A Reappraisal of Time Trends in Ulcer Disease: Factors Related to Changes in Ulcer Hospitalization And Mortality Rates

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Abstract: There has been a dramatic decline in reported hospitalization and mortality rates for peptic ulcer disease in the past two decades. Data from the National Center for Health Statistics and from the Commission on Professional and Hospital Activities were examined to determine the cause(s) for this decline. Gastric and duodenal ulcer mortality rates decreased by 58 per cent and 68 per cent, respectively, from 1962 to 1978; changes in criteria for selecting the underlying cause of death might account for some of this apparent decrease. Hospitalization rates for duodenal ulcers decreased nearly 50 per cent from 1970 to 1978, but hospitalizations for gastric ulcers did not decrease. During this same time period, hospitalizations for peptic ulcers as one of the "all listed" causes remained stable, and hospitalizations for a closely related diagnosis, gastritis/duodenitis, increased. Changes in coding practices, hospitalization criteria, and diagnostic procedures appear to have contributed to the decline in reported hospitalization and mortality rates for peptic ulcer disease. (*Am J Public Health* 1983; 73:1066–1072.)

Introduction

During the past 20 years in the United States, reported mortality rates for peptic ulcer disease have decreased 50 per cent and hospitalization rates 24 per cent.[1–8] Several investigators suggest that these trends indicate a decrease in the incidence (number of new cases) of ulcer disease.[2,5,8] There has been no direct study of ulcer incidence in the US. The only study of this kind in the literature is that by Bonnevie in Denmark[9,10] in which radiology and surgery log books were searched for peptic ulcer diagnoses. He found no changes from 1963 to 1968. In 1978 he repeated the study and again found no notable changes.*

A mortality study, conducted over the same time period as Bonnevie's study, concluded that the number of deaths from peptic ulcer disease decreased in Denmark between 1958 and 1968.[11] However, analysis of the original paper and data published in the World Health Statistics Annual[12] indicates that the peptic ulcer mortality rate did not decrease during that time period.

Three studies are frequently cited to illustrate the decline in United States hospitalization rates for peptic ulcers. One study reported that hospitalizations for perforated duodenal ulcers decreased significantly (36 per cent) in Seattle between 1966–1970 and 1971–1975.[8] Another study in an Oregon health maintenance organization (HMO) found hospitalization rates decreased 60 per cent for duodenal ulcer and 50 per cent for gastric ulcer from 1966 to 1975.[5] A third found that during the period 1970–1978, national hospital admissions for duodenal ulcer decreased 43 per cent, whereas admissions for gastric ulcer did not decrease.[3]

Studies which have used other types of information besides mortality and hospitalization data have produced mixed results. Mendeloff found a 50 per cent decrease in disability rates for peptic ulcer among males in a manufacturing company between 1960 and 1970.[4] Vogt reported a significant decline in outpatient episodes of duodenal ulcer in an Oregon HMO (from 13.7 to 4.1 episodes per 1,000 person-years 1967–1973).[5] Gastric ulcer episodes declined from 4.6 to 2.2 per 1,000 PY during this same time period, but this decrease was not statistically significant. In contrast, National Health Interview Survey (HIS) data showed no decrease in "perceived" ulcer incidence between 1968 and 1975.[13,14] It has been suggested that this survey, which is based on self-reported conditions, may overestimate the occurrence of ulcer disease,[15] however, a careful study found that the total number of peptic ulcer conditions reported in interviews equaled the number reported in medical records.[16]

If the incidence of ulcer disease is decreasing, then assessment of concurrent changes in the environment, lifestyle, and ethnic composition of the US population might lead to further understanding of the etiology of peptic ulcer disease. Unfortunately, it is not clear when the decline for ulcer hospitalizations and deaths began and what proportion of the observed decrease can be accounted for by factors such as changes in coding practices, hospitalization criteria, diagnostic procedures, or medical treatment.

In this paper, we examine in detail United States ulcer hospitalization and mortality data and assess the influence on observed rates of factors other than changes in true incidence.

Methods

Hospitalization and mortality figures used in this report are based on data collected by the Commission on Professional and Hospital Activities (CPHA) and the National Center for Health Statistics (NCHS).

