

ORIGINAL RESEARCH—CLINICAL

Study of Acid-related Disorders: Real-world Physician and Patient Perspectives on Burden of *Helicobacter pylori* InfectionColin W. Howden,¹ Stuart J. Spechler,² Michael F. Vaezi,³ A. Mark Fendrick,⁴ Christian Atkinson,⁵ Corey Pelletier,⁶ Rinu Jacob,⁶ and Stephen Brunton⁷

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BACKGROUND AND AIMS: *Helicobacter pylori* eradication rates have declined as antibiotic resistance rates have increased. In addition, adherence to treatment guidelines is suboptimal. It is therefore important that contemporary, real-world evidence of diagnostic and treatment patterns is explored and compared with evidence-based guidelines. The Study of Acid-Related Disorders investigated unmet needs among patients with *H pylori* infection and past or current dyspepsia. **METHODS:** Gastroenterologists (GIs) and family physicians (FPs) or general practitioners (GPs) treating patients with *H pylori* infection and past or current dyspepsia completed a physician survey and invited patients to complete a patient survey; data were also extracted from the medical records of enrolled patients. **RESULTS:** Two hundred fifty-one physicians and 77 patients were enrolled. A total of 19.5% of patients were diagnosed by serology, whereas the urea breath test was used by 6.5% of GIs and 50.0% of FPs or GPs. A total of 68.6% of GIs and 79.8% of FPs or GPs selected clarithromycin, amoxicillin, and proton pump inhibitor triple therapy as their ideal first-line treatment. Physicians reported that 52.9% of patients experienced dyspepsia daily. A total of 46.8% of patients believed that complete resolution of dyspepsia would indicate effective treatment. As their treatment goal, 69.3% of physicians selected improvement in overall symptoms, whereas 92.2% of patients specified improvement in dyspepsia. Only 28.7% of physicians were satisfied with current treatment options. A total of 59.7% of patients took all of their prescribed medicine(s). A total of 59.7% of patients would prefer to take fewer pills; 45.5% would prefer convenience packs. **CONCLUSION:** This study reveals a lack of adherence to current *H pylori* guidelines for diagnosis, testing, and treatment. New treatment options that are more efficacious and simpler for patients to adhere to are needed.

Background

Helicobacter pylori is a microaerophilic gram-negative bacterium, with infection spread among humans through person-to-person contact.^{1,2} A 2017 systematic review and meta-analysis estimated that over half the world's population (4.4 billion individuals) is *H pylori*-seropositive, with notable differences in prevalence as per race, geographical location, and socioeconomic status.³ Although most individuals with *H pylori* infection are asymptomatic,⁴ infection may lead to peptic ulcer disease, gastric adenocarcinoma, or gastric mucosa-associated lymphoid tissue lymphoma.^{5,6} Some individuals with *H pylori* infection develop dyspeptic symptoms in the absence of peptic ulceration.⁷ However, eradication of *H pylori* infection often does not lead to resolution of dyspepsia.^{8,9}

The 2017 American College of Gastroenterology (ACG) guideline recommends that all patients who test positive for *H pylori* infection should be offered eradication treatment. The guideline recommends that triple therapy, comprising a proton pump inhibitor (PPI) and 2 antibiotics (typically, clarithromycin with either amoxicillin or metronidazole),^{10,11} should only be used for patients with no prior macrolide exposure and who come from regions where local

Abbreviations used in this paper: ACG, American College of Gastroenterology; eCRF, electronic case report form; FP, family physician; GIs, gastroenterologists; GP, general practitioner; HP, *Helicobacter pylori*; PPI, proton pump inhibitor; SD, standard deviation; UBT, urea breath test.

Most current article

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resistance to clarithromycin is known to be <15%.¹¹ Otherwise, it recommends 14-day bismuth quadruple therapy (PPI, bismuth, metronidazole, and tetracycline) as first-line treatment.^{11–13}

The ACG guideline also recommends tests of active infection for diagnosis of *H pylori* infection. These may be noninvasive (eg, urea breath test [UBT] and fecal antigen test) or invasive (biopsy urease testing, histology, and bacterial culture). Confirmation of eradication with a noninvasive test of active infection is advised after treatment in all patients¹⁰ as the presence or absence of symptoms does not correlate with *H pylori* status after treatment.^{8,9} However, serological testing is not recommended for either diagnosing active infection or confirming eradication in either the ACG guideline or the Houston Consensus Conference on testing for *H pylori* infection in the United States.^{10,14}

Despite different treatment options, *H pylori* eradication rates with currently used first-line treatments (especially those including metronidazole, clarithromycin, or levofloxacin) have declined^{15,16} as antibiotic resistance rates have increased.¹⁷ Factors contributing to failure of eradication and/or development of resistance include lack of adherence to treatment regimens,¹⁸ use of known inferior regimens to treat *H pylori*,^{18,19} and uncontrolled use of common antibiotics in the general population.^{18,19} Therefore, clinicians should review prior antibiotic exposure when selecting a treatment regimen.^{7,10}

Previous studies have shown that adherence to *H pylori* treatment guidelines is suboptimal among both gastroenterologists (GIs) and primary care practitioners.^{20–22} As per a 2017 survey, only 84% of GIs offered treatment to ‘every patient’ with a positive *H pylori* test, and only 38% asked about prior antibiotics before prescribing treatment for *H pylori* infection.²¹ In another study, 50% of US primary care physicians used a suboptimal test to diagnose *H pylori* infection, and only 54% used a ‘test and treat’ process for the management of dyspepsia.²²

Despite increasing attention paid to the importance of *H pylori* resistance, little is currently known about clinical practice patterns in North America.¹⁵ It is therefore important that real-world evidence is explored to evaluate testing for initial diagnosis and for documentation of eradication as well as treatment patterns and adherence to treatment guidelines in contemporary practice. Thus, we designed the Study of Acid-Related Disorders to investigate unmet needs among patients with *H pylori* infection and past or current dyspepsia in terms of initial diagnosis and evaluation, treatment patterns, symptom burden, treatment satisfaction, and adherence.

