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Awareness and Knowledge of Gastrointestinal Diseases and Their Prevention Among Adults in Abia State, Nigeria: A Cross-Sectional Study

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Abstract

Background: Gastrointestinal (GI) diseases remain a significant cause of morbidity in tropical regions, yet community-level knowledge and awareness are poorly documented in Nigeria. This study assessed awareness, knowledge, and perceived barriers related to GI diseases and their prevention in Abia State, Nigeria.

Methods: A community-based cross-sectional study was conducted from December 2024 to February 2025, involving 320 participants selected through multistage and systematic random sampling across the three senatorial zones of Abia State. A structured, pilot-tested questionnaire was used to collect data on sociodemographic characteristics, knowledge of GI diseases, preventive practices, and perceived barriers. Data were collected in person, uploaded to Google Forms, and analyzed using SPSS version 27.0 (IBM Corp., Armonk, NY). We used descriptive statistics and chi-square tests, with statistical significance set at $P < 0.05$.

Results: Most respondents were female (192, 60.0%) and aged 18-29 years (175, 54.5%). While 192 (60%) were aware of common causes of GI diseases, only 135 (42.2%) reported knowledge of preventive hygiene and dietary practices, and 113 (35.3%) could not identify common symptoms. Cultural or traditional beliefs influenced disease perception in 198 (61.9%) of participants. The most frequently mentioned conditions were diarrhoea (79.1%), peptic ulcer disease (60.9%), and gastritis (26.6%), while 28 (8.7%) could not name any GI condition. Only 63 (19.7%) had participated in any GI health education program, and 83 (25.9%) reported receiving formal training. Major barriers included financial constraints (206, 65%), limited healthcare facilities (140, 44.2%), lack of health insurance (134, 42.3%), and poor knowledge of sanitation (199, 62.4%). Multivariate analysis identified educational attainment and occupation as the strongest predictors of awareness. Associations with age, gender, and place of residence lost significance after adjustment.

Conclusions: This study highlights significant knowledge gaps, cultural misconceptions, and systemic barriers to GI health awareness in Abia State, Nigeria. Targeted health education programs, strengthened water, sanitation, and hygiene (WASH) initiatives, and expanded access to affordable healthcare are urgently needed to improve the prevention and control of GI diseases in tropical settings.

Categories: Epidemiology/Public Health, Internal Medicine, Gastroenterology
Keywords: awareness, gi diseases, knowledge, prevention, wash

Introduction

Gastrointestinal (GI) diseases pose a significant public health burden worldwide, affecting millions of individuals and causing widespread morbidity and mortality [1,2]. In tropical regions, the impact is particularly severe, not only on individual health but also on social and economic development [3,4]. GI diseases encompass a broad spectrum of conditions that affect the digestive system, including infectious diseases, inflammatory and functional disorders, and GI cancers [3,5].

Common GI diseases in tropical regions include diarrheal illnesses, hepatitis, peptic ulcer disease, gastritis, intestinal obstruction, and malabsorption syndromes due to parasitic infections such as giardiasis, strongyloidiasis, and tropical sprue [3]. Helminths, including nematodes, flukes, and tapeworms, remain important causative agents in many endemic communities [6,7]. Clinical manifestations typically include diarrhea, abdominal pain, GI bleeding, malabsorption, and weight loss [4].

The burden of GI diseases extends beyond individual health outcomes. They impose substantial costs on

healthcare systems and contribute to reduced productivity and diminished quality of life [2]. In tropical and subtropical regions, high prevalence rates are strongly associated with environmental and socioeconomic conditions such as inadequate sanitation, unsafe water supplies, poverty, and limited access to healthcare services [8]. Estimating the true burden of these conditions remains challenging, as reliable data are often limited by underreporting, insufficient surveillance systems, and weak health information infrastructure in many low- and middle-income countries (LMICs) [8].

Improving the prevention and control of GI diseases requires not only medical interventions but also adequate community knowledge and awareness. Public awareness of risk factors, modes of transmission, early recognition of symptoms, and preventive strategies such as safe water, sanitation, hygiene, and vaccination plays a pivotal role in reducing disease burden [4].

Despite the well-documented burden of GI diseases in tropical regions, limited research has been conducted in Nigeria assessing population-level awareness and knowledge of these conditions and their preventive measures. Recent studies have also highlighted deficiencies in diagnostic capacity, with a national survey showing limited endoscopy services and recommending targeted awareness campaigns to strengthen prevention and early detection [9]. Evaluating population-level awareness and knowledge is therefore critical for identifying gaps, understanding cultural and behavioral influences, and designing effective interventions tailored to local contexts.

This study therefore aims to assess awareness and knowledge of common GI diseases and their preventive measures in Abia State, Nigeria. Findings from this study will inform public health strategies and community education initiatives targeted at reducing the burden of GI diseases in tropical populations. This study is among the first community-based, multizone assessments in southeastern Nigeria.

Materials And Methods

Study design

This community-based cross-sectional study was conducted to assess the awareness and knowledge of a tropical population about common GI diseases and their preventive measures. The guidelines for Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) were followed in conducting and reporting the findings of this study [10].

Study area

The study was conducted in Abia State, a tropical region in southeastern Nigeria, with a population engaged primarily in commerce, agriculture, and small-scale enterprise.

Study setting

The study was conducted in the three senatorial zones in Abia State between December 2024 and February 2025. The three zones include Abia North, Abia South, and Abia Central.

Study participants and eligibility criteria

Eligible participants were adults aged 18-65 years, drawn from diverse socioeconomic groups, including students, healthcare professionals, artisans, entrepreneurs, and farmers.

Inclusion criteria

The study included adults aged 18-65 years who provided informed consent.

Exclusion criteria

Individuals who declined consent or were unable to complete the questionnaire were excluded.

Sample size determination

The minimum sample size was estimated using Cochran's formula for a single proportion, expressed as:

$$n = \frac{Z^2 \cdot p(1-p)}{d^2},$$

where n represents the required sample size, Z is the standard normal deviate corresponding to the selected confidence level, p is the expected proportion, and d is the margin of error [11].

In the absence of reliable prior prevalence estimates for GI disease awareness in the study population, p was set at 0.5 to yield the maximum sample size and ensure adequate precision. Using a 95% confidence level (Z

= 1.96) and a margin of error of 5% (d = 0.05), the sample size was calculated as follows: $n = (1.96^2 \times 0.5(1 - 0.5)) / 0.05^2 = (3.842 \times 0.25)/0.0025 = 0.9605/0.0025 = 384.2 \approx 384$.

The minimum sample size was calculated to be 384 participants; however, due to logistical and time constraints during the multistage sampling process across the three senatorial zones, a final sample size of 320 participants was achieved.

Sampling technique

A multistage sampling technique was employed. First, the study area was stratified into the three senatorial zones of Abia State: Abia North, Abia South, and Abia Central. Subsequently, two local government areas (LGAs) were selected within each zone: Isuikwuato and Arochukwu in Abia North, Osisioma and Aba North in Abia Central, and Umuahia North and Ikwuano in Abia South. Simple random sampling was then conducted within each LGA to obtain the final sample of 320 participants.

Data collection instrument

The questionnaire was developed after an extensive review of relevant literature and consultation with subject experts (Appendices A-B) [12,13-15]. To ensure content validity, the draft tool was reviewed independently by survey research specialists, and a pilot study was carried out among a small group of participants outside the main study sample to establish face validity. Responses from the pilot were excluded from the main analysis. Cronbach's alpha was used to assess the internal consistency of each section of the questionnaire. The first section captured sociodemographic information such as age, sex, place of residence, occupation, and educational status and had a Cronbach's alpha of 0.74. The second section assessed participants' knowledge of GI diseases, including their awareness and understanding of common conditions, symptoms, and preventive measures, with a Cronbach's alpha of 0.77. The third section examined perceived challenges to acquiring knowledge about GI diseases, as well as suggestions for improving awareness, and had a Cronbach's alpha of 0.75.