The CPHA data come from over 400,000 hospital patient records selected annually from a sample of over 750 US non-federal short-term general hospitals. CPHA methods are described in detail elsewhere.[3]

*Bonnevie O: unpublished data, 1980.

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NCHS hospital discharge data are collected through the National Hospital Discharge Survey, an ongoing survey conducted since 1965.[17] Data are obtained from a sample of medical records selected from a national sample of over 400 non-federal short-stay hospitals. The design of this survey is described in a NCHS publication.[18]

It should be emphasized that the data for hospitalizations refer to the number of hospital discharges and not to the number of different individuals hospitalized. A person may be hospitalized several times for the same disease process in any given time period.

NCHS mortality figures for the US are based on a complete enumeration of all death certificates (except in 1972 when they were based on a 50 per cent sample).[19] Preliminary figures for 1980–1982 are based on a 10 per cent sample.[20,21]

Disease Classification

From 1970 to 1973, the CPHA used the Hospital Adaptation of the International Classification of Diseases (H-ICDA), First Edition, Commission on Professional and Hospital Activities, Ann Arbor, Michigan, 1968. They shifted to the Second Edition (1973) in January of 1974. In 1979, CPHA hospitals began using ICD-9-CM.

Reporting of hospital data by NCHS is based on the 7th revision of the ICDA for 1965–1968, the 8th revision for 1970–1978, and the ICD-9-CM for 1979-present. Data for 1969 were not coded.

Mortality data from the NCHS are reported according to the 6th revision of the ICD for 1949–1957, the 7th revision for 1958–1967, and the 9th revision for 1979-present. Between 1968 and 1978, the 8th revision used the adapted version of the International Classification of Diseases (ICDA). See Appendix for list of codes.[22–26]

In this report, unofficial estimates of the US civilian noninstitutionalized population were used as the denominator to calculate the hospitalization rates for non-census years. Resident US population figures (includes institutionalized and armed forces population) were used to calculate the mortality rates. These data were provided by the US Bureau of the Census and are consistent with reports published by the Bureau in Series P-25, Current Population Reports.[27]

Peptic ulcer disease in this article includes gastric, duodenal, and site unspecified ulcers. Gastrojejunal ulcers are excluded.

Results and Discussion

Mortality

Figure 1 shows the NCHS peptic ulcer mortality rates, based on "underlying cause of death," from 1946 through 1982. Death rates for peptic ulcer rose slowly from 1946 until 1962 and then fell rapidly until 1979. This disease, with a relatively low mortality rate, ranked as the seventeenth leading cause of death in 1979.[28]

Coding—The determination of mortality rates can be strongly influenced by changes in codes and coding practices.[29–34] Time points where coding changes for peptic ulcer disease have been made are shown in Figure 1.

In 1949, the 6th Revision of the ICD was implemented. In addition to the coding changes there was a change in the instructions for selecting the underlying cause of death when

