Background: Peptic ulcer disease has well-defined causes, with most cases related to Helicobacter pylori infection and nonsteroidal anti-inflammatory drug use.

Objectives: To report performance rates on measures of care related to peptic ulcer disease in hospitalized Medicare patients and to identify improvement opportunities.

Methods: Retrospective study of 2267 Medicare beneficiaries hospitalized with peptic ulcer disease. Data were obtained from 2 sources: medical records (n = 1580) from 80 hospitals—16 hospitals in each of 5 states (Alabama, Florida, Louisiana, Tennessee, and Texas)—and a national random sample (n = 687). Three measures of care were evaluated: (1) rate of diagnostic screening or treatment for H pylori infection, (2) rate of screening for nonsteroidal anti-inflammatory drug use on admission to the hospital, and (3) rate of assessment of risk factors for recurrence.

Results: The rate of screening or treatment for H pylori infection was 52.9% to 59.8% among the 5 states and 55.6% in the national random sample. The rate of screening for nonsteroidal anti-inflammatory drug use was 64.6% to 75.4% among the states and 73.4% in the national random sample. The rate of assessment at discharge from the hospital for additional risks for ulcer recurrence was 66.1% to 73.6% among the states and 70.9% in the national random sample.

Conclusions: Based on hospital records, slightly more than half of the Medicare patients admitted with diagnoses studied are being considered for H pylori eradication. If recurrence of this disease is to be reduced, physicians must adopt current screening and treatment recommendations.

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Untill 1984, peptic ulcer disease was considered an idiopathic illness. More than 13 years have elapsed since Marshall et al2 satisfied Koch’s postulates and established a “curved bacillus” as a causative agent for acute gastritis. With the explosion of research in this area, the curved bacillus initially named Campylobacter pyloridis has been subsequently classified as Helicobacter pylori3 and is recognized as the most common chronic bacterial infection in humans.4 The organism has been associated with duodenal ulcer in more than 90% of cases and with gastric ulcer in 60% to 80% of cases.3

Peptic ulcer disease, now recognized as an infectious disease, is readily diagnosed and cured with common oral antibiotic drug therapy. Several position papers have been published establishing recommendations for diagnosis and treatment. In 1994, the National Institutes of Health Consensus Development Panel6 suggested screening patients with peptic ulcer disease for H pylori infection and eradicating the organism if present. In 1996, the American College of Gastroenterology7 had a similar recommendation for treatment of H pylori infection in addition to screening for nonsteroidal anti-inflammatory drug (NSAID) use and eliminating or reducing the dose if possible.

Despite these recommendations, recurrent peptic ulcer disease remains common. More than 500,000 new cases are diagnosed each year in the United States, and 4 million people experience recurrence.8 The current prevalence rate of H pylori infection is approximately 35% in the United States, and it increases by 1% per year of age. By age 65 years, almost 65% of this age group is infected, making the Medicare population particularly prone to this illness.9 In 1995, 145,717 Medicare patients discharged from the hospital had a principal diagnosis of peptic ulcer disease10 at a cost of more than $826 million. The number of patients more than doubled (n = 420,764) when patients with sec-
opportunities for improvement.

...capitalized Medicare patients and attempts to identify ulcer disease are being followed by practitioners in hospitals. The present study reviews how closely current recommendations for diagnosis and treatment of peptic ulcer disease in 1994 were tested for...Infection (measure of care statement 1) ranged from 12.5% (Texas) to 55.8% (Louisiana). Percentage of Medicare beneficiaries impacted is derived from the total number of claims reported by selected hospitals in calendar year 1995, not from the actual number sampled.

Medical records were selected using the National Payment Claims History File to identify Medicare Prospective Payment System hospital claims with principal diagnoses believed to possibly be caused by H pylori infection or NSAID use. These diagnoses included duodenal and gastric ulcer. Gastritis and duodenitis codes were omitted. The top 10 International Classification of Diseases, Ninth Revision, Clinical Modification codes in the 5-state sample are noted in Table 1. (All the codes used are as follows: 531.00, 531.01, 531.10, 531.11, 531.20, 531.21, 531.30, 531.40, 531.41, 531.50, 531.51, 531.60, 531.61, 531.70, 531.71, 531.90, 531.91, 532.00, 532.01, 532.10, 532.11, 532.20, 532.21, 532.30, 532.31, 532.40, 532.41, 532.50, 532.51, 532.60, 532.61, 532.70, 532.71, 532.90, 532.91, 533.00, 533.01, 533.10, 533.11, 533.20, 533.21, 533.40, 533.41, 533.50, 533.51, 533.60, 533.61, 533.70, 533.71, 533.90, 533.91, 534.00, 534.01, 534.04, 534.11, 534.20, 534.21, 534.30, 534.40, 534.41, 534.50, 534.51, 534.60, 534.61, 534.70, 534.71, 534.90, and 534.91.)

