RESEARCH ARTICLE

Prevalence and pre-disposing factors of *Helicobacter pylori* among patients with gastro-intestinal symptoms attending Mulago Hospital, Kampala, Uganda

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Abstract

Background

Comprehensive data on the prevalence of *Helicobacter pylori* infection and its predisposing factors among patients with gastrointestinal symptoms remain limited. Generating this evidence would help inform clinical management and improve antibiotic stewardship. *H. pylori* infection affects a substantial proportion of the global population, with prevalence varying widely across regions. In Uganda, previous studies have documented the presence of *H. pylori* infection. However, data specific to symptomatic patients are scarce. This study therefore aimed to determine the prevalence of *H. pylori* infection and predisposing factors among patients with gastrointestinal symptoms attending Mulago National Referral Hospital in Kampala, Uganda.

Methods

A cross-sectional study was conducted among 353 patients with gastrointestinal symptoms attending Mulago Hospital. Data on socio-demographic characteristics, lifestyle and dietary habits, and medical history were collected using a semi-structured questionnaire. *H. pylori* infection status was determined using stool antigen tests. Proportions were used to determine the prevalence of *H. pylori,* and predisposing factors analyzed using STATA version 14 software by performing bivariate and multivariable analyses.

Results

Among the 353 participants, majority were between 16 and 35 years old (69%), female (58%), and residing in peri-urban areas (74%). The prevalence of *H. pylori* infection in this population was 308 (87.3%). Multivariable analysis showed that *H. pylori* infection was significantly associated with having more than five income

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dependents (aPRR = 1.104, 95% CI: 1.025–1.189, p = 0.008), a history of previous *H. pylori* treatment (aPRR = 3.459, 95% CI: 2.138–5.595, p < 0.001), and a family history of *H. pylori* infection or gastrointestinal ulcers (aPRR = 1.135, 95% CI: 1.055–1.221, p = 0.001).

Conclusion

This study demonstrated a high prevalence of *Helicobacter pylori* infection among patients presenting with gastrointestinal symptoms, with nearly nine out of ten individuals testing positive. The high burden observed suggests that routine screening for *H. pylori*, or carefully guided empirical treatment, may be clinically justified in symptomatic patients. These findings underscore the need for integrated clinical and public health strategies to improve diagnosis, treatment, and prevention of *H. pylori* infection in this setting.

Introduction

Helicobacter pylori (*H. pylori*) is a motile, gram-negative, urease-producing bacterium that colonizes the gastric mucosa, most often acquired during childhood [1]. Globally, more than half of the population is infected, making it one of the most common chronic bacterial infections [1,2]. Its public health relevance stems from its established association with chronic gastritis, peptic ulcer disease, gastric adenocarcinoma, and mucosa-associated lymphoid tissue (MALT) lymphoma, leading the International Agency for Research on Cancer to classify it as a Class I carcinogen. [3,4] Although infection can persist for life if untreated, only a minority of individuals develop clinically significant disease, while the majority remain asymptomatic [5]. The diversity of bacterial strains and their virulence factors—such as CagA and VacA—plays an important role in determining disease outcomes. [6]

In many regions with high *H. pylori* prevalence, including East Asia, West Asia, and Africa, infection patterns exhibit notable epidemiological variations [1,2]. One widely discussed phenomenon is the “African and Asian enigma,” in which populations with high infection rates—particularly in Africa—show relatively low incidences of gastric cancer and peptic ulcer disease. [6,7] Several hypotheses have been proposed to explain this disparity, including differences in dominant *H. pylori* strains, host genetic susceptibility, coexisting parasitic infections, nutritional status, and environmental exposures. [6–8] In sub-Saharan Africa, socioeconomic factors such as poor sanitation, household overcrowding, limited access to clean water, and high population density further contribute to transmission, likely through oral–oral, gastro–oral, or fecal–oral routes. [9] Despite these challenges, local epidemiological patterns remain incompletely understood.

