

# The Prevalence of Self-Reported Peptic Ulcer in the United States

## ABSTRACT

**Objectives.** The purpose of this study was to draw a current picture of the sociodemographic characteristics of peptic ulcer in the United States.

**Methods.** During the National Health Interview Survey of 1989, a special questionnaire on digestive diseases was administered to 41 457 randomly selected individuals. Data were retrieved from public use tapes provided by the National Center for Health Statistics. Odds ratios were calculated by logistic regression after adjustment for sample weights in the survey.

**Results.** Of adult US residents, 10% reported having physician-diagnosed ulcer disease, and one third of these individuals reported having an ulcer in the past year. Old age, short education, low family income, being a veteran, and smoking acted as significant and independent risk factors. Gastric and duodenal ulcer occurred in both sexes equally often. Duodenal ulcer was more common in Whites than non-Whites, while gastric ulcer was more common in non-Whites.

**Conclusions.** The age-related rise and socioeconomic gradients of peptic ulcer represent the historic scars of previous infection rates with *Helicobacter pylori*. The racial variations reflect different ages at the time of first infection; younger and older age at the acquisition of *H. pylori* appear to be associated with gastric and duodenal ulcer, respectively. (*Am J Public Health*. 1996;86:200-205)

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## Introduction

The National Health Interview Survey (NHIS) is a nationwide survey conducted annually by the National Center for Health Statistics (NCHS). Households distributed throughout the United States are selected from a representative cross-sectional sample of the civilian noninstitutionalized US population. Information is collected from household members in face-to-face interviews, and a standard questionnaire is used.<sup>1</sup> In 1989, a special questionnaire on digestive diseases was administered to one randomly selected member of each sample family who was 18 years old or older. Approximately 42 000 individuals were interviewed.<sup>2</sup> The objective of the present study was to take advantage of this large data source and assess the behavior of peptic ulcer in the United States. Peptic ulcer disease is one of the most common disorders affecting the digestive system. Its epidemiology has been characterized by marked temporal changes.<sup>3</sup> The NHIS data set is well suited to provide a current picture of peptic ulcer in the United States; no other equally large and comprehensive documentation of peptic ulcer in the general population exists.

## Methods

### Data Sources

All data for the present analysis were retrieved from public use data tapes provided by NCHS. The national sample of the 1989 NHIS was composed of 45 711 households containing 116 929 persons. One randomly selected adult per household was administered a detailed questionnaire on digestive diseases; 41 457 individuals responded to this supplemental questionnaire. The questionnaire asked

about specific digestive conditions such as gallstones, peptic ulcer, and diverticulitis. Respondents also answered questions about the time of onset, means of diagnosis, and treatment of their digestive condition. Because the validity of the questionnaire could not be assessed by medical record data, the present analysis was restricted to responses indicating that the ulcer had been diagnosed by a physician. The respondents were also asked whether they had undergone either an upper gastrointestinal series or an upper endoscopy or gastroscopy to diagnose the ulcer. If necessary, the following descriptions of these procedures were read: (1) "For an upper gastrointestinal series, you drink a chalky white liquid called barium, and then x-rays are taken" and (2) "For an upper endoscopy or gastroscopy, a long flexible tube with a light on the end is inserted down the throat so that the lining of the stomach and the upper intestine can be examined."

The standard core questionnaire of the NHIS collected basic demographic, socioeconomic, and health information from all respondents. In the core component, a random sample of one sixth of all households was asked about the presence of digestive diseases in the previous 12 months, including ulcers. The core questionnaire could be answered by self-response or by proxy for other household

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**TABLE 1—US Prevalence Rates of Peptic Ulcer, by Ulcer History, Type, and Diagnostic Confirmation: The 1989 National Health Interview Survey**

