

# Occupational Risk of *Helicobacter pylori* Infection among Endoscopy Staff at a Saudi Tertiary Care Hospital: A Prospective Cohort Study

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## Abstract

**Objectives:** *Helicobacter pylori* (*H. pylori*) infection is highly prevalent in the general population, but its prevalence among hospital staff remains unclear. This study aimed to determine the prevalence of *H. pylori* infection among healthcare workers, particularly endoscopy unit personnel, who may face occupational exposure risks. **Methods:** In this prospective cohort study, we compared the prevalence of *H. pylori* among endoscopy unit staff (Group A) and matched controls from hemodialysis and family medicine clinics (Group B) at a tertiary care hospital. Infection status was assessed using the Helikit® MS01 urea breath test (UBT). The study was conducted from March 15, 2021, to February 15, 2022. Participants with dyspepsia or prior *H. pylori* diagnosis were excluded. **Results:** Among 61 participants (mean age 37.1 years; 43 (70.5%) female), the overall prevalence of *H. pylori* infection was 20 (32.8%). Group A (endoscopy staff; 18 [29.5% of cohort]) had an infection prevalence of 6 (33.3%), while Group B (controls; 43 [70.5% of cohort]) had a prevalence of 14 (32.6%). The unadjusted odds ratio for infection in endoscopy staff (Group A) versus controls (Group B) was 1.04 (95% CI: 0.31 - 3.28; p = 0.95). Multivariable adjustment yielded similar non-significant results (aOR = 0.98; p = 0.98). **Conclusion:** The prevalence of *H. pylori* infection among hospital staff was 20/61 (32.8%), with no significant increase observed in endoscopy personnel (6/18 [33.3%] vs. 14/43 [32.6%]). Occupational exposure in endoscopy units does not appear to increase infection risk.

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## Keywords

*Helicobacter pylori*, Prevalence, Endoscopy, Urea Breath Test, Occupational Health

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## 1. Introduction

*Helicobacter pylori* (*H. pylori*) is a gram-negative, microaerophilic bacterium characterized by its spiral morphology and flagella, which facilitate colonization of the gastric mucosa. Globally, it infects approximately 50% of the population, representing one of the most widespread chronic bacterial infections worldwide [1]. Prevalence varies significantly by geographic region, socioeconomic status, age, and living conditions. In Saudi Arabia, studies report infection rates of 28% - 46% among adults with dyspepsia, with the highest prevalence observed in the southern region [2].

*H. pylori* have diverse virulence mechanisms to survive the acidic gastric environment and induce mucosal injury. Its urease enzyme hydrolyzes urea to ammonia and carbon dioxide, neutralizing gastric acidity and creating a hospitable microenvironment. Flagella-mediated motility and adhesins such as BabA enable bacterial migration and attachment to gastric epithelial cells. Pathogenicity is further amplified by cytotoxin-associated gene A (CagA) and vacuolating cytotoxin A (VacA), which drive inflammation and cellular damage [3].

Transmission routes remain incompletely elucidated but are hypothesized to include person-to-person spread (oral-oral, fecal-oral, or gastro-oral) and iatrogenic exposure. Familial clustering and elevated prevalence in institutionalized populations highlight the role of close contact [4]. Endoscopic procedures pose a particular risk due to potential equipment contamination, such as endoscopes and nasogastric tubes. Inadequately disinfected endoscopes may harbor *H. pylori*, raising concerns about occupational exposure among gastroenterologists and endoscopy staff. A meta-analysis reported a 1.6-fold higher infection risk among gastroenterologists compared to the general population, though evidence for endoscopy nurses remains inconsistent [5].

Despite these risks, occupational exposure among endoscopy personnel in Saudi Arabia remains understudied. Strict infection control protocols—including standardized endoscope reprocessing and consistent use of personal protective equipment (PPE)—may reduce transmission [2]. This study aimed to assess the prevalence of *H. pylori* infection among endoscopy unit staff at a tertiary care hospital in Riyadh, Saudi Arabia, and compare it to non-endoscopy healthcare workers to evaluate occupational risk.

## 2. Methods

**Study Design and Setting:** We conducted a prospective cohort study at King Faisal Specialist Hospital and Research Center, Riyadh, Saudi Arabia. The study

protocol was approved by the Institutional Review Board (IRB No: 2201026). The study was conducted from March 15, 2021, to February 15, 2022.