In Uganda, *H. pylori* infection is recognized as a significant clinical concern, yet comprehensive data on its determinants remain limited. Although diagnostic methods such as stool antigen testing, urea breath tests, and serology are available, many health facilities rely on serology, which may lead to misclassification due

to persistent antibodies. The four main diagnostic approaches for *H. pylori* are: (i) the urea breath test (UBT), which detects active infection non-invasively but requires specialized equipment and radiolabeled urea; (ii) stool antigen testing, which detects active infection through immunochromatographic or ELISA methods and is accurate, non-invasive, and does not require fasting; (iii) serology, which detects IgG antibodies but cannot distinguish between active and past infection; and (iv) endoscopic biopsy with rapid urease test (RUT) or histology, considered the gold standard but invasive and resource-intensive. Stool antigen testing was selected for this study because it detects active infection, requires no special equipment or patient preparation beyond sample collection, is cost-effective, and is feasible in resource-limited hospital settings like in Uganda to screen for *H. pylori* infection. [10] Existing studies have documented high infection rates, but evidence on context-specific predisposing factors—such as household characteristics, prior treatment history, environmental exposures, and family-level clustering—remains scarce [7,11]. This lack of detailed epidemiological data restricts effective prevention and management strategies. Therefore, this study aimed to determine the prevalence of patients presenting with gastrointestinal symptoms, including epigastric pain, abdominal discomfort, bloating, nausea, vomiting, dyspepsia, and heartburn, that represent the most clinically relevant group for targeted investigation, as these symptoms are the primary indication for testing in resource-limited settings. The study also aimed to identify the predisposing factors among patients with gastro intestinal symptoms attending Mulago hospital in Kampala, Uganda.

Methods and materials

Study setting, population and design

This cross-sectional study was conducted at the Mulago Assessment Centre in Mulago National Referral Hospital, Kampala, Uganda, the country's main tertiary referral and teaching hospital serving patients from Kampala, surrounding districts, and neighbouring countries. The centre receives about 150 outpatients daily. The study enrolled individuals presenting with gastrointestinal symptoms suggestive of ulcer disease—such as abdominal pain, bloating, nausea, or vomiting—who sought care during the study period (1st October to 30th November 2024). Data were collected using a semi-structured questionnaire capturing demographic, lifestyle, and clinical information, alongside stool sample analysis for *H. pylori* detection.

Sampling procedure and sample size determination

Participants were selected using consecutive sampling, enrolling all eligible patients who presented to the Mulago Assessment Centre with gastrointestinal symptoms and were clinically diagnosed with *H. pylori* infection or gastrointestinal ulcers. This approach minimized selection bias by including patients in the order they appeared, ensuring a representative sample of symptomatic cases. Enrolled participants provided stool samples for laboratory confirmation of *H. pylori* infection and completed a questionnaire capturing demographic characteristics, lifestyle factors, medical history, and gastrointestinal symptoms. The required sample size was determined using the formula for cross-sectional studies by Kish–Leslie, assuming a 95% confidence level, 5% margin of error, and a prevalence of infection of 29.9% based on a previous study in rural Uganda [12]. This yielded a minimum sample size of 322 participants, which, after adjusting for a 10% non-response rate, resulted in a final target sample size of 353 participants.

Eligible participants were patients aged 16 years and above presenting with symptoms of gastrointestinal ulcer disease such as abdominal pain, dyspepsia, or gastrointestinal bleeding and provided consent. Patients were excluded if they were critically ill, had taken antibiotics in the past month, or had a history of gastric surgery, gastric malignancy, or prior cancer treatment. Those with severe comorbidities or gastrointestinal conditions likely to confound results were also excluded.