Definitions

GI diseases are defined as a broad spectrum of conditions that affect the digestive system, including infectious diseases, inflammatory and functional disorders, and cancers [3,5].

Assessment of knowledge

The level of knowledge about GI diseases was assessed by evaluating participants' responses to items relating to awareness of the causes of GI diseases, ability to identify common symptoms, familiarity with preventive hygiene and dietary practices, and formal education or training on GI diseases. Each correct or appropriate response was assigned a score of 1, while incorrect or absent responses were scored 0. Those who scored 1 out of 4 were categorized as having *poor* knowledge, 2 out of 4 as having *average* knowledge, and 3 or 4 out of 4 as having *good* knowledge (i.e., above average).

Data preparation and analysis

The completed questionnaires were uploaded to Google Forms and subsequently downloaded into a Google spreadsheet before being imported into IBM SPSS Statistics for Windows, version 27.0 (IBM Corp., Armonk, NY), for data analysis. Categorical variables were summarized using frequencies and percentages. Barriers and gaps in knowledge were analyzed descriptively, with proportions calculated for each reported challenge (e.g., financial constraints, limited facilities, and cultural beliefs). Similarly, recommendations suggested by respondents to improve GI awareness were presented as frequencies and percentages. Associations between sociodemographic characteristics (age, gender, occupation, residence, and education) and awareness of GI diseases were assessed using chi-square tests. Multivariate logistic regression was performed to adjust for potential confounding variables and identify independent predictors of awareness. Variables included in the multivariable logistic regression model were selected a priori based on their epidemiological relevance and availability in the study dataset. These included age, gender, place of residence, occupation, and educational level. Statistical significance was set at $P < 0.05$. Age, gender, place of residence, occupation, and educational level were included in the multivariable logistic regression model based on their relevance to the study objectives and their potential association with awareness. Region was not included because place of residence (urban, semi-urban, or rural) was considered a more informative measure of respondents' residential context, whereas region represented broad geographical location. Familiarity with GI diseases was also not included as a sociodemographic predictor because educational level was considered a more appropriate measure of respondents' educational background.

Ethical consideration

Participants were fully informed about the study's purpose, procedures, and their rights, including the right to withdraw at any time without any consequences. Informed consent was obtained electronically, ensuring that participants were aware of how their data would be used and protected. Ethical approval for the study was obtained from the Ethics Committee for Public Health Research, Department of Public Health and

Disease Control, Abia State Ministry of Health, Umuahia, Nigeria, with approval number ASMH/EC/24/022 on November 25, 2024. Personal identifiers such as names, addresses, or any other identifying information were not collected during the study. Participants were assigned numbers to ensure anonymity.

Results

A total of 320 individuals participated in the study. Table *1* presents the sociodemographic characteristics of the respondents. The majority of the respondents (175, 54.5%) were between 18 and 29 years of age, followed by 62 respondents (19.3%) aged 30-39 years, 48 respondents (15.0%) aged 40-49 years, 33 respondents (10.3%) aged 50-59 years, and 2 respondents (0.6%) aged 60 years and older. Regarding gender, 192 respondents (60.0%) were female, while 128 respondents (40.0%) were male. With respect to the regions within Abia State, most respondents were from Abia Central (136, 42.5%), followed by Abia South (98, 30.6%) and Abia North (86, 26.9%). Concerning their place of residence, most respondents lived in urban areas (161, 50.2%), followed by those in suburban (93, 29.0%) and rural areas (66, 20.6%). In terms of occupation, the largest group comprised students (132, 41.1%), followed by entrepreneurs (77, 24.0%), artisans (43, 13.4%), health professionals (35, 10.9%), and civil servants (33, 10.3%). In terms of educational attainment, 213 respondents (66.4%) had a university-level education, 76 (23.7%) had completed secondary school, 22 (6.9%) had attained postgraduate degrees, and 9 (2.8%) had only an elementary school education.

Variable	Category	Frequency (*n*)	Percentage (%)
Age group (years)	18-29	175	54.6
	30-39	62	19.3
	40-49	48	15.0
	50-59	33	10.3
	≥60	2	0.6
Sex	Female	192	60.0
	Male	128	40.0
Region	Abia Central	136	42.5
	Abia South	98	30.6
	Abia North	86	26.9
Place of residence	Urban	161	50.3
	Suburban	93	29.0
	Rural	66	20.6
Occupation	Student	132	41.3
	Entrepreneur	77	24.0
	Artisan	43	13.4
	Health professional	35	10.9
	Civil servant	33	10.3
Education level	University	213	66.5
	Secondary	76	23.7
	Postgraduate	22	6.9
	Elementary	9	2.8

TABLE 1: Sociodemographic characteristics of respondents.

From Figure *1*, of the 320 participants assessed, four questions were used to assess their knowledge of GI diseases and their preventive measures. Knowledge was assessed based on the participants' ability to identify common symptoms of GI diseases, awareness of their common causes, knowledge of recommended dietary and hygiene practices for prevention, and previous formal education or training on GI diseases.

Based on the number of questions to which participants responded *Yes*, 135 (42.2%) demonstrated good knowledge, having responded *Yes* to three or four questions, while 59 (18.4%) exhibited average knowledge, having responded *Yes* to two questions. In contrast, 126 (39.4%) had poor knowledge, having responded *Yes* to one or none of the questions.

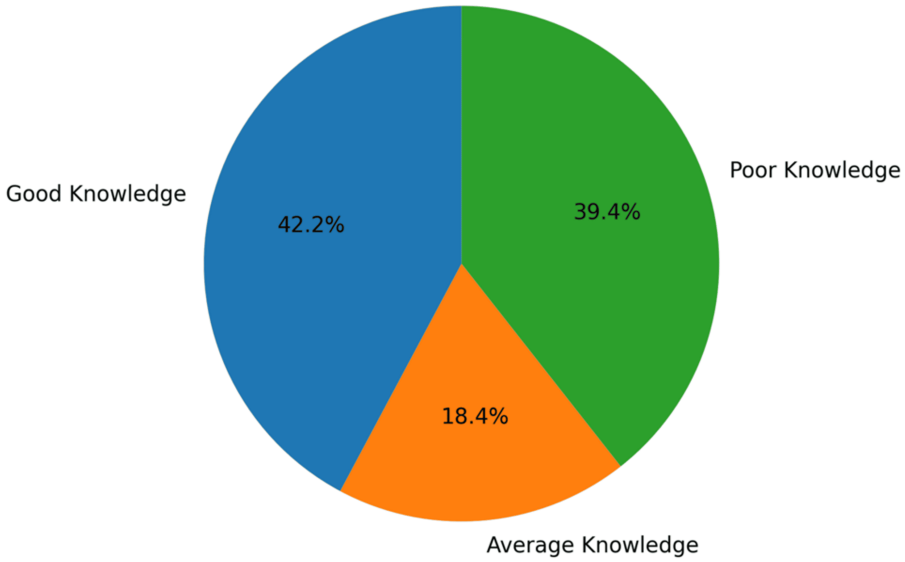


FIGURE 1: Distribution of knowledge levels among respondents.

From Table 2, overall awareness of GI diseases varied among respondents. A total of 192 (60.0%) reported being aware of common GI causes, and 207 (64.7%) could identify common symptoms, while 113 (35.3%) could not identify common GI symptoms. Knowledge of recommended prevention practices was reported by 135 (42.2%) respondents. In addition, 198 (61.9%) believed that cultural factors influence GI disease management. Regarding familiarity with preventive measures, 87 (27.2%) reported high familiarity with GI disease prevention, whereas 39 (12.2%) indicated moderate familiarity and 194 (60.6%) reported low familiarity. Only 63 (19.7%) respondents reported the existence of community-based GI education programs, and 83 (25.9%) had received formal training on GI diseases.