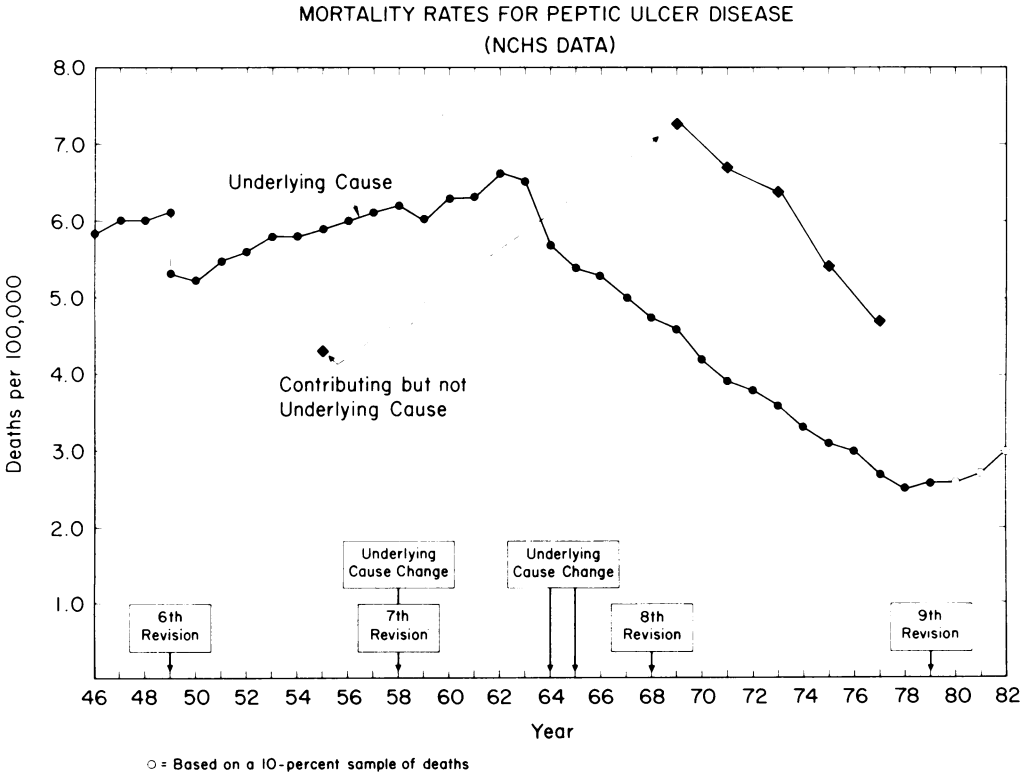

FIGURE 1—Mortality Rates for Peptic Ulcer Disease as Underlying Cause of Death from 1946 to 1982, and as Contributing cause for 1955 and 1969 to 1977. [Rates are reported per 100,000 population. Estimate for 1982 includes 12-month period ending in May 1982. Based on data from NCHS.][19,21]

multiple causes were listed on the death certificate. Prior to 1949 a uniform system known as the Manual of Joint Causes of Death was used to establish the underlying cause of death. Starting in 1949 a new standard death certificate was issued and if completed correctly, the underlying cause specified by the physician was used for tabulations. A special comparability study showed that coding under the 6th as opposed to the 5th Revision resulted in a 12 per cent reduction in the ulcer disease death rate, a 0.88 comparability ratio.[29]

After 1950, there was little disruption in ulcer mortality statistics resulting from the introduction of new revisions until the 9th Revision in 1978. The comparability ratios for the 7th and 8th Revisions were 1.01[30] and 0.99.[31] The comparability ratio between the 8th and 9th Revision was 1.12.[35] The implementation of this revision accounts for the increase between 1978 and 1979, the first upturn in 16 years. Reasons for the continued increase since 1979 remain to be determined.

In addition to changes in codes, major changes were made in 1958, 1964, and 1965 in rules for selection of the underlying cause of death. A special study on mortality trends by the NCHS reported:

> "Part of the reported higher level of the death rate for peptic ulcer for 1958–63 and part of the downturn for this rate during the latter half of the 1960s are attributable to changes in coding procedures for selecting the underlying cause of death from the medical entities on the death certificate."[31]

Another report by the NCHS described the specific change in 1964 as follows:

> "With increasing frequency, gastric and peptic ulcers are being reported on the death certificate with an indication that the ulcer resulted from a chronic disease or a vascular and neurogenic condition. Prior to 1964 most of these sequences stated as 'gastric ulcer or peptic ulcer due to another condition' were considered 'highly improbable' and therefore ulcer of the stomach (540) was coded as the underlying cause. Beginning with 1964 the underlying cause in these cases was assigned as reported, resulting in some decrease in deaths attributed to ulcer of the stomach."[36]

A similar change was made in the selection criteria for duodenal ulcer in 1965.[37]

Evidence that more ulcer related deaths are now recorded as a contributing rather than as an underlying cause is presented in Figure 1. A study of multiple causes of death for 1955 showed that peptic ulcer was selected as the underlying cause of 9,730 deaths, and was entered 6,683 times on the death certificates as a contributing but not underlying cause.[38] In marked contrast, since 1969 ulcer disease has been recorded as a contributing cause about twice as frequently as it has as an underlying cause. Although no data on contributing cause of death are available at the time of the coding changes in 1963, it seems likely that this sharp reversal was a consequence of those changes.