MEASURES OF CARE

Three measures of care were used in this study: (1) percentage of patients diagnostically screened or treated for H pylori infection, (2) percentage of patients assessed at admission to the hospital for NSAID use, and (3) percentage of patients assessed for risk factors (for recurrence) at discharge from the hospital.

Key variables noted in the measure of care statements require further clarification. The first measure of care...diagnosis codes of peptic ulcer disease were included. Are hospitals providing the best quality of care for Medicare beneficiaries who are hospitalized for peptic ulcer disease and its complications? Roll et al11 reported that only 39% of patients 65 years and older admitted to California fee-for-service hospitals for peptic ulcer disease in 1994 were tested for H pylori infection. The present study reviews how closely current recommendations for diagnosis and treatment of peptic ulcer disease are being followed by practitioners in hospitalized Medicare patients and attempts to identify opportunities for improvement.

RESULTS

The 5-state study population (n = 1580) was 47.1% men and 52.9% women, with a mean age of 75 years. The national random sample (n = 687) was 46.4% men and 53.6% women, with a mean age of 76 years. Initial analysis of the national random sample revealed 82.8% whites, 14% African Americans, and 4% Hispanics. This correlated very closely with the 5-state sample, which was 75% white, 19% African American, and 6% Hispanic. Economic characterization could not be determined.

The rate of screening or treatment for H pylori infection (measure of care statement 1) ranged from 52.9% to 59.8% in the 5 states. The national rate for patients sampled was 55.6%. The rate of screening for NSAID use (measure of care statement 2) ranged from 64.6% to 75.4% in the 5-state study population, with a national rate of 73.4%. The rate of assessment for additional risks for recurrence (measure of care statement 3) ranged from 66.1% to 73.6% in the 5-state study population, with a national rate of 70.9%. Institution ranges for the measures of care varied within each state (Table 2).

In the 5-state study population of 1580 patients, 1336 patients (84.6%) underwent endoscopy (92.3% in the national sample). Of the 84.6% who underwent endoscopy, 851 patients (63.7%) were screened or treated for H pylori infection. Of the 1580 patients studied, 853 patients (54.0%) were screened for H pylori infection, resulting in 293 positive and 440 negative results. The screening results for the remaining 120 patients could not be determined by the abstractor because of illegible handwriting or lack of information. The percentage of patients with positive screening results treated was 70.3%; the percentage with negative screening results treated was 18.2%. Of patients not screened, 3.5% were treated.

Claims data were used to identify the top 10 physician specialty groups providing care for the individual...
patients in the 5-state study. Identifying information was available for 1515 of 1580 patients. Physician identifiers could not be retrieved for the national random sample. Physician specialty was ranked by the number of patients admitted to the hospital by each (Figure 1). Most patients were admitted to the hospital by internists (n = 667), followed by family practitioners (n = 238), and gastroenterologists (n = 201). However, surgeons and other specialists also served as attending physicians. Adherence to the 3 measures of care by specialty are displayed in Figure 2.

The second measure of care statement refers to “screening for H pylori infection.” Patients passed this indicator if an NSAID was listed as a hospital admission medication or if the physician documented the status of current NSAID use (whether NSAIDs were being used by the patient). The collection tool contained an NSAID medication list.

The third measure of care statement states that the patient was “assessed for additional risks for recurrence at discharge from the hospital.” Two components of this measure of care were noted: (1) if NSAID administration was continued at or after discharge from the hospital, there must have been physician documentation as to the indications for use (eg, aspirin use because of transient ischemic attacks or unstable angina), and (2) if there was documentation of current alcohol or tobacco use, there must have been documentation of education about risk factors associated with gastrointestinal (GI) tract bleeding and the use of alcohol or tobacco. “Current” was defined as “at the time of admission to the hospital” or “within 3 months before admission to the hospital.”

DATA COLLECTION

An electronic data collection instrument was used to collect administrative and clinical information from the medical records specific to peptic ulcer disease. Abstraction services were performed by 2 clinical data abstraction centers.

ANALYSIS METHODS

The measure of care performance rates were calculated using a software program (Microsoft Access 2.0; Microsoft Corp, Redmond, Wash). The STATA statistical software package was used to verify the algorithmic logic.

RELIABILITY

Clinical data abstraction centers conducted extensive training programs and competency testing before abstraction of study records. Abstraction reliability testing was performed by dual abstraction of a subset of study records. The overall abstraction reliability rate for the data elements was 95%.