Category	Subcategory	Frequency (*n*)	Percentage (%)
Awareness and knowledge (*N* = 320)	Aware of common GI causes	192	60.0
	Know recommended prevention practices	135	42.2
	Identify common symptoms	207	64.7
	Believe culture affects management	198	61.9
	High familiarity (Rated 8-10)	87	27.2
	Moderate familiarity (Rated 4-7)	39	12.2
	Low familiarity	194	60.6
	Community education programs exist	63	19.7
	Formal training on GI diseases	83	25.9
Communication (*N* = 320)	Rarely discuss GI health	137	42.7
	Occasionally	85	26.5
	Never	71	22.1
	Frequently	27	8.4
	Info source: Healthcare professionals	178	55.5
	Info source: Internet	109	34.0

	Info source: Traditional knowledge	26	8.1
	Info source: Other	7	2.2
Knowledge of common GI diseases (*N* = 320)	1-2 diseases known	201	62.6
	3-5 diseases known	76	23.7
	More than 5 diseases	15	4.7
	None	28	8.7
Diseases as mentioned (*N* = 320)	Diarrhea	253	79.1
	Peptic ulcer disease	195	60.9
	Gastritis	85	26.6
	Hemorrhoids	64	20.0
	Gastroenteritis	56	17.5
	Irritable bowel syndrome	38	11.9
	Gastroesophageal reflux disease	24	7.5
	Hiatal hernia	19	5.9
	Dyspepsia	16	5.0
	Diverticulosis	11	3.4
	Cholera	10	3.1
	Typhoid	3	0.9
	Gallstone	1	0.3
	Pancreatitis	1	0.3
	Vibriosis	1	0.3
	Salmonellosis	1	0.3
Factors affecting knowledge (*N* = 320)	Lack of healthcare access	172	54.1
	Limited health education programs	157	49.4
	Socioeconomic constraints	113	35.5
	Lack of formal education	94	29.6
	Cultural beliefs and practices	72	22.6

TABLE 2: Awareness and knowledge of GI disease.

Note: Respondents were allowed to select more than one response; therefore, percentages may exceed 100%.

GI, gastrointestinal

Communication about GI health was generally infrequent. A total of 137 (42.7%) respondents reported rarely discussing GI health issues, while 71 (22.1%) reported never discussing them. Occasional discussions were reported by 85 (26.5%), and only 27 (8.4%) reported frequent discussions. Healthcare professionals were the most common source of information, cited by 178 (55.5%) respondents, followed by the internet (109, 34.0%). Traditional knowledge and other sources were less commonly reported, at 26 (8.1%) and 7 (2.2%), respectively.

Knowledge of specific GI diseases was limited. The majority of respondents (201, 62.6%) could identify only 1-2 GI diseases. Knowledge of 3-5 GI diseases was reported by 76 (23.7%), while only 15 (4.7%) could identify more than five GI diseases. Notably, 28 (8.7%) respondents were unable to identify any GI disease.

Several barriers to GI disease knowledge were identified. Lack of access to healthcare was the most

commonly reported factor, cited by 172 (54.1%) respondents. Limited health education programs were reported by 157 (49.4%), while socioeconomic constraints affected 113 (35.5%) respondents. Lack of formal education was reported by 94 (29.6%), and cultural beliefs and practices were cited by 72 (22.6%) respondents.

From Table 3, respondents reported several barriers to accessing GI healthcare services. The most commonly identified barrier was financial constraints, reported by 206 (65.0%) respondents. Limited availability of healthcare facilities was reported by 140 (44.2%), while lack of health insurance affected 134 (42.3%) respondents. Additionally, 110 (34.7%) respondents indicated limited awareness of available healthcare services as a significant barrier.

Category	Subcategory	Frequency (*n*)	Percentage (%)
Perceived barriers	Financial constraints	206	65.0
	Limited availability of healthcare facilities	140	44.2
	Lack of health insurance	134	42.3
	Limited awareness of available healthcare services	110	34.7
Key knowledge gaps	Hygiene and sanitation	199	62.4
	Prevention and management	172	53.9
	Early symptom recognition	170	53.3
	Community/public health resources	142	44.5
	Dietary practices	139	43.6
Recommendations	Health screenings	207	64.9
	Awareness campaigns	205	64.3
	Improve PHC centers	190	59.6
	Free educational workshops	149	46.7
	Use of social media	126	39.5

TABLE 3: Barriers, identified gaps, and recommendations.

Note: Respondents were allowed to select more than one response; therefore, percentages may exceed 100%.

PHC, primary healthcare

Multiple gaps in knowledge related to GI health were identified. Poor understanding of hygiene and sanitation was the most frequently reported gap, cited by 199 (62.4%) respondents. Gaps in prevention and management of GI diseases were reported by 172 (53.9%), while 170 (53.3%) respondents indicated inadequate knowledge of early symptom recognition. Limited awareness of community and public health resources was reported by 142 (44.5%), and 139 (43.6%) respondents identified dietary practices as a key knowledge gap.

Respondents suggested several strategies to improve GI health outcomes. Health screenings were the most frequently recommended intervention, supported by 207 (64.9%) respondents. Awareness campaigns were recommended by 205 (64.3%), while improving primary healthcare (PHC) centers was supported by 190 (59.6%) respondents. Free educational workshops were recommended by 149 (46.7%), and the use of social media for health education was suggested by 126 (39.5%) respondents.

Table 4 shows the multivariable analysis of factors associated with awareness of common causes of GI diseases, presenting both the crude and adjusted odds ratios (AORs) for the associations between respondents' characteristics and their awareness of common causes of GI diseases. Age was significantly associated with awareness in the unadjusted model. Respondents aged 18-29 years were over twice as likely to be aware of the causes of GI diseases as those aged 30 years and above (COR = 2.212, 95% CI: 1.402-3.490). However, after adjusting for other variables in the full model, the association was no longer statistically significant (AOR = 0.904, 95% CI: 0.346-2.363).

Variable	Category	COR (95% CI)	AOR (95% CI)	*P*-value (AOR)
Age group	≥30 years	1.00	1.00	-
	18-29 years	2.212 (1.402-3.490)	0.904 (0.346-2.363)	0.837
Gender	Male	1.00	1.00	-
	Female	1.793 (1.136-2.832)	1.403 (0.844-2.335)	0.192
Residence	Urban	1.00	1.00	-
	Rural	0.646 (0.374-1.114)	1.133 (0.613-2.092)	0.691
Occupation	Student	1.00	1.00	-
	Artisan	0.433 (0.267-0.701)	0.755 (0.275-2.071)	0.585
	Health professional	8.250 (1.892-35.969)	7.772 (1.746-34.599)	0.007
Education level	University	1.00	1.00	-
	Secondary school	0.197 (0.116-0.337)	0.271 (0.144-0.513)	<0.001

TABLE 4: COR and AOR for predictors of awareness of GI disease causes.

Model fit (full model): $\chi^2 = 55.575$, $P < 0.001$, Nagelkerke $R^2 = 0.216$.

Ref, reference category; COR, crude odds ratio; AOR, adjusted odds ratio

Gender also showed a significant association in the crude model. Female respondents were significantly more likely to be aware than male respondents (COR = 1.793, 95% CI: 1.136-2.832). However, this association did not remain statistically significant in the adjusted model (AOR = 1.403, 95% CI: 0.844-2.335).

Respondents living in rural areas were less likely to be aware of the causes of GI diseases than their urban counterparts, although this association was not statistically significant in either the unadjusted (COR = 0.646, 95% CI: 0.374-1.114) or adjusted model (AOR = 1.133, 95% CI: 0.613-2.092).

