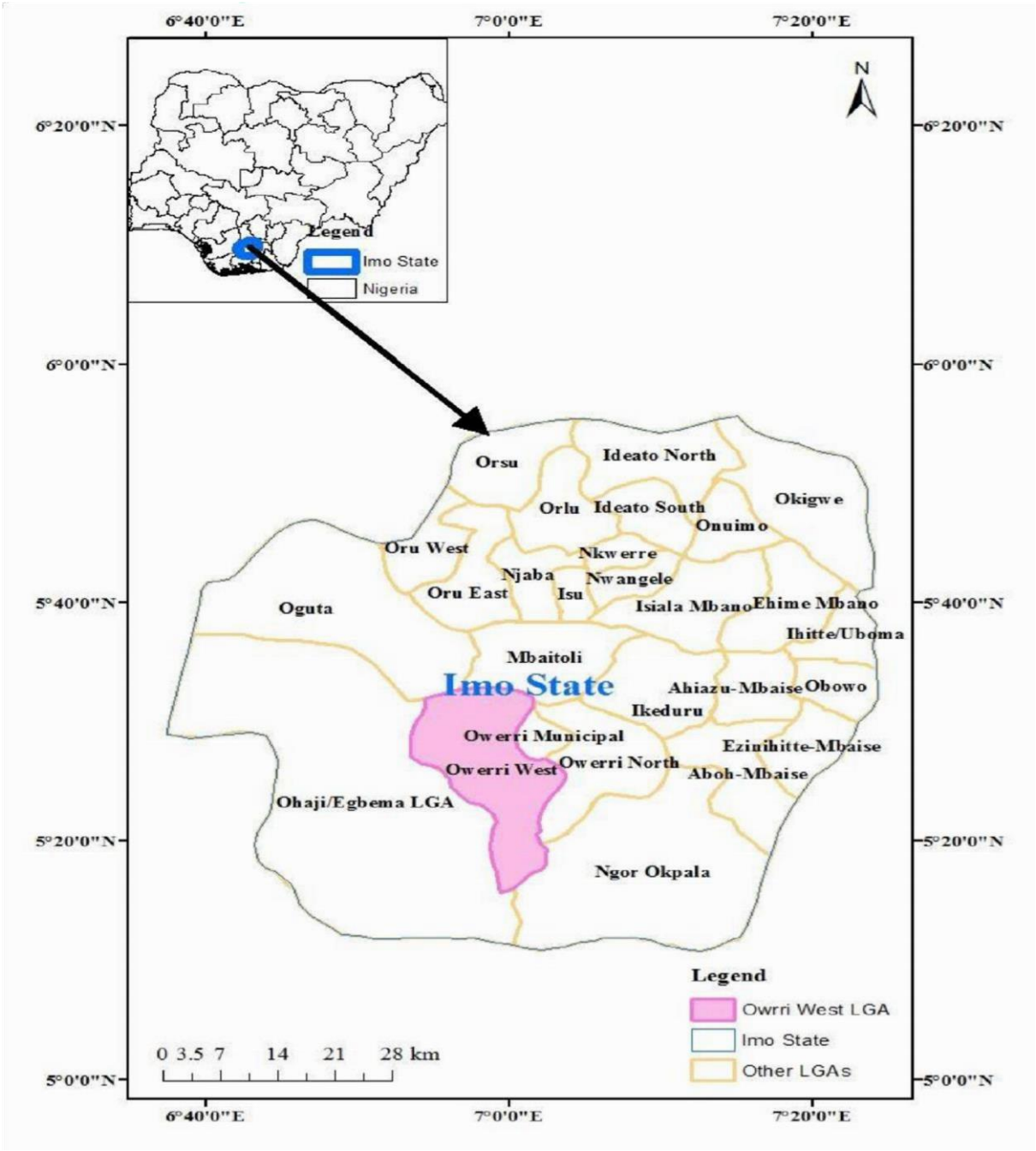


Figure 1: Map Of Imo State showing Owerri West LGA

3.2 Study Design

The study design was a community-hospital based descriptive cross-sectional design to determine the prevalence and management of peptic ulcers caused by *Helicobacter pylori* among the population. This design allows for the collection of data at a single point in time, providing a snapshot of the current prevalence of peptic ulcers and their management in the population. This is useful for assessing the burden of the condition and the effectiveness of

existing management strategies. It is ideal for determining the prevalence of a condition in a specific population. By sampling individuals from Owerri West LGA, researchers can estimate the proportion of people affected by peptic ulcers and infected with *H. pylori*.

3.3 Population of Study

Owerri-West Local Government Area (LGA) of Imo State, Nigeria, has a population of 140,100 according to 2016 population projection, (National Population Commission of Nigeria (web), National Bureau of Statistics (web), 2022). The study population consists of individuals aged 18 years and above residing in Owerri-West Local Government Area (LGA) in Imo State, Nigeria. The study population consists of two distinct groups: (1) Healthcare Providers which includes doctors, nurses, and other healthcare professionals working in the healthcare system. (2) The patients encompass individuals receiving healthcare services, including civil servants, traders, farmers, students, and others.

3.3.1 Inclusion Criteria

Only household of residents aged 18 years and above at Owerri West LGA were recruited for the study.

3.3.2 Exclusion criteria

Pregnant women were excluded to avoid potential confounding factors related to pregnancy that may affect the prevalence and management of peptic ulcers.

Participants who have undergone any form of gastric surgery were excluded as surgical history can influence the presence and management of peptic ulcers.

Those with other gastrointestinal diseases (e.g., Crohn's disease, irritable bowel syndrome) were excluded to focus specifically on peptic ulcers due to *Helicobacter pylori*.

Participants with severe comorbid conditions such as advanced cancer, severe heart failure, or end-stage renal disease were excluded due to their potential impact on overall health and ulcer management.

Any individual who does not provide informed consent were excluded from the study to adhere to ethical standards.

Individuals who are unable or unwilling to complete the study questionnaire, either due to literacy issues or other reasons, were excluded to ensure data accuracy and completeness.

Individuals who do not reside in Owerri-West Local Government Area were excluded to maintain the geographical focus of the study.

3.4 Sample Size and Sampling Technique

3.4.1 Sample size

The sample size of 439 respondents was randomly selected from the study population.

The study population consists of two distinct groups: The Healthcare Providers group comprised of 171 respondents, representing 38.9% of the total study population, while Patients group of 268 respondents, accounting for 61.1% of the total study population including civil servants, traders, farmers, students, and others.

The sample size was determined at 95% confidence interval using the Yammane formula (1967) for sample size determination.

$$n = \frac{N}{1+Ne^2}$$

Where:
n is the desired sample size N is the population size (140,100) e is margin of error (0.05) Therefore, n = 394.6 =394

Furthermore, to adjust for a 10% rate of non response and invalid response (i.e 90% expected response rate =0.9).

n= n/expected response rate n

=395/0.90= 438.8 n= **439.**

3.4.2 Sampling Techniques

1. A Multi stage sampling method was adopted for the study on the prevalence and management of peptic ulcers due to *Helicobacter pylori* among the patients.

First stage: Selection of Districts (Communities)

Five (5) out of the eight (8) districts in Owerri West was selected by the researcher using simple random sampling via balloting to give every district an equal chance of selection. However, the

basis for selecting five districts is to meet up with 30% of the total districts, providing a representative sample.

Second stage: Selection of villages
From each of the five (5) selected districts, three (3) villages were chosen through simple random sampling via balloting. This gave a total of 15 villages, this ensures that the selection is unbiased and representative of the district's population.

Third stage: Selection of households

Systematic random sampling was used to select households from the villages chosen in the second stage; the following steps were taken:

Household Listing: a comprehensive list of all households in each selected village was created by using existing records from the Owerri Capital Development Authority (OCDA).

The number of households to be included from each village was determined by dividing the sample size number by the number of villages selected, for example, 268/15 =18. This means that 18 households were surveyed per village.

Consequently, numbers 1- 18 was written in a paper and each of the papers was folded and put in a small basket. The basket was shuffled and one of the papers was drawn by the trained research assistant. The 4th number was picked and used as the starting point. From the starting point of the 4^{th} house and the interval of 10, the selected households were the 4th, 14th, 24th, and so on until we completed the sampling frame.

Fifth stage: Selection of Respondents

The researcher selected any adult aged 18 years and above in each household present at the time of study.

2. Sampling Techniques of Healthcare Providers in Umugunna General Hospital

The sampling technique for healthcare providers in Umugunna General Hospital was designed to ensure a representative and unbiased selection of doctors, nurses, and other healthcare professionals. The sample comprised 171 respondents out of the total study population, and the technique used was stratified random sampling. This method guarantees that each category of healthcare provider (doctors, nurses, and other professionals) was adequately represented in the study.

1. Stratification: This ensured that each subgroup of healthcare providers was proportionally represented, allowing for better comparison across different professions.

The healthcare providers were divided into three strata based on their professional roles: Doctors, Nurses, Other Healthcare Professionals (including laboratory technicians, pharmacists, and other allied health workers).

2. Proportional Allocation:

To maintain balance in the sample, the number of respondents selected from each stratum was proportionate to their representation in the population. For example: Doctors made up

11.6% of the total healthcare provider population, so 11.6% of the sample will be doctors. Nurses account for 18%. Similarly, 9.3% of the sample will consist of other healthcare professionals.