Methods

Study Design

A geographically representative sample of physicians currently treating patients with *H pylori* infection and past or current dyspepsia was recruited from community practices throughout the United States using internet panels and targeted custom enrollment.

Eligible physicians were asked to complete a survey of their demographic characteristics and their consulting population. Enrolled physicians then invited 1 to 4 of their patients with *H pylori* infection and past or current dyspepsia to complete a patient survey. Finally, prespecified medical information was extracted from the medical records of patients who completed the survey via an electronic case report form (eCRF). Thus, patient survey and medical chart data were matched for all patients.

Survey Populations

GIs and family physicians (FPs) or general practitioners (GPs) who qualified for the study had 4–40 years’ experience in clinical practice in the United States. They were eligible if they were responsible for the management of at least 10 (GIs) or 5 (FPs or GPs) patients per month with previously diagnosed *H pylori* infection and past or current dyspepsia. Physicians were ineligible if they estimated that more than 40% of their patients were currently included in clinical trials.

Patients were eligible if they were between 18 and 75 years old at the time of informed consent, could read and understand English, had a confirmed diagnosis of *H pylori* infection (International Classification of Disease 10 code of B96.81; *H pylori* as the cause of diseases classified elsewhere) and a past or present diagnosis of dyspepsia (pain or discomfort centered in the upper abdomen lasting at least 2 weeks), and had been treated (within the past 3 months or currently) with a PPI-antibiotic combination for *H pylori* infection. We excluded patients diagnosed with an untreated psychiatric disorder or memory problems.

Data Collection

Data were derived from 3 distinct components: (1) physician survey, (2) patient survey, and (3) eCRF data. The physician and patient surveys were completed online, and both took approximately 30 minutes. Data capture from medical charts via the eCRF took around 15 minutes. Physicians and patients were remunerated for their time in participating in the study.

The physician survey ([Supplementary Information 1](#)) covered the physician’s demographic characteristics, consulting population, prescribing habits, treatment satisfaction, and perception of patient adherence. Responses were rated on a scale from 1 (strongly disagree) to 7 (strongly agree); ‘agreement’ was indicated by scoring 6 or 7 on the 7-point scale. The patient survey ([Supplementary Information 2](#)) covered demographics, treatment adherence, symptom burden, treatment patterns, and treatment satisfaction. Responses were rated on a scale from 1 (not at all) to 7 (extremely); ‘agreement’ was indicated by scoring 6 or 7 on the 7-point scale. The eCRF captured information relating to patient demographics, clinical characteristics, patient management, testing, treatment, and any hospitalizations and procedures.

Prespecified and exacting quality control measures were followed at all stages throughout the data collection process to maximize data quality.

Statistical Analysis

Categorical variables are presented as frequency and percentage distributions; ordinal variables are reported as

frequencies and percentages, as appropriate; continuous variables (age, time since diagnosis, and questions with numeric rating scale responses) are presented as mean and standard deviation (SD).

There was no imputation of missing data or aggregation across questions.

Ethical Considerations

All data collected were deidentified and aggregated as per relevant ethical guidelines and laws, including the European Pharmaceutical Market Research Association²³ and Health Insurance Portability and Accountability Act of 1996.²⁴ The study protocol was approved by the Western Institutional Review Board (Puyallup, Washington, US).

Results

Study Population

In total, 251 physicians (102 GIs and 149 FPs or GPs) completed the survey. Nineteen GIs and 28 FPs or GPs completed a patient eCRF (47 physicians provided eCRF data). GIs saw 24.6% of patients in the hospital and 73.4% in an office setting, compared with 6.3% and 91.7%, respectively, for FPs or GPs. GIs and FPs or GPs had seen a mean of 39.8 and 30.1 patients with *H pylori* infection, respectively, in the preceding month.

We included data from 77 patients, 31 from GIs and 46 from FPs or GPs. Overall, 34% of patients were male (29% of GIs and 37% of FPs or GPs). The mean (SD) age of patients at the time of the survey and at time of *H pylori* diagnosis was 45.7 (15.5) and 43.8 (15.3) years, respectively. The mean (SD) time since diagnosis was 1.7 (2.8) years.

Evaluation and Diagnosis

From the physician survey, 67.6% of GIs and 60.4% of FPs or GPs agreed that many individuals with *H pylori* infection are currently undiagnosed (Table 1). A summary of tests undergone by patients at diagnosis as per eCRF data is provided in Figure 1. Fifteen patients (19.5%) were diagnosed by serology, all of whom were diagnosed by FPs or GPs (32.6% of FP or GP patients). The UBT was used by only 6.5% of GIs and 50.0% of FPs or GPs.

From the patient survey, 41.6% of patients considered that their family members should be tested for *H pylori* infection (Table 2).

Treatment Patterns

In total, 65.7% of physicians noted that increased eradication rates are the most important need in *H pylori* management (72.5% GIs and 61.1% FPs or GPs). Physicians estimated that 29.0% of patients would fail first-line treatment (GIs: 29.9%; FPs or GPs: 28.4%), whereas eCRF data revealed that 27.3% of patients had received 2 courses of treatment for *H pylori* infection, and 9.1% had received 3 courses.

Therapies that typically used first- or second-line treatment for patients newly diagnosed with *H pylori* infection are summarized in Figure 2A and B. Overall, 68.6% of GIs and 79.8% of FPs or GPs selected clarithromycin, amoxicillin, and PPI triple therapy as their ideal first-line treatment. Clarithromycin-based regimens also comprised 50% of those selected for second-line treatment.