Occupation was a significant predictor of awareness in both the unadjusted and adjusted models. Compared with students, health professionals were substantially more likely to be aware of the causes of GI diseases (COR = 8.250, 95% CI: 1.892-35.969; AOR = 7.772, 95% CI: 1.746-34.599). Conversely, artisans were significantly less likely to be aware than students in the crude model (COR = 0.433, 95% CI: 0.267-0.701), although the adjusted odds ratio (AOR = 0.755, 95% CI: 0.275-2.071) suggested that the association weakened after accounting for other factors.

Educational attainment emerged as a strong and consistent predictor. Respondents with secondary education were significantly less likely to be aware than those with university education in both the unadjusted (COR = 0.197, 95% CI: 0.116-0.337) and adjusted models (AOR = 0.271, 95% CI: 0.144-0.513), highlighting a strong positive association between higher education and awareness of GI disease causes.

Discussion

The extent to which an individual understands the risks associated with an infectious disease and recognizes the benefits of preventive measures strongly influences awareness levels and subsequent health-seeking behavior [12]. GI diseases remain a major public health challenge globally and are particularly burdensome in low- and middle-income countries, where inadequate water, sanitation, and hygiene (WASH) infrastructure, poverty, and limited access to health information persist [1,8]. In sub-Saharan Africa, preventable GI conditions such as diarrheal diseases and helminth infections continue to contribute significantly to morbidity and mortality across all age groups [1,3]. Individual knowledge, perceptions, and beliefs may play a central role in shaping health-seeking behavior, early recognition of symptoms, and adoption of preventive practices. Understanding community-level awareness, perceived barriers, and contextual drivers of GI disease prevention is therefore critical for designing effective public health interventions. This study assessed awareness, knowledge, beliefs, barriers, and proposed solutions related to GI diseases among respondents in our study setting.

Findings of this study showed that the majority of respondents (175, 54.5%) were aged 18-29 years, indicating a predominantly young adult population. This is relevant because younger age groups are often more actively engaged in learning environments and community interactions, which may influence their

exposure to health-related information and awareness levels. The higher proportion of female respondents, 192 (59.8%), observed in this study is also noteworthy, as women often demonstrate greater engagement with health services and preventive practices, especially in relation to household health management. Similar patterns have been reported in some parts of Nigeria, where females were more likely than males to seek healthcare and utilize formal providers, reflecting higher health-seeking behavior among women [16].

In this study, the distribution of respondents across Abia Central, Abia South, and Abia North helps to situate the findings within the different parts of the state. Although a substantial proportion of respondents were drawn from urban and suburban areas within these regions, where access to healthcare facilities and health information is expected to be relatively better, significant knowledge gaps were still evident.

Findings of this study showed that health-related occupation and higher educational attainment were significantly associated with better knowledge of GI diseases. Specifically, respondents with only secondary education had significantly lower odds of awareness compared with those holding university degrees, while health professionals demonstrated substantially higher awareness than students or artisans. These findings are both biologically and socially plausible, as formal education is associated with enhanced health literacy, analytical capacity, and access to reliable health information, while engagement in health-related professions facilitates sustained exposure to disease-prevention principles and clinical practice.

These observations are consistent with findings from other knowledge, attitude, and practice (KAP) studies in both similar and diverse settings. For instance, a study in Pakistan assessing KAP around diarrheal diseases reported significantly higher knowledge scores among participants with higher educational levels [14]. Similarly, a study conducted among university students in Ghana found that greater knowledge of cholera was associated with improved attitudes and appropriate disease management practices [17].

Overall awareness of GI diseases in this study was suboptimal. Only 192 (60%) of respondents demonstrated awareness of common causes of GI diseases, while just 135 (42.2%) reported knowledge of relevant preventive hygiene and dietary practices. Furthermore, 113 (35.3%) of participants were unable to correctly identify key GI symptoms, and 28 (8.7%) could not mention any specific GI condition. This is particularly concerning given that diarrheal diseases and helminth infections remain leading causes of morbidity in sub-Saharan Africa, largely driven by poor WASH conditions and delayed care-seeking [15,18]. Inadequate recognition of symptoms may contribute to late presentation, increased disease severity, avoidable complications such as dehydration or sepsis, and preventable hospital admissions. Disease recall findings further illustrate limitations in community-level knowledge. While most respondents could name one or two GI diseases, only a small proportion could identify more than five, and nearly 9% could not name any. This suggests limited depth of understanding and restricted exposure to structured health education.

The GI diseases most commonly mentioned by respondents were diarrhea (253, 79.1%), peptic ulcer disease (195, 60.9%), and gastritis (85, 26.6%). These conditions align with major GI public health threats in the region [18]. Diarrheal illnesses remain among the leading causes of under-five mortality in Africa and are largely preventable through improved access to clean water, sanitation, and hand hygiene [19]. Peptic ulcer disease and gastritis also represent substantial disease burdens and are frequently associated with Helicobacter pylori infection, dietary factors, and lifestyle-related behaviors [20,21]. Recent studies have reported H. pylori prevalence rates as high as 70-85% in Nigeria and Ghana [22,23], implicating poor sanitation, overcrowding, and inadequate hygiene practices as major contributors to transmission. Notably, Bojuwoye et al. reported that although a high proportion of students had heard of peptic ulcer disease, only a minority were aware of H. pylori as the underlying cause or of appropriate treatment options [13], reflecting superficial awareness without deeper understanding.

Other GI conditions, such as hemorrhoids (64, 20%), gastroenteritis (56, 17.5%), and irritable bowel syndrome (38, 11.9%), were less frequently mentioned. While these conditions may not carry the same mortality risk as acute diarrheal diseases, they contribute significantly to chronic morbidity, reduced quality of life, and healthcare utilization [24,25]. Limited awareness of these conditions may result in self-medication, inappropriate use of traditional remedies, or delayed presentation to healthcare facilities.

Cultural and traditional beliefs emerged as an important theme in this study, with 198 (61.9%) of respondents attributing GI health and disease causation to cultural or traditional factors. This finding underscores the persistence of misconceptions within many tropical and low-resource communities and is consistent with previous reports demonstrating that cultural interpretations are often associated with perceptions of disease causes, prevention, and treatment-seeking behaviors in low- and middle-income countries [26]. Such beliefs may encourage reliance on traditional remedies, delay medical care, or discourage adherence to preventive practices. These findings highlight the need for culturally sensitive health education strategies, such as involving traditional rulers, adapting messages and campaigns to existing belief systems, and using local dialects for education and awareness, while respectfully addressing misconceptions and incorporating trusted community structures.

With respect to barriers to effective GI disease prevention and control, the majority of respondents demonstrated limited knowledge of the importance of hygiene and sanitation, with 199 (62.4%) reporting

inadequate awareness. This is particularly concerning given that simple, low-cost interventions such as regular handwashing with soap have been shown to significantly reduce diarrheal incidence and transmission [27,28]. Beyond knowledge deficits, structural and socioeconomic barriers were also prominent. Financial constraints were cited by 206 (65%) participants, while 140 (44.2%) participants reported inadequate healthcare facilities as major obstacles to GI disease prevention and management. These findings reflect broader patterns observed across low- and middle-income countries, where the intersection of low health literacy, poverty, and weak health systems perpetuates a disproportionate burden of GI diseases [29,30].

The absence of structured GI health education programs identified in this study mirrors findings from other African surveys that document persistent gaps in preventive knowledge and limited community engagement, contributing to ongoing disease transmission and delayed presentation [31]. Although direct comparisons are constrained by the scarcity of studies specifically assessing GI disease awareness, parallels can be drawn from research on parasitic infections and cholera, where inadequate health education and poor sanitation have been consistently identified as major barriers to disease control [32]. Notably, only 63 (19.7%) respondents reported ever participating in a GI-focused education program, and just 83 (25.9%) had received any form of formal GI training, highlighting a substantial gap in community-based outreach and preventive health promotion.