**Study Population and Sampling:** Participants were recruited via stratified sampling of endoscopy unit staff, including gastroenterologists, nurses, and technicians, with strata defined by job role. Age- and gender-matched controls were selected from non-endoscopy units such as general wards and outpatient clinics.

**Inclusion and Exclusion Criteria:** Inclusion criteria consisted of asymptomatic adults aged 18 - 65 years with at least six months of occupational exposure in the endoscopy or non-endoscopy unit, adapted from the Maastricht VI/Florence consensus report [6]. Exclusion criteria included active gastrointestinal symptoms, prior *H. pylori* diagnosis or eradication therapy within the past five years, and recent use of proton pump inhibitors (PPIs), antibiotics, or bismuth compounds within four weeks of testing, which may compromise UBT accuracy.

**UBT Protocol:** Active *H. pylori* infection was diagnosed using the Helikit® MS01 urea breath test (Isodiagnostika, Edmonton, Canada), a non-invasive method with 96% sensitivity and 98% specificity [7]. Participants fasted for at least six hours prior to testing. A baseline breath sample was collected, followed by ingestion of 75 mg C-labeled urea dissolved in 50 mL water. A second breath sample was collected 30 minutes post-ingestion. The ratio was analyzed via isotope ratio mass spectrometry (IRMS), with a delta over baseline (DOB) value  $\geq 3.5\%$  defining a positive result.

**Data Collection:** Standardized case report forms captured demographics (age, gender, nationality), occupational factors (job role, years of service, frequency of PPE use), and UBT results.

**Statistical Analysis:** Analyses followed STROBE guidelines for observational studies. Prevalence was calculated with 95% confidence intervals (CI). Between-group comparisons used independent t-tests or Mann-Whitney U tests for continuous variables and  $\chi^2$  or Fisher's exact tests for categorical variables. Multivariable logistic regression adjusted for age, gender, employment duration, and nationality. Statistical significance was set at  $p < 0.05$ . Analyses were performed using SPSS 26 (IBM) and JAMovi (v2.3).

**Quality Assurance:** UBT operators completed hospital infection control-certified training. IRMS equipment was calibrated monthly per manufacturer guidelines. A 10% random sample underwent repeat testing, with discrepancies resolved by retesting.

**Ethical Considerations:** The study adhered to the Declaration of Helsinki and Saudi National Committee of Bioethics guidelines. Participants received pretest counseling, confidential result disclosure, and referral to gastroenterology for guideline-based treatment if positive.

### 3. Results

**Demographic and Clinical Characteristics:** The study cohort comprised 61 participants with a mean age of 37.1 years ( $\pm 8.6$  SD) and an age range of 23 to 57

years (**Table 1**). The majority were female (43, 70.5%). Saudi Arabian nationals formed the largest single group (21, 34.4%), followed by participants from the Philippines (9, 14.8%), India (8, 13.1%), and Malaysia (7, 11.5%); the remaining participants (16, 26.2%) represented diverse other nationalities (Jordan, South Africa, UK, Pakistan, Ireland, Poland, Yemen, Portugal). Regarding employment, 40 of 54 participants with data (74.1%) joined their institution in 2011 or later, and 43 participants (70.5%) reported a stable workplace over the preceding year. Endoscopy exposure was reported in 18 participants (29.5%). Testing revealed a *Helicobacter pylori* infection prevalence of 20 participants (32.8%) based on a positive urea breath test.

**Table 1.** Participant characteristics (N = 61).

Variable	Category/Statistic	Value
<b>Demographics</b>		
Age (years)	Mean ± SD	37.1 ± 8.6
	Range	23.0 - 57.0
Gender	Female	43 (70.5%)
	Male	18 (29.5%)
Nationality	Saudi	21 (34.4%)
	Philippines	9 (14.8%)
	Indian	8 (13.1%)
	Malaysia	7 (11.5%)
	Others	16 (26.2%)
<b>Employment Characteristics</b>		
Joining year	<2011	14 (25.9%)*
	≥2011	40 (74.1%)*
Stable workplace (past year)	Yes	43 (70.5%)
Endoscopy exposure	No	43 (70.5%)
	Yes	18 (29.5%)
<i>H. pylori</i> status		
Urea breath test result	Positive	20 (32.8%)

Values are presented as mean ± standard deviation (SD), range, or number (percentage) unless otherwise specified. Other nationalities: Jordan (4), South African (4), UK (2), Pakistan (2), Irish (1), Poland (1), Yemen (1), Portuguese (1). SD: Standard deviation; PPI: Proton pump inhibitor. Asterisk (\*) indicates missing data for 7 participants in joining year (percentages calculated from n = 54 with available data).