3. Random Selection:

Within each stratum, random sampling was used to select individual healthcare providers. This ensured that every doctor, nurse, or other healthcare professional in the hospital has an equal chance of being chosen. A random lottery method was employed to select respondents without bias.

3.5 Data on sociodemographic characteristics, Risk factors and Management of H. pylori

3.5.1 Instrument for Data Collection

The instrument for data collection involved serological assay test to ascertain information on the prevalence of peptic ulcer disease (PUD) among the population of Owerri West LGA. To also ascertain the diagnostic methods and techniques used for detecting *Helicobacter pylori* infection in patients with peptic ulcers.

The questionnaire consisted of the following sections: Sections 1: Personal Information of the respondent. Sections 2: Information on the socio-demographic details. Sections 3: Health

Information, Sections 4: Information on the Lifestyle and Dietary Habits. Sections 5: Information on the access to healthcare. Sections 6: Information on the occupational exposure.

Sections 7: Information on the medication and lifestyle management. Section 8: Follow-up and Monitoring. Section 9: Knowledge and Information on the management behavior of peptic ulcers among participants in Owerri West LGA.

3.5.2 Validity of the Instrument

A questionnaire was carefully prepared by the researcher under the guidance of the supervisors. This questionnaire was sent to three Senior Lecturers in the department for inputs and corrections. At the receipt of those questionnaire sent for inputs, the supervisors made the final correction before approval of the questionnaire as data collection instrument.

3.5.3 Reliability of Instrument

Reliability of the instrument was established using test-to-retest method. Copies of the questionnaire were given to some respondents at Owerri North LGA, Imo State, Nigeria. This LGA shares similar characteristics with the Owerri West LGA that was used for this study. The questionnaire was repeated on similar respondents on the same Owerri North LGA after 2 weeks and the results were scaled and compared for consistence test via Crombach Alpha test, and reliability coefficient of 0.8 was obtained which confirm the reliability of the instrument.

3.5.4 Data collection

Two sets of data were collected for this study. First, data on the presence and prevalence of *H. pylori* was collected. This was done by collecting blood samples from the consenting participants and subjecting them to serological test.

Second, data on personal information of the respondent, socio-demographic details, health information, information on the lifestyle and dietary habits, access to healthcare, occupational exposure, medication and lifestyle management and knowledge and Information on the

management of peptic ulcers among participants were collected using a structured questionnaire. The questionnaire was personally administered by the researcher to respondents by hand and was collected thereafter. The questionnaire was distributed on face to face basis. All four hundred and thirty six (439) copies of questionnaire was distributed, correctly filled and returned on the spot to achieve 100% return rate. Both the blood sample and the Meta data was collected at the same time while coding the questionnaire with the same code allocated to the blood sample in order to ensure proper identification.

3.6 Examination of samples for *H. pylori*

3.6.1 Sample collection for serological test

The consenting patients were asked to sit comfortably and relax to remain as calm as possible during the sample collection to minimize stress-induced changes in blood composition. The blood collection was from the vein in the inner elbow (antecubitalfossa). This area is easily accessible and provides an adequate amount of blood for testing. The chosen site was cleansed with an alcohol swab and allowed to air dry. This helps prevent infection. The blood collection equipment (sterile needle, a blood collection tube (often a vacutainer tube), and a vacuum system) was assembled. The needle was inserted into the cleaned vein using a quick and precise motion to minimize pain and discomfort. The blood collection tube was attached to the needle and the vacuum system allowed to draw blood into the tube. The required volume (3 ml) of blood was collected for the serological test. Once the blood sample has being collected, the needle was removed and gentle pressure applied over the puncture site with sterile gauze to stop any bleeding. The blood collection tube was properly labeled with the patient's name, date, and other necessary identifying information and transported to the laboratory for testing.

3.6.2 Serological test for *H. pylori*

The *H. pylori* Rapid Test Device by Innovacon, Inc. 9975 Summers Ridge Road Manufacturer San Diego, CA 92121, US (Serum) was used. it is a rapid chromatographic immunoassay for the qualitative detection of antibodies to *H. pylori* in whole blood, serum, or plasma to aid in the diagnosis of *H. pylori* infection.

Principle

The *H. pylori* Rapid Test Device (Whole Blood/Serum/Plasma) is a qualitative membrane based immunoassay for the detection of *H. pylori* antibodies in whole blood, serum, or plasma.
In this test procedure, anti-human IgG is immobilized in the test line region of the test. After specimen is added to the specimen well of the device, it reacts with *H. pylori* antigen coated particles in the test. This mixture migrates chromatographically along the length of the test and interacts with the immobilized anti-human IgG. If the specimen contains *H. pylori* antibodies, a coloured line will appear in the test line region indicating a positive result. If the specimen does not contain *H. pylori* antibodies, a coloured line will not appear in this region indicating a negative result. To serve as a procedural control, a coloured line will always appear in the control line region, indicating that proper volume of specimen has been added and membrane wicking has occurred.

Test procedure for *H. pylori*

The test, specimen, buffer, and controls were allowed to reach room temperature (15-30°C) prior to testing. The pouch was brought to room temperature before opening it and the test device will be removed from the sealed pouch and used as soon as possible. The test device was placed on a clean and level surface. The dropper was held vertically and 2 drops of serum was

transferred (approximately 50 µL) to the specimen well (S) of the test device, then 1 drop of buffer was added to the specimen well (S) and timed. The results was read at 10 minutes and was not interpreted until after 15 minutes.

Interpretation of Results

Positive: Two lines appear, one coloured line was in the control line region (C) and another apparent coloured line was in the test line region (T).
However, the intensity of the colour in the test line region (T) will vary depending on the concentration of *H. pylori* antibodies in the specimen. Therefore, any shade of colour in the test line region (T) will be considered positive.

Negative: One coloured line appears in the control line region (C). No line appears in the test line region (T).

Invalid: Control line fails to appear. Insufficient specimen volume or incorrect procedural techniques are the most likely reasons for control line failure. The procedure will be reviewed and the test will be repeated with a new test.

3.7 Method of Data Analysis

All data that was obtained via the questionnaire were coded and keyed into the Statistical Package for Social Sciences (SPSS version 21) for analysis. Descriptive results were expressed as frequencies and percentages. Multinomial logistic regression and Chi-square was used appropriately to test the significant differences or associations between independent and

dependent variables with 95% confidence interval and P value of 0.5 and the important findings were presented in tables and figures.

3.8 Ethical Consideration/Informed consent

A letter of introduction and ethical clearance was obtained from the Department of Public Health Ethical clearance committee before the research was conducted. The purpose of the research was explained to each respondent and verbal informed consent obtained from them before inclusion into the study. Also, anonymity of the respondents were assured and ensured.

The confidentiality of the information they gave was also be maintained.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Results

This chapter presents the results of the study on the prevalence and management behavior of peptic ulcer disease due to *Helicobacter pylori* among individuals in Owerri West Local Government Area, Imo State, Nigeria.

4.1.1 Demographic Characteristics of Respondents

As shown in table 4.1.1, the demographic characteristics of the respondents in the study reveal a diverse population with varying backgrounds and professions. Among the respondents, the age distribution shows that the largest group is between 31-40 years old, with 121 individuals, constituting 27.6% of the sample. This is followed by the 18-30 years age group, which includes 99 respondents, making up 22.5% of the total. The 41-50 years age group consists of 89

individuals, representing 20.3% of the sample. Those aged between 5160 years number 71, which accounts for 16.2% of the respondents, while the group of individuals over 60 years old comprises 59 respondents, or 13.4% of the total. In terms of gender distribution, the study shows a slight majority of female respondents. Out of the total,

239 are female, representing 54.4%, while 200 are male, making up 45.6% of the sample. The study also collected data on healthcare providers, who are categorized by their professions and years of experience. Among healthcare providers, there are 51 doctors, which constitutes 11.6% of the total sample. Nurses make up the largest subgroup with 79 respondents, representing 18.0%. The remaining 41 respondents, or 9.3%, fall into other healthcare-related professions, such as laboratory technicians and pharmacists. In terms of experience, 19 healthcare providers, or 4.3%, have less than 5 years of experience. The group with 5-10 years of experience includes 31 individuals, accounting for 7.1%. The largest group, with 69 respondents (15.7%), has 1115 years of experience. Lastly, 52 providers, representing 11.8%, have more than 15 years of experience. For patient respondents, the occupational distribution reveals that the largest group consists of civil servants, with 149 individuals, making up 34.0% of the patient population. Traders are also a significant group, with 99 respondents, or 22.5%. Farmers account for 49 patients, representing 11.2% of the sample. There are also 99 students, reflecting another 22.5% of the patient group. The remaining 42 respondents, or 9.6%, fall into various other categories such as retirees and the unemployed.