Beyond these individual indicators, categorization of overall knowledge based on the four assessment items, namely, recognition of GI symptoms, awareness of common causes, knowledge of recommended dietary and hygiene practices, and prior formal education or training on GI diseases, revealed that 126 (39.4%) of respondents fell into the poor knowledge category, having answered correctly on only one or none of the four items. This finding has direct practical significance for disease control efforts in the study area. Respondents in this category are less likely to recognize early GI symptoms, less likely to be aware of preventable causes, and more likely to lack exposure to basic dietary and hygiene guidance, all of which increase the likelihood of delayed care-seeking, inappropriate self-medication, and reliance on unregulated traditional remedies. In practical terms, this subgroup represents a population at heightened risk of late presentation and preventable complications, with attendant implications for household productivity and downstream healthcare costs. Given that poor knowledge was closely associated with lower educational attainment and non-health-related occupations, as demonstrated in the regression analysis, targeted rather than generalized interventions may be more effective in addressing this gap. Structured, low-literacy health education delivered through community channels, workplaces, and primary healthcare contacts could plausibly shift a meaningful proportion of this group out of the poor knowledge category, with downstream benefits for early symptom recognition and timely care-seeking. This reinforces the broader argument that GI health education strategies should be stratified to reach the specific subgroups identified as having the greatest knowledge deficits in this study, rather than delivered as a uniform, one-size-fits-all campaign.

The implications of these findings extend beyond individual knowledge deficits. Poor awareness and persistent barriers to prevention may contribute to higher disease incidence, recurrent infections, productivity losses, and increased healthcare costs at the household and system levels. In resource-constrained settings, preventable GI diseases place additional strain on already overstretched primary healthcare services and may exacerbate inequities in access to care. Strengthening preventive education and early intervention strategies is therefore critical not only for reducing morbidity but also for improving health system efficiency and resilience.

In response to the identified gaps, approximately 65% of respondents recommended the implementation of regular health screening programs as a strategy to address the ongoing challenges associated with GI diseases. This was closely followed by calls for increased community awareness initiatives and improvements in the quality and accessibility of primary healthcare centers. Other notable suggestions included public education through digital platforms and free community-based education workshops. The growing use of digital media for health education in low- and middle-income countries has shown promising results in improving knowledge and promoting behavior change, further supporting the relevance of these recommendations [33]. Integrating these approaches into existing primary healthcare and public health frameworks may represent a cost-effective and scalable strategy for improving GI health outcomes in similar settings.

Multivariable logistic regression analysis further clarified the independent predictors of awareness of GI disease causes in this study. Although younger respondents aged 18-29 years were more than twice as likely to be aware in the unadjusted analysis (COR = 2.212, 95% CI: 1.402-3.490), this association was no longer statistically significant after adjustment for other factors (AOR = 0.904, 95% CI: 0.346-2.363). A similar pattern was observed for gender, where female respondents demonstrated higher awareness in the crude model (COR = 1.793, 95% CI: 1.136-2.832), but the association weakened and became nonsignificant after adjustment (AOR = 1.403, 95% CI: 0.844-2.335). These findings suggest that apparent age- and gender-related differences in awareness may be explained by underlying factors such as education and occupation rather than independent effects.

Occupation emerged as a strong and independent predictor of awareness. Health professionals were almost eight times more likely to be aware of common GI disease causes than students, even after controlling for

potential confounders (AOR = 7.772, 95% CI: 1.746-34.599). This finding is expected, given their professional exposure to disease prevention, diagnosis, and health education. Conversely, artisans showed reduced awareness compared with students in the crude analysis, although this association was attenuated in the adjusted model, suggesting that lower educational attainment rather than occupation alone may drive reduced awareness in this group.

Educational attainment remained the most consistent and robust predictor of awareness in both unadjusted and adjusted models. Respondents with only secondary education were approximately 73% less likely to be aware of GI disease causes than those with university education (AOR = 0.271, 95% CI: 0.144-0.513). The persistence of this association after adjustment highlights the central role of formal education in shaping health literacy and reinforces the heightened vulnerability of individuals with lower educational attainment, particularly in underserved communities with limited access to health information, preventive campaigns, and health-promoting environments.

The loss of statistical significance for age and gender after adjustment suggests confounding, meaning that the crude associations were likely driven by differences in the distribution of education and occupation across age and gender groups. In practical terms, this indicates that interventions aiming to improve awareness should prioritize structural determinants, particularly educational exposure and health-related occupational contact, rather than assuming that younger age or female gender independently ensures better awareness. The strong association among health professionals further supports the role of repeated exposure to clinical information and prevention messaging as a mechanism for improved awareness. This pattern is consistent with broader health literacy frameworks in which formal education increases the ability to interpret health information, while contact with healthcare systems improves access to accurate disease knowledge and reinforces preventive behaviors.

Strengths and limitations

The main strength of this study lies in its focus on GI disease knowledge and awareness in a tropical African setting, an area where published evidence remains scarce. By recruiting participants from diverse sociodemographic groups across the three senatorial zones of Abia State, Nigeria, through multistage sampling, the study provides a more representative perspective on awareness and barriers within the population. In addition, the use of a pilot-tested and expert-reviewed survey instrument enhanced the reliability and validity of the findings. The study also contributes to public health by identifying specific knowledge gaps, such as limited understanding of hygiene, sanitation, and preventive practices, that can guide targeted interventions and policy formulation.

Nonetheless, several limitations must be acknowledged. First, the study was cross-sectional, which restricts the ability to establish causal relationships between knowledge levels and associated factors. Second, although multistage and simple random sampling were employed, the sample was limited to Abia State, which may affect the generalizability of the findings to other regions of Nigeria or sub-Saharan Africa. Third, the reliance on self-reported data introduces the potential for recall or social desirability bias. Fourth, due to time and logistical constraints, a sample of only 320 participants could be achieved. Also, the study did not explore knowledge in depth through qualitative methods, which may have provided richer insights into cultural and contextual drivers of misconceptions.

The multivariable model had a Nagelkerke R^2 value of 0.216, indicating that the variables included in the model accounted for a modest proportion of the variation in awareness of GI disease causes. This suggests that other factors may also influence awareness. Such factors may include health literacy, household WASH conditions, previous experience with GI diseases, prior exposure to health education, and access to reliable health information. Future studies should consider incorporating these factors to provide a more comprehensive understanding of the determinants of awareness of GI diseases and to inform more targeted interventions.

Despite these limitations, this study offers valuable evidence on the awareness and knowledge of GI diseases and preventive measures in a tropical Nigerian population. The findings highlight critical gaps that warrant urgent attention and can serve as a foundation for future large-scale, mixed-methods research aimed at improving community health education, strengthening WASH interventions, and ultimately reducing the burden of GI diseases in the region.

Recommendations

Based on the findings of this study, the following recommendations can be made.

Strengthening Community-Based Health Education on GI Diseases

The findings of this study indicate substantial gaps in knowledge regarding GI disease prevention, hygiene, sanitation, and symptom recognition, with a significant proportion of respondents demonstrating poor or average knowledge levels. It is therefore recommended that structured, community-based health education programs be strengthened and sustained. These programs should focus on basic concepts of GI disease

transmission, early symptom recognition, safe food handling, personal hygiene, and appropriate dietary practices. Health education initiatives should be designed to be culturally sensitive and delivered in simple, locally understood language to address misconceptions influenced by traditional beliefs, which were reported by a majority of respondents.