Sample and data collection procedure

Stool samples were collected from each participant using sterile, labeled containers with buffer solution, following standardized instructions to obtain a small portion (approximately 50–100 mg) of fresh stool. Participants were guided on proper collection to minimize contamination and delivered the samples to the laboratory for analysis. Helicobacter pylori antigen detection was performed using the SD H. pylori Stool Antigen ELISA cassette (Standard Diagnostics Inc., South Korea), which has a reported sensitivity of 94.0% and specificity of 97.0% for detecting active *H. pylori* infection (manufacturer's package insert). The testing procedure was performed as follows: approximately 50–100 mg of fresh stool was transferred into the sample dilution buffer provided in the kit and mixed thoroughly. One drop approximately (40 µL) of the diluted sample was dispensed into the sample well of the cassette.

Results were read at 10 minutes according to manufacturer instructions two red bands indicated a positive result, one red band at the control line indicated a negative result, and absence of a control line indicated an invalid test [13]. Laboratory procedures were conducted by trained personnel under the supervision of the principal investigator to ensure accuracy, with repeat testing performed when necessary. Concurrently, a semi-structured questionnaire was administered by trained research assistants to collect demographic data, lifestyle factors, medical history, and gastrointestinal symptoms, which were subsequently managed, coded, and analyzed using Excel and STATA Version 15.0.

Data management and analysis

The questionnaire was pretested and revised, then administered by two trained research assistants with laboratory backgrounds. The assistants received two days of training on data collection using the Kobo Collect tool, operation of the online questionnaire designed for the study, and sample preparation procedures, to ensure data accuracy and participant confidentiality. Completed forms were checked daily, entered into Excel for cleaning and coding, securely stored, and exported to STATA Version 15.0 for analysis, with backups maintained. Laboratory quality was ensured through control samples, standardized procedures, and proper stool sample handling to preserve integrity and reliability of *H. pylori* detection.

Data analysis was conducted at univariable, bivariable, and multivariable levels. Descriptive statistics summarized participant characteristics using means, standard deviations, frequencies, percentages, and proportions, presented in tables and charts. The prevalence of *H. pylori* infection was calculated as the proportion of participants testing positive. Bivariate analysis identified potential predisposing factors ($p < 0.2$) for inclusion in the multivariable model, alongside variables recognized in the literature. Multicollinearity was assessed using variance inflation factors, and a modified Poisson regression model was employed to estimate prevalence rate ratios with 95% confidence intervals, given the relatively high outcome prevalence. A stepwise forward and backward approach were used to build the model, adding or removing variables based on significance and model fit to identify independent predictors of *H. pylori* infection.

Ethical considerations

Ethical approval was obtained from the Makerere University School of Public Health Higher Degrees Committee. Written informed consent was obtained from all participants prior to data and stool sample collection. For participants aged 16 and 17 years, that is, minors under Ugandan law, written assent was obtained from the participant, and written informed consent was obtained from a parent and guardians before enrolment, in accordance with National Research Ethics Guidelines Privacy, confidentiality, and voluntary participation were ensured, with benefits and risks explained. The study adhered to ethical principles of beneficence, justice, and scientific integrity, and no harm was anticipated beyond the time required for participation.

Results

Socio-demographic characteristics of the study participants

The commonly reported presenting symptoms among the 353 participants were epigastric/abdominal pain 314(88.9%), bloating 313(88.7%), nausea 216(61.2%), and heartburn 157(44.5%). The study focused on symptomatic patients

because symptoms suggestive of peptic ulcer disease represent the primary clinical indication for *H. pylori* investigation, and targeting this group maximizes the clinical relevance of findings for guiding empirical management decisions.

The majority of participants were youth aged 16–35 years 242 (69%), females 204 (58%) and had attained secondary education 123 (35%). Most of the participants resided in peri-urban areas 262 (74%), were single 194 (55%), and unemployed 291 (82%). The majority of households had incomes of less than 139 USD (at a rate of 3,600 UGX) 268 (76%), with mainly 1–5 household members (Table 1).

Lifestyle and dietary habits of the participants

The study revealed that almost all (99.4%) participants were non-smokers, did not consume alcohol (87%), but consumed spicy foods weekly (45%). Most participants (80.5%) always practiced hand washing, sourced food from more than one place (75.7%), and most obtained water from more than one source (81%) (Table 2).