Preferred second-line treatment as per main first-line preferences is summarized in Figures 2C and D. Twenty-four percent of physicians would repeat clarithromycin

Table 1. Physician Attitudes to Treatment Goals

Statement	Agreement ^a		
	Overall (n = 251)	Gastroenterologist (n = 102)	FP/GP (n = 149)
Increased eradication rates are the most important need in <i>Helicobacter pylori</i> management	65.7%	72.5%	61.1%
High eradication rates with fewer pills per day are important to me	65.7%	66.7%	65.1%
Increasing eradication rates would result in reducing the risk of gastric cancer	65.3%	62.7%	67.1%
Many <i>Helicobacter pylori</i> patients are undiagnosed	63.3%	67.6%	60.4%
Finding a product that is effective in patients with resistance to standard treatments is important to me	62.2%	65.7%	59.7%
I desire a more effective treatment option to limit overuse of antibiotics	61.0%	61.8%	60.4%
Decreasing eradication rates concerns me	58.2%	63.7%	54.4%
Antibiotic resistance limits treatment options	51.0%	59.8%	45.0%

Base: Physicians (251).

^aAgreement indicated by scoring 6 or 7 on a 7-point scale where 1 is strongly disagree and 7 is strongly agree.

Source: Physician Survey: DQ2a. Please rate your agreement with the following statements regarding *Helicobacter pylori* with past/present dyspepsia.

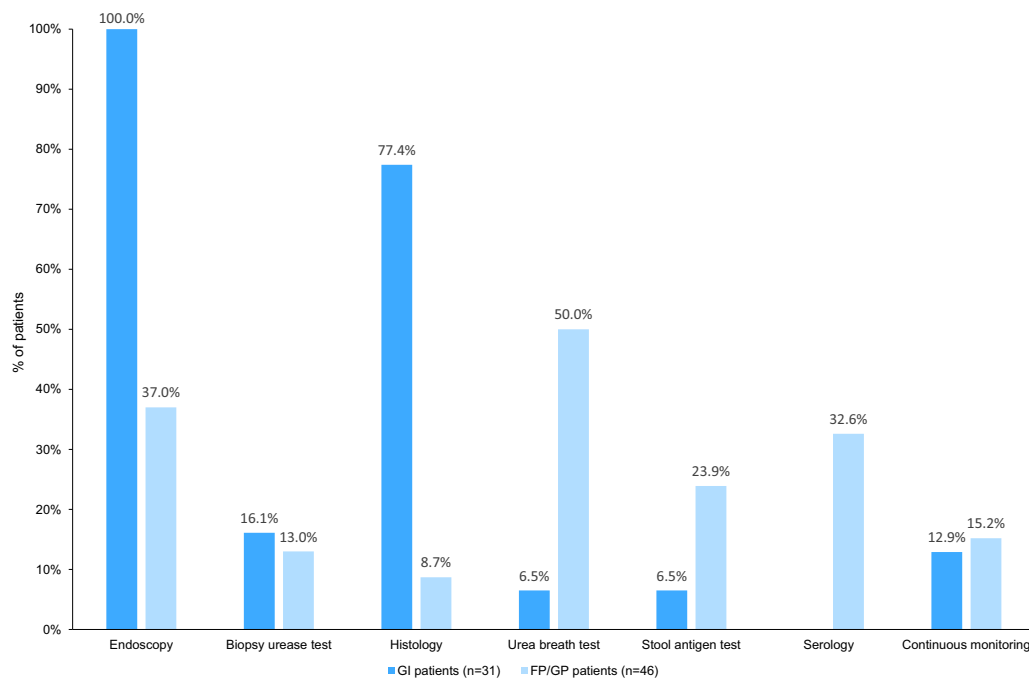


Figure 1. Tests undergone among patients diagnosed by gastroenterologists and family or general physicians.

triple therapy after Prevpac, whereas 43% would follow nonbranded clarithromycin triple therapy with another clarithromycin-based therapy (31% clarithromycin, metronidazole, and any PPI and 12% Prevpac).

Reasons given by physicians for their preferred first-line therapies are summarized in Figure 3A. Among physicians who selected Prevpac (clarithromycin, amoxicillin, and lansoprazole) or clarithromycin/amoxicillin/any PPI as their first-line preference, familiarity was their primary reason (52.7% for Prevpac; 62% for clarithromycin, amoxicillin, and any PPI).

Table 2. Patient Attitudes to Treatment Goals

Statement	Agreement ^a
I desire a product that completely cures my <i>Helicobacter pylori</i> with 1 course	80.5%
I understand what “antibiotic resistance” means	58.4%
I understand how antibiotic resistance impacts treatments	57.1%
I would prefer to limit antibiotic use	50.6%
I understand the implications of <i>Helicobacter pylori</i> on my long-term health	44.2%
I think that my family should be tested for <i>Helicobacter pylori</i>	41.6%
I am concerned other people may have <i>Helicobacter pylori</i> and do not know it	39.0%
I am aware of the issue of “increased eradication rates”	32.5%

H pylori Patient Survey: C9.

Base: All patients (77).

^aAgreement indicated by scoring 6 or 7 on a 7-point scale where 1 is completely disagree and 7 is completely agree.

Symptom Burden

Despite prescribing eradication treatment for *H pylori* infection, physicians reported that 52.9% of patients continued to experience dyspepsia daily. Both patients and physicians rated dyspepsia among the most bothersome symptoms (Figure 3B). Severity of dyspepsia as recorded in the eCRF was moderate or severe in 23.4% of patients at the time of the survey and in 96.1% of patients at initiation of current treatment.