Integration of GI Health Education into Primary Healthcare Services

Given that healthcare professionals were identified as the primary source of information for many respondents, there is a need to further integrate GI health education into routine primary healthcare services. Primary healthcare centers should incorporate regular educational sessions on GI disease prevention during outpatient visits, antenatal clinics, and community outreach programs. Training and capacity building of primary healthcare workers should be prioritized to ensure they are adequately equipped to provide accurate, consistent, and practical information tailored to community needs.

Targeted Interventions for Low-Education and High-Risk Occupational Groups

Educational attainment and occupation emerged as the strongest predictors of awareness in this study. Respondents with lower levels of formal education and non-health-related occupations demonstrated significantly lower awareness of GI disease causes. Targeted interventions should therefore be developed for these vulnerable groups, including artisans, informal sector workers, and individuals with secondary or lower levels of education. Tailored educational materials such as visual aids, demonstrations, and interactive sessions should be employed to enhance comprehension and retention of preventive information.

Enhancement of WASH Initiatives

The study identified poor knowledge of hygiene and sanitation as a major gap, alongside financial constraints and limited access to healthcare facilities as significant barriers. Strengthening WASH initiatives is therefore critical. Public health authorities should collaborate with local governments and development partners to improve access to clean water, sanitation facilities, and handwashing infrastructure. Community sensitization on the importance of hygiene practices, including regular handwashing with soap, should accompany infrastructural improvements to maximize public health impact.

Use of Digital Media and Social Platforms for Health Promotion

A considerable proportion of respondents recommended the use of digital platforms and social media for disseminating health information. Leveraging digital media presents an opportunity to reach younger populations and urban residents more effectively. Public health agencies should utilize social media, mobile health platforms, and community radio programs to disseminate accurate, evidence-based information on GI disease prevention, symptoms, and available healthcare services. Content should be engaging, locally relevant, and designed to counter misinformation.

Promotion of Regular Health Screening and Community Outreach Programs

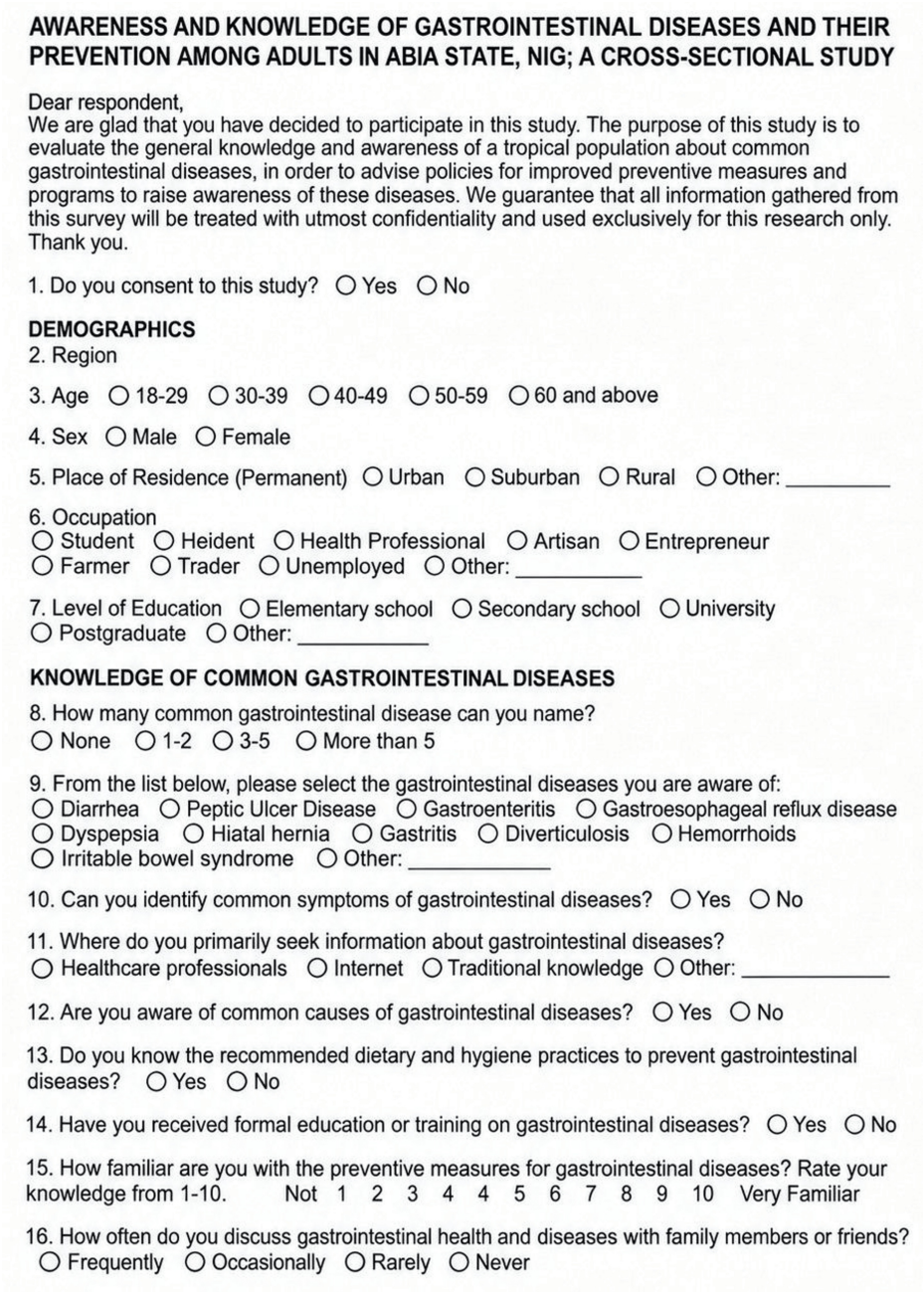
Regular health screening was the most frequently recommended intervention by respondents. Community-based screening programs should be promoted to facilitate early detection of GI conditions and encourage timely healthcare-seeking behavior. These programs can be integrated into existing public health outreach activities and supported through partnerships with non-governmental organizations and local health authorities. Free or subsidized screening initiatives would also help mitigate financial barriers that limit access to care.

Conclusions

This study revealed significant gaps in knowledge and awareness of GI diseases and their preventive measures among adults in Abia State, Nigeria. Although a majority of respondents were able to identify diarrhea and peptic ulcer disease as common GI conditions, substantial proportions lacked knowledge of preventive hygiene and dietary practices, and many held cultural or traditional misconceptions about GI health. Furthermore, barriers such as limited access to healthcare facilities, financial constraints, and the absence of structured educational programs were identified as critical obstacles to improved awareness. The findings suggest that enhancing GI disease knowledge requires targeted, community-based interventions that address both educational and structural barriers. Public health authorities should prioritize culturally sensitive health education campaigns, strengthen school- and community-based outreach programs, and expand WASH initiatives. Increasing access to affordable healthcare and integrating GI health education into existing public health frameworks would further support these efforts.

Appendices

Appendix A



AWARENESS AND KNOWLEDGE OF GASTROINTESTINAL DISEASES AND THEIR PREVENTION AMONG ADULTS IN ABIA STATE, NIG; A CROSS-SECTIONAL STUDY

Dear respondent,
We are glad that you have decided to participate in this study. The purpose of this study is to evaluate the general knowledge and awareness of a tropical population about common gastrointestinal diseases, in order to advise policies for improved preventive measures and programs to raise awareness of these diseases. We guarantee that all information gathered from this survey will be treated with utmost confidentiality and used exclusively for this research only. Thank you.