**Univariate Analysis:** Among the 61 participants, 20 (32.8%) tested positive for *H. pylori* infection via urea breath test (**Table 2**). Univariate analysis comparing

**Table 2.** Predictors of *Helicobacter pylori* infection: univariate and multivariate logistic regression analysis.

Variable	Univariate Analysis		Multivariate Analysis		
	Negative (N=41)	Positive (N=20)	Adjusted OR (95% CI)	Test Statistic	p-value
Age (years), median [IQR]	36.0 [29.7 - 42.3]	37.0 [31.0 - 44.8]	1.03 (0.97 - 1.10)	W = 379.5	0.312
Gender (Male), n (%)	9 (22.0%)	9 (45.0%)	3.42 (1.05 - 11.15)	z = 2.040	<b>0.041</b>
Nationality, n (%)					
Saudi	13 (31.7%)	8 (40.0%)	1.25 (0.40 - 3.91)	z = 0.384	0.701
Philippines	6 (14.6%)	3 (15.0%)	—	—	—
Indian	8 (19.5%)	0 (0.0%)	—	—	—
Other	14 (34.1%)	9 (45.0%)	—	—	—
Endoscopy nurse, n (%)	11 (26.8%)	3 (15.0%)	0.42 (0.09 - 1.89)	z = -1.117	0.256
Endoscopy exposure, n (%)	12 (29.3%)	6 (30.0%)	0.98 (0.29 - 3.35)	z = -0.032	0.976
Stable workplace, n (%)	31 (75.6%)	12 (60.0%)	0.47 (0.15 - 1.50)	z = -1.285	0.201

Notes: 1) Univariate analysis: Categorical variables: Pearson  $\chi^2$  test (reported as  $\chi^2$  value). Continuous variables: Wilcoxon rank-sum test (reported as W statistic). Nationality comparison:  $\chi^2$  (df = 11) = 11.24, p = 0.390. Other nationalities: Malaysia (n = 7), Jordan (n = 4), South African (n = 4), UK (n = 2), Pakistan (n = 2), Irish (n = 1), Poland (n = 1), Yemen (n = 1), Portuguese (n = 1); 2) Multivariate analysis: Binomial logistic regression adjusted for all listed variables. Test statistic: Wald z-values (computed from OR/95% CI). Reference groups: Female (gender), Non-Saudi (nationality). Model fit: Nagelkerke R<sup>2</sup> = 0.21, AUC = 0.72; 3) Statistical tests legend: Univariate p-values: Categorical: Pearson  $\chi^2$  test. Continuous: Wilcoxon rank-sum test. Multivariate p-values: Wald test from logistic regression. Bolded p-value denotes statistical significance (p < 0.05).

infected (n = 20) and uninfected (n = 41) participants revealed no statistically significant difference in age (median [IQR]: 37.0 [31.0 - 44.8] years vs. 36.0 [29.7 - 42.3] years, p > 0.05). A higher proportion of infected participants were male (9, 45.0%) compared to uninfected participants (9, 22.0%; p > 0.05). Regarding endoscopy exposure, the prevalence of infection was similar among exposed (6/18 (33.3%)) and non-exposed participants (14/43 (32.6%); p > 0.05). No significant differences were observed for nationality (p = 0.390), endoscopy nurse role (positive: 3 (15.0%) vs. negative: 11 (26.8%); p > 0.05), or stable workplace status (positive: 12 (60.0%) vs. negative: 31 (75.6%); p > 0.05). Endoscopy exposure prevalence was comparable: 6/18 exposed participants (33.3%) were positive versus 14/43 non-exposed participants (32.6%; p > 0.05).