Treatment Goals and Satisfaction

The most important treatment goals recorded by physicians and patients are summarized in Figure 3C and D, respectively. Symptomatic improvement of dyspepsia was the most important treatment goal for both groups (69.3% of physicians; 62.7% GIs and 73.8% FPs, or GPs). Among patients, 92.2% specified improvement in dyspepsia as their treatment goal. The second most important treatment goal among patients was reducing risk of stomach cancer (83.1%). However, physicians did not consider gastric cancer reduction (41.2% GIs and 26.8% FPs or GPs) to be a top treatment priority.

Only 53.0% of physicians (43.1% GIs and 59.7% FPs or GPs) believed that treatment goals were achievable with current treatments, and 63.7% (62.7% GIs and 64.4% FPs or GPs) reported a need for effective, dual therapy. Only 28.7% physicians were satisfied with current treatment options.

Sixty-one percent of physicians desired a more effective treatment option to limit overuse of antibiotics (Table 3). Patients were also concerned about antibiotic overuse, with 50.6% preferring to limit antibiotic use (Table 2).

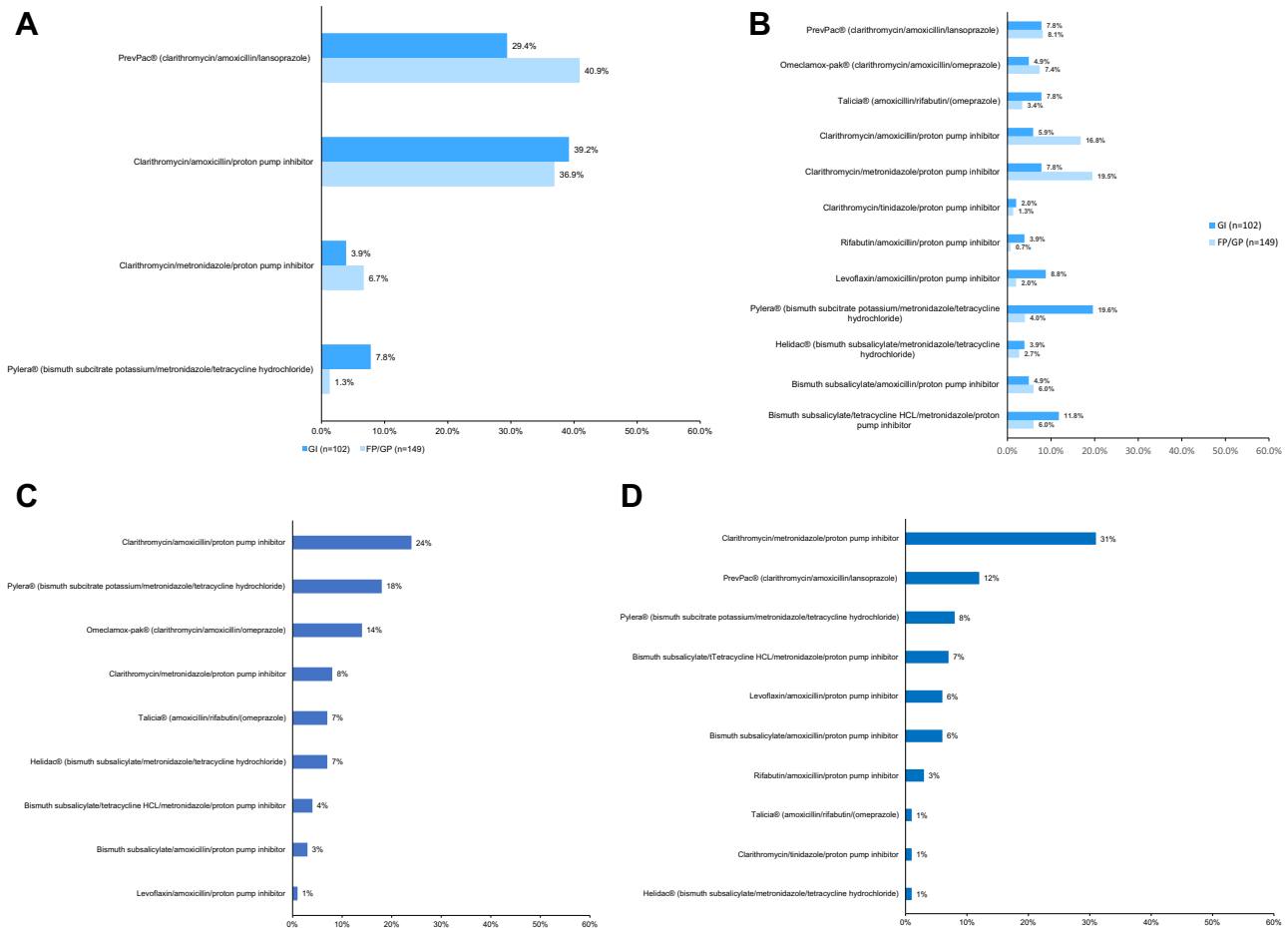


Figure 2. Therapies typically used in newly diagnosed patients with *H. pylori*: (A) first-line; (B) second-line. Therapies typically used second-line treatment after (C) first-line Prevpac and (D) first-line clarithromycin, amoxicillin, and PPI.

Only 36.7% of physicians believed that their patients understood the link between *H. pylori* and gastric cancer (Table 3).

Overall, 46.8% of patients considered that complete cessation of dyspepsia would demonstrate effectiveness of current or recent treatment, whereas 39.0% believed that treatment effectiveness would be demonstrated by reduced dyspepsia severity. A substantial majority of patients (80.5%) desired a product that would reliably cure *H. pylori* infection in one course, but only 51.9% believed that their current treatment was actually a cure for infection.