Ulcer History	Ulcer Type	All Physician-Diagnosed Ulcers			Ulcer with Diagnostic Confirmation			Subjects with Diagnostic Confirmation, %
		No. Subjects (millions)	Prevalence per 100	95% CI	No. Subjects (millions)	Prevalence per 100	95% CI	
Any time in the past	Gastric ulcer	4.29	2.44	2.26, 2.63	3.15	1.79	1.64, 1.94	73
	Duodenal ulcer	4.44	2.53	2.36, 2.71	4.07	2.31	2.15, 2.48	91
	Peptic ulcer of any type	10.04	5.64	5.38, 5.90	6.89	3.88	3.68, 4.10	69
	All types	18.30	10.28	9.94, 10.63	13.66	7.71	7.43, 8.00	75
Within the last year	Gastric ulcer	1.64	0.92	0.83, 1.02	1.25	0.70	0.61, 0.79	76
	Duodenal ulcer	1.26	0.71	0.62, 0.79	1.19	0.67	0.59, 0.75	94
	Peptic ulcer of any type	3.28	1.85	1.71, 1.97	2.34	1.31	1.19, 1.43	71
	All types	5.98	3.35	3.16, 3.54	4.57	2.56	2.39, 2.73	76

Note. The ulcer categories used in the present study were as follows: physician-diagnosed ulcers of all types, gastric ulcer with diagnostic confirmation, and duodenal ulcer with diagnostic confirmation. (Diagnoses were confirmed with an upper gastrointestinal series of x-rays or an upper endoscopy.) See the "Results" for sample sizes. CI = confidence interval.

members. In 6877 persons, information on ulcer was obtained through both the core questionnaire and the digestive disease supplement. Information on smoking was obtained by self-response from 20 847 adults in a random half sample of households whose members replied to a second supplement of the 1989 NHIS regarding diabetes risk factors.

#### Types of Peptic Ulcer

Peptic ulcer disease was broken down into the following four types: (1) gastric and stomach ulcer, (2) duodenal ulcer, (3) unspecified peptic ulcer, and (4) any ulcer (which comprised all types). Each ulcer type was further broken down by the time of its last occurrence: at any point in time throughout life or during the 12 months preceding the interview. In addition, ulcers were separated into those with and without diagnostic confirmation. Table 1 shows the prevalence rates of the various ulcer types. The broad category "any ulcer" concerned any type of physician-diagnosed peptic ulceration without temporal limitation, with or without a confirming diagnostic procedure. For the analyses of the more restricted definitions of gastric and duodenal ulcer, we required the ulcer to be physician diagnosed, to have been present during the previous 12 months, and to have been confirmed by a diagnostic procedure. It was assumed that the first group would provide the most comprehensive picture of peptic ulcer epidemiology in the United States, while the latter two groups would present the most reliable picture of either gastric or duodenal ulcer alone.

#### Statistical Analyses

The occurrence of peptic ulcer was expressed as prevalence rates per 100 living US residents. The rates were calculated by means of the SESUDAAN procedure, which provided estimates of the standard error by incorporating the sample weights and characteristics of the complex sampling design used in the NHIS.<sup>4</sup> As a means of accounting for the different age distributions among various socio-demographic strata, the rates were adjusted to the age distribution of the surveyed population by the method of direct standardization. The sample weights were used to extrapolate the number of respondents to an estimate of US residents with a given condition. The agreement between the responses from the core and the supplement of the NHIS was expressed as a kappa statistic.<sup>5</sup>

For multivariate logistic regression, the RTILOGIST procedure within the PROC LOGISTIC program of SAS was used.<sup>6,7</sup> RTILOGIST considers the NHIS weights and the sample design for estimating the variances and covariances in the calculation of odds ratios and their confidence intervals. In all analyses, the occurrence of peptic ulcer served as the outcome variable; modifier variables included age, sex, race, marital status, and veteran status, among others. The influences of the individual modifier variables were expressed as odds ratios and their 95% confidence intervals. Smoking status was known for only 50% of the respondents who were responding to the supplement of the survey regarding diabetes risk

factors. As a means of avoiding loss of precision from a smaller sample, the logistic regression was performed first in the whole population without including smoking as an independent variable. In a second run, the logistic regression was repeated in the subset of subjects whose smoking status was known.

#### Results

Table 1 shows the prevalence rates of peptic ulcer in the United States by history, ulcer type, and diagnostic confirmation. Of the sample respondents, 1064 reported physician-diagnosed stomach or gastric ulcer; 1043 reported duodenal ulcer, and 2474 reported unspecified ulcer. Because some individuals reported more than one ulcer type, the total number of persons with a history of physician-diagnosed ulcer was 4470 (111 less than the above sum). These differences are reflected in the weighted data of Table 1. Of the estimated 18.3 million US residents with a lifetime history of ulcers, about 75% have had their diagnosis confirmed by a physician. The lifetime prevalence for any type of ulcer was 10.3%. Gastric and duodenal ulcer were about equally common. The majority of patients could remember the diagnostic procedure that had led to the confirmation of the diagnosis, this fraction being highest for duodenal ulcer.