The combined peptic ulcer mortality rates for underlying and contributing causes show a decrease between 1955 and 1977, but the rate of decline is less than half that for the underlying cause of death (25 per cent vs 54 per cent).

Validity of Mortality as an Index of Ulcer Incidence—People do not in general die of "ulcer disease" but only of its more severe and rare complications.

Mortality rates for peptic ulcer disease are strongly related to age and sex. However, age-adjusted mortality rates for peptic ulcer (Figure 2) show essentially the same pattern of decrease as the crude rates, so changes in the age distribution cannot account for the pattern seen. Two previous studies[39,40] examined the age-adjusted mortality rates by sex and race (White, non-White) groups for the US population. From 1950 to the present, ulcer mortality rates decreased for all four sex-race groups, but the magnitude of decrease differed for these groups. The average annual per cent decrease in the death rate was greater for the males in both the White and non-White populations than their female counterparts.

Rates for mortality from "all causes" are presented in Figure 2 so that ulcer mortality trends can be seen in context with overall mortality. There has been a decrease of about 30 per cent in overall age adjusted United States mortality rates since 1950.[41] This suggests that the decline in mortality from

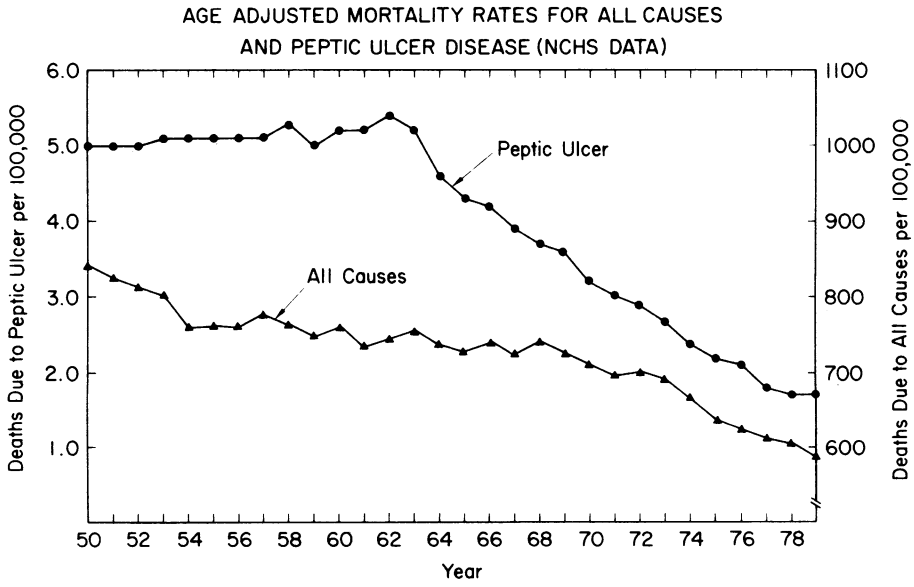

FIGURE 2—Age-adjusted Mortality Rates for All Causes of Death and Peptic Ulcer Disease from 1950 to 1979. [Rates are reported per 100,000 population. Based on data from NCHS[28,31] and unpublished data, NCHS, Mortality Statistics Branch.]