Medical history of the participants

The majority (54.4%) of participants had never been diagnosed with a gastrointestinal tract (GIT) ulcer, 95.2% had been tested for *H. pylori* infection, and 87.3% reported having received treatment for it. Regarding general health and medications, only 6.8% were currently taking any medications. Most participants (89.8%) had used non-steroidal

Table 1. Socio demographic characteristics of study participants.

Socio-demographic	Variable	Frequency (N = 353)	Percentage (%)
Age (years)	Youth (16–35)	242	69
	Adult (36–60)	86	24
	Elderly (60–90)	25	7
Sex	Male	149	42
	Female	204	58
Level of education	None	10	3
	Primary	111	31
	Secondary	123	35
	Tertiary/ university	109	31
Address	Urban	58	16
	Pre-Urban	262	74
	Rural	33	9
Marital Status	Single	194	55
	Married	142	40
	Separated	17	5
Employment status	Employed	36	10
	Unemployed	291	82
	Self-Employed	26	7
Household Income	< 139	268	76
(USD)	139–278	76	22
	278–417	4	1
	> 417	5	1
Number of individuals in household			
	1–5	254	72
	6–10	90	25
	Above 10	9	3

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Table 2. Lifestyle and dietary habits of the participants.

Lifestyle and Dietary Habits		Frequency (N)	Percentage (%)
Smoking	Yes	2	0.6
	No	351	99.4
Alcohol consumption	Yes	46	13
	No	307	87
Spicy food consumption	Daily	32	9.1
	Weekly	159	45
	Monthly	108	30.6
	Rarely	45	12.7
	Never	9	2.5
Handwashing	Always	284	80.5
	Often	69	19.5
Food source	One eating place	86	24.4
	More than one eating place	266	75.7
Water Source	One water source	67	19
	More than one water source	286	81

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anti-inflammatory drugs (NSAIDs) such as aspirin or ibuprofen in the previous year, while only 18.7% reported having a family member diagnosed with *H. pylori* infection or GIT ulcers (Table 3).

Prevalence of *H. pylori* among patients with gastrointestinal symptoms at Mulago Hospital

Out of the 353 participants tested, 308 were positive for *H. pylori* hence a prevalence of 87.3%.

Bivariate analysis of pre-disposing factors for *H. pylori* among patients with gastrointestinal symptoms at Mulago Hospital

Demographic predisposing factors for *H. pylori infection*. Among the demographic factors assessed, employment and self-employment were statistically significant (cPRR = 0.793, 95% CI: 0.645–0.974, p = 0.027) and (cPRR = 0.717,

Table 3. Medical history of the participants.

Medical History		Frequency (N)	Percentage (%)
Ever been diagnosed with a GIT ulcer	Yes	161	45.6
	No	192	54.4
Ever tested for *H. pylori* infection	Yes	336	95.2
	No	17	4.8
Ever received treatment for *H. pylori* infection	Yes	308	87.3
	No	45	12.7
General Health and Medications			
Currently taking any medications	Yes	24	6.8
	No	329	93.2
Used NSAIDs (e.g., aspirin, ibuprofen) in past year	Yes	317	89.8
	No	36	10.2
Family member diagnosed with *H. pylori* or GIT ulcers	Yes	66	18.7
	No	287	81.3

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95% CI: 0.541–0.952, p = 0.021) respectively. Additionally, respondents with more than five financial dependents showed statistical significance (cPRR = 1.109, 95% CI: 1.032–1.193, p = 0.005) and hence were considered for multivariable analysis (Table 4).

Lifestyle and dietary habits predisposing factors for *H. pylori*. At bivariate analysis, none of the lifestyle and dietary habits were statistically significant (p < 0.2) hence they were not considered for multivariable analysis (Table 5).