We examined in some detail the correspondence between the answers on the digestive diseases supplement and those on the core component of the NHIS. For self-responders who also re-

**TABLE 2—Agreement between Core and Supplement Questionnaires of the National Health Interview Survey Regarding Ulcer Status**

Core Questionnaire	Supplement Questionnaire		κ
	No Ulcer	Ulcer	
Self-response			
No ulcer	5033	69	0.73
Ulcer	21 <sup>a</sup>	124	
Proxy response			
No ulcer	1568	25	0.56
Ulcer	12	25	

Note. These data summarize agreement for the question "Did you have an ulcer in the past 12 months?"

<sup>a</sup>11/21 said in the supplement that they had an ulcer prior to the past 12 months.

ceived the digestive diseases supplement, the percentage agreement on the question of ulcers during the previous 12 months was 98.4%, the kappa statistic being 0.73 (Table 2). The percentage agreement and the kappa statistic varied little by most demographic factors. Agreement was good to excellent when restricted to self-responders on the core questionnaire; however, the utility of the core responses was limited in instances of proxy responses (which represented one of the main reasons for initiating the digestive diseases supplement). The response rate to the digestive diseases supplement was 90.6%, resulting in a low possibility of nonresponse bias.

The demographic and socioeconomic distributions of peptic ulcer showed similar patterns in the various subgroups of ulcer patients from Table 1. The results of the logistic regressions also varied little among the different groups of patients. For statistical analyses and graphical presentation, we selected the group with a lifetime history of a physician-diagnosed peptic ulcer of any type, and the group with a physician-diagnosed gastric or duodenal ulcer during the past 12 months involving a diagnostic confirmation.

Figures 1 through 5 contain most of the age-adjusted associations with ulcer. Table 3 lists the outcomes of the multivariate analysis after adjustment for the joint influences of various independent variables. Peptic ulcers of any type and duodenal ulcers both showed an age-

**TABLE 3—Adjusted Odds Ratios for Lifetime Prevalence of Any Physician-Diagnosed Peptic Ulcer or Active Gastric and Duodenal Ulcer with Diagnostic Confirmation during the Previous 12 Months: The 1989 National Health Interview Survey**

	Any Peptic Ulcer		Gastric Ulcer		Duodenal Ulcer	
	OR	95% CI	OR	95% CI	OR	95% CI
Age (10-year intervals)	1.19	1.16, 1.22	1.06	0.97, 1.16	1.35	1.23, 1.48
Sex						
Male	1.10	1.00, 1.20	1.01	0.75, 1.36	0.73	0.54, 1.00
Female	1.00	...	1.00	...	1.00	...
Race						
Black	0.75	0.67, 0.85	1.23	0.85, 1.80	0.57	0.33, 0.99
Hispanic	0.60	0.49, 0.74	1.53	0.95, 2.47	0.32	0.12, 0.84
White	1.00	...	1.00	...	1.00	...
Veteran status						
Veteran	1.22	1.09, 1.37	0.90	0.57, 1.41	1.74	1.18, 2.57
Nonveteran	1.00	...	1.00	...	1.00	...
Marital status						
Widowed	0.71	0.63, 0.80	0.61	0.40, 0.94	0.74	0.49, 1.11
Divorced/separated	1.13	1.02, 1.26	1.31	0.97, 1.78	1.39	0.97, 1.99
Never married	0.65	0.58, 0.74	0.70	0.46, 1.08	1.04	0.66, 1.63
Married	1.00	...	1.00	...	1.00	...
Education, y						
≤ 8	1.70	1.45, 1.99	3.10	1.58, 6.08	1.24	0.69, 2.20
9–11	1.67	1.44, 1.94	2.45	1.33, 4.52	1.67	0.94, 2.95
12	1.44	1.29, 1.62	2.22	1.28, 3.83	1.36	0.91, 2.04
13–15	1.32	1.16, 1.50	1.50	0.83, 2.73	2.06	1.30, 3.26
≥ 16	1.00	...	1.00	...	1.00	...
Income, \$						
< 10 000	1.59	1.39, 1.82	1.92	1.21, 3.05	0.67	0.43, 1.05
10 000–20 000	1.35	1.21, 1.49	1.38	0.92, 2.06	0.82	0.55, 1.23
20 000–35 000	1.24	1.13, 1.37	0.98	0.64, 1.51	1.08	0.74, 1.56
> 35 000	1.00	...	1.00	...	1.00	...
Smoking status						
Smoker	1.39	1.23, 1.58	1.72	1.19, 2.47	1.64	1.09, 2.48
Nonsmoker	1.00	...	1.00	...	1.00	...