**Multivariate Analysis:** Binomial logistic regression, adjusted for age, gender, nationality, endoscopy nurse status, endoscopy exposure, and stable workplace, identified male gender as the sole significant independent predictor of *H. pylori* infection (Adjusted OR = 3.42; 95% CI: 1.05 - 11.15; p = 0.041). Endoscopy exposure was not associated with infection status (Adjusted OR = 0.98; 95% CI: 0.29 - 3.35; p = 0.976). Similarly, no significant associations were found for age (Adjusted OR = 1.03; 95% CI: 0.97 - 1.10; p = 0.312), Saudi nationality vs. non-Saudi (Adjusted OR = 1.25; 95% CI: 0.40 - 3.91; p = 0.701), endoscopy nurse role (Adjusted OR = 0.42; 95% CI: 0.09 - 1.89; p = 0.256), or stable workplace (Adjusted OR = 0.47; 95% CI: 0.15 - 1.50; p = 0.201). The multivariate model demonstrated mod-

erate explanatory power (Nagelkerke  $R^2 = 0.21$ ) and discrimination (AUC = 0.72). Endoscopy exposure was not associated with infection (aOR = 0.98; 95% CI: 0.29 - 3.35;  $p = 0.976$ ).

**Occupational Exposure:** Thirty-three percent (6/18) of endoscopy-exposed staff tested positive compared to 32.6% (14/43) of non-exposed workers ( $p = 0.952$ ). The unadjusted odds ratio was 1.04 (95% CI: 0.31 - 3.28); after adjustment, it was 0.98 (95% CI: 0.29 - 3.35;  $p = 0.976$ ). These findings indicate that neither demographic factors nor endoscopy unit exposure was significantly associated with *H. pylori* infection.

**Comparative Risk Across Hospital Units:** Risk ratios (RR) for *H. pylori* infection among staff in the endoscopy unit versus family medicine and hemodialysis units revealed no statistically significant elevation in risk.

## 4. Discussion

**Key Findings:** The 32.8% infection prevalence among hospital staff aligns with Saudi Arabian community rates (28% - 46%) in adults with dyspepsia, suggesting comparable infection risks between healthcare workers and the general population [2]. Endoscopy personnel showed no elevated risk (unadjusted OR = 1.04,  $p = 0.95$ ; adjusted OR = 0.98,  $p = 0.98$ ), contrasting with international studies reporting increased prevalence among gastroenterologists [5]. This discrepancy likely reflects strict adherence to Saudi national endoscope reprocessing guidelines. The observed male predominance in infection rates (45% vs. 22% positivity,  $p = 0.062$ ) aligns with meta-analyses identifying a male predilection in adults, potentially reflecting biological, behavioral, or environmental factors [8].

**Infection Control Context:** The absence of occupational risk aligns with evidence that modern disinfection protocols effectively eradicate *H. pylori* from reprocessed equipment. Saudi Arabia's adherence to rigorous disinfection minimizes risks despite high community prevalence [2]. Traditional cleaning methods (e.g., alcohol rinsing) are insufficient; meticulous compliance with validated guidelines ensures elimination of *H. pylori* [9].

**Contrasts with Global Evidence:** While some studies associate endoscopy with elevated *H. pylori* risk, our null results align with recent reports attributing reduced transmission to improved PPE compliance and disinfection [10]-[13]. Conflicting data on endoscopy nurses may reflect variability in protocol adherence or statistical power limitations.

**Strengths and Limitations:** Strengths include the use of UBT for active infection detection, avoiding serology's recall bias. Limitations include a small sample size, single-center design, unmeasured confounders (e.g., procedure volumes), and potential underestimation of prevalence due to exclusion of symptomatic staff.

**Clinical and Public Health Implications:** Comparable prevalence between endoscopy and non-endoscopy staff supports the efficacy of Saudi reprocessing standards. Routine occupational screening is unwarranted; public health initia-

tives should prioritize high-risk community groups and staff awareness of non-occupational transmission routes.

## 5. Conclusion

This study found a 32.8% prevalence of *H. pylori* infection among hospital staff, with no significant increase in endoscopy personnel. Occupational exposure in endoscopy units does not substantially elevate infection risk, supporting the effectiveness of current safety protocols. Community acquisition likely remains the primary source of infection, reinforcing the need for broader public health measures to reduce transmission.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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