1. Do you consent to this study? ○ Yes ○ No

DEMOGRAPHICS

2. Region

3. Age ○ 18-29 ○ 30-39 ○ 40-49 ○ 50-59 ○ 60 and above

4. Sex ○ Male ○ Female

5. Place of Residence (Permanent) ○ Urban ○ Suburban ○ Rural ○ Other: _____

6. Occupation
○ Student ○ Heident ○ Health Professional ○ Artisan ○ Entrepreneur
○ Farmer ○ Trader ○ Unemployed ○ Other: _____

7. Level of Education ○ Elementary school ○ Secondary school ○ University
○ Postgraduate ○ Other: _____

KNOWLEDGE OF COMMON GASTROINTESTINAL DISEASES

8. How many common gastrointestinal disease can you name?
○ None ○ 1-2 ○ 3-5 ○ More than 5

9. From the list below, please select the gastrointestinal diseases you are aware of:
○ Diarrhea ○ Peptic Ulcer Disease ○ Gastroenteritis ○ Gastroesophageal reflux disease
○ Dyspepsia ○ Hiatal hernia ○ Gastritis ○ Diverticulosis ○ Hemorrhoids
○ Irritable bowel syndrome ○ Other: _____

10. Can you identify common symptoms of gastrointestinal diseases? ○ Yes ○ No

11. Where do you primarily seek information about gastrointestinal diseases?
○ Healthcare professionals ○ Internet ○ Traditional knowledge ○ Other: _____

12. Are you aware of common causes of gastrointestinal diseases? ○ Yes ○ No

13. Do you know the recommended dietary and hygiene practices to prevent gastrointestinal diseases? ○ Yes ○ No

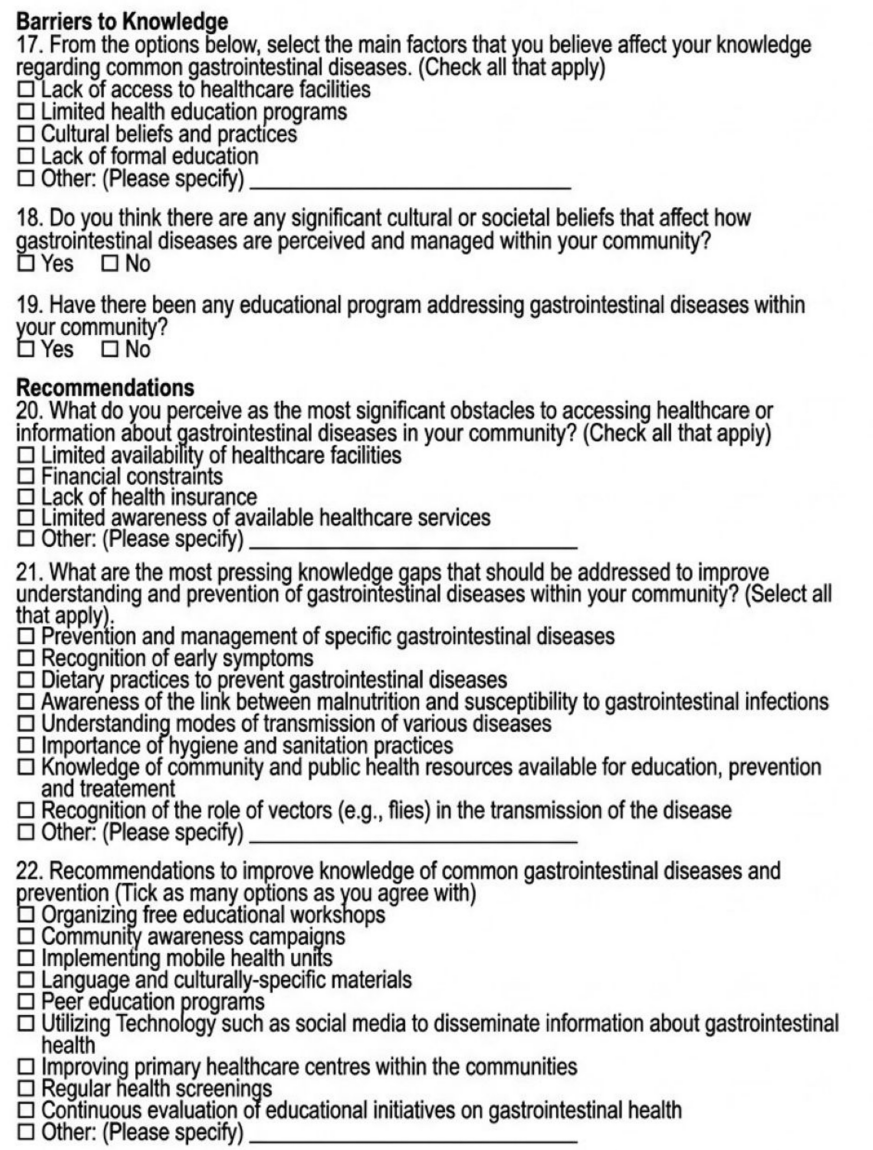
14. Have you received formal education or training on gastrointestinal diseases? ○ Yes ○ No

15. How familiar are you with the preventive measures for gastrointestinal diseases? Rate your knowledge from 1-10. Not 1 2 3 4 4 5 6 7 8 9 10 Very Familiar

16. How often do you discuss gastrointestinal health and diseases with family members or friends?
○ Frequently ○ Occasionally ○ Rarely ○ Never

FIGURE 2: Demographics and knowledge of common gastrointestinal diseases.

Appendix B



Barriers to Knowledge

17. From the options below, select the main factors that you believe affect your knowledge regarding common gastrointestinal diseases. (Check all that apply)
☐ Lack of access to healthcare facilities
☐ Limited health education programs
☐ Cultural beliefs and practices
☐ Lack of formal education
☐ Other: (Please specify) _____

18. Do you think there are any significant cultural or societal beliefs that affect how gastrointestinal diseases are perceived and managed within your community?
☐ Yes ☐ No

19. Have there been any educational program addressing gastrointestinal diseases within your community?
☐ Yes ☐ No

Recommendations

20. What do you perceive as the most significant obstacles to accessing healthcare or information about gastrointestinal diseases in your community? (Check all that apply)
☐ Limited availability of healthcare facilities
☐ Financial constraints
☐ Lack of health insurance
☐ Limited awareness of available healthcare services
☐ Other: (Please specify) _____

21. What are the most pressing knowledge gaps that should be addressed to improve understanding and prevention of gastrointestinal diseases within your community? (Select all that apply).
☐ Prevention and management of specific gastrointestinal diseases
☐ Recognition of early symptoms
☐ Dietary practices to prevent gastrointestinal diseases
☐ Awareness of the link between malnutrition and susceptibility to gastrointestinal infections
☐ Understanding modes of transmission of various diseases
☐ Importance of hygiene and sanitation practices
☐ Knowledge of community and public health resources available for education, prevention and treatement
☐ Recognition of the role of vectors (e.g., flies) in the transmission of the disease
☐ Other: (Please specify) _____

22. Recommendations to improve knowledge of common gastrointestinal diseases and prevention (Tick as many options as you agree with)
☐ Organizing free educational workshops
☐ Community awareness campaigns
☐ Implementing mobile health units
☐ Language and culturally-specific materials
☐ Peer education programs
☐ Utilizing Technology such as social media to disseminate information about gastrointestinal health
☐ Improving primary healthcare centres within the communities
☐ Regular health screenings
☐ Continuous evaluation of educational initiatives on gastrointestinal health
☐ Other: (Please specify) _____

FIGURE 3: Barriers to knowledge and recommendations.