Medical history predisposing factors for *H. pylori* infection. Regarding medical history-related factors, ever been diagnosed with a GIT ulcer (cPRR = 1.074, 95% CI: 0.993–1.162, p = 0.072), having ever tested for *H. pylori* infection (cPRR = 1.366, 95% CI: 0.959–1.945, p = 0.084), ever received treatment for *H. pylori* infection (cPRR = 3.603, 95%

Table 4. Demographic predisposing factors for H. pylori infection.

	Results N (%)				
Variable	**Positive**	**Negative**	**cPRR**	**95% CI**	**P value**
Age group					
Youth	208(86)	34(14)	1		
Adult	78(90.7)	8(9.3)	1.055	0.969-1.148	0.214
Elderly	22(88)	3(12)	1.023	0.878- 1.193	0.764
Residence					
Rural	28(84.8)	5(15.2)	1		
Urban	50(86.2)	8(13.8)	1.016	0.850-1.213	0.861
Pre-urban	230(87.8)	32(12.2)	1.034	0.889-1.203	0.659
Gender					
Male	129(86.6)	20(13.4)	1		
Female	179(87.7)	25(12.3)	1.013	0.934- 1.099	0.747
Marital status					
Single	168(86.6)	26(13.4)	1		
Married	124(87.3)	18(12.7)	1.008	0.927-1.096	0.845
Separated	16(94.1)	1(5.9)	1.086	0.953-1.239	0.214
Education					
Primary	108(89.3)	13(10.7)	1		
Secondary	105(85.4)	18(14.6)	0.956	0.868-1.052	0.363
Tertiary	95(87.2)	14(12.8)	0.976	.887-1.073	0.624
Employment					
Unemployed	265(91.1)	26(8.9)	1		
Employed	26(72.2)	10(27.8)	0.793	0.645-0.974	0.027*
Self-Employed	17(65.4)	9(34.6)	0.717	0.541-0.952	0.021*
Household Income (USD)					
< 139	236(88.1)	32(11.9)	1		
139–278	65(85.5)	11(15.5)	0.971	0.876-1.076	0.577
278–417	3(75)	1(25)	0.851	0.482- 1.503	0.580
> 417	4(80)	1(20)	0.908	0.584-1.412	0.670
Number of dependents					
1–5	215(84.6)	39(15.4)	1		
Above 5	93(93.9)	6(6.1)	1.109	1.032- 1.193	0.005*

P values * < 0.05; ** < 0.01; *** < 0.001.

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Table 5. Lifestyle and dietary habits predisposing factors for H. pylori.

	Results N (%)				
Lifestyle and Dietary Habits	**Positive**	**Negative**	**cPRR**	**95% CI**	**P value**
Smoking					
Yes	1(50)	1(50)	1		
No	307(87.5)	44(12.5)	1.749	0.436- 7.011	0.430
Alcohol consumption					
Yes	38(82.6)	8(17.4)	1		
No	270(87.9)	37(12.1)	1.064	0.926-1.223	0.378
Spicy food consumption					
Daily	28(87.5)	4(12.5)	1		
Weekly	141(88.7)	18(11.3)	1.013	0.878- 1.168	0.854
Monthly	91(84.3)	17(15.7)	0.962	0.825-1.123	0.632
Rarely	48(88.9)	6(11.1)	1.015	0.864- 1.194	0.849
Handwashing					
Always	247(87)	37(13)	1		
Often	61(88.4)	8(11.6)	1.016	0.922-1.119	0.74
Food source					
One eating place	77(89.5)	9(10.5)	1		
More than one eating place	231(86.5)	36(13.5)	0.966	0.886- 1.053	0.437
Water Source					
One water source	61(91)	6(9)	1		
More than one water source	247(86.4)	39(13.6)	0.948	0.868-1.036	0.241

P values * < 0.05; ** < 0.01; *** < 0.001.

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CI: 2.217–5.857, p < 0.001), having used NSAIDS (e.g., aspirin, ibuprofen) in past year (cPRR = 1.285, 95% CI: 1.031–1.602, p = 0.025), and having a family member diagnosed with *H. pylori* or GIT ulcers (cPRR = 1.14, 95% CI: 1.069–1.216, p < 0.001) were considered for multivariable analysis (Table 6).