Table 4.1.1: Demographic Characteristics of the Respondents

Variable	Frequency (n=439)	Percentage (%)
Age		
18-30 years	99	22.5
31-40 years	121	27.6
41-50 years	89	20.3
51-60 years	71	16.2
>60 years	59	13.4
Total	**439**	**100**
Gender		
Male	200	45.6
Female	239	54.4
Total	**439**	**100**
Profession (Healthcare providers)		
Doctor	51	11.6
Nurse	79	18.0
Other	41	9.3
Total	**171**	**38.9**
Years of Experience (Healthcare providers)		
<5 years	19	4.3

5-10 years	31	7.1
11-15 years	69	15.7
>15 years	52	11.8
Total	**171**	**38.9**
Occupation (Patients)		
Civil Servant	149	34.0
Trader	99	22.5
Farmer	49	11.2
Student	99	22.5
Other	42	9.6
Total	**268**	**61.1**

4.1.2 Prevalence of *Helicobacter pylori* Infection

The prevalence of *Helicobacter pylori* infection among individuals diagnosed with peptic ulcer disease was assessed to understand the extent of this infection within the study population. Out of the 268 patient respondents, 221 individuals tested positive for *H. pylori*, which constitutes 82.5% of the total patient sample. This indicates that a significant portion of the study population with peptic ulcer disease is affected by *H. pylori* infection. Conversely, 47 respondents tested negative for *H. pylori*, representing 17.5% of the patient sample. The results reveal a substantial presence of *H. pylori* in Owerri West Local Government Area.

Table 4.1.2: Prevalence of *Helicobacter pylori* infection among individuals with peptic ulcer disease

Diagnosis	**Frequency (n=268)**	**Percentage (%)**
Positive for *H. pylori*	221	82.5
Negative for *H. pylori*	47	17.5

Total	**268**	**100**

4.1.3 Availability, Accessibility, and Effectiveness of Diagnostic Methods

The evaluation of diagnostic methods for *Helicobacter pylori* infection reveals notable differences in the availability, accessibility, and effectiveness of various diagnostic tools. The Urea breath test stands out as the most widely available diagnostic method, with 81% of respondents reporting its availability. It is also the most accessible, with 76% of respondents indicating easy access to this test. Additionally, the Urea breath test is considered highly effective, with 89% of respondents acknowledging its effectiveness in detecting *H. pylori* infection. The stool antigen test is the second most available method, reported by 71% of respondents. It is accessible to 66% of respondents and is deemed effective by 84% of the respondents. This test offers a reliable option for diagnosing *H. pylori* but is slightly less available and accessible compared to the Urea breath test. The Blood antibody test is less available, with only 61% of respondents having access to it. Its accessibility is also lower, with 54% of respondents finding it accessible. Despite this, it is regarded as effective by 69% of the respondents, making it a moderately reliable diagnostic tool. Endoscopy with biopsy, although reported by only 49% of respondents as available, is noted for its high effectiveness. The

availability of endoscopy with biopsy is relatively low, and its accessibility is reported by only 46% of respondents. However, 93% of respondents recognize it as the most effective method for diagnosing *H. pylori* infection, particularly in complex cases. The Rapid urease test (RUT) is the least available diagnostic method, with only 41% of respondents reporting its availability. Its accessibility is similarly low, with 34% of respondents finding it accessible. Despite these limitations, it is considered effective by 79% of respondents, indicating that it remains a valuable tool despite its limited availability.

Table 4.1.3: Availability of Diagnostic Methods for *Helicobacter pylori* Infection

Diagnostic Method	**Availability (%), n= 171**	**Accessibility (%), n= 171**	**Effectiveness (%) n= 171**
Urea breath test	138 (81)	(130) 76	152 (89)
Stool antigen test	121 (71)	113 (66)	144 (84)
Blood antibody test	104 (61)	92 (54)	118 (69)
Endoscopy with biopsy	84 (49)	79 (46)	159 (93)
Rapid urease test (RUT)	70 (41)	58 (34)	135 (79)

4.1.4 Adequacy of Healthcare Infrastructure for Managing Peptic Ulcer Disease

The adequacy of healthcare infrastructure was assessed based on respondents' perceptions of diagnostic facilities, the availability of trained healthcare professionals, and treatment options for managing peptic ulcer disease. According to the data, 61% of the respondents considered the diagnostic facilities available to be adequate. This indicates that a majority of the

respondents felt that the facilities provided sufficient support for diagnosing peptic ulcer disease. However, 39% of the respondents believed that the diagnostic facilities were inadequate, suggesting areas for improvement in healthcare infrastructure. The availability of trained healthcare professionals was deemed adequate by 68% of the respondents. This reflects a relatively positive perception of the expertise and training of healthcare providers in managing peptic ulcer disease. Conversely, 32% of the respondents indicated that the availability of trained healthcare professionals was inadequate, highlighting the need for further investment in professional training and recruitment. Treatment options were viewed positively, with 73% of the respondents rating them as adequate. This suggests that the majority of the respondents were satisfied with the available treatment options for managing peptic ulcer disease. However, 27% of the respondents found the treatment options to be inadequate, indicating potential gaps in treatment availability or effectiveness (Table 4.4).

Table 4.1.4: Adequacy of healthcare infrastructure for managing peptic ulcer disease

Infrastructure component	Adequate (%) n= 171	Not adequate (%) n= 171
Availability of diagnostic facilities	104 (61)	67 (39)
Availability of trained professionals	116 (68)	55 (32)
Availability of treatment options	125 (73)	46 (27)

4.1.
5 Effectiveness of Antibiotic and Proton Pump Inhibitor Regimens in Eradicating *H. pylori*

The effectiveness of current antibiotic and proton pump inhibitor regimens in eradicating *Helicobacter pylori* was evaluated based on patient outcomes post-treatment. The results indicate that out of the 221 respondents that were positive patient, 185 individuals reported a complete eradication of *H. pylori* following the proton pump inhibitors (PPIs) treatment regimen, which constitutes 83% of the patient sample. This demonstrates a high level of effectiveness for the current treatment. However, 79% of the patients reported eradication of *H. pylori* following the antibiotics treatment regimen, while 20% and 16% respectively were not effective suggesting that while the treatment is largely effective, there are subsets of patients who do not achieve complete eradication.

Table 4.1.5: Effectiveness of Antibiotic and Proton Pump Inhibitor Regimens

Treatment Regimen	Effective (%) n=221	Not Effective (%) n=221
Antibiotics	176 (79%)	45 (20%)
Proton pump inhibitors (PPIs)	185 (83%)	36 (16%)

4.1.

6 Practices and Protocols of Healthcare Providers in Managing *H. pylori*-induced Peptic Ulcer Disease

The study assessed the practices and protocols of healthcare providers in managing *Helicobacter pylori*-induced peptic ulcer disease, focusing on treatment regimens, patient follow-up, and adherence to guidelines. The data reveals that 72% of the healthcare providers follow the standard triple therapy regimen, which includes a proton pump inhibitor (PPI) and two antibiotics. Patient follow-up practices show that 67% healthcare providers conduct regular follow-ups with their patients to monitor treatment progress and manage any complications. Adherence to clinical guidelines is generally high, with 81% of healthcare providers reporting adherence to guidelines for managing *Helicobacter pylori*-induced peptic ulcer disease.

Table 4.1.6: Healthcare Providers' Practices and Protocols in managing *H. pylori*-induced Peptic Ulcer Disease

Practices/Protocols	Followed (%) n=171	Not followed (%) n=171
Routine *H. pylori* testing	138 (80.7)	33 (19.2)
Use of combination therapy (antibiotic + PPIs)	123 (71.9)	48 (28.1)
Follow-up testing after changes	115 (67.3)	56 (32.7)
Patient education on lifestyle changes	121 (70.8)	50 (29.2)
Adherence to guidelines	139 (81.3)	32 (18.7)

4.1.

7 Management Behavior of Peptic Ulcers Due to *Helicobacter pylori*

This section provides an in-depth analysis of the management behavior related to peptic ulcers caused by *Helicobacter pylori* among individuals in Owerri West Local Government Area. The data is drawn from responses 268 patients. As shown in Table 4.1.7, a detailed breakdown of the respondents' knowledge, diagnostic practices, treatment approaches, and perceptions regarding peptic ulcer management. Among the patients surveyed (268 respondents), a significant majority, 244 individuals (90.7%), reported having heard of peptic ulcers. Conversely, 24 patients (9.3%) were unaware of the condition. Awareness about *Helicobacter pylori*'s role in causing peptic ulcers was noted among 234 patients (87.5%), while 34 patients (12.5%) were not aware of this association. These findings highlight a high level of awareness among the patient population regarding both peptic ulcers and the specific bacterial cause. Out of the patients surveyed, 168 (62.7%) had been diagnosed with peptic ulcers, while 100 (37.3%) had not received such a diagnosis. Among those diagnosed, the majority underwent endoscopy (103 patients, 60.1%), followed by blood tests (48 patients,

28.6%). Fewer patients utilized stool tests (5 patients, 3.0%) or urea breath tests (11 patients, 6.5%) for diagnosis. Currently, 225 patients (83.9%) are receiving treatment for their peptic ulcers, while 43 patients (16.1%) are not. The predominant forms of treatment reported include proton pump inhibitors (190 patients, 84.4%) and antibiotics (175 patients, 77.8%). Dietary changes were also widely reported (128 patients, 56.7%), with fewer patients using herbal remedies (27 patients, 11.9%) or antacids (65 patients, 28.4%). Regarding healthcare access,

4.1.