Louisiana Health Care Review Inc, Baton Rouge, conducted an independent assessment of reliability using a subset of study records (n = 259) (R. Horswell, written communication, May 20, 1997). Raw agreement rates for the measures of care were reported to range from .94 to .83. Reported k values were as follows: the H pylori infection measure was 0.88, the NSAID use measure was 0.77, and the risks at hospital discharge measure was 0.56. The Health Care Financing Administration Data Quality Team has adopted reporting of k values, in addition to raw agreement rates, to assess agreement beyond that which would normally occur by chance. Using references in the literature to assist with interpretation of reported k values, the reliability of the H pylori infection measure is near perfect, the NSAID use indicator has substantial agreement, and the risks at hospital discharge measure has moderate agreement.

A popular phrase that appears in current outcomes research is “best practice.” This concept is used to define a clinical practice that results in an optimal outcome and has literature and research support. Clearly, the identification of H pylori as a causative agent for peptic ulcer disease and the eradication of the organism in preventing recurrence would be considered a best practice. Effective treatment of this infectious disease would be expected to improve quality of life, to reduce morbidity, and to eventually affect the prevalence of this disease. Despite the dollars spent and the articles written on this issue, recommendations for medical interventions are still not being followed. Physician adherence rates to best practices was a topic of a study by Krumholz et al in an observational study that showed that aspirin was not prescribed at discharge to 24% of elderly patients who had been hospitalized with acute myocardial infarction and did not have a contraindication to aspirin use. Gleason et al noted that treatment of community-acquired pneumonia in young patients was consistent with American Thoracic Society guidelines in 62% of patients. Treatment of patients older than 60 years with 1 or more comorbid conditions was consistent with American Thoracic Society guidelines in only 18% of patients.
increase physician knowledge but fails to improve any practice guidelines to the medical community may serve to performance. Eisenberg\textsuperscript{20} surmised that dissemination of practices have been identified that enhance physician performance. They were able to show a limited increase in use from 8.8\% to 30.6\% during the study despite widely accepted indications.

Educational methods for improving adherence rates to best practices have been studied, but no clear methods have been identified that enhance physician performance. Eisenberg\textsuperscript{20} surmised that dissemination of practice guidelines to the medical community may serve to increase physician knowledge but fails to improve any outcomes measurement. However, involvement of administrative staff, physicians, and support staff in a focus group approach seems to improve outcomes that are measurable.\textsuperscript{21} In a report by Lomas et al,\textsuperscript{22} improvement in outcomes occurred only when a clinical staff opinion leader was involved in surveillance and feedback of performance data to the other practitioners in a study encouraging compliance with guidelines for the management of delivery in women with a previous cesarean section. Hirth et al\textsuperscript{23} reported that, compared with gastroenterologists, primary care physicians are more conservative in their approach to new research on H pylori and may take a “wait and see” attitude toward the treatment of peptic ulcer disease with antibiotic drugs.

Hirth et al also reported that generalists in multispecialty practice settings adopted National Institutes of Health Consensus Conference recommendations faster than those in solo practice. This suggests that practice environment may affect the flow of information about new therapies. These reports may partially explain the low percentage of hospitalized Medicare patients being screened or treated for H pylori infection in the present study. The data in the present study were abstracted from hospital discharge records dated October 1, 1995, through March 31, 1996, when H pylori infection treatment guidelines had been in the literature for longer than 1 year.

### Table 1. Top 10 ICD-9-CM* Codes in the 5-State Study Population

<table>
<thead>
<tr>
<th>ICD-9-CM Code</th>
<th>Definition</th>
<th>Patients, No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>531.40</td>
<td>Chronic stomach ulcer with hemorrhage</td>
<td>391 (24.7)</td>
</tr>
<tr>
<td>531.00</td>
<td>Acute stomach ulcer with hemorrhage</td>
<td>248 (15.7)</td>
</tr>
<tr>
<td>532.40</td>
<td>Chronic duodenal ulcer with hemorrhage</td>
<td>238 (15.1)</td>
</tr>
<tr>
<td>532.00</td>
<td>Acute duodenal ulcer with hemorrhage</td>
<td>179 (11.3)</td>
</tr>
<tr>
<td>531.90</td>
<td>Unspecified gastric ulcer without mention of hemorrhage or perforation without mention of obstruction</td>
<td>103 (6.5)</td>
</tr>
<tr>
<td>533.40</td>
<td>Chronic peptic ulcer with hemorrhage</td>
<td>48 (3.0)</td>
</tr>
<tr>
<td>532.90</td>
<td>Unspecified duodenal ulcer without mention of hemorrhage or perforation without mention of obstruction</td>
<td>46 (2.9)</td>
</tr>
<tr>
<td>533.90</td>
<td>Peptic ulcer, unspecified acute or chronic, without mention of hemorrhage or perforation without mention obstruction</td>
<td>36 (2.3)</td>
</tr>
<tr>
<td>531.30</td>
<td>Acute gastric ulcer without hemorrhage without perforation without mention of obstruction</td>
<td>31 (2.0)</td>
</tr>
<tr>
<td>532.50</td>
<td>Chronic duodenal ulcer with perforation without mention of obstruction</td>
<td>31 (2.0)</td>
</tr>
</tbody>
</table>