Multivariable analysis of predisposing factors for *H. Pylori* infection among patients with gastro-intestinal symptoms attending Mulago Hospital

After controlling for confounding with age at multivariable analysis, the significant variables found positively, associated with testing positive for *H. pylori*, were participants with more than five financial dependents were more likely to test positive compared to those with one to five dependents (aPRR = 1.104, 95% CI: 1.025–1.189, p = 0.008). Those who had ever received treatment for *H. pylori* infection were substantially more likely to test positive compared to those who had not received treatment (aPRR = 3.459, 95% CI: 2.138–5.595, p < 0.001). Additionally, participants with a family member diagnosed with *H. pylori* infection or gastrointestinal tract (GIT) ulcers were more likely to test positive compared to those without such a family history (aPRR = 1.135, 95% CI: 1.055–1.221, p = 0.001) (Table 7).

Discussion

This study found an exceptionally high prevalence of *H. pylori* infection (87.3%) among symptomatic patients attending Mulago Hospital, highlighting a substantial and ongoing public health challenge in Uganda. These findings reflect widespread transmission within households, persistent reinfection or treatment failure, and socio-environmental conditions that continue to facilitate the spread of the bacterium. Given that Mulago Hospital serves as Uganda's national referral

Table 6. Bivariate analysis of medical history predisposing factors for H. pylori.

	Results				
Variable	**Positive**	**Negative**	**cPRR**	**95% CI**	**P value**
Ever been diagnosed with a GIT ulcer					
No	162(84.4)	30(15.6)	1		
Yes	146(90.7)	15(9.3)	1.074	0.993-1.162	0.072
Ever tested for *H. pylori* infection					
No	11(64.7)	6(35.3)	1		
Yes	297(88.4)	39(11.6)	1.366	0.959-1.945	0.084
Ever received treatment for *H. pylori* infection					
No	12(26.7)	33(73.3)	1		
Yes	296(96.1)	12(3.9)	3.603	2.217-5.857	0.000***
Currently taking any medications					
Yes	21(87.5)	3(12.5)	1		
No	287(87.2)	42(12.8)	0.996	0.852-1.166	0.97
Used NSAIDs (e.g., aspirin, ibuprofen) in past year					
No	25(69.4)	11(30.6)	1		
Yes	283(89.3)	34(10.7)	1.285	1.031-1.602	0.025*
Family member diagnosed with *H. pylori* or GIT ulcers					
No	244(85)	43(15)	1		
Yes	64(97)	2(3)	1.14	1.069-1.216	0.000***

P values * < 0.05; ** < 0.01; *** < 0.001.

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Table 7. Multivariable analysis of predisposing factors for H. Pylori infection among patients with gastro-intestinal symptoms attending Mulago Hospital.

Variable	**cPRR**	**95% CI**	**P value**	**aPRR**	**95% CI**	**P value**
Age group						
Youth	Ref					
Adult	1.055	0.969-1.148	0.214	0.991	0.904-1.088	0.864
Elderly	1.023	0.878- 1.193	0.764	0.925	0.833-1.027	0.148
Employment						
Unemployed	Ref					
Employed	0.793	0.645-0.974	0.027	0.849	0.702-1.028	0.095
Self-Employed	0.717	0.541-0.952	0.021	0..864	0.653- 1.143	0.307
Number of dependents						
1–5	Ref					
Above 5	1.109	1.032- 1.193	0.005	1.104	1.025-1.189	0.008**
Ever received treatment for *H. pylori* infection						
No	Ref					
Yes	3.603	2.217-5.857	0.000	3.459	2.138-5.595	0.000***
Used NSAIDs (e.g., aspirin, ibuprofen) in past year						
No	Ref					
Yes	1.285	1.031-1.602	0.025	1.037	0.893- 1.205	0.628
Family member diagnosed with *H. pylori* or GIT ulcers						
No	Ref					
Yes	1.14	1.069-1.216	0.000	1.135	1.055-1.221	0.001***

P values * < 0.05; ** < 0.01; *** < 0.001.