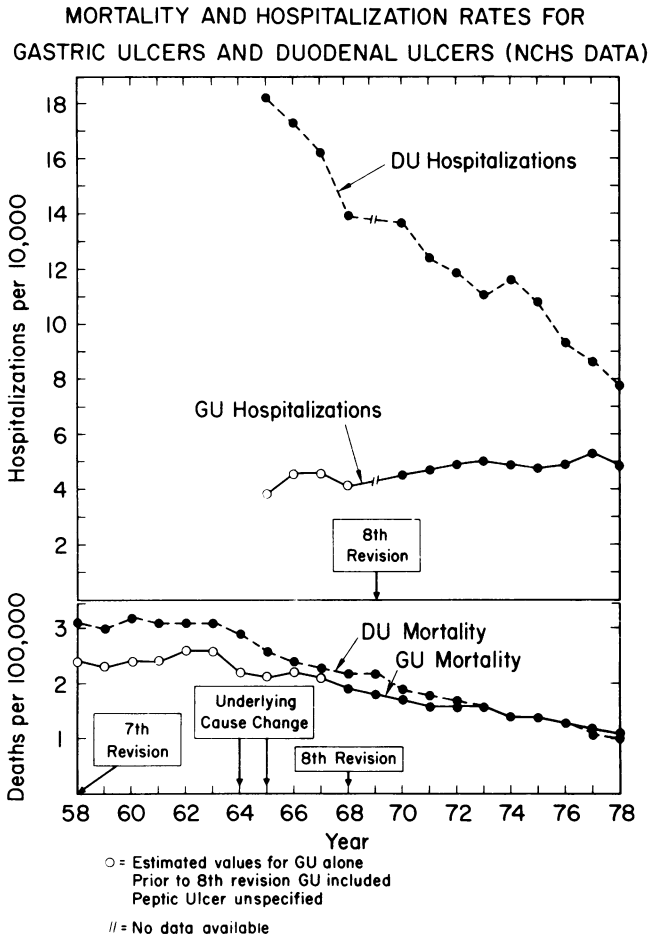

FIGURE 3—Hospitalization and Mortality Rates for Gastric Ulcers (GU) and Duodenal Ulcers (DU). [Hospitalization rates are reported per 10,000 population, mortality rates per 100,000 population. Mortality values for GU alone for years 1958 to 1967 were estimated by using the ratio of GU death to GU + PU, unspecified deaths 1968. Hospitalization values for GU alone for years 1965 to 1968 were estimated by using the ratio of GU hospitalizations to GU + PU, unspecified hospitalizations for 1970,[17-19] and unpublished data, NCHS, National Hospital Care Statistics Branch.]

ulcer disease may in part reflect a general improvement in the mortality picture in the United States during the past several decades. The drop in mortality may be influenced by general factors such as improvement in health care or lifestyle changes that extend beyond a specific category of disease.

Mortality vs Hospitalization Trends—Gastric ulcer and duodenal ulcer hospitalization and mortality data are presented in Figure 3. Both hospitalization and mortality data are displayed along the same time axis to illustrate the differences in the time trends for these two measures of peptic ulcer disease. For duodenal ulcer, both hospitalization and mortality rates decreased; while for gastric ulcer, mortality decreased during the period when hospitalizations did not change. The change in coding of underlying cause of death is one change which could have affected ulcer disease mortality rates without affecting hospitalization rates. However, since the mortality rates for duodenal ulcer are decreasing more rapidly than for gastric ulcer, it is likely that factors other than coding changes are influencing the duodenal ulcer rates.

Hospitalization

Duodenal and Gastric Ulcers, 8th Revision—CPHA and NCHS hospitalization rates for duodenal and gastric ulcers, 1970–1978, based on the first listed diagnosis using the 8th revision of the ICDA code are presented in Figures 4–5. Prior to 1970, and subsequent to 1978, data are based on different revisions of the ICDA codes.

Figure 4 shows the hospitalization data for gastric ulcer broken down into complicated and uncomplicated cases. None shows any consistent change over this period.

The data for duodenal ulcer shown in Figure 5 show a marked drop in uncomplicated cases, a smaller drop for hemorrhage, and little if any change for perforation. Uncomplicated cases are most subject to changes in diagnosis and medical care patterns. Data from the Southern California Kaiser Permanente Medical Care Program (1.5 million members) do not show this marked drop in uncomplicated cases.[42] Rates for the HMO (which has an economic incentive not to hospitalize uncomplicated or "discretionary" cases) have been much lower than the national rates. This suggests that part of the drop in duodenal ulcer hospitalizations is attributable to a decrease in the practice of hospitalizing patients with less severe ulcer disease.