Adherence

Only 59.7% of patients reported that they took all prescribed medication. Of the 40.3% of patients who were not fully adherent, 90.3% forgot to take their medication at least some of the time, 74.2% failed to complete a course of therapy, 48.5% often missed a dose at least some of the time because they did not understand the instructions correctly, whereas 25.9% decreased dosing and 25.8% increased dosing independently at least 50% of the time.

The patient survey also showed that patients desired simpler treatment regimens. For example, 59.7% would

prefer to consume fewer pills daily, and 45.5% indicated that packaging that grouped medicines by dose and time would help them remember to take the medicines correctly.

Physician-stated reasons for patients altering their treatment frequency are summarized in Figure 3E. The most common reasons were that the treatment was burdensome and that side effects were not tolerable (reported by 48.6% of physicians in both cases). In total, 67.3% of physicians believed that adherence was multifaceted (61.8% GIs and 71.1% FPs or GPs) (Table 3). Furthermore, 57.8% of physicians felt that simpler treatment regimens would lead to higher eradication rates, whereas 66.1% believed that convenience packs would make daily dosing easier to remember and would be helpful.

Discussion

A number of measures have been recommended to improve the management of *H. pylori* infection, including appropriate diagnosis and testing through greater adherence to current guidelines, pretreatment testing for antibiotic resistance by traditional or molecular methods (currently not easily available throughout much of the

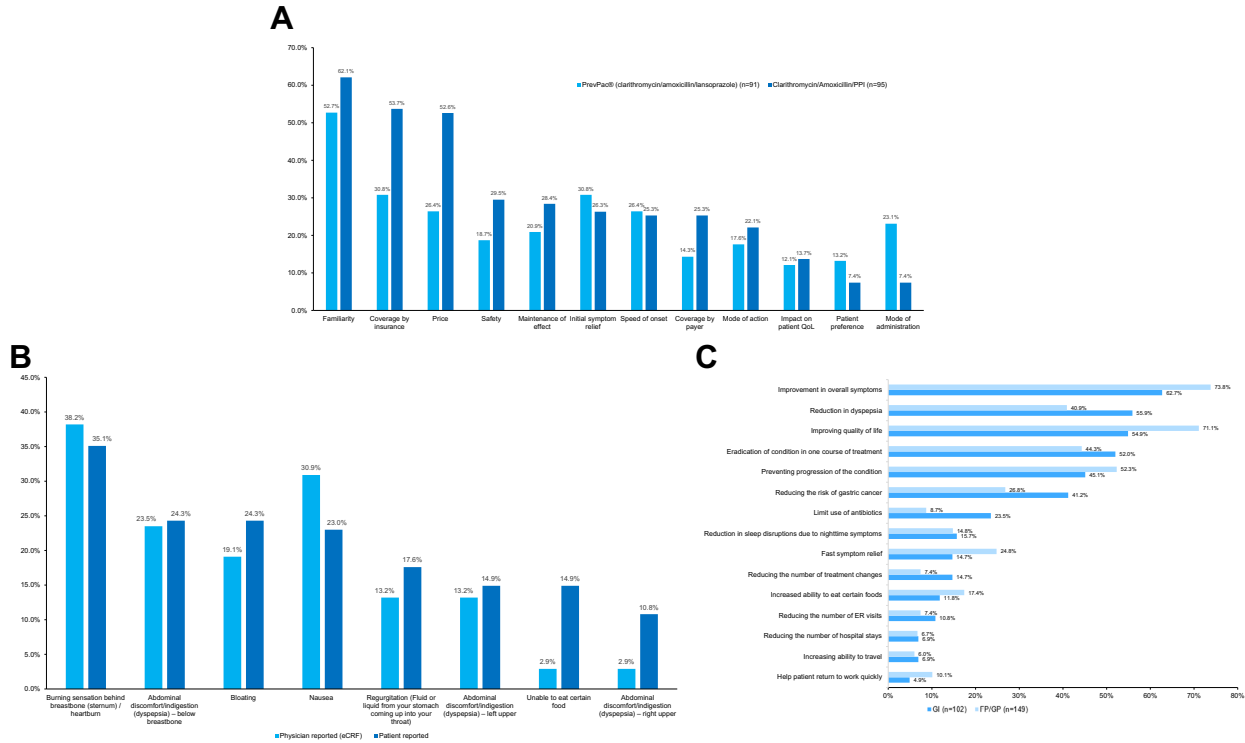


Figure 3. (A) Physician-given reasons for preferred first-line treatment. (B) Most bothersome symptoms as reported by physicians and patients. Most important treatment goals among (C) physicians and (D) patients. (E) Reasons given for patients altering treatment frequency.

United States), avoidance of known inferior regimens, review of a patient’s antibiotic history, and addressing adherence challenges.^{10,15,16} Current recommendations for first-line treatment of *H pylori* infection in the United States include clarithromycin-based triple therapy (with the limitations outlined previously) and bismuth quadruple therapy.¹⁰ However, among patients with dyspepsia, eradication of *H pylori* infection often does not lead to symptom resolution.^{8,9,25–27}

To improve patient outcomes after treatment of *H pylori* infection, it is important to have a clear and detailed understanding of current real-world practices, from the perspectives of patients and physicians. This study provides deep insights into current practices regarding initial evaluation of *H pylori* infection as well as symptom burden and treatment patterns, satisfaction, goals, and adherence.

One important finding from this study is that noninvasive testing for active *H pylori* infection is still not consistently used in practice, despite widespread availability. For example, one-third of patients were inappropriately tested by FPs or GPs with serology, although—encouragingly—the use of the UBT by this group was greater than previously estimated.²³ Although the UBT was used by only 7% of GIs, this presumably reflects their more frequent use of endoscopy to diagnose *H pylori* infection. The ongoing use of serology for diagnosis indicates that some recommendations from the 2017 ACG guideline¹⁰ and Houston Consensus¹⁴ are not being followed in real-world clinical practice. Interestingly, 68% of GIs and 60% of FPs or GPs

agreed that many individuals with *H pylori* infection remained undiagnosed. Encouraging greater compliance with current guidelines may help to improve patient outcomes.

