

Gastroesophageal Reflux Among Different Racial Groups in the United States

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Background & Aims: White people in the United States are several-fold more affected by esophageal adenocarcinoma than black people. It remains unknown whether this racial discrepancy reflects a higher prevalence of gastroesophageal reflux disease (GERD) symptoms or a higher degree of esophageal damage. **Methods:** A cross-sectional survey followed by endoscopy was performed among employees at a VA medical center. The association between race and GERD symptoms and erosive esophagitis was analyzed in logistic regression analyses controlling for demographic, clinical, and histologic variables. **Results:** A total of 496 of 915 people (54%) returned interpretable questionnaires, and endoscopy was performed in 215 participants. The mean age was 45 years, and 336 (68%) were women. Racial distribution was 43% black, 34% white, and 23% other races. Heartburn occurring at least weekly was reported in 27%, 23%, and 24% of these racial groups, respectively. The age-adjusted prevalence of heartburn or regurgitation was not significantly different among the groups. Erosive esophagitis was found in 50 of 215 participants (23%); 31 of these cases were mild. Only one person had Barrett's esophagus (0.4%). For weekly heartburn or regurgitation, black participants had significantly less frequent erosive esophagitis than white participants (24% vs. 50%; $P = 0.03$). With multiple adjustments, black participants had a persistently lower risk of esophagitis (adjusted odds ratio, 0.22–0.46; $P < 0.001$). **Conclusions:** White and black people in the United States have a similarly high prevalence of GERD symptoms. However, black people have a lower prevalence of esophagitis for the same frequency of GERD symptoms. Barrett's esophagus was rare in this study, even among those with frequent symptoms.

Symptoms suggestive of gastroesophageal reflux disease (GERD), such as heartburn and acid regurgitation, are common in the general population.^{1–3} These symptoms can be present with no visible damage to the esophageal mucosa or can be associated with erosive esophagitis, esophageal stricture, Barrett's esophagus (BE), or esophageal adenocarcinoma. Population-based

studies in the United States indicate a 4-fold increase in the age-adjusted incidence rates of esophageal adenocarcinoma in white people compared with black people.^{4–6} Similarly, studies that examined samples of patients referred for endoscopy showed a preponderance of white people (70%–90%) among patients with BE.^{7,8} The mechanism(s) responsible for the striking racial differences in the incidence of esophageal adenocarcinoma remain unknown. Possibilities include a lower prevalence or severity of GERD or decreased susceptibility to esophageal mucosal damage in black people.

Current thinking is that GERD predisposes to BE, which may further develop into esophageal adenocarcinoma. Three published population-based cross-sectional surveys performed in the United States examined the prevalence of GERD symptoms; however, none provide information regarding possible racial differences in GERD.^{1–3} The study by Nebel et al. in 1976 used a questionnaire to survey 335 hospital staff members for GERD symptoms.^{1–3} They reported that 7% had daily heartburn and 14% had weekly symptoms. Twenty years later (1994), a Gallup survey reported similar results with a 19% prevalence of weekly GERD symptoms among 1000 randomly selected persons. Neither study, however, reported the prevalence of GERD in different racial groups. Investigators from the Mayo Clinic estimated that 20% of the population of Olmsted County, Minnesota, experienced frequent (more than once a week) GERD symptoms.^{1–3} However, the study could not provide information on racial differences because the great majority of inhabitants of Olmsted County (96%), and hence the participants in that survey, were of white race.

There are no U.S. population-based prevalence estimates of erosive esophagitis, esophageal strictures, or BE.

Abbreviations used in this paper: BE, Barrett's esophagus; BMI, body mass index; GERD, gastroesophageal reflux disease; H2RA, H₂-receptor antagonist; OTC, over-the-counter; PPI, proton pump inhibitor.

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Cross-sectional studies among patients referred for endoscopy have reported erosive esophagitis, esophageal strictures, and BE to be uncommon in black people compared with white people.^{9,10} However, the racial distribution of the populations from which the patients were referred for endoscopy is not known. Ethnic or racial differences might also have resulted from a potential selection bias in physicians' tendency to refer patients to endoscopy or from patients' willingness to undergo endoscopy.