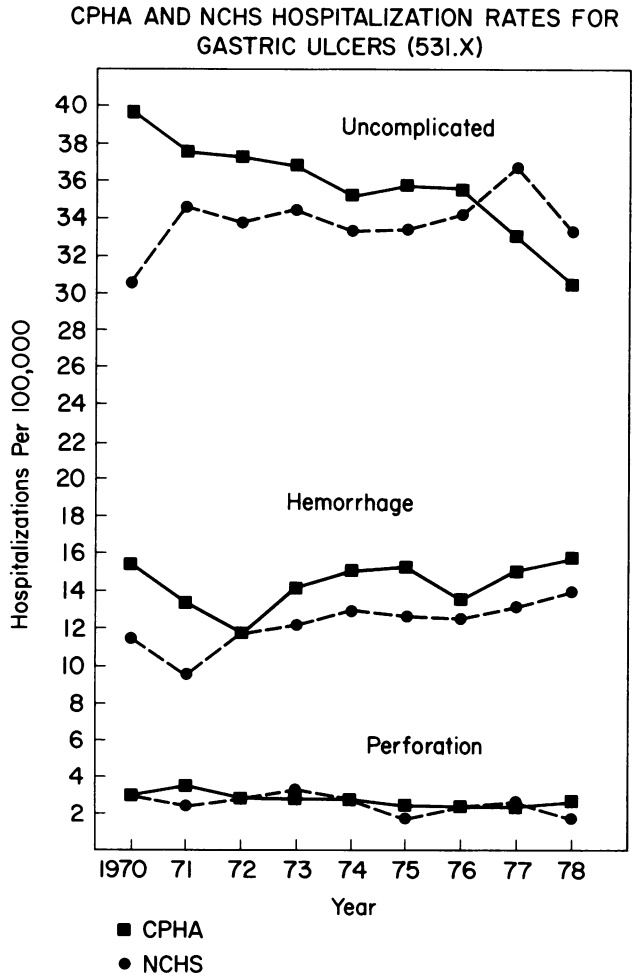

FIGURE 4—Hospitalization Rates for Gastric Ulcers by Uncomplicated, Hemorrhage, or Perforation from 1970 to 1978. [Rates reported per 100,000 population. Based on data from CPHA and NCHS, and unpublished data, NCHS, National Hospital Care Statistics Branch.]

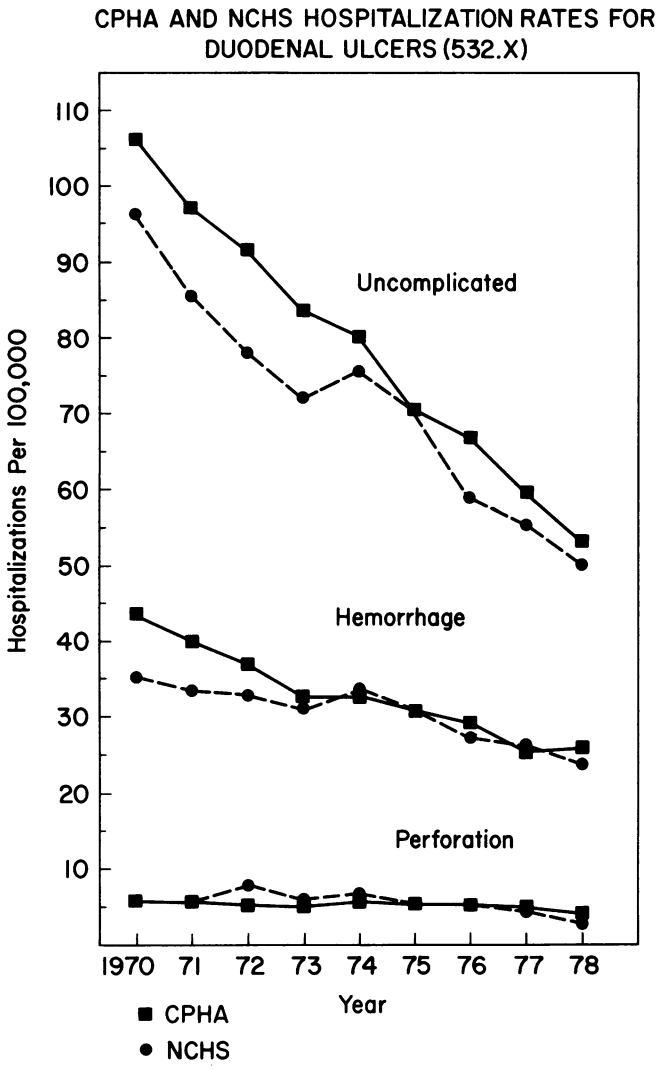

FIGURE 5—Hospitalization Rates for Duodenal Ulcers by Uncomplicated, Hemorrhage, or Perforation from 1970 to 1978. [Rates reported per 100,000 population. Based on data from CPHA and NCHS and unpublished data, NCHS, National Hospital Care Statistics Branch.]