Eradication rates may be falling because of antibiotic resistance, nonadherence, host genetics, other host factors, and *H pylori* strain diversity.^{16,29,30}

Suboptimal rates of *H pylori* eradication are also reflected in the present study. In total, 58% of physicians were concerned that eradication rates are declining, leading to poorer treatment outcomes. Despite this, use of triple regimens that include a PPI and clarithromycin is still common practice.

Nineteen percent of GIs and 32% of FPs or GPs selected clarithromycin-based triple therapy (branded or nonbranded) as their ideal first-line treatment. Furthermore—and concerning—many physicians stated that they would select a clarithromycin-based regimen for second-line treatment after failure of clarithromycin triple therapy first-line treatment. Specifically, 24% would repeat clarithromycin triple therapy for patients already treated with clarithromycin, whereas 43% would follow clarithromycin triple therapy with another clarithromycin-based option. Despite their apparent confidence in their treatment choices, physicians estimated that 29% of patients would fail first-line treatment. This is reflected in eCRF data, indicating that 27% of patients had received 2 courses of treatment for *H pylori* infection and that 9% had received 3 courses.

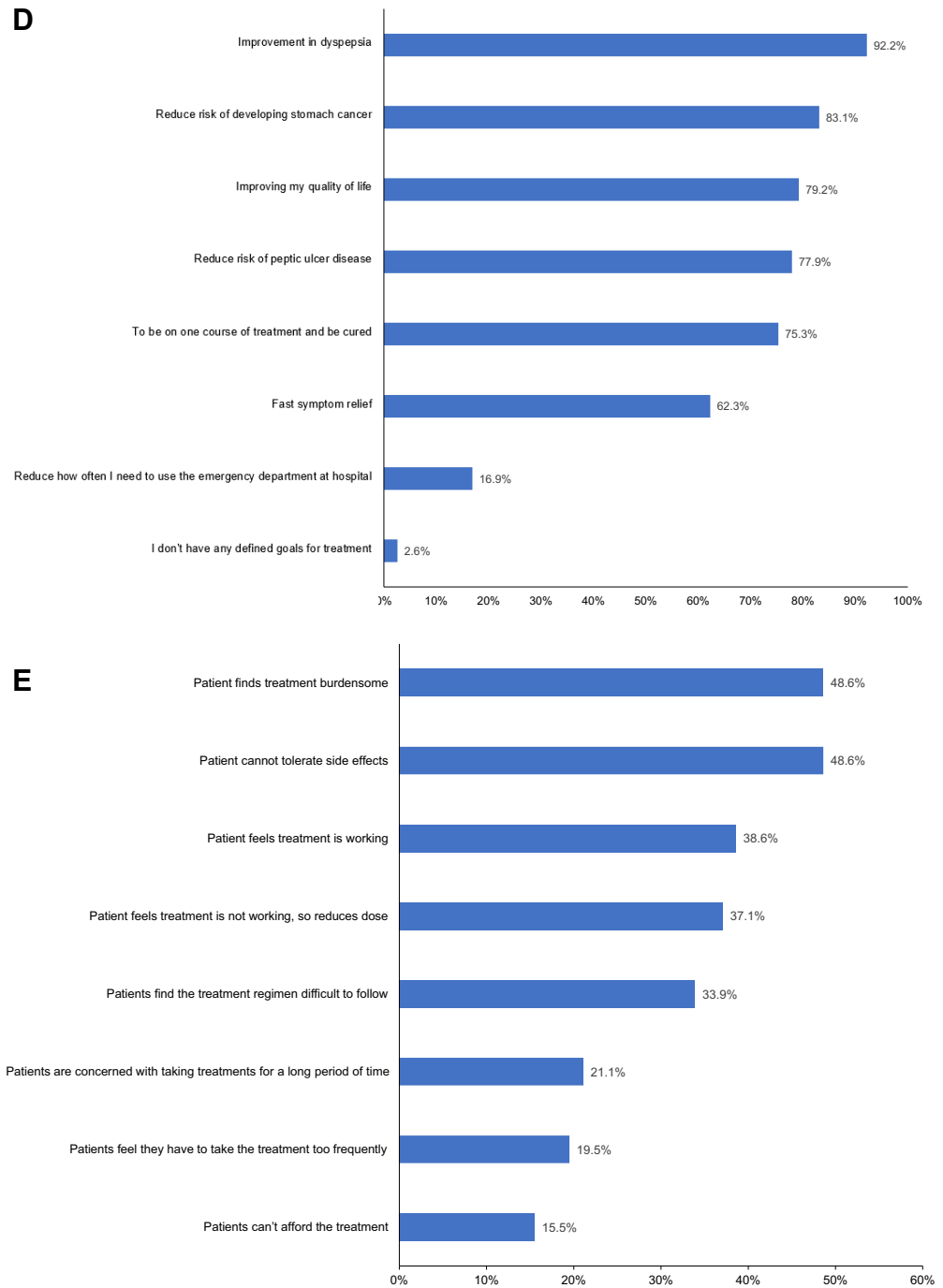


Figure 3. Continued.