Note. OR = odds ratio; CI = confidence interval.

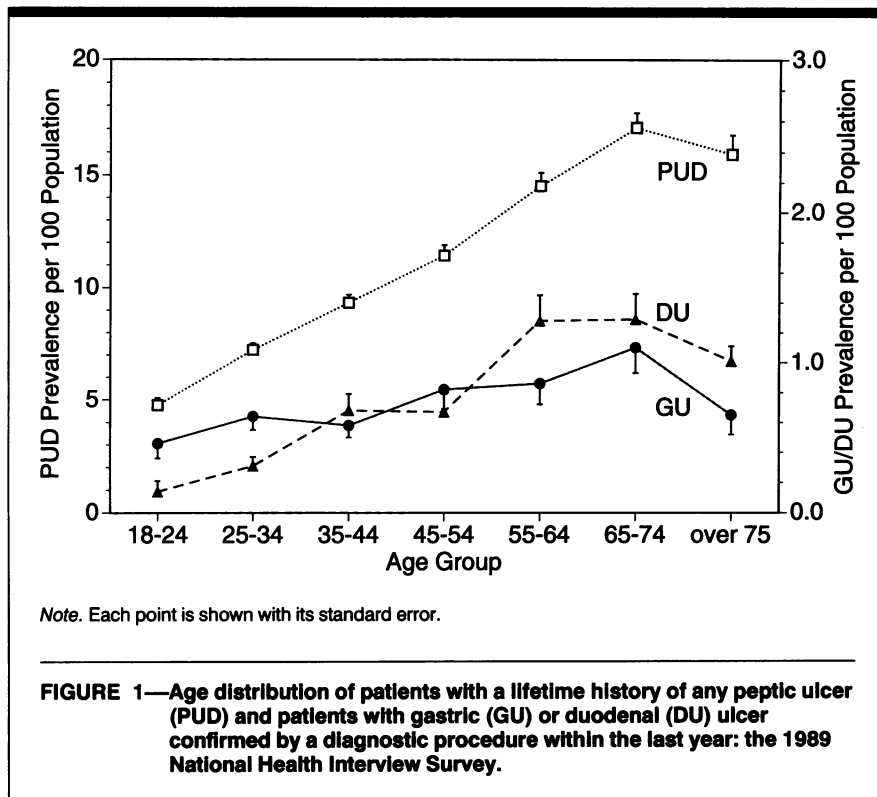
related rise in their prevalence rates. In gastric ulcer, however, the rise appeared somewhat blunted (Figure 1). The prevalence rates of all ulcers and each ulcer type analyzed separately were quite similar among male and female respondents (Figure 2). Only past history of any peptic ulcer was slightly more common in male than in female respondents. Non-Hispanic Whites more frequently reported any ulcer history and duodenal ulcer in the previous 12 months than either Hispanics or non-Hispanic Blacks. The three groups of ulcer patients showed a rather consistent pattern with respect to marital status. In comparison with married status, divorced or separated status was associated with an increased prevalence rate of peptic ulcer. Never married or widowed status was associated with a reduced ulcer risk (Figure 3).

Peptic ulcer in general, as well as gastric or duodenal ulcer taken alone, was more common in veterans than nonveterans. This relationship persisted after all other variables had been adjusted (Table 3). Peptic ulcers of any type and gastric ulcers were characterized by an inverse relationship between income and prevalence. However, duodenal ulcers appeared to be modestly more common in the high-income groups (Figure 4). The distribution by length of education revealed a similar inverse relationship between peptic ulcers of any type or gastric ulcers and length of education (Figure 5). The prevalence of duodenal ulcers remained unaffected by length of education. Current smoking was strongly associated with each ulcer category, but particularly with gastric and duodenal ulcers present in the past year.