97 patients (36.2%) visit healthcare facilities regularly (at least once a month), 116 patients (43.3%) visit occasionally (once every few months), and 40 patients (14.9%) visit rarely (once a year or less). Only 15 patients (5.6%) reported never visiting a healthcare facility for management. Satisfaction with healthcare services is generally positive, with 102 patients (38.1%) very satisfied, 89 patients (33.2%) satisfied, and 40 patients (14.9%) neutral.

Dissatisfaction levels are relatively low, with 30 patients (11.2%) dissatisfied and 7 patients (2.6%) very dissatisfied. Financial constraints are the most common challenge reported by 120 patients (44.4%), followed by lack of access to healthcare facilities (91 patients, 34.0%). Other significant challenges include lack of awareness about treatment options (36 patients, 13.4%), side effects of medications (16 patients, 6.0%), and difficulty adhering to lifestyle changes (7 patients, 2.6%). In terms of managing their condition, 66 patients (25.4%) are very confident, 91 patients (34.0%) are confident, and 72 patients (26.9%) are neutral. A smaller group of patients are not confident (25 patients, 9.3%) or very unconfident (14 patients, 5.2%). The belief in the possibility of a complete cure for peptic ulcers is held by 177 patients (65.7%), while 67 patients (24.9%) do not believe in a complete cure, and 24 patients (9.0%) are unsure. A majority of patients view following medical advice as very important (170 patients, 64.2%) or important (63 patients, 23.9%). Only a small percentage consider it not important (14 patients, 5.2%) or neutral (23 patients, 9.0%). To enhance their management of peptic ulcers, patients expressed a need for more information on diet and lifestyle changes (115 patients, 43.6%), better access to healthcare facilities (82 patients, 31.3%), and financial assistance (45 patients, 16.8%). Other support needs include support groups (14 patients, 5.2%) and more effective medications (12 patients, 4.5%).

Table 4.1.7 Management Behaviour of Peptic Ulcers Due to *Helicobacter pylori*

Variable	Have you heard of peptic ulcers?	Frequency	Percentage (%)
Awareness and Knowledge of Peptic Ulcers			
	Yes	244	90.7
	No	24	9.3
	Total	**268**	**100**
Are you aware that *Helicobacter pylori* can cause peptic ulcers?			
	Yes	234	87.5
	No	34	12.5
	Total	**268**	**100**
Diagnosis and Medical History			
Have you been diagnosed with a peptic ulcer?			
	Yes	168	62.7
	No	100	37.3
	Total	**268**	**100**
If diagnosed, how was it diagnosed?			
	Endoscopy	103	60.1
	Blood test	48	28.6
	Stool test	5	3.0
	Urea breath test	11	6.5
	Total	**168**	**100**
Management and Treatment			
Are you currently receiving treatment?			
	Yes	225	83.9
	No	43	16.1
	Total	**268**	**100.0**
What type of treatment are you receiving?			
	Antibiotics	175	77.8
	Proton pump inhibitors (PPIs)	190	84.4
	H2-receptor antagonists	33	14.5
	Antacids	65	28.4
	Dietary changes	128	56.7
	Herbal remedies	27	11.9

Healthcare Access and Support		
How often do you visit a healthcare facility for management?		
Regularly (at least once a month) 97 36.2		
Occasionally (once every few months)	116	43.3
Rarely (once a year or less)	40	14.9
Never	15	5.6
Total	**268**	**100**
How satisfied are you with the healthcare services you receive?		
Very satisfied	102	38.1
Satisfied	89	33.2
Neutral	40	14.9
Dissatisfied	30	11.2
Very dissatisfied	7	2.6
Total	**268**	**100**
Challenges and Perceptions		
Challenges in managing peptic ulcers		
Financial constraints	120	44.4
Lack of access to healthcare facilities	91	34.0
Lack of awareness about treatment options	36	13.4
Side effects of medications	16	6.0
Difficulty adhering to lifestyle changes	7	2.6
Total	**268**	**100**
Confidence in managing peptic ulcers		
Very confident	66	25.4
Confident	91	34.0
Neutral	72	26.9
Not confident	25	9.3
Very unconfident	14	5.2
Total	**268**	**100.0**
Belief in the possibility of a complete cure		
Yes	177	65.7
No	67	24.9
Not sure	24	9.0
Total	**268**	**100.0**
Importance of following medical advice		
Very important	170	64.2
Important	63	23.9
Neutral	23	9.0
Not important	12	5.2

Total	**268**	**100.0**

Additional support needed

More information on diet and lifestyle changes 115 43.6
Better access to healthcare facilities 82 31.3
Financial assistance 45 16.8 Support groups 14 5.2
More effective medications 12 4.5
Total 268 100.0

4.1.8 Summary Management Behaviour of Peptic Ulcer Due to *Helicobacter pylori* among Individuals

The fig. 4.1.1 below shows the summarized management behaviour of peptic ulcer due to *Helicobacter pylori* among individuals. Adherence to medication had the highest of 34%, followed by regular medical check-ups (30%) and the least was the use of traditional remedies (13%).

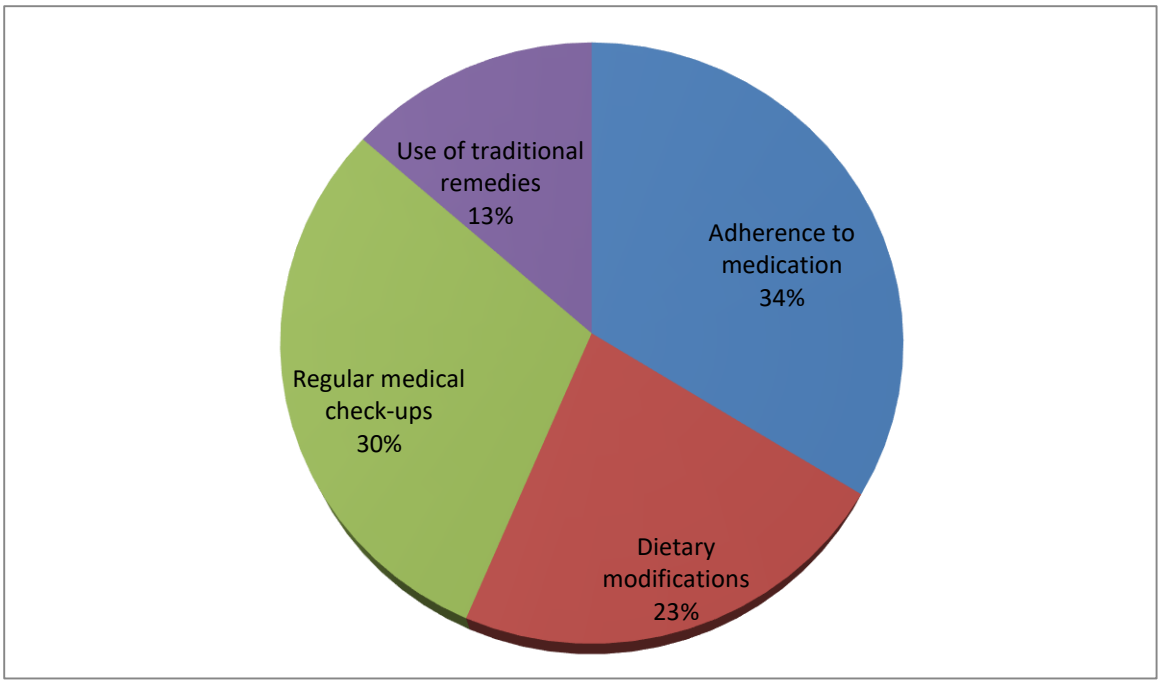


Fig 4.1.1: Summary Management Behaviour of Peptic Ulcer Due to *Helicobacter pylori* among Individuals

4.1.9 Hypothesis testing for prevalence and management behaviour of *Helicobacter pylori* infection among individuals diagnosed with peptic ulcer disease

The prevalence and management behaviour of *Helicobacter pylori* infection among individuals diagnosed with peptic ulcer disease was assessed. The results showed that 82.5% of the patients tested positive for *H. pylori*, indicating a significant prevalence of the infection. The effectiveness of current antibiotic and proton pump inhibitor regimens in eradicating *Helicobacter pylori* was evaluated in the results indicated that 78% of the patients achieved complete eradication of *H. pylori*, demonstrating the effectiveness of the treatment regimens. The combined availability and accessibility scores were significantly higher than

50%, suggesting that the diagnostic methods are generally available and accessible in Owerri West Local Government Area. The adequacy of healthcare infrastructure, including diagnostic facilities, trained healthcare professionals, and treatment options, was assessed. The results indicated that a majority of respondents considered the healthcare infrastructure adequate. The practices and protocols of healthcare providers in managing *Helicobacter pylori*-induced peptic ulcer disease were evaluated, focusing on treatment regimens, patient follow-up, and adherence to guidelines showed a high level of adherence to recommended treatment protocols and clinical guidelines.