Although both physicians and patients cited symptomatic improvement of dyspepsia as their most important treatment goal, many patients continued to experience dyspepsia after treatment. Indeed, 47% of patients believed that resolution of dyspepsia, and 39% that reduced severity of dyspepsia, would indicate effective treatment. In practice, however, resolution of dyspepsia through eradication of *H pylori* infection is not achieved in many patients,^{8,9} reinforcing the importance of setting realistic treatment expectations for patients. This disconnect between the treatment goals of patients and physicians and the realistic potential of current treatment

regimens may explain some of the dissatisfaction with treatment and may explain why only 53% of physicians believed that treatment goals were achievable with current treatments. Indeed, poor treatment satisfaction was reported both in the present study (only 28.7% of physicians were satisfied with current treatment options) and in previous studies.^{25,31} Both physicians (61%) and patients (51%) also indicated they would also like to reduce antibiotic use. This confirms the importance of educating patients that eradication of *H pylori* does not guarantee symptom resolution so that realistic treatment goals may be established.

Table 3. Physician Attitudes to Treatment Satisfaction

Statement	Agreement ^a		
	Overall (n = 251)	Gastroenterologist (n = 102)	FP/GP (n = 149)
Full course completion is critical to HP eradication	76.1%	76.5%	75.8%
Completion of the full course of treatment is essential even if the patient is improving	75.3%	76.5%	74.5%
It is important that the patient follows up as recommended	69.7%	69.6%	69.8%
High pill burden contributes to decreased adherence	68.9%	69.6%	68.5%
A treatment with fewer pills per day would be preferable	68.1%	63.7%	71.1%
Medication adherence is multifaceted	67.3%	61.8%	71.1%
Convenience packs that make daily dosing easier to remember are helpful	66.1%	64.7%	67.1%
There is a need for an effective dual therapy regimen that can lead to greater eradication rates	63.7%	62.7%	64.4%
I desire a more effective treatment option to limit overuse of antibiotics	61.0%	61.8%	60.4%
Simpler treatment regimens can lead to greater eradication rates	57.8%	57.8%	57.7%
High pill burden is the largest contributor to low adherence	56.2%	54.9%	57.0%
My patients understand the link between HP and gastric cancer	36.7%	42.2%	32.9%
I am satisfied with the current treatment options for my HP patients	28.7%	28.4%	28.9%

Base: Physicians (251).

HP, *Helicobacter pylori*.

^aAgreement indicated by scoring 6 or 7 on a 7-point scale where 1 is completely disagree and 7 is completely agree.

Source: Physician Survey: DQ2aii. Please rate your agreement with the following statements regarding *Helicobacter pylori* with past/present dyspepsia.

In general, patients were concerned with the long-term health complications of *H pylori* infection and would like to reduce their risk of gastric cancer. Health care professionals, by contrast, did not consider long-term health concerns as top treatment priorities, perhaps because they were focusing on the more short-term management of patients' dyspeptic symptoms. Most physicians believed that their patients did not understand the link between *H pylori* infection and gastric cancer. Just over half of the patients (52%) believed their treatment would cure *H. pylori* infection, and 81% expressed a desire for a product that would reliably cure infection in one course.

Finally, and as reported previously,^{16,32,33} these data confirm that adherence is a major issue in the treatment of *H pylori* infection. Approximately 40% of patients were not fully adherent, and 49% did not understand dosing instructions properly, whereas 49% of physicians indicated that patients found treatment burdensome, and 34% believed that patients found regimens difficult to follow. There was a strong feeling among physicians and patients that simpler treatment regimens would improve eradication rates, with 66% of physicians and 46% of patients believing that convenience packs would be helpful.

Strengths and Limitations

The major strength of this study is that it reflects real-world clinical practice in the United States. However, a number of limitations also need to be acknowledged. For example, the quality of data collected depends to a large extent on the accurate reporting of information by physicians and patients, whereas reliance on physicians to recruit patients who have recently consulted may have led to selection bias. In addition, as the study only included patients with *H pylori* infection and past or current dyspepsia, patients who consult less frequently may have been under-represented in the sample, whereas individuals with asymptomatic infection would not have been included.

The cross-sectional design means that information captured from both the physician and patient surveys represents a single point in time. However, the eCRF captured historical data relating to patients' disease history, allowing an overview of patients' disease journey over time.

Finally, although physicians were recruited on the basis of predefined inclusion and exclusion criteria, physician inclusion was likely to have been influenced by willingness to take part and the ability to do so. This may have yielded a nonrepresentative sample of clinicians.

Conclusions

These results reveal a lack of adherence to current guidelines for testing and treatment of *H pylori* infection and dissatisfaction among health care professionals concerning current treatment options. The results also reveal that many patients and physicians have unrealistic expectations regarding the efficacy of *H pylori* eradication in eliminating dyspeptic symptoms. The concern noted in this study regarding falling eradication rates suggests the need for new treatment options that are both more efficacious and simpler for patients to understand and follow.