The study of racial differences is a helpful method to identify disease determinants or risk factors that can facilitate prevention and/or treatment. To test the hypothesis that GERD occurs less frequently in black people, we designed a population-based study that examined the racial differences in the prevalence and determinants of GERD symptoms and esophageal findings.

Patients and Methods

Study Design and Population

This was a cross-sectional survey followed by endoscopy. We targeted a sample of 1000 employees at the Houston VA Medical Center, which is one of the largest employers in the Houston area with 3095 employees. Of the total number of employees, 1424 (46%) are black, of whom 954 (67%) are women; 1114 (36%) are white, of whom 635 (57%) are women. The mean age is 45 years (range, 18–75 years). Every employee belongs to one of 19 hospital services each headed by a Chief of Service, an arrangement that facilitated organized and comprehensive distribution of the study questionnaires. Our sampling frame comprised employees who belonged to 12 selected services within the hospital; these services were specifically chosen to represent the racial as well as professional spectrum of employees. These services include nurses, physicians, administrators, researchers, and laborers in building maintenance. The 1000 employees targeted in the study were randomly chosen from lists of employees in these 12 services. The study was approved by the Institutional Review Board for Human Subject Research at Baylor College of Medicine.

Questionnaire

The Gastro Esophageal Reflux Questionnaire is a self-report instrument containing 32 questions that examine symptoms of heartburn and acid regurgitation in detail. The questionnaire identifies the onset for GERD symptoms (heartburn, acid regurgitation) and grades the frequency and severity of the symptoms experienced over the past year.^{2,11,12} Symptom frequency over the past year is measured on the following scale: 1, less than once a month; 2, about once a month; 3, about once a week; 4, several times a week; and 5, daily. Previous testing has shown this instrument to be reliable on test-retest, with a median κ statistic for the symptom items of 0.71

(interquartile range, 0.63–0.81). Compared with a physician interview, the questionnaire was also found to be a valid measure of symptoms (median κ , 0.62; interquartile range, 0.49–0.74).¹¹ Additional information from the Gastro Esophageal Reflux Questionnaire included tobacco smoking, alcohol drinking, family history of GERD, and physician visits for GERD. Supplemental questions included body mass index (BMI) and intake of the following medications: aspirin or nonsteroidal anti-inflammatory drugs (NSAID), H₂-receptor antagonists (H2RAs), proton pump inhibitors (PPIs), or over-the-counter (OTC) GERD therapy.

The survey questionnaires were either dropped in mailboxes or given in person to those who did not have a mailbox. Questionnaires were distributed a second time to those who did not respond initially.

Endoscopy

Upper endoscopy was offered to all participants who responded to the survey. Standardized nonsedated endoscopic examination of the esophagus, stomach, and duodenum was performed. One endoscopist (H.B.E.) who was blinded to the results of the questionnaire performed all procedures. The severity of erosive esophagitis seen on endoscopy was graded from A to D according to the LA classification.¹³ The presence of esophageal stricture, rings, or areas suspicious for BE was also recorded. Gastric mucosal biopsy specimens were taken (2 from the antrum, 2 from the corpus, and one from the incisura angularis). This protocol follows the recommendations of the International Workshop on Histopathology of Gastritis (1996)¹⁴ and allows the optimal assessment of histopathologic and topographic patterns of gastritis with the minimum number of biopsy specimens taken. Four quadrant biopsy specimens were also taken at 2-cm intervals from any visible length of columnar-lined esophagus to assess the presence of Barrett's metaplastic epithelium.

Histopathology

Sections from the gastric biopsy specimens were stained with the Genta stain, a specialized triple stain (silver, H&E, Alcian blue) that allows the simultaneous visualization of *Helicobacter pylori*, mucosal architecture, key features of gastritis, and the presence of intestinal metaplasia as denoted by the presence of goblet cells.¹⁵ This stain is highly sensitive ($\geq 95\%$) for the presence of *H. pylori*. The presence, type, severity, and extent of gastritis and gastric atrophy was identified and graded according to the updated Sydney system (1996).¹⁴ In esophageal biopsy specimens, the Alcian blue stain was used to detect the presence of specialized intestinal metaplasia, the hallmark of BE. Biopsy specimens were examined and graded by a single gastrointestinal pathologist (R.M.G.) who was blinded to the results of questionnaires and endoscopy.