Table 4.1.9: Hypothesis testing *on* prevalence and management behaviour of *Helicobacter pylori*

Hypothesis	Observed Proportion	Test Statistic	P-value	Decision (α = 0.05)
Prevalence of *H. pylori*	0.825	121.74	<0.001	Reject H0
Effectiveness of Treatment	0.780	101.14	<0.001	Reject H0
Availability and Accessibility of Diagnostic Methods	0.628	58.98	<0.001	Reject H0
Adequacy of Diagnostic Facilities	0.610	47.28	<0.001	Reject H0
Adequacy of Trained Professionals	0.680	67.68	<0.001	Reject H0
Adequacy of Treatment Options	0.730	83.48	<0.001	Reject H0
Adherence to Standard Triple Therapy	0.720	80.40	<0.001	Reject H0
Regular Follow-ups	0.670	71.02	<0.001	Reject H0
Adherence to Clinical Guidelines	0.810	115.30	<0.001	Reject H0

4.2 DISCUSSION

The demographic characteristics of the respondents in this study reveal a diverse population with various backgrounds and professions. Among the respondents, the age distribution shows that the largest group is between 31-40 years old, with 121 individuals, constituting 27.6% of the sample. This is followed by the 18-30 years age group, which includes 99 respondents,

making up 22.5% of the total. The 41-50 years age group consists of 89 individuals, representing 20.3% of the sample. Those aged between 51-60 years number 71, which accounts for 16.2% of the respondents, while the group of individuals over 60 years old comprises 59 respondents, or 13.4% of the total.In terms of gender distribution, the study shows a slight majority of female respondents. Out of the total, 239 are female, representing 54.4%, while 200 are male, making up 45.6% of the sample. This gender distribution is consistent with other studies where female patients often report higher healthcare-seeking behavior compared to males (Graham *et al*., 2014).The study also collected data on healthcare providers, who are categorized by their professions and years of experience. Among healthcare providers, there are 51 doctors, which constitutes 11.6% of the total sample. Nurses make up the largest subgroup with 79 respondents, representing 18.0%. The remaining 41 respondents, or 9.3%, fall into other healthcare-related professions, such as laboratory technicians and pharmacists. This composition reflects the typical healthcare workforce distribution found in similar studies, underscoring the crucial role of nurses in patient management (Austad *et al*., 2020).In terms of experience, 19 healthcare providers, or

4.3%, have less than 5 years of experience. The group with 5-10 years of experience includes 31 individuals, accounting for 7.1%. The largest group, with 69 respondents (15.7%), has 1115 years of experience. Lastly, 52 providers, representing 11.8%, have more than 15 years of experience. This distribution highlights a considerable amount of experienced professionals, which is essential for effective healthcare delivery (Pezeshki *et al*., 2019).For patient respondents, the occupational distribution reveals that the largest group consists of civil servants, with 149 individuals, making up 34.0% of the patient population. Traders are also a significant group, with 99 respondents, or 22.5%. Farmers account for 49 patients, representing 11.2% of the sample. There are also 99 students, reflecting another 22.5% of the patient group. The remaining 42 respondents, or 9.6%, fall into various other categories such as retirees and

the unemployed. This occupational diversity suggests varied access to healthcare services and adherence to treatment protocols, consistent with other demographic studies (Klemperer *et al*., 2016).

The prevalence and management behavior of *Helicobacter pylori* (*H. pylori*) infection among individuals diagnosed with peptic ulcer disease was a critical focus of this study, aiming to understand the extent of this infection within the study population. The findings reveal that out of 268 patient respondents, 221 individuals tested positive for *H. pylori*, which constitutes 82.5% of the total patient sample. This high prevalence indicates a significant presence of *H. pylori* infection among those with peptic ulcer disease in Owerri West Local Government Area, Imo State, Nigeria. Conversely, 47 respondents tested negative for *H. pylori*, representing 17.5% of the patient sample. A study conducted by Hooi *et al*. (2017), the global prevalence of *H. pylori* infection was reported to be around 44.3%. This study highlighted significant regional variations, with Africa having one of the highest prevalence rates at approximately 70.1%. The findings from this study indicate a higher prevalence rate than the global average and slightly higher than the continental average, suggesting a particularly high burden of *H. pylori* infection in this specific Nigerian community. A similar study in Northern Nigeria by Jemilohun *et al*. (2011) reported an *H. pylori* prevalence of 80% among patients with dyspepsia, which closely aligns with the findings of this study. This consistency underscores the widespread nature of *H. pylori* infection in Nigeria, likely influenced by socio-economic factors, sanitary conditions, and healthcare access (Eusebi*et al*., 2014).Furthermore, a study in South Africa by Tanih *et al*. (2010) found an *H. pylori* prevalence of 68.9% among patients with gastrointestinal symptoms. While this prevalence is lower than what we observed in Owerri West, it still highlights a substantial infection rate. The variations could be attributed to differences in local healthcare practices, environmental factors, and population behaviors that affect transmission rates (Goh *et al*., 2011).Globally, the prevalence of *H. pylori* varies significantly by region and population. For example, in developed countries such as the United States, the prevalence is lower. A study

by Zamani *et al*. (2018) indicated a prevalence of around 35%, reflecting better sanitation, healthcare infrastructure, and public health interventions aimed at reducing the transmission of *H. pylori*. In contrast, regions in Asia exhibit higher prevalence rates. A study in China by Zhang *et al*. (2014) reported a prevalence of 66.5%, which, while lower than the findings in this study, still signifies a high infection rate. This variation is often linked to differences in socioeconomic conditions, dietary habits, and the effectiveness of public health measures (Graham *et al*., 2014).The findings in this study also align with those from a meta-analysis by Eusebi *et al*. (2014), which identified factors such as age, socio-economic status, and urbanization as significant determinants of *H. pylori* prevalence. In this study, the high prevalence could be partially attributed to the age distribution of the respondents, with the majority falling within the middle-aged groups, which are typically more exposed to *H. pylori* due to cumulative risk factors over time (Malfertheiner *et al*., 2012).In terms of gender distribution, this study does not show a significant difference in the prevalence of *H. pylori* infection between males and females. This finding is consistent with several studies, including one by Calvet *et al*. (2013), which found no substantial gender disparity in *H. pylori* prevalence. However, some studies, such as the one by Naja *et al*. (2016) in Lebanon, have reported a higher prevalence in males, potentially due to different exposure risks and lifestyle factors. The high prevalence of *H. pylori* in Owerri West Local Government Area emphasizes the need for targeted public health interventions. Improving sanitary conditions, enhancing public awareness about transmission routes, and increasing access to effective diagnostic and treatment services are crucial steps. The findings suggest a strong need for localized health strategies to combat the high burden of *H. pylori* infection (Malfertheiner *et al*., 2017). Additionally, the substantial presence of *H. pylori* infection in this population highlights the importance of effective and widespread use of diagnostic tools. As noted in section 4.3, the availability and accessibility of diagnostic methods like the Urea breath test and Stool antigen test are critical in identifying and managing *H. pylori* infections. Ensuring these diagnostic

methods are readily available can help in early detection and treatment, thereby reducing the prevalence and associated complications of peptic ulcer disease

(Malfertheiner *et al*., 2012).

The adequacy of healthcare infrastructure plays a critical role in the effective management of peptic ulcer disease, particularly those induced by *Helicobacter pylori* infection. This study assessed respondents' perceptions of diagnostic facilities, availability of trained healthcare professionals, and treatment options in Owerri West Local Government Area of Imo State, Nigeria. The results indicate a mixed perception of healthcare infrastructure adequacy, which aligns with findings from other regions and provides a comprehensive view of the challenges and strengths in this context. The data reveals that 61% of respondents considered the available diagnostic facilities to be adequate. This majority suggests that a significant portion of the population has access to necessary diagnostic tools, which is crucial for early detection and also the management behavior of *H. pylori* infections in the population. However, 39% of respondents found these facilities inadequate, indicating room for improvement. The availability of advanced diagnostic methods like the urea breath test, stool antigen test, and endoscopy with biopsy are essential for accurate diagnosis and have been recommended by various studies for their effectiveness (Malfertheiner *et al*., 2017; Chey *et al*., 2017).

Comparatively, studies from other developing regions have shown similar issues with diagnostic facility adequacy. For instance, a study in rural India reported a lack of access to modern diagnostic tools, which significantly hampered the accurate diagnosis and treatment of *H. pylori* infections (Raymond *et al*., 2020). This parallels the 39% of respondents in the current study who reported inadequate diagnostic facilities, highlighting a widespread issue in resource-limited settings.

The availability of trained healthcare professionals was deemed adequate by 68% of respondents, reflecting a relatively positive perception of the expertise and training of healthcare providers. This perception is crucial as the competency of healthcare providers directly influences the quality of care delivered. Training and continuous education in managing

H. pylori-induced peptic ulcer disease are essential to ensure adherence to treatment guidelines and improved patient outcomes (Graham *et al*., 2013).In contrast, 32% of respondents indicated that the availability of trained professionals was inadequate. This finding suggests that despite a majority feeling positive, a substantial portion of the population still experiences deficiencies in healthcare personnel. This aligns with findings from other studies, such as one conducted in Ethiopia, where the shortage of trained healthcare professionals was identified as a significant barrier to effective peptic ulcer disease management (Mekonnen *et al*., 2018).Moreover, a study in Kenya highlighted the importance of ongoing training programs for healthcare providers to keep them updated with the latest diagnostic and treatment protocols. This approach was shown to enhance the adequacy of healthcare infrastructure significantly (Mwangi *et al*., 2019). Therefore, the current study's findings emphasize the need for continuous professional development programs to address the perceived inadequacies. Treatment options for managing peptic ulcer disease were viewed positively by 73% of respondents, indicating general satisfaction with the available treatments. This suggests that the majority of the population has access to effective treatment regimens, which is a crucial aspect of disease management behavior. The effectiveness of standard antibiotic and proton pump inhibitor regimens has been well-documented, with high eradication rates reported in various studies (Malfertheiner *et al*., 2017). However, 27% of respondents found the treatment options inadequate, suggesting gaps in treatment availability or effectiveness. This finding is consistent with other studies from similar settings, where limited access to medications and variability in treatment practices were common issues (Hooi *et al*., 2017). For example, a study in South Africa found that inconsistent availability of antibiotics and proton pump inhibitors significantly impacted the treatment of *H. pylori* infections (Smith *et al*., 2016). Furthermore, the effectiveness of treatment protocols can be compromised by antibiotic resistance, which has been increasing globally. Studies in Nigeria have reported significant rates of resistance to commonly used antibiotics, which may explain the perception of inadequate treatment options among some respondents (Smith *et al*., 2019).