The different findings of the Seattle[8] and Oregon HMO[5] studies should be noted here. The decrease in the number of perforated duodenal ulcer hospitalizations in certain Seattle hospitals is not reflected in the corresponding national rates. The decline in gastric ulcer hospitalizations (although not statistically significant) in the Oregon HMO is also not reflected in the national trends. Furthermore, the Oregon HMO had a 20 per cent decline in the rates for all causes of hospitalizations during the same time period[43] which again suggests that the decrease in hospitalizations for gastric ulcer could be due to policy rather than etiologic changes.

Changes in Diagnostic Patterns—When hospitalization data are collected, up to five diagnoses are coded. The first listed condition is the primary diagnosis. A diagnosis of peptic ulcer in the "all listed" category means that ulcer disease was included as one of the five diagnoses.

Although ulcer as first listed diagnosis shows a marked decrease from 1970 to 1978, the "all listed" category has been relatively stable (see Figure 6) suggesting that the proportion of the population hospitalized with ulcer disease did not change.

The apparent decrease in hospitalization rates for peptic ulcer as first listed cause might also reflect changes in diagnostic practices, most notably the advent of the endoscope. The flexible fiberoptic endoscope was introduced in 1958.[44] Although it is not known how many endoscopies are currently performed in the United States, one report estimated that there were 510,000 endoscopies performed in the US for 1977.[45] In comparison, there were 379,000 hospitalizations for peptic ulcer that year. A recent National Institutes of Health report[46] concluded that: ". . . endoscopy has made it possible to identify the sites of upper gastrointestinal bleeding by direct observation and has shown that erosions and not ulcers are the common cause of hemorrhage." This suggests that some of the decrease in duodenal ulcer hospitalizations may be due to an increasing proportion of formerly presumptive ulcer cases (especially hemorrhage) being now classified as erosions, peptic ulcer-unspecified, gastritis/duodenitis, or other closely related diagnoses.

Data for gastritis/duodenitis hospitalizations are also shown in Figure 6. There has been a slight increase for first listed and a marked increase for "all listed" hospitalizations for gastritis/duodenitis. Perhaps with the increasing use of endoscopy some cases previously assumed to be peptic ulcer are now being classified as gastritis/duodenitis.

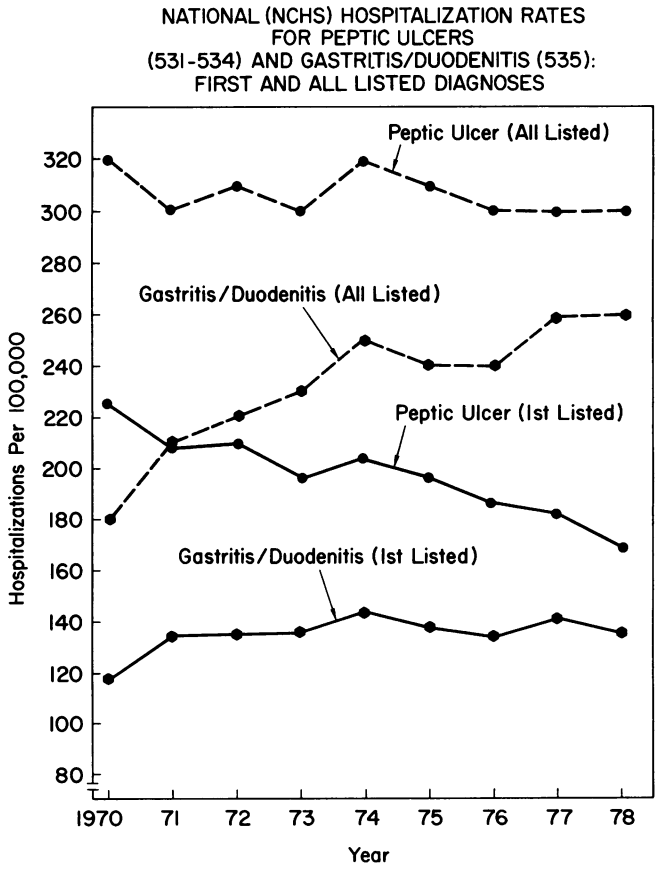

FIGURE 6—Hospitalization Rates for Peptic Ulcers and Gastritis/Duodenitis, First and All Listed Diagnoses. [Rates reported per 100,000 population. Based on data from NCHS.][17]