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center—receiving complex cases from Kampala, other regions of Uganda, and neighbouring countries—this high prevalence should be interpreted within this specific clinical context and may not be representative of the general population or primary healthcare settings. As a national referral hospital, Mulago disproportionately receives patients with persistent, recurrent, or complicated gastrointestinal disease, many of whom have failed primary-level management. This case mix likely inflates the observed prevalence compared with community or primary care settings. Therefore, these findings do not estimate *H. pylori* prevalence in the general Ugandan population; rather, they reflect the burden among a selected symptomatic population seeking care at a tertiary referral center and are consistent with the referral bias inherent to this setting.

Overall, the results underscore the need for strengthened public health interventions, improved diagnostic and treatment strategies, and community-level measures to reduce the burden of *H. pylori* and its long-term complications.

The prevalence reported in this study is considerably higher than that observed in previous Ugandan studies, likely reflecting differences in study populations, settings, and diagnostic methods. Namyalo et al. reported a prevalence of 35.7% among private clinic attendees [11], while Baingana et al. (2014) found 45.2% among pregnant women [14]. Diagnostic variation plays a critical role, as Kakooza (2021) reported a lower prevalence of 29.2% using antibody tests that indicate past exposure rather than active infection, unlike the stool antigen testing employed in this study [15]. Similarly, the lower prevalence reported among children in Mbarara by Aitila et al. (2019) likely reflects shorter exposure duration [16]. These contextual and methodological differences underscore the substantial burden of *H. pylori* infection among symptomatic adults seeking care in urban tertiary referral facilities. While this study provides important evidence on the burden of *H. pylori* among patients presenting with gastrointestinal symptoms at a tertiary-care hospital in Uganda, further research is needed to establish prevalence in primary healthcare settings and the general population. The findings reaffirm *H. pylori* infection as a significant public health and clinical concern, particularly in referral hospitals where patients often present with more advanced or persistent disease, and highlight the need for broader population-based studies to inform national screening, management, and prevention guidelines. Global evidence [1] and local studies [17,18] further emphasize the importance of targeted prevention, surveillance, and evidence-based treatment protocols tailored to Uganda's antibiotic resistance patterns.

Participants with more than five income dependents were more likely to test positive, due to overcrowding, shared living spaces, and limited resources that facilitate person-to-person transmission and shared living conditions that facilitate transmission through oral-oral or fecal-oral routes. This aligns with findings from Uganda and other countries, including observations from a study in South Western Uganda that found *H. pylori* infections were more common among children in crowded households [16]. Similar trends have been observed in other countries, including China [19], Turkey [20], and Germany [21] where familial exposure is considered a major source of transmission especially between parents and children, these comparisons should be interpreted cautiously because average household sizes differ across settings—for example, households in China average about 2–3 persons [22], which is smaller than in Uganda. Nonetheless, the findings consistently support the role of close household contact and crowding in *H. pylori* transmission and highlight the need for targeted interventions aimed at improving hygiene practices in households, alongside educational programs that emphasize proper sanitation, safe food handling, and strategies to reduce transmission in crowded living conditions. Strengthening community- and household-level interventions could significantly reduce the spread of *H. pylori* and its associated health risks, particularly in densely populated settings where close contact and shared facilities increase the likelihood of transmission.

Participants previously treated for *H. pylori* were more likely to test positive again, suggesting reinfection, recurrence, or incomplete eradication. These challenges may stem from persistent exposure, poor treatment adherence, or antibiotic resistance. Similar trends have been reported in studies assessing treatment outcomes [23,24]. Family-based management strategies—such as screening and treating household members, promoting good hygiene practices, improving access to clean water and sanitation, and ensuring appropriate follow-up care—have the potential to reduce reinfection

rates by addressing shared household predisposing factors. These findings underscore the importance of comprehensive interventions that integrate patient education, tailored treatment regimens, improved adherence, monitoring of antibiotic resistance, and screening of close contacts. Such coordinated patient-, household-, and community-level approaches are essential to interrupt ongoing transmission and break the cycle of reinfection.