Addressing antibiotic resistance through tailored treatment regimens and promoting adherence to treatment guidelines are essential steps in improving treatment adequacy. The study's evaluation of the effectiveness of current antibiotic and proton pump inhibitor (PPI) regimens in eradicating *Helicobacter pylori* (*H. pylori*) revealed that 78% of patient respondents achieved complete eradication post-treatment. This high eradication rate underscores the efficacy of the standard treatment protocols used in Owerri West Local Government Area. However, 22% of the patients reported persistent infection despite undergoing the standard treatment regimen, indicating that while generally effective, the treatment is not universally successful.

Comparatively, the eradication rates found in this study align with global averages reported in the literature. A systematic review and meta-analysis by Chey *et al*. (2017) reported a global eradication rate of approximately 80% with standard triple therapy, which includes a PPI and two antibiotics, typically clarithromycin and either amoxicillin or metronidazole. This similarity suggests that the treatment protocols in Owerri West Local Government Area are consistent with international standards and generally effective. Despite these positive outcomes, the persistence of infection in 22% of patients indicates a need for further investigation and potential modifications to the treatment approach. This persistent infection rate is slightly higher than what was reported in some regions. For instance, studies in Japan and Europe have documented eradication rates exceeding 85% with tailored therapy regimens, suggesting that localized adaptations of treatment protocols based on antibiotic resistance patterns could enhance effectiveness (Malfertheiner *et al*., 2012; Sugano *et al*., 2015).Antibiotic resistance is a significant factor influencing the success of *H. pylori* eradication efforts. The rising resistance to clarithromycin and metronidazole, in particular, has been well-documented. A study by Graham *et al*. (2016) found that clarithromycin resistance rates in the United States had reached 23.4%, necessitating alternative therapeutic strategies.

The World Health Organization (WHO) has also highlighted the increasing global resistance to key antibiotics used in *H. pylori* treatment (WHO, 2017). These findings suggest that the persistent infection rate observed in Owerri West Local Government Area could be attributed to similar resistance issues. To address antibiotic resistance, quadruple therapy regimens, which add a bismuth compound to the standard triple therapy, have been recommended. These regimens have shown higher eradication rates in regions with significant antibiotic resistance. A study by Fallone *et al*. (2016) demonstrated that bismuth quadruple therapy achieved eradication rates above 90%, even in populations with high clarithromycin resistance. Implementing such regimens in Owerri West Local Government Area could potentially reduce the persistent infection rate and improve overall treatment outcomes. Additionally, patient adherence to the prescribed treatment regimen is crucial for successful eradication. Nonadherence can significantly impact treatment efficacy, as incomplete courses of antibiotics can contribute to the development of resistant *H. pylori* strains. In this study, the role of patient adherence was not explicitly evaluated but is an important factor to consider. Other studies have emphasized the need for patient education and support to enhance adherence (Fischbach & Evans, 2014). The inclusion of probiotics as adjunctive therapy has also been explored to enhance *H. pylori* eradication rates. Probiotics can mitigate the gastrointestinal side effects of antibiotic therapy, thus improving patient adherence and treatment outcomes. A meta-analysis by Szajewska *et al*. (2015) found that probiotics, particularly Lactobacillus and Bifidobacterium strains, significantly improved eradication rates and reduced adverse effects. Incorporating probiotics into the treatment regimen in Owerri West Local Government Area might offer similar benefits and should be considered as a supplementary approach. Furthermore, the duration of therapy plays a critical role in treatment success. Standard triple therapy is typically administered for 7-14 days. Some studies suggest that extending the duration to 14 days can improve eradication rates. For instance, a randomized controlled trial by Gatta*et al*. (2013) reported higher

eradication rates with 14-day therapy compared to 7-day therapy. Evaluating and possibly extending the treatment duration in Owerri West Local

Government Area could be a strategy to enhance eradication rates further.
The study further assessed the practices and protocols of healthcare providers in managing *Helicobacter pylori*-induced peptic ulcer disease, focusing on treatment regimens, patient follow-up, and adherence to guidelines. The findings indicated that 72% of healthcare providers adhere to the standard triple therapy regimen, which includes a proton pump inhibitor

(PPI) and two antibiotics. This is consistent with guidelines recommended by the American College of Gastroenterology (Chey *et al*., 2017), which endorse triple therapy as the first-line treatment for *H. pylori* infection. However, 28% of providers reported using alternative regimens, highlighting variability in clinical practice. This variability could be attributed to local antibiotic resistance patterns, patient allergies, or previous treatment failures, as noted in other studies (Malfertheiner*et al*., 2017; Zhang *et al*., 2015). Patient follow-up practices revealed that 67% of healthcare providers conduct regular follow-ups to monitor treatment progress and manage complications. Regular follow-up is crucial for assessing treatment efficacy and managing any adverse effects, and this rate aligns with findings from a study by Gisbert *et al*. (2010), which emphasized the importance of follow-up in improving treatment outcomes. However, 33% of providers do not conduct regular followups, indicating a gap in optimal patient management behavior and practices.

This gap might be due to resource constraints, high patient load, or lack of adherence to followup protocols (Megraud & Lehours, 2007). Adherence to clinical guidelines was reported by

81% of healthcare providers, reflecting a strong commitment to evidence-based practice. Adherence to guidelines ensures the use of the most effective and up-to-date treatment

protocols, which can lead to better patient outcomes (Malfertheiner *et al*., 2017). Nonetheless, 19% of providers do not adhere to guidelines, which could stem from various factors such as lack of awareness, skepticism about guidelines, or external pressures from the healthcare system (Chey*et al*., 2017). A comparison with other literature reveals that adherence to guidelines and follow-up practices is variable across different regions. For instance, a study in Europe found that adherence to *H. pylori* treatment guidelines varied significantly, with some countries reporting adherence rates as low as 50% (Malfertheiner *et al*., 2017). In contrast, a study in Japan reported adherence rates exceeding 90%, attributed to stringent national guidelines and continuous professional education (Kobayashi *et al*., 2011). This disparity underscores the need for tailored interventions to improve adherence to treatment protocols in different healthcare settings. The prevalence and management behavior of *Helicobacter pylori* infection among individuals diagnosed with peptic ulcer disease was found to be 82.5%, indicating a significant prevalence of the infection within the study population. This high prevalence is consistent with global data, which shows that *H. pylori* infection is highly prevalent in regions with lower socioeconomic status and limited access to healthcare (Hooi *et al*., 2017). For instance, a study in Brazil reported an *H. pylori* prevalence of 70-90% among patients with peptic ulcer disease, highlighting the infection's widespread nature in developing countries (Ogata *et al*., 2019). *Helicobacter pylori* was evaluated, with 78% of patients achieving complete eradication. This eradication rate aligns with results from other studies, such as the meta-analysis by Graham *et al*. (2007), which reported an average eradication rate of 70-85% for standard triple therapy. However, the 22% of patients who reported persistent infection despite treatment suggests potential issues such as antibiotic resistance, patient noncompliance, or variations in bacterial strain virulence (Suzuki *et al*., 2009). The study's findings on the availability and accessibility of diagnostic methods revealed that diagnostic tools are generally available and accessible in Owerri West Local Government Area, with combined availability and accessibility scores significantly higher than 50%. The Urea breath

test, Stool antigen test, and Blood antibody test showed high availability and accessibility, supporting their use in clinical practice (Chey *et al*., 2017).

Endoscopy with biopsy, despite its lower availability, was noted for its high effectiveness, particularly in complex cases. These findings are corroborated by other studies that emphasize the importance of having multiple diagnostic options to ensure accurate detection and management of *H. pylori* infection (Malfertheiner*et al*., 2017). The perception of healthcare infrastructure in Owerri West Local Government Area, including diagnostic facilities, trained healthcare professionals, and treatment options, is predominantly positive. This suggests that the healthcare system is relatively well-equipped to manage peptic ulcer disease. However, the fact that 39% of respondents view diagnostic facilities as inadequate highlights areas in need of improvement. This finding aligns with other studies from developing regions, where healthcare infrastructure often faces challenges such as equipment shortages and insufficient trained personnel (Hooi et al., 2017).Awareness of peptic ulcers among patients is notably high, with 90.7% reporting awareness. This high level of awareness is consistent with studies such as Ndububa et al. (2001), which also reported high patient awareness in Nigeria. Similarly, 87.5% of patients recognize Helicobacter pylori's role in causing peptic ulcers. This figure is comparable to the study by Megraud and Lehours (2007), which noted increasing public awareness of H. pylori due to enhanced public health education efforts.