Implications

The correct interpretation of vital statistics data is a complex problem. The issues raised here and in recent studies of other chronic diseases[32,34,47–52] point out the care with which interpretations of such data must be made. There is a strong need for caution when attempting to assess trends in the incidence of a disease based only on hospitalization and mortality data. Hospitalization and mortality rates are poor indicators of disease incidence for a chronic disease with few complications and low mortality.

In addition to the possibility of a decrease in disease incidence, we have shown that changes in hospitalization criteria, diagnostic procedures, and coding practices may have contributed to the decrease in peptic ulcer hospitalization and mortality rates. For gastric ulcers, the differences between the hospitalization and mortality trends, and the information from the multiple causes of death data, suggest that changes in coding practices caused much of the sharp decrease in gastric ulcer mortality rates beginning in 1963. For duodenal ulcers, both hospitalization and mortality data show a consistent decrease. However, most of the decline in duodenal ulcer hospitalizations is due to the large decrease in uncomplicated cases, and there has been a concomitant increase in a closely related diagnosis, gastritis/duodenitis. Thus, it is likely that other factors besides a decrease in incidence have contributed to the duodenal ulcer time trends. How much each of these factors has contributed has not been determined.

Studies of x-ray and endoscopy records are necessary to evaluate ulcer incidence trends accurately. The impact of changes in medical treatment (i.e., changes in types of surgeries, introduction of cimetidine) need to be addressed. A medical record study should be done comparing past and present diagnostic criteria for hospitalizations to determine if hospitalization criteria have indeed changed. These studies and further analyses of the relationship of age and sex to ulcer disease rates will help to increase our understanding of why there has been a decrease in duodenal ulcer hospitalization and mortality rates.

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APPENDIX
ICD* CODES FOR SIXTH-NINTH REVISIONS (NCHS)

6th[22] & 7th**[24] Revisions		8th Revision[25]		9th Revision[26]	
Ulcer of Stomach	540	Ulcer of Stomach	531	The three digit codes, 531 through 534, are same as for 8th revision. The following 4th-digit codes apply for 531–534 (indicated by "XXX"):	
Without mention of P	540.0	With H only	531.0		
With P	540.1	With P only	531.1		
		With H and P	531.2		
		Other and unspecified	531.9	Acute with H	XXX.0
Ulcer of Duodenum	541	Ulcer of Duodenum	532	Acute with P	XXX.1
Without mention of P	541.0	With H only	532.0	Acute with H and P	XXX.2
With P	541.1	With P only	532.1	Acute without mention of H & P	XXX.3
		With H and P	532.2	Chronic or unspecified with H	XXX.4
		Other and unspecified	532.9	Chronic or unspecified with P	XXX.5
Gastrojejunal Ulcer	542	Gastrojejunal Ulcer	534	Chronic or unspecified with H & P	XXX.6
Without mention of P	542.0	With H only	534.0	Chronic without mention of H or P	XXX.7
With P	542.1	With P only	534.1	Unspecified as acute or chronic,	
		With H and P	534.2	without mention of H or P	XXX.9
		Other and unspecified	534.9		
Peptic Ulcer, site unspecified	—	Peptic Ulcer, site unspecified	533	(In addition there is a fifth-digit subclassification: "0" for without mention of obstruction and "1" for with obstruction. For example, 531.11 would be an acute gastric ulcer with perforation and obstruction.	
(For these revisions,	—	With P	533.0		
this category was included	—	Without mention of P	533.9		
with Ulcer of Stomach)					

H = Hemorrhage
P = Perforation
*For the 8th Revision, an adapted version (ICDA) of the International Classification of Diseases (ICD) was used.
**For the 7th Revision, mortality data have 2 subcodes (as presented in above table); hospitalization data have 4 subcodes (see reference #23).