## Discussion

Despite the marked decline in mortality and medical care indices of peptic ulcer during the past few decades, peptic ulcer is still a common disease. It affects large portions of the US population and leads to appreciable health expenditures because many patients become unable to work or spend days of restricted activity.<sup>3</sup> Previous studies of ulcer epidemiology have reported that duodenal ulcers occur three to four times more frequently than gastric ulcers.<sup>8-10</sup> Both ulcer types have been shown to affect men more commonly than women, the male:female ratio being markedly higher for duodenal ulcer than for gastric ulcer (e.g., about 4:1 in duodenal ulcer vs 2:1 in gastric ulcer).<sup>11,12</sup> Today, such distributions are observed only in the developing countries of Africa and Asia.<sup>13-15</sup> In Western societies, the past few decades have displayed a steep decline in the prevalence of peptic ulcer that has been more pronounced in duodenal ulcer than in gastric ulcer and more pronounced in men than in women.<sup>3</sup> As evidenced by the data presented here, these trends have led to a more equal distribution of both ulcer types among the sexes. The mechanisms underlying these changes are unknown. It has been speculated that occupational workload is one exogenous risk factor leading to increased acid secretion and favoring male predominance with respect to peptic ulcer.<sup>16</sup>

To our knowledge, the only nationally representative data on prevalence of ulcer disease have been reported annually in the NHIS (including 1989, the year of the digestive diseases supplement to the survey).<sup>17</sup> These yearly estimates have had limitations. An NCHS study from 1973 compared the completeness and accuracy of chronic conditions reported by health plan enrollees in household interviews with the information recorded by physicians. The fraction of underreported peptic ulcers (i.e., those reported in the medical records only) and the fraction of over-reported ulcers (i.e., those reported in the interviews only) both amounted to 40%. Similarly sized fractions were observed with respect to most other chronic conditions.<sup>18</sup> The current supplement was designed to partially overcome previous deficiencies. First, in the core questionnaire, approximately 24% of the answers to the digestive diseases list were provided by proxy rather than by self-response. Agreement between the core and the supplement was better regarding digestive disease questions for self-responses (on



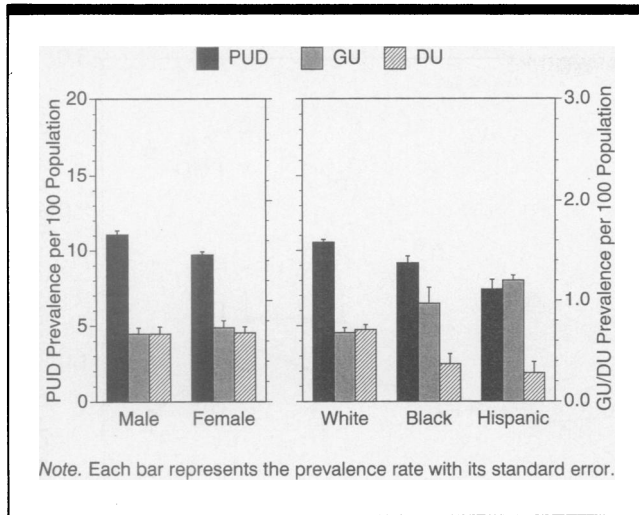
**FIGURE 1**—Age distribution of patients with a lifetime history of any peptic ulcer (PUD) and patients with gastric (GU) or duodenal (DU) ulcer confirmed by a diagnostic procedure within the last year: the 1989 National Health Interview Survey.

the core questionnaire) than for proxy responses (Table 2). Second, coding rules for core responses do not allow appropriate differentiation by ulcer type. The large majority are coded as stomach ulcers. Third, no information is available from the core questionnaire on ulcers that were not present in the previous year, precluding any analysis of the broader lifetime experience of ulcer patients. Finally, no confirming information is provided in the core questions. Even though medical record confirmation was lacking in both the core questionnaire and the digestive diseases supplement, the supplement asked about specific tests by which ulcers may be diagnosed. Each of these advantages of the digestive diseases supplement was used in the current analysis.