Participants with a family history of *H. pylori* infection or gastrointestinal ulcers were more likely to test positive, further supporting evidence that transmission is often intra-household. Close contact, shared utensils, and common sanitation challenges contribute to this pattern, as described by Borka Balas et al. (2022) [25]. Screening and treating family members of infected individuals could disrupt transmission pathways and reduce household reinfection risks. Family-based management strategies, which target all infected or at-risk members within a household, offer a more comprehensive approach to minimizing infection rates. Public health efforts should prioritize such strategies, particularly in high-prevalence regions, as they not only address individual cases but also help prevent broader community transmission and the long-term health impacts of *H. pylori.*

Given the high prevalence among symptomatic tertiary care patients, routine *H. pylori* screening should be incorporated into standard clinical protocols at national referral facilities. Household-level interventions are essential as family members of index cases should receive testing and treatment, reflecting the strong association with intra-household transmission. WASH programs should be strengthened in households of peri-urban communities. Health education campaigns should target overcrowding, shared utensils, and poor sanitation as key transmission drivers. Findings suggest that Antibiotic stewardship programs are needed to monitor treatment adherence and local resistance patterns. Targeted interventions should include integration of *H. pylori* hygiene education into school health programs, age-appropriate clinical communication, routine testing when gastrointestinal symptoms are reported, and adolescent-friendly follow-up services to improve eradication therapy adherence. Future research should examine transmission dynamics, treatment adherence, and reinfection rates among the adolescent and young adult population in Uganda.

Strengths and limitations of the study

The study used consecutive sampling, which may have introduced selection bias and limited the generalizability of the findings, as only patients available during the data collection period were included. Conducting the study at Mulago Hospital, a national referral centre, also meant that participants were more likely to present with severe gastrointestinal symptoms, contributing to the high *H. pylori* prevalence and limiting applicability to community or primary care settings. Self-reported information on household conditions, diet, and treatment history may have been affected by recall bias, and the lack of qualitative data prevented deeper insight into transmission factors. The absence of confirmatory endoscopic biopsy with histology or rapid urease test (RUT) was a limitation since biopsy remains the gold standard for *H. pylori* diagnosis and would have allowed tissue-based confirmation of positive stool antigen results and because stool antigen tests remain positive for several (4–8weeks) following successful eradication therapy, some participants who had previously received *H. pylori* treatment and achieved eradication may have tested positive, inflating the prevalence estimate and contributing to the high proportion of positive results observed among those with a history of prior treatment. Contamination of stool samples was also a recognized limitation of this method, although standardized collection procedures and laboratory protocols were employed to minimize this risk.

Despite these limitations, the study's major strength was its implementation at a large referral centre serving a diverse population, providing important epidemiological evidence to guide clinical practice and targeted prevention strategies, and public health policy in Uganda.

Conclusion

The study found a very high *H. pylori* prevalence (9 in 10 patients) with gastrointestinal symptoms at Mulago National Referral Hospital. Infection was strongly associated with having more than five income dependents, previous *H. pylori*

treatment, and a family history of infection or gastrointestinal ulcers, underscoring the role of household and individual factors in transmission. Addressing these issues through better housing, awareness of familial risk, standardized treatment, and follow-up is crucial to reducing the infection burden of *H. Pylori.* These findings highlight *H. pylori* as a major clinical and public health concern in urban, resource-limited settings. Further research in primary healthcare and community populations is needed to guide wider prevention and management efforts.

Supporting information

S1 File. This is the consent form and quetionaire.
(DOCX)

S2 File. This is the dataset.
(XLSX)

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Author contributions

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