Statistical Analyses

The period prevalence rates of GERD symptoms (over 1 year) were calculated as the proportion of persons reporting

heartburn and/or regurgitation either monthly or weekly of the total number of respondents with complete answers to questions about GERD symptoms. These rates were compared between the 3 racial groups (black, white, and other) and between men and women. Because of the possibility that the age distribution of the groups being compared may differ, we used the direct method of standardization to adjust the calculated prevalence. The reference population used as the standard was the 1990 U.S. population (<http://factfinder.census.gov>).¹⁶

The presence of weekly heartburn, acid regurgitation, or either symptom was examined separately as outcome variables in logistic multiple regression analyses. The main predictor in the model was race (white, black, or other). Adjustments were made for several covariates including age, sex, BMI, physician visits for GERD, tobacco smoking, alcohol drinking, and the use of medications (aspirin/NSAIDs, PPIs, H2RAs, or OTC GERD therapy).

Univariate and multivariate comparisons were performed between persons undergoing endoscopy and the rest of respondents. Among those who underwent endoscopy, similar comparisons were performed between those with any erosive esophagitis or severe esophagitis and the rest of the persons who underwent endoscopy. The presence of any grade of erosive esophagitis was examined as an outcome variable in multivariable logistic regression analyses. The main predictor variable in these models was race. Covariates included age, sex, GERD symptoms, BMI, *H. pylori* infection, the presence and distribution of gastritis (antrum or corpus), alcohol, smoking, and the use of aspirin/NSAIDs, H2RAs, or PPIs. For all models, the number of covariates examined was determined by the number of outcome events, with 10 events required for one covariate.¹⁷

Results

Study Population

Of 1000 targeted individuals, 915 were verified to have received the study questionnaires, 512 (54%) returned the questionnaires, and 496 had complete and interpretable answers to both heartburn and regurgitation questions. Of these 496 respondents, 212 (43%) were of black race, 171 (34%) were of white race, and the remaining 113 (23%) were of another race (8% Hispanic, 11% Asian, 1% Native American, and 3% other). The mean age of the participants was 45 years (SD, 10; age range, 18–75 years), and 336 (68%) were women. There were no significant differences in age or race between participants and nonparticipants; however, there were significantly more women among participants. Of those who had complete questionnaires, 215 of 496 persons (43%) underwent upper endoscopy with gastric biopsies; 107 (50%) were of black race, and 139 (65%) were women. This was the first endoscopy for 72% of participants.

Race and GERD Symptoms

Heartburn occurring at least weekly was reported in 27.4% of black participants, 23.4% of white participants, and 23.9% of participants of other races (Table 1). These prevalence rates were not significantly different among the 3 racial groups ($P > 0.05$).

There was a slight age-related increase in the prevalence of at least weekly heartburn and/or regurgitation: 24%, 24%, 30%, and 33% for ages 18–34 years, 35–44 years, 45–54 years, and 55 years and older, respectively. Compared with white participants, the average age of participants was lower in black persons and persons of other races. However, the age-adjusted prevalence rates were not significantly different between these 3 groups for heartburn, regurgitation, or either symptom.

Predictors of GERD Symptoms

In general, the prevalence rates of GERD symptoms were slightly higher in women than men. For example, women had a significantly higher prevalence of weekly regurgitation (16.7% vs. 11.3%; $P = 0.04$) but not weekly heartburn (25.9% vs. 23.8%; $P = 0.46$) or weekly heartburn or regurgitation (30.1% vs. 22.4%; $P = 0.07$). The proportion of persons with a positive family history of GERD was greater among participants who reported monthly heartburn or acid regurgitation (34.8%) or weekly symptoms (37.8%) compared with those who reported no such symptoms (26.6%). There were no significant differences between the proportions of smokers, those who drank alcohol more than once weekly, or those reporting use of NSAIDs, PPIs, H2RAs, or OTC GERD therapy.

Race and GERD Symptoms

Black participants were more likely to have visited a physician for GERD symptoms and less likely to report a family history of GERD. However, race (black vs. white) was not a significant predictor of the presence of either heartburn or regurgitation (whether monthly or weekly) when examined in a multivariate logistic regression model that controlled for age, sex, medications, BMI, and family history of GERD. The adjusted odds ratio for black (vs. white) was 0.86 (95% confidence interval, 0.51–1.45; $P = 0.57$) and that for other races (vs. white) was 1.14 (95% confidence interval, 0.64–2.06; $P = 0.66$).