Additional Information

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All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. Ethics Committee for Public Health Research, Department of Public Health and Disease Control, Abia State Ministry of Health, Abia State, Nigeria issued approval ASMH/EC/24/022. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

References

1. Milivojevic V, Milosavljevic T: Burden of gastroduodenal diseases from the global perspective . Curr Treat Options Gastroenterol. 2020, 18:148-57. 10.1007/s11938-020-00277-z
2. Wang R, Li Z, Liu S, Zhang D: Global, regional, and national burden of 10 digestive diseases in 204 countries and territories from 1990 to 2019. Front Public Health. 2023, 11:1061453. 10.3389/fpubh.2023.1061453
3. Ananthakrishnan AN, Xavier RJ: Gastrointestinal Diseases. Hunter's Tropical Medicine and Emerging Infectious Diseases. 2020, 16-26. 10.1016/C2016-0-01879-X
4. Ghazy RM, Alshaikhi SA, Assiri HA, Almozaini AA, Alhazmi AF, Elhasaneen HE, Abdo SM: Tropical diseases and the gastrointestinal tract: an overlooked connection. Front Trop Dis. 2025, 26:1612952. 10.3389/fitd.2025.1612952
5. Musa Y, Saleh HT, Onyia CP: Unmasking inflammatory bowel disease in Nigeria: a multicenter cross-sectional analysis of clinico-pathological and endoscopic findings. J Transl Gastroenterol. 2025, 9:10.14218/JTG.2025.00011
6. Orish VN, Asumbono MA, Addei IB, et al.: Knowledge, attitude, and practice towards prevention of intestinal helminth infection among residents of the ho municipality in the volta region of Ghana. J Parasitol Res. 2023, 2023:5515603. 10.1155/2023/5515603
7. Becker SL, Vogt J, Knopp S, et al.: Persistent digestive disorders in the tropics: causative infectious pathogens and reference diagnostic tests. BMC Infect Dis. 2013, 13:37. 10.1186/1471-2334-13-37
8. Desta BN, Pires SM, Hald T, et al.: The epidemiology of acute gastrointestinal illness in Ethiopia, Mozambique, Nigeria, and Tanzania: a population survey. Epidemiol Infect. 2025, 153:e63. 10.1017/S095026882500038X
9. Alatise OI, Allen H, Barton-Burke M, et al.: Endoscopy capacity in Nigeria: a national needs assessment and recommendations. Surg Endosc. 2025, 39:5698-713. 10.1007/s00464-025-11874-3
10. Von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP: The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. Lancet. 2007, 370:1453-7. 10.1016/S0140-6736(07)61602-X
11. Cochrane WG: Sampling Techniques, 3rd edn. Wiley, 1977.
12. Wang H, Liu Z, Guo C, et al.: Health-seeking behavior and barriers to treatment of patients with upper gastrointestinal cancer detected by screening in rural China: real-world evidence from the ESECC trial. Lancet Reg Health West Pac. 2021, 12:100181. 10.1016/j.lanwpc.2021.100181
13. Bojuwoye MO, Ogunmodede JA, Ogunlaja OA, Fasiku MM, Oyeleke GK, Olokoba AB: The knowledge and attitude of students of a Nigerian tertiary institution about peptic ulcer disease. Res J Health Sci. 2021, 13:142-9. 10.4314/rejhs.v9i2.4
14. Abbasi A, Shahzad K, Shabbir RM, et al.: Demographic attributes of knowledge, attitude, practices, and One Health perspective regarding diarrhea in Pakistan. Front Public Health. 2021, 9:731272. 10.3389/fpubh.2021.731272
15. Wolf J, Johnston RB, Ambelu A, et al.: Burden of disease attributable to unsafe drinking water, sanitation, and hygiene in domestic settings: a global analysis for selected adverse health outcomes. Lancet. 2023, 401:2060-71. 10.1016/S0140-6736(23)00458-0
16. Osakede UA, Ayadi MF: Regional disparities in health-seeking behaviour in Nigeria: evidence from the World Bank General Household Survey. Managing Global Trans. 2025, 30:23. 10.26493/1854-6935.23.451-483
17. Blankson SS, Ashie-Nikoi PA: Knowledge, practice, and attitude towards cholera management among university students in Greater Accra Region. J Contemp Stud Epidemiol Public Health. 2025, 6:10.29333/jconseph/15937
18. Archer J, O'Halloran L, Al-Shehri H, et al.: Intestinal schistosomiasis and giardiasis co-infection in sub-Saharan Africa: can a one health approach improve control of each waterborne parasite simultaneously?. Trop Med Infect Dis. 2020, 5:10.3390/tropicalmed5030137
19. World Health Organization: Sanitation. WHO, 2024.
20. Abdu SM, Assefa EM, Abdu H: Prevalence and patterns of peptic ulcer disease in Africa: a systematic review and meta-analysis. BMC Gastroenterol. 2025, 25:298. 10.1186/s12876-025-03906-y
21. Bai Z, Wang H, Shen C, An J, Yang Z, Mo X: The global, regional, and national patterns of change in the burden of nonmalignant upper gastrointestinal diseases from 1990 to 2019 and the forecast for the next decade. Int J Surg. 2025, 111:80-92. 10.1097/JS9.0000000000001902
22. Tague C, Makeda D, Yokolo H, Joshua E, Bavurhe RF, Akilimali A: Helicobacter pylori: main cause of gastric adenocarcinoma in sub-saharan Africa, status report and control strategies. Ann Med Surg (Lond). 2025, 87:4005-6. 10.1097/MS9.0000000000003376

23. Emmanuel BN, Peter DA, Peter MO, Adedayo IS, Olaifa K: Helicobacter pylori infection in Africa: comprehensive insight into its pathogenesis, management, and future perspectives. J Umm Al-Qura Univ Appl Sci. 2025, 11:378-401. 10.1007/s43994-024-00166-6
24. Staller K, Olén O, Söderling J, et al.: Mortality risk in irritable bowel syndrome: results from a nationwide prospective cohort study. Am J Gastroenterol. 2020, 115:746-55. 10.14309/ajg.0000000000000573
25. Ranasinghe S, Nic Fhogartaigh C: Bacterial gastroenteritis. Medicine. 20211, 49:687-93. 10.1016/j.mpmed.2021.08.002
26. Petersen Z, Jaca A, Ginindza TG, et al.: Barriers to uptake of cervical cancer screening services in low-and-middle-income countries: a systematic review. BMC Womens Health. 2022, 22:486. 10.1186/s12905-022-02043-y
27. Wolf J, Hubbard S, Brauer M, et al.: Effectiveness of interventions to improve drinking water, sanitation, and handwashing with soap on risk of diarrhoeal disease in children in low-income and middle-income settings: a systematic review and meta-analysis. Lancet. 2022, 400:48-59. 10.1016/S0140-6736(22)00937-0
28. Diarrhoeal disease. (2024). https://www.who.int/news-room/fact-sheets/detail/diarrhoeal-disease.
29. Burden of disease attributable to unsafe water, sanitation and hygiene (WASH) . (2024). https://www.who.int/data/gho/data/themes/topics/water-sanitation-and-hygiene-burden-of-disease.
30. Okesanya OJ, Eshun G, Ukoaka BM, et al.: Water, sanitation, and hygiene (WASH) practices in Africa: exploring the effects on public health and sustainable development plans. Trop Med Health. 2024, 52:68. 10.1186/s41182-024-00614-3
31. Thystrup C, Majowicz SE, Kitila DB, et al.: Etiology-specific incidence and mortality of diarrheal diseases in the African region: a systematic review and meta-analysis. BMC Public Health. 2024, 24:1864. 10.1186/s12889-024-19334-8
32. Challa JM, Getachew T, Debella A, et al.: Inadequate hand washing, lack of clean drinking water and latrines as major determinants of cholera outbreak in Somali region, Ethiopia in 2019. Front Public Health. 2022, 10:845057. 10.3389/fpubh.2022.845057
33. Hagg E, Dahinten VS, Currie LM: The emerging use of social media for health-related purposes in low and middle-income countries: a scoping review. Int J Med Inform. 2018, 115:92-105. 10.1016/j.ijmedinf.2018.04.010