*ICD-9-CM indicates International Classification of Diseases, Ninth Revision, Clinical Modification.\textsuperscript{11}

### Table 2. State Rates for Peptic Ulcer Disease Measures of Care*

<table>
<thead>
<tr>
<th>State</th>
<th>Measure 1</th>
<th>Measure 2</th>
<th>Measure 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama</td>
<td>52.9 (n = 329)</td>
<td>69.6 (n = 329)</td>
<td>71.4 (n = 315)</td>
</tr>
<tr>
<td>Florida</td>
<td>54.4 (n = 342)</td>
<td>71.9 (n = 342)</td>
<td>71.9 (n = 320)</td>
</tr>
<tr>
<td>Louisiana</td>
<td>59.8 (n = 333)</td>
<td>64.6 (n = 333)</td>
<td>73.6 (n = 318)</td>
</tr>
<tr>
<td>Tennessee</td>
<td>56.5 (n = 333)</td>
<td>75.4 (n = 333)</td>
<td>71.1 (n = 318)</td>
</tr>
<tr>
<td>Texas</td>
<td>54.7 (n = 243)</td>
<td>65.0 (n = 243)</td>
<td>66.1 (n = 224)</td>
</tr>
<tr>
<td>National</td>
<td>55.6 (n = 687)</td>
<td>73.4 (n = 687)</td>
<td>70.9 (n = 657)</td>
</tr>
</tbody>
</table>

*Data are given as percentages unless otherwise indicated. First-row rates are means; second-row rates are ranges.\textsuperscript{†}Patients admitted to the hospital with gastric or duodenal ulcers are screened or treated for Helicobacter pylori.\textsuperscript{‡}Patients admitted to the hospital with gastric or duodenal ulcers are screened for nonsteroidal anti-inflammatory drug use on admissions.\textsuperscript{§}Patients admitted to the hospital with gastric or duodenal ulcers are assessed and educated on risk factors at discharge (nonsteroidal anti-inflammatory drug use, alcohol use, and smoking).
Recognition of *H pylori* infection and NSAID use as causes of peptic ulcer disease and recommendations for treatment were well established in the literature by 1993. Increased adherence to *H pylori* infection screening by medical specialists over surgeons in the present study could be predicted and explained by specific interest and the content of differing literature. Not surprising is the enhanced screening of NSAID use by cardiologists or the increased rate of risk recurrence screening by pulmonologists that included smoking cessation.

In the present study, upper GI tract endoscopy was performed in 84.6% of patients in the 5-state sample and in 92.3% of the national sample with the implication that biopsy sampling and the opportunity for diagnosis by urease testing, histological examination, or culture existed. Readmission rates for patients in the study group were not studied but would have been of interest with an expectation that treatment groups would have had a lower hospital readmission rate. Information about specific medical specialties performing endoscopic procedures was not abstracted.

Billing codes have inherent error rates in that some patients may be included in the diagnostic category of peptic ulcer disease when in fact clinical tests would fail to confirm the diagnosis. This type of error could result in an underestimate of the rates for the measures of care. Overall adherence rates for the measures of care were determined for patients with the principal diagnosis confirmed by chart abstraction and compared with principal diagnosis by claims data in the 5-state study. A discrepancy of less than 2.4% in rates was found. The diagnostic confirmation algorithm was not used because of a variable kappa value of 0.47 and poor correlation with clinical validation in a study of 30 patients.

In the present study, the scope was limited to hospitalized patients. Outpatient documentation was not available—the low rate of *H pylori* infection screening in the hospital could be partly explained by this. Measuring hospital performance rates based on chart review may not be a reflection of health care delivery because data would not be captured if documentation were missing. Not included in this analysis are patients with no active ulcer but with peptic ulcer disease listed as a secondary diagnosis. These may be most of the patients with ulcer disease who should be screened for *H pylori* infection and eventually receive eradication therapy. Nevertheless, the diagnosis and treatment of *H pylori*—associated illness does not require sophisticated technology or unfamiliar medications. Invasive procedures are not usually required, and physicians with primary care training should be able to correctly diagnose and treat this infectious disease. If the rate of recurrence of peptic ulcer disease is to be further reduced, appropriate targeting must be developed, with educational methods directed toward physicians and patients. Educational methods that do not rely on dissemination of information by conventional media alone must be initiated, with an emphasis on organizing focus groups and enlisting