Determinants of Endoscopy Among Study Participants

Persons of races other than black or white were less likely to undergo endoscopy (114 [34%], 212

Table 1. Racial Differences and GERD for All Participants

Demographic features	Black (n = 212) (%)	White (n = 170) (%)	Other (n = 114) (%)	P
Mean age, yr (SD)	44.7 (9.8)	46.2 (12.1)	42.1 (10.8)	0.0082
18–34	32 (15.1)	36 (21.2)	35 (30.7)	0.0011
35–44	64 (30.2)	40 (23.5)	28 (24.6)	
45–54	87 (41.0)	52 (30.6)	34 (29.8)	
55+	29 (13.7)	42 (24.7)	16 (14.0)	
Sex				
Men	61 (28.8)	60 (35.3)	39 (34.2)	0.3510
Women	151 (71.2)	110 (64.7)	75 (65.8)	
GERD symptoms				
Monthly heartburn	86 (40.6)	60 (35.3)	39 (34.2)	0.4222
Weekly heartburn	58 (27.4)	40 (23.5)	27 (23.7)	0.6330
Monthly regurgitation	59 (27.8)	41 (24.1)	29 (25.4)	0.7045
Weekly regurgitation	33 (15.6)	25 (14.7)	16 (14.0)	0.9295
Monthly heartburn and/or regurgitation	98 (46.2)	70 (41.2)	45 (39.5)	0.4254
Weekly heartburn and/or regurgitation	61 (28.8)	48 (28.2)	29 (25.4)	0.8055
Severity of GERD symptoms				
Mild heartburn and/or regurgitation	130 (61.3)	113 (66.5)	81 (19.6)	0.1969
Severe heartburn and/or regurgitation	17 (8.0)	14 (8.2)	5 (1.2)	0.4024
Medications				
NSAID	7/208 (3.4)	4/168 (2.4)	1/113 (0.9)	0.3891
Aspirin	70/208 (33.7)	40/168 (23.8)	14/113 (12.4)	0.0001
PPI	15/208 (7.2)	14/168 (8.3)	10/113 (8.8)	0.8554
H2RA	57/208 (27.4)	39/168 (23.2)	24/113 (21.2)	0.4178
OTC	64/208 (30.8)	63/168 (37.5)	24/113 (21.2)	0.0152
PPI, H2RA, or OTC	88/208 (42.3)	78/168 (46.4)	41/113 (36.3)	0.2407
Social habits				
Smoking/tobacco use	54/167 (32.3)	45/134 (33.6)	20/97 (20.6)	0.0697
Alcohol use ≥1/wk	44/153 (28.8)	52/125 (41.6)	16/96 (16.7)	0.0003
Medical history				
Family history of GERD	35/172 (20.4)	52/144 (36.1)	36/105 (34.3)	0.0038
Physician visit for GERD	38/140 (27.1)	17/117 (14.5)	11/81 (13.6)	0.0120

[50%], and 170 [41%], respectively). A greater proportion of those who underwent endoscopy had weekly heartburn or regurgitation (36% vs. 21%; $P = 0.0002$) or used PPIs, H2RAs, or OTC GERD therapy (50% vs. 36%; $P = 0.003$) than those who did not undergo endoscopy. Importantly, there were no significant differences in age, sex, BMI, tobacco smoking, alcohol drinking, or physician visits for GERD between the 2 groups. In a multivariate logistic regression, only the presence of weekly heartburn or regurgitation was found to be an independent predictor of upper endoscopy (adjusted odds ratio, 2.1; 95% confidence interval, 1.2–3.5; $P = 0.007$).

Endoscopic Findings

Overall, erosive esophagitis was detected in 50 of 226 participants (22%) who underwent endoscopy and in 50 of the 215 who answered questions about both heartburn and regurgitation (Figure 1). The endoscopic scores were A in 31, B in 18, and C in one person. Hiatus hernia was present in 46% (99 of 215). Columnar-lined esophagus was suspected in 29 subjects during endoscopy; 26 of those were ≤2 cm in length. However, only one patient (a 57-year-old Hispanic man) was subse-

quently diagnosed with BE based on histologic findings of intestinal metaplasia, giving an overall prevalence of 0.4%.