References

- Gravina AG, Zagari RM, Musis CD, et al. Helicobacter pylori and extragastric diseases: a review. *World J Gastroenterol* 2018;24:3204–3221.
- Yang JC, Lu CW, Lin CJ. Treatment of Helicobacter pylori infection: current status and future concepts. *World J Gastroenterol* 2014;20:5283–5293.
- Hooi JKY, Lai WY, Ng WK, et al. Global prevalence of Helicobacter pylori infection: systematic review and meta-analysis. *Gastroenterology* 2017;153:420–429.
- Meurer LN, Bower DJ. Management of Helicobacter pylori infection. *Am Fam Physician* 2002;65:1327–1336.
- Dore MP, Pes GM, Bassotti G, et al. Dyspepsia: when and how to test for Helicobacter pylori infection. *Gastroenterol Res Pract* 2016;2016:8463614.
- Graham DY. History of Helicobacter pylori, duodenal ulcer, gastric ulcer and gastric cancer. *World J Gastroenterol* 2014;20:5191–5204.
- Kusters JG, Vliet AH, Kuipers EJ. Pathogenesis of Helicobacter pylori infection. *Clin Microbiol Rev* 2006;19:449–490.
- Wang XT, Zhang M, Chen CY, et al. [Helicobacter pylori eradication and gastroesophageal reflux disease: a Meta-analysis]. *Zhonghua Nei Ke Za Zhi* 2016;55:710–716.
- Mou WL, Feng MY, Hu LH. Eradication of Helicobacter Pylori Infections and GERD: a systematic review and meta-analysis. *Turk J Gastroenterol* 2020;31:853–859.
- Chey WD, Leontiadis GI, Howden CW, et al. ACG clinical guideline: treatment of Helicobacter pylori infection. *Am J Gastroenterol* 2017;112:212–239.
- Roszczenko-Jasińska P, Wojtyś MI, Jagusztyn-Krynicka EK. Helicobacter pylori treatment in the post-antibiotics era—searching for new drug targets. *Appl Microbiol Biotechnol* 2020;104:9891–9905.
- Malfertheiner P, Megraud F, O’Morain CA, et al. Management of Helicobacter pylori infection—the Maastricht V/Florence Consensus report. *Gut* 2017;66:6–30.
- Fallone CA, Moss SF, Malfertheiner P. Reconciliation of recent Helicobacter pylori treatment guidelines in a time of increasing resistance to antibiotics. *Gastroenterology* 2019;157:44–53.
- El-Serag HB, Kao JY, Kanwal F, et al. Houston Consensus Conference on testing for Helicobacter pylori infection in the United States. *Clin Gastroenterol Hepatol* 2018;16:992–1002.e6.
- Siddique O, Ovalle A, Siddique AS, et al. Helicobacter pylori infection: an update for the internist in the age of increasing global antibiotic resistance. *Am J Med* 2018;131:473–479.
- Shah SC, Iyer PG, Moss SF. AGA clinical practice update on the management of refractory Helicobacter pylori infection: expert review. *Gastroenterology* 2021;160:1831–1841.
- Savoldi A, Carrara E, Graham DY, et al. Prevalence of antibiotic resistance in Helicobacter pylori: a systematic review and meta-analysis in World Health Organization regions. *Gastroenterology* 2018;155:1372–1382.e17.
- Graham DY. Helicobacter pylori eradication therapy research: ethical issues and description of results. *Clin Gastroenterol Hepatol* 2010;8:1032–1036.
- Fischbach L, Evans EL. Meta-analysis: the effect of antibiotic resistance status on the efficacy of triple and quadruple first-line therapies for Helicobacter pylori. *Aliment Pharmacol Ther* 2007;26:343–357.
- Boltin D, Dotan I, Birkenfeld S. Improvement in the implementation of Helicobacter pylori management guidelines among primary care physicians following a targeted educational intervention. *Ann Gastroenterol* 2019;32:52–59.
- Murakami TT, Scranton RA, Brown HE, et al. Management of Helicobacter Pylori in the United States: results from a national survey of gastroenterology physicians. *Prev Med* 2017;100:216–222.
- Spiegel BM, Farid M, Oijen MG, et al. Adherence to best practice guidelines in dyspepsia: a survey comparing dyspepsia experts, community gastroenterologists and primary-care providers. *Aliment Pharmacol Ther* 2009;29:871–881.
- EphMRA. <https://www.ephmra.org/standards/code-of-conduct/>. Accessed May 15, 2021.
- CDC. <https://www.cdc.gov/php/publications/topic/hipaa.html>. Accessed May 15, 2021.
- Froehlich F, Gonvers JJ, Wietlisbach V, et al. Helicobacter pylori eradication treatment does not benefit patients with nonulcer dyspepsia. *Am J Gastroenterol* 2001;96:2329–2336.
- Blum AL, Talley NJ, O’Morain C, et al. Lack of effect of treating Helicobacter pylori infection in patients with nonulcer dyspepsia. Omeprazole plus clarithromycin and amoxicillin effect one year after treatment (OCAY) study group. *N Engl J Med* 1998;339:1875–1881.
- Talley NJ, Vakil N, Ballard ED 2nd, et al. Absence of benefit of eradicating Helicobacter pylori in patients with nonulcer dyspepsia. *N Engl J Med* 1999;341:1106–1111.
- Howden CW, Blume SW, Lissovoy G. Practice patterns for managing Helicobacter pylori infection and upper gastrointestinal symptoms. *Am J Manag Care* 2007;13:37–44.
- Tang Y, Tang G, Pan L, et al. Clinical factors associated with initial Helicobacter pylori eradication therapy: a retrospective study in China. *Sci Rep* 2020;10:15403.
- Wu TS, Hu HM, Kuo FC, et al. Eradication of Helicobacter pylori infection. *Kaohsiung J Med Sci* 2014;30:167–172.

31. Labenz J, Labenz G, Stephan D, et al. Insufficient symptom control under long-term treatment with PPI in GERD - fact or fiction? *MMW Fortschr Med* 2016; 158(Suppl 4):7–11.
32. Shrestha SS, Bhandari M, Thapa SR, et al. Medication adherence pattern and factors affecting adherence in *Helicobacter pylori* eradication therapy. *Kathmandu Univ Med J (KUMJ)* 2016;14:58–64.
33. Lefebvre M, Chang HJ, Morse A, et al. Adherence and barriers to *H. pylori* treatment in Arctic Canada. *Int J Circumpolar Health* 2013;72:22791.

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Colin W. Howden, Stuart J. Spechler, Michael F. Vaezi, A. Mark Fendrick, and Stephen Brunton consulted on study design and contributed to result interpretation and analysis of data, drafting of the manuscript, and critical analysis of the manuscript. Christian Atkinson contributed to study design, data

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The corresponding author, on behalf of all authors, jointly and severally, certifies that their institution has approved the protocol for any investigation involving humans or animals and that all experimentation was conducted in conformity with ethical and humane principles of research.

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