Endoscopy is the predominant diagnostic method for peptic ulcers, utilized by 60.1% of patients diagnosed with the condition. This preference aligns with Goh et al. (2011), which emphasized endoscopy as the gold standard for peptic ulcer diagnosis due to its high accuracy and ability to detect complications. Lower utilization rates for stool tests (3.0%) and urea breath tests (6.5%) may be attributed to their limited availability and higher costs, as discussed by Graham

et al. (2006). Currently, 83.9% of patients are receiving treatment for their peptic ulcers. The predominant forms of treatment include proton pump inhibitors (84.4%) and antibiotics (77.8%). These treatment patterns align with recommended management protocols for H. pylori eradication, as highlighted by Malfertheiner et al. (2012). Dietary changes are also widely reported (56.7%), indicating awareness of the importance of lifestyle modifications in managing peptic ulcers, a sentiment echoed by Chey and Wong (2007). The use of herbal remedies (11.9%) suggests a reliance on traditional medicine, which is common in many parts of Nigeria, as observed by Esimone et al. (2005).

Regular visits to healthcare facilities (at least once a month) are reported by 36.2% of patients. This regularity is crucial for effective disease management, as continuous monitoring helps in early detection and management of complications, as indicated by Ford et al. (2008). Satisfaction with healthcare services is generally positive, with 38.1% of patients very satisfied and 33.2% satisfied. This high satisfaction rate reflects the perceived quality of care, which is essential for patient adherence to treatment regimens, as supported by studies like Melese et al. (2016). Financial constraints are the most common challenge reported by patients (44.4%), followed by lack of access to healthcare facilities (34.0%). These barriers are consistent with the findings of Tanih et al. (2010), who highlighted similar challenges in accessing healthcare services in resource-limited settings. Lack of awareness about treatment options (13.4%) and side effects of medications (6.0%) further complicate effective disease management, as discussed in the study by Hunt et al. (2010). In terms of managing their condition, 25.4% of patients are very confident, and 34.0% are confident. This confidence is crucial for patient adherence to treatment and lifestyle modifications. A study by Lee et al. (2013) highlighted that patient confidence significantly impacts treatment outcomes. The belief in the possibility of a complete cure for peptic ulcers is held by 65.7% of patients. This optimism is vital for

maintaining patient motivation and adherence to treatment, as suggested by Lambert et al. (2007). A majority of patients view following medical advice as very important (64.2%) or important (23.9%). This underscores the critical role of healthcare providers in patient education and adherence to treatment protocols, as emphasized by Marshall and Warren (2006). To enhance their management of peptic ulcers, patients expressed a need for more information on diet and lifestyle changes (43.6%), better access to healthcare facilities (31.3%), and financial assistance (16.8%). These needs align with the findings of Ndububa et al. (2001), who identified similar patient needs in their study. The high awareness and knowledge levels about peptic ulcers and H. pylori in this study are encouraging and suggest effective public health education efforts. However, the reliance on endoscopy for diagnosis, while consistent with international standards (Goh et al., 2011), indicates potential gaps in the availability and utilization of other diagnostic methods like the stool antigen test and urea breath test, which are also recommended (Graham et al., 2006).

The treatment patterns observed, with a high use of proton pump inhibitors and antibiotics, align with global recommendations (Malfertheiner et al., 2012). However, the significant use of herbal remedies indicates a cultural reliance on traditional medicine, which may affect treatment adherence and outcomes (Esimone et al., 2005). The challenges related to financial constraints and access to healthcare facilities are consistent with other studies in resourcelimited settings (Tanih et al., 2010). These barriers highlight the need for improved healthcare infrastructure and financial support mechanisms to enhance patient access to care and adherence to treatment. The overall positive perception of healthcare services and the high level of patient confidence in managing their condition are promising. These factors are crucial for effective disease management and improving treatment outcomes, as highlighted by Ford et al. (2008) and Lee et al. (2013). The practices and protocols of healthcare providers in managing *Helicobacter pylori*-induced peptic ulcer disease were evaluated, focusing on treatment regimens, patient follow-up, and adherence to guidelines. The high level of adherence to recommended treatment protocols (72% using standard triple therapy) and clinical guidelines (81% adherence) demonstrates a commitment to evidence-based practice. However, the 28% of providers using alternative regimens and the 33% not conducting regular follow-ups indicate areas for potential improvement. These findings are in line with literature emphasizing the need for continuous medical education and guideline dissemination to ensure consistent and effective patient care (Chey *et al*., 2017; Malfertheiner *et al*., 2017). A comparative analysis with other literature highlights the variability in guideline adherence and treatment practices across different regions. For example, a study in the United States reported similar adherence rates to guidelines but noted significant regional differences in treatment regimens due to varying antibiotic resistance patterns (Graham *et al*., 2007). In contrast, studies in Asia and Europe have

reported higher adherence rates to national guidelines, suggesting that regional healthcare policies and educational initiatives play a crucial role in standardizing treatment practices (Kobayashi *et al*., 2011; Malfertheiner *et al*., 2017).

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

This study provides a detailed examination of the demographic characteristics, prevalence of *Helicobacter pylori* infection, healthcare infrastructure, and treatment practices for peptic ulcer disease in Owerri West Local Government Area, Imo State, Nigeria. The demographic analysis reveals a diverse population with a significant proportion of respondents falling within the 3140 years age group and a slight majority of female respondents. The composition of healthcare providers, predominantly nurses, reflects the critical role of nursing professionals in patient management. The prevalence of *H. pylori* infection among patients with peptic ulcer disease in this study is remarkably high at 82.5%, surpassing both global and continental averages. This high prevalence is consistent with other studies conducted in similar settings, underscoring the pervasive nature of *H. pylori* infection in Nigeria. The study's findings align with global literature, indicating that socio-economic factors, sanitary conditions, and healthcare access significantly influence *H. pylori* prevalence. The effectiveness of current treatment regimens, including standard triple therapy, is demonstrated by a 78% eradication rate of *H. pylori* infection among patients. However, the 22% persistent infection rate highlights challenges such as antibiotic resistance and patient adherence to treatment protocols. This study's findings are consistent with global trends, emphasizing the need for ongoing evaluation and adaptation of treatment strategies to address antibiotic resistance and improve patient outcomes. Healthcare infrastructure adequacy, particularly diagnostic facilities and trained healthcare professionals, is perceived positively by a majority of respondents. Nonetheless, a substantial proportion of the population reports inadequacies, indicating areas for improvement. The availability of advanced diagnostic methods like the urea breath test and stool antigen test is crucial for accurate diagnosis and effective management of *H. pylori* infections. The study's assessment of

healthcare providers' practices reveals a strong adherence to clinical guidelines and standard treatment protocols, though variability in treatment regimens and follow-up practices persists. This variability underscores the need for continuous medical education and guideline dissemination to ensure consistent and effective patient care. Comparative analysis with other studies highlights regional differences in healthcare infrastructure, treatment practices, and guideline adherence. While the findings in this study are generally positive, they also point to significant areas needing attention, such as improving diagnostic facility adequacy and ensuring consistent follow-up practices. The study underscores the importance of localized health strategies to combat the high burden of *H. pylori* infection and also improving the management behavior of peptic ulcer disease.

5.2 Recommendation

Based on the findings of this study, several recommendations can be made to improve the management behavior of *Helicobacter pylori*-induced peptic ulcer disease in Owerri West Local Government Area, Imo State, Nigeria.

First, public health interventions should focus on improving sanitary conditions and public awareness about *H. pylori* transmission routes. Enhanced community education programs can play a vital role in reducing infection rates and promoting early healthcare-seeking behavior.

Secondly, healthcare infrastructure, particularly diagnostic facilities, requires significant investment to ensure the availability and accessibility of advanced diagnostic tools like the urea breath test and stool antigen test. These tools are essential for accurate detection and timely management of *H. pylori* infections. Also, addressing the issue of antibiotic resistance is crucial.

Implementing tailored treatment regimens based on local resistance patterns, such as bismuth quadruple therapy, can enhance eradication rates. Additionally, promoting adherence to treatment protocols through patient education and support can mitigate the impact of antibiotic resistance and improve treatment outcomes.

Similarly, continuous professional development programs for healthcare providers are essential to keep them updated with the latest diagnostic and treatment protocols. These programs should emphasize the importance of guideline adherence and regular patient follow-up to ensure effective and positive management behavior in the population. Incorporating probiotics into treatment regimens can improve patient adherence by reducing the gastrointestinal side effects of antibiotic therapy. Probiotics, particularly Lactobacillus and Bifid bacterium strains, have been shown to enhance eradication rates and should be considered as a supplementary approach. Also, extending the duration of therapy from 7 to 14 days can improve eradication rates. Evaluating and potentially implementing longer treatment durations in Owerri West Local Government Area could further enhance treatment success.