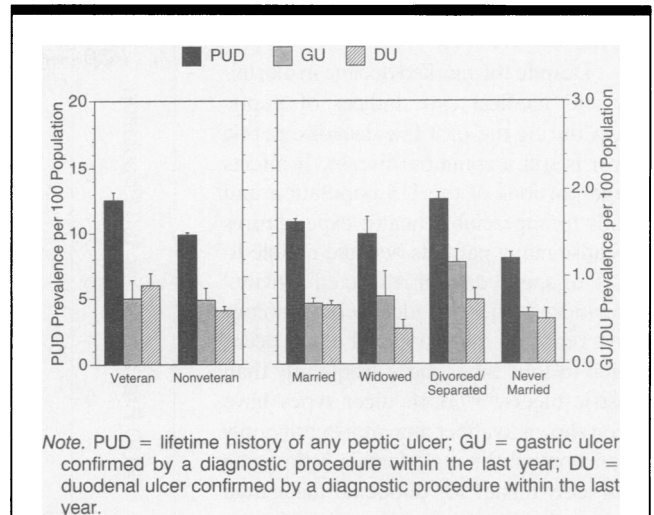
Among the findings for gastric and duodenal ulcer, some confirmed previous studies, some were contrary to current opinion, and some were novel. It must be emphasized that all findings were subject to possible reporting errors: self-report could not be substantiated by medical records, and half of the respondents did not specify whether the ulcer was gastric or duodenal. As anticipated, gastric ulcer in the previous 12 months was associated with both lower education and lower income. Smoking was also associated with gastric ulceration. Surprisingly, gastric ulcer prevalence was only weakly corre-

lated with age, increasing by about 6% with each 10 years. Both sexes were equally affected by gastric ulcer, this observation being consistent with other studies. The high prevalence among Hispanics has not been previously reported. Gastric ulcer prevalence was associated with marital status: individuals widowed and those who had never been married reported fewer gastric ulcers than married persons, while those who were divorced or separated reported an increased number.

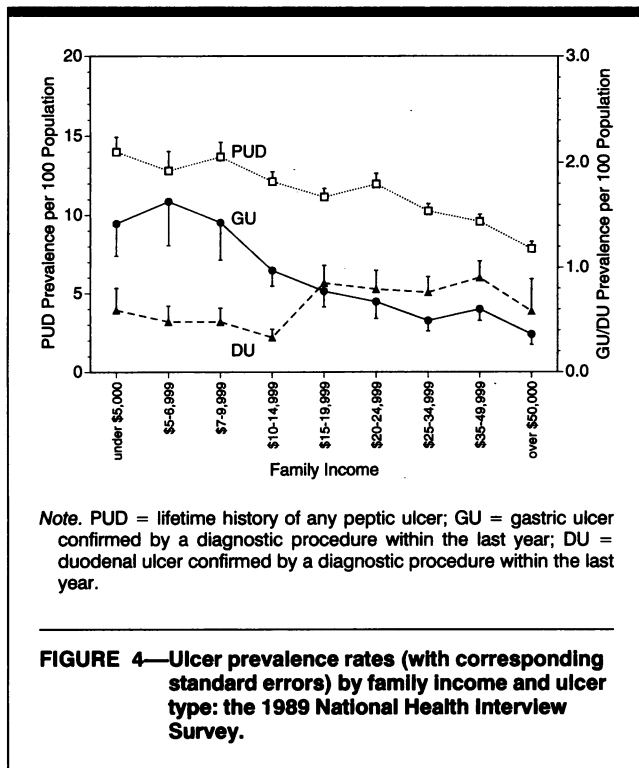
Duodenal ulcers were, as expected, strongly associated with age and smoking.<sup>19,20</sup> Surprisingly, men had lower odds than women, Blacks and Hispanics had lower odds than non-Hispanic Whites, and there was little relationship between either low education or income and duodenal ulcer. Throughout this century, men have had a greater burden from duodenal ulcer than women. Although medical care data indicate that this difference has narrowed in recent years, no other data have suggested that duodenal ulcer may actually have become less common in men than women. Because the age-adjusted prevalence of duodenal ulcer was almost identical in men and women (0.67% and 0.68%, respectively), adjustment for other factors such as veteran status and smoking may have had a marked effect on the sex relationship. Despite other possible preconceptions,