Race and Erosive Esophagitis

Table 2 shows a comparison of individuals with any erosive esophagitis with those with no erosive esoph-

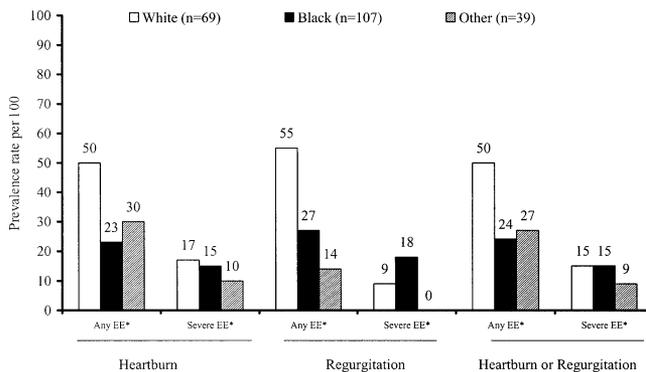


Figure 1. Prevalence rates of erosive esophagitis (EE) stratified by weekly GERD symptoms (heartburn, regurgitation, heartburn or regurgitation) in 215 participants from different racial groups. EE, erosive esophagitis; severe, grade B or greater.

Table 2. A Comparison Between Participants With and Without Erosive Esophagitis Observed by Upper Endoscopy

Demographic features	Erosive esophagitis (n = 50) (%)	No erosive esophagitis (n = 165) (%)	P
Mean age, yr (SD)	47 (10.9)	44 (10.4)	0.6563
18–34	6 (12.0)	38 (23.0)	0.2103
35–44	13 (26.0)	41 (24.8)	
45–54	18 (36.0)	60 (36.4)	
55+	13 (26.0)	26 (15.8)	
Sex			0.9125
Men	18 (36.0)	58 (35.2)	
Women	32 (64.0)	107 (64.8)	
Race			0.0002
Black	17 (34.0)	90 (54.5)	
White	28 (56.0)	41 (24.8)	
Other	5 (10.0)	34 (20.6)	
GERD symptoms			
Monthly heartburn	28 (56.0)	68 (41.2)	0.0654
Weekly heartburn	24 (48.0)	50 (30.3)	0.0210
Monthly regurgitation	18 (36.0)	42 (25.5)	0.1453
Weekly regurgitation	13 (26.0)	27 (16.4)	0.1250
Weekly heartburn and/or regurgitation	26 (52.0)	52 (31.5)	0.0083
Severity			
Mild heartburn and/or regurgitation	39 (78.0)	112 (67.9)	0.1703
Severe heartburn and/or regurgitation	10 (20.0)	14 (8.5)	0.0235
Medications			
Aspirin or NSAID	15 (30.0)	53/164 (32.3)	0.7580
PPI	6 (12.0)	17/164 (10.4)	0.7440
H2RA	19 (38.0)	42/164 (25.6)	0.0893
OTC	26 (52.0)	54/164 (32.9)	0.0147
Social habits			
Smoking/tobacco use	13/36 (36.1)	40/132 (30.3)	0.5062
Alcohol use ≥ 1 /wk	11/31 (35.5)	36/124 (29.0)	0.4846
Medical history			
Family history of GERD	9/38 (23.7)	49/141 (34.8)	0.1957
Physician visit for GERD	14/43 (32.6)	29/123 (23.6)	0.2472
Endoscopic finding			
Hiatus hernia (any size)	38 (76.0)	61 (37.0)	<0.0001
Hiatus hernia >3 cm	13 (26.0)	21 (12.7)	0.0242
Histopathologic features			
Antrum gastritis	14 (42)	71 (43.0)	0.1838
Corpus gastritis	16 (32)	69 (41.8)	0.2135
<i>H. pylori</i> anywhere in the stomach	21 (28)	87 (52.7)	0.0569

agitis. White participants constituted a significantly greater proportion of persons with any erosive esophagitis than did black participants. For the same frequency of heartburn or regurgitation, erosive esophagitis was found less frequently in black participants than in white participants. For example, among persons with weekly heartburn or regurgitation, erosive esophagitis of any grade was present in 10 of 41 black participants (24%) and 13 of 26 white participants (50%) ($P = 0.03$).

We constructed several multivariable logistic regression models to examine the association between erosive esophagitis and race (black participants vs. all others) controlling for 1–3 covariates at a time (Table 3). In these models, black participants consistently had a significantly lower risk of erosive esophagitis as compared with all others (adjusted odds ratio ranged between 0.22

and 0.46). Hiatus hernia of any size was the variable with the most explanatory effect in these models.

Other Predictors of Erosive Esophagitis

Other predictors of erosive esophagitis are shown in Table 2. A greater proportion of persons with erosive esophagitis reported weekly or severe heartburn (but no regurgitation) than those without erosive esophagitis. Among participants with erosive esophagitis, weekly heartburn or regurgitation was present in approximately one half and monthly symptoms were present in two thirds. However, 7 of 50 (14%) had no GERD symptoms (data not shown). Conversely, only 15 of 31 persons (48%) with grade A esophagitis had weekly heartburn or regurgitation and 3 of 31 (10%) had no symptoms (data not shown). The use of OTC medications for GERD was

Table 3. The Risk of Erosive Esophagitis in Black Participants: Results of Multivariate Logistic Regression Analysis Among 215 Individuals Who Underwent Upper Endoscopy

(Black participants vs. other)	Adjusted odds ratio	95% Confidence intervals	P
Effect of race unadjusted	0.43	0.22–0.83	0.0121
Effect of race adjusted for			
Age	0.43	0.22–0.83	0.0117
Sex	0.43	0.22–0.83	0.0122
<i>H. pylori</i> infection	0.45	0.23–0.88	0.0197
BMI	0.30	0.14–0.60	0.0008
Hiatus hernia	0.49	0.25–0.98	0.0453
Aspirin/NSAID use	0.42	0.21–0.82	0.0119
Tobacco smoking	0.34	0.15–0.77	0.0097
BMI	0.30	0.15–0.60	0.0020
Frequency of heartburn or regurgitation	0.40	0.20–0.79	0.0078
Severity of heartburn or regurgitation	0.38	0.19–0.75	0.0060
Corpus gastritis	0.43	0.22–0.84	0.0131
Age, <i>H. pylori</i> infection	0.45	0.23–0.89	0.0114
Age, corpus gastritis	0.46	0.23–0.90	0.0233
Age and hiatus hernia	0.49	0.24–0.98	0.0453
Age, tobacco smoking	0.33	0.14–0.74	0.0091
Age, BMI	0.30	0.15–0.61	0.0009
Age, frequency of heartburn or regurgitation	0.40	0.20–0.78	0.0079
Age, severity of heartburn or regurgitation	0.39	0.19–0.74	0.0065
Aspirin/NSAID use, tobacco smoking, alcohol drinking	0.22	0.08–0.57	0.0014
Frequency of heartburn or regurgitation, BMI	0.28	0.13–0.57	0.0006
Frequency of heartburn or regurgitation, BMI, hiatus hernia	0.38	0.18–0.80	0.0110
Severity of heartburn or regurgitation, BMI, hiatus hernia	0.35	0.16–0.74	0.0064
Frequency and severity of heartburn or regurgitation, BMI	0.26	0.12–0.54	0.0004
Frequency and severity of heartburn or regurgitation, BMI, hiatus hernia	0.35	0.15–0.76	0.0070

more frequent in persons with erosive esophagitis than in those without erosive esophagitis. The mean size of hiatus hernia was 3.3 cm in those with any erosive esophagitis compared with 3.1 cm in participants without erosive esophagitis ($P = 0.45$). Further, the proportion of participants with a hiatus hernia ≥ 3 cm was greater in the erosive esophagitis group. The presence of weekly heartburn or regurgitation was an independent risk factor for erosive esophagitis (adjusted odds ratio, 2.27; 95% confidence interval, 1.11–4.66; $P = 0.03$).

In univariate (Table 2) and multivariate analyses, neither the presence nor severity of erosive esophagitis was associated with any of the following variables: alcohol drinking, tobacco smoking, intake of aspirin or NSAIDs, *H. pylori* anywhere in the stomach, or corpus gastritis.

Discussion

To our knowledge, this is the first study to examine racial differences in the prevalence of GERD symptoms and erosive GERD. This is also the first study in the United States to use a population-based sample to examine the prevalence of endoscopic findings of GERD. Our findings indicate that black and white people in the United States have a similar prevalence of GERD symptoms. Remarkably, black people have a lower prevalence of esophagitis than white people for the same frequency

and severity of GERD symptoms. Irrespective of race, monthly GERD symptoms were present in more than one half and weekly symptoms were present in approximately one fourth of all participants. While mild erosive esophagitis was relatively common even in asymptomatic persons, BE was rare (0.4%) even among those with frequent GERD symptoms.

A key strength of this research is that we chose a large, accessible, ethnically diverse sample of the general population. Surveys conducted among patients seeking medical care, although relatively straightforward to perform, are prone to selection bias. This bias may be due to differential access to health care facilities based on race. On the other hand, surveys performed in random samples of the general population are more time consuming and logistically difficult, particularly if endoscopic investigation is included. Other strengths include the use of a single endoscopist who was blinded to the results of the questionnaire and a single pathologist blinded to the results of endoscopy. The fact that more than 70% of participants were receiving their first endoscopy is an indication that most participants are neither previous patients nor “career” volunteers for medical studies.

There are a number of limitations that should be acknowledged. The moderate response rate to the questionnaire may have resulted in a selection bias, with

persons with GERD symptoms more likely to participate in the study. Therefore, the reported prevalence rates probably overestimate GERD symptoms as compared with the general population. However, given the similar racial composition of participants and nonparticipants, this bias is unlikely to affect the relative difference between the racial groups, which was the primary focus of the study. As with other survey studies, participants may differ from nonparticipants in important features. In this case, age and race were not different between participants and nonparticipants; however, we have no information on the prevalence of heartburn or regurgitation among nonparticipants.

Selection bias may have affected the endoscopy phase of the study. Participants who underwent endoscopy were more likely to report heartburn or regurgitation. This bias is likely to result in an overestimate of the prevalence of erosive esophagitis. On the other hand, this bias makes the findings of a very low prevalence of BE more credible. Further, only the frequency of heartburn or regurgitation was an independent predictor of undergoing endoscopy. Given the lack of difference in these symptoms among the racial groups, we believe it is unlikely that the observed racial differences in endoscopic findings were a result of bias related to undergoing endoscopy.

The finding of a very low prevalence of BE seems to contradict a recent observation that the prevalence of this condition is as high as 20% in asymptomatic individuals.¹⁸ However, the mean age of persons with BE is approximately 61 years in previously reported studies.¹⁹ The relatively younger study population (average age, 44 years) and the large proportion of persons who were not white may explain this difference. Indirectly, this finding supports an important role for older age as a risk factor for BE and has important implications regarding screening practices for BE.

One explanation for these differences could be the relationship between *H. pylori* and GERD. The prevalence of *H. pylori* infection is inversely related to socioeconomic status (education, occupation, family income level, and living conditions) during childhood, the period of highest risk for acquiring the infection.^{20,21} In *H. pylori*-infected patients, the organism colonizes primarily the gastric antrum, resulting in an antrum-dominant gastritis characterized by increased gastrin and acid secretion. In many patients, *H. pylori* infection extends from the antrum toward the more proximal gastric corpus, which is the main acid-producing region of the stomach. *H. pylori* itself produces acid-inhibitory proteins, whereas the infection-induced inflammation gen-

erates interleukin 1 β , which is a potent inhibitor of acid secretion.^{22,23} Previous cross-sectional studies among patients referred for endoscopy reported corpus gastritis to be less frequent and less severe among patients with erosive esophagitis compared with the rest of patients without erosive esophagitis.²⁴ Despite a trend toward a lower prevalence of *H. pylori* in participants with erosive esophagitis, the current study failed to show a statistically significant association between symptoms and the prevalence of *H. pylori* or the distribution of gastritis. However, the study had low power to detect significant differences in the observed prevalence of corpus gastritis between those with erosive esophagitis and those without. Therefore these findings, although not supportive, do not completely exclude a role for *H. pylori* gastritis.

This study indicates that risk factors other than the presence, frequency, or severity of GERD symptoms may play a role in causing esophageal damage (esophagitis, BE, or adenocarcinoma). Further studies should examine the role of environmental and genetic factors to explain the lower frequency of erosive esophagitis, BE, and esophageal adenocarcinoma in black people.

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