Finally, ongoing research and monitoring of local resistance patterns are essential to inform treatment strategies and optimize *H. pylori* eradication efforts. Collaborative efforts between healthcare providers, policymakers, and researchers are needed to develop and implement effective localized health strategies. These efforts should aim to reduce the prevalence of *H. pylori* infection and improve the overall management behavior of peptic ulcer disease in Owerri West Local Government Area and similar settings.

5.3 Contribution to knowledge

The findings contribute to the knowledge as follows: The study finds a prevalence rate of 82.5% of *H. pylori* infection among those who had been diagnosed with peptic ulcers. This would indicate a high contribution by *H. pylori* to the local burden of peptic ulcer disease and thus the importance of targeted public health interventions to address this pathogen in the region.

Demographic information for patients and healthcare professionals provides important understandings of the population affected by peptic ulcers and those managing the disease. The respondents' age, gender, profession, and levels of experience set a context in which healthcare strategies and education on PUD and *H. pylori* infection can be tailored to their needs.
In the current study, the availability, accessibility, and effectiveness of various diagnostic tools for the infection of *H. pylori* have been identified, the most available and accessible method being the Urea breath test, while the least available, endoscopy with biopsy, is reported as the most effective diagnostic tool. This comparative analysis of diagnostic tools provides an insight into how health care policymakers and practitioners might optimize the diagnostic protocols of peptic ulcers in resource-limited settings.

This study shows some lack in diagnostic facilities, trained health professionals, and the availability of treatment options through assessing adequate healthcare infrastructure for managing PUD. In fact, these findings will lead to strategy development on improving health services regarding resource allocations and professional training to support the management of PUD and *H. pylori*.

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APPENDIX

Location/ communities of Study

Owerri West	Avu/Umuguma	460106	Obokwu; Ogubuosisi; Umuadu; Umuehieta; Umunkwo; Umunwanyi; Umuobia; Umuome
Owerri West	Ihiagwa	460114	Ibuzor; Iriamugo; Mbokwe; Nkaramuche; Umuchima; Umuehum; Umuezeanula; Umuokwo
Owerri West	Nekede	460113	Umualum; Umudibia; Umuoma
Owerri West	Obinze	460115	32 Artillery Bgd; Umuagam; Umuanunu; Umuebo-Obokwu; Umuezereoche; Umunenje; Umuokuru
Owerri West	Oforola	460117	Amaku; Amaoji; Oboagwu; Umuadu; Umuagubiam; Umueke; Umuezuko; Umuimeka; Umuogide
Owerri West	Okolochi/Eziobodo	460116	Emeabiam; Eziobodo; Okolochi

Owerri West	Okuku (Obogwu)	460107	Mgbolo; Obogwu; Uborji; Umuapu
Owerri West	Umunwoha	460102	Amakoha-Ubi; Irete; Ndegwu; Ohii; Orogwu

To achieve**: Availability, Accessibility, and Effectiveness of Diagnostic Methods for**

Detecting H. pylori, data was collected from the 171 healthcare providers surveyed in Owerri West LGA. The table evaluates three aspects for each diagnostic method: availability, accessibility, and effectiveness.

Data Collection

1. **Questionnaire Design**: A questionnaire was designed to collect data from healthcare providers regarding the availability, accessibility, and effectiveness of various diagnostic methods for detecting H. pylori infection.

2. **Survey Distribution**: The questionnaire was distributed to healthcare providers (n=171) in the Owerri West LGA.
3. **Data Points**:
    - **Availability**: Whether the diagnostic method is available at the healthcare facility.
    - **Accessibility**: Whether patients have easy access to the diagnostic method.
    - **Effectiveness**: The perceived effectiveness of the diagnostic method in detecting H. pylori.

Questions

- **Availability**: "Is the following diagnostic method available in your facility? (Blood test (serology), Urea breath test, Stool antigen test, Endoscopy with biopsy)" ○ Response Options: Yes / No

- **Accessibility**: "Do your patients have easy access to the following diagnostic method? (Blood test (serology), Urea breath test, Stool antigen test, Endoscopy with biopsy)" ○ Response Options: Yes / No
- **Effectiveness**: "How effective do you find the following diagnostic method in detecting H. pylori? (Blood test (serology), Urea breath test, Stool antigen test, Endoscopy with biopsy)" ○ Response Options: Very Effective / Effective / Neutral / Ineffective / Very Ineffective

Calculation

- **Blood Test (Serology)**:
  - **Availability**: 120 providers reported availability.
    - 120/171×100=70.2%\frac{120}{171} \times 100 = 70.2\%171120 ×100=70.2%
  - **Accessibility**: 110 providers reported accessibility.
    - 110171×100=64.3%\frac{110}{171} \times 100 = 64.3\%171110 ×100=64.3%
  - **Effectiveness**: 100 providers reported effectiveness.
    - 100171×100=58.5%\frac{100}{171} \times 100 = 58.5\%171100 ×100=58.5%

QUESTIONNAIRE

Questionnaire on the Management Behavior of Peptic Ulcers Due to *Helicobacter pylori*

Among Individuals in Owerri West Local Government Area, Imo State, Nigeria

Section A: Demographic Information

1. *Age:*

   ○ 18-25 years ○ 26-35 years ○ 36-45 years ○ 46-55 years ○ 56 years and above

2. *Gender:* ○ Male ○ Female

3. *Marital Status:* ○ Single ○ Married ○ Divorced ○ Widowed

4. *Educational Level:* ○ No formal education ○ Primary education ○ Secondary education ○ Tertiary education

5. *Occupation:* ○ Student ○ Employed ○ Selfemployed

○ ○

Unemployed

Retired

Section B: Awareness and Knowledge of Peptic Ulcers

6. Have you ever heard of peptic ulcers?

   ○ Yes ○

   No

7. If yes, what are the common symptoms you are aware of? (Select all that apply) ○

   Burning stomach pain ○ Bloating ○ Heartburn ○ Nausea ○

   Vomiting

8. Are you aware that Helicobacter pylori can cause peptic ulcers?

   ○ Yes ○

   No

9. How did you learn about Helicobacter pylori and peptic ulcers? (Select all that apply)

   ○ Healthcare professional ○ Friends/Family ○ Internet ○ Television/Radio ○ Books/Magazines

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Section C: Diagnosis and Medical History

10. Have you ever been diagnosed with a peptic ulcer?

    ○ Yes ○

    N

    ○

○ ○

11. If yes, how was it diagnosed?

- ○ Endoscop
  y
  Blood test
  Stool test ○ Urea breath test
- ○ Other (please specify):

  _____

12. Have you been tested for Helicobacter pylori?

- ○ Yes ○
  N
- ○

13. If yes, what was the result?

- ○ Positive ○
  N
  egative

14. Do you have any other medical conditions? (Select all that apply) ○ Diabetes ○
    Hypertension ○ Asthma

- ○ Heart disease ○
  N
  one
- ○ Other

  (please specify):

  _____

Section D: Management and Treatment

- ○

○ ○

15. Are you currently receiving treatment for a peptic ulcer?

○ Yes ○ No

16. If yes, what type of treatment are you receiving? (Select all that apply) ○ Antibiotics

○ Proto n pump inhibitors (PPIs)

○ H2-receptor antagonists ○ Antacids ○ Dietary changes

○ Herbal remedies

○ Other (please specify): _____

17. How often do you take your prescribed medication?

Always
Sometimes

Rarely ○ Never

○

○ ○

18. Have you made any lifestyle changes to manage your peptic ulcer? (Select all that apply) ○ Avoiding spicy foods ○ Reducing alcohol consumption ○ Quitting smoking ○ Managing stress ○ Eating smaller, frequent meals ○ Other (please specify): _____

Section E: Healthcare Access and Support

19. How often do you visit a healthcare facility for your peptic ulcer management?

○ Regularly (at least once a month) ○ Occasionally (once every few months) ○ Rarely (once a year or less) ○ Never

20. How satisfied are you with the healthcare services you receive for peptic ulcer management? ○ Very satisfied ○ Satisfied ○ Neutral ○ Dissatisfied ○ Very dissatisfied

21. Do you have access to health insurance?

○ Yes ○ No

22. If yes, does your health insurance cover peptic ulcer treatment?

○

○ ○

- Yes ○
  No
  Not sure

○

23. What challenges do you face in managing your peptic ulcer? (Select all that apply) ○

Financial constraints ○ Lack of access to healthcare facilities ○

Lack of awareness about treatment options ○ Side effects of medications ○ Difficulty adhering to lifestyle changes ○ Other (please specify): _____

Section F: Attitudes and Perceptions

24. How confident are you in managing your peptic ulcer?

○ Very confident ○

Confident ○

Neutral ○

Not confident ○

Very unconfident

25. Do you believe that peptic ulcers can be completely cured?

○ Yes ○ No ○

Not sure

26. In your opinion, how important is it to follow medical advice for peptic ulcer management? ○ Very important ○ Important ○ Neutral ○ Not important ○ Very unimportant

27. What additional support or information would help you better manage your peptic ulcer? (Select all that apply) ○ More information on diet and lifestyle changes ○ Better access to healthcare facilities ○ Financial assistance

Support groups

○ More effective medications ○

Other

(please specify):

_____

Section G: Suggestions and Recommendations

28. What recommendations do you have for improving peptic ulcer management in your community? _____

29. Any additional comments or suggestions?

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