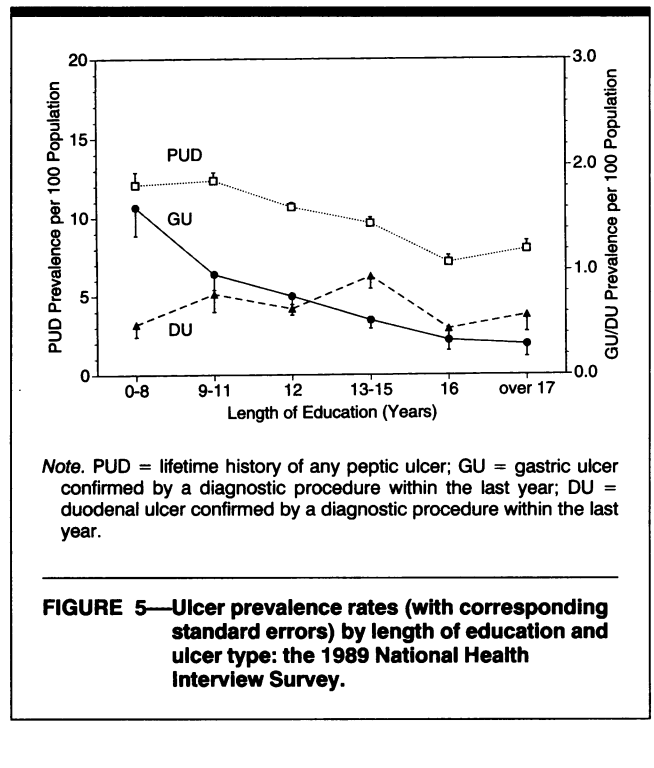
**FIGURE 2—Sex and race distribution of patients with a lifetime history of any peptic ulcer (PUD) and patients with gastric (GU) or duodenal (DU) ulcer confirmed by a diagnostic procedure within the last year: the 1989 National Health Interview Survey.**



**FIGURE 3—Ulcer prevalence rates (with corresponding standard errors) by veteran status, marital status, and ulcer type: the 1989 National Health Interview Survey.**



**FIGURE 4—Ulcer prevalence rates (with corresponding standard errors) by family income and ulcer type: the 1989 National Health Interview Survey.**



**FIGURE 5—Ulcer prevalence rates (with corresponding standard errors) by length of education and ulcer type: the 1989 National Health Interview Survey.**

US epidemiologic data are consistent with respect to the impact of duodenal ulcer among Blacks. Medicare hospitalization rates, doctor visits, and mortality from duodenal ulcer are all lower in Blacks than in Whites.<sup>3</sup> The nonassociation of education and income with duodenal ulcer was unexpected. Currently there is an emphasis on *Helicobacter pylori* infection as the major risk factor for duodenal

ulcer, and international studies suggest that *H. pylori* strongly favors those who are economically disadvantaged. However, US population-based *H. pylori* infection prevalence data are not available. Since most people with *H. pylori* do not develop duodenal ulcers, additional factors not associated with the bacterium must play a role in the development of such ulcers.<sup>21,22</sup> Besides a general infection with *H. pylori*,

the age of its acquisition is thought to play a role in the development of specific diseases. Preliminary data suggest that acquisition of *H. pylori* during the first few years of life actually protects against duodenal ulcer but promotes the subsequent development of gastric cancer and, possibly, gastric ulcer.<sup>23</sup>

In examinations of the broader category of lifetime prevalence of ulcer

disease, the expected associations with increasing age, male sex, veteran status, lower education, lower income, and smoking were found. A lower risk among Blacks and Hispanics was also found, which suggests that the low prevalence of duodenal ulcer was not merely due to a lack of specificity in ulcer diagnosis. The pattern associated with marital status in gastric ulcer was also seen for all peptic ulcer (i.e., a low risk in widowed and never-married subjects and a high risk in divorced/separated subjects). These associations have no obvious explanation.

In summary, the data from the NHIS show that, in the United States, peptic ulcer is still a common disease affecting health in large parts of the population. The varying declines of risk factors responsible for gastric and duodenal ulcer have resulted in a more uniform epidemiologic pattern among both sexes. The age-related rise and socioeconomic gradients of peptic ulcer could represent the historic scars of high infection rates with *H. pylori* experienced during early childhood. These national data, obtained prior to the widespread use of antimicrobials to treat peptic ulcer, may also be useful as a baseline for monitoring the effectiveness of newer therapies from a public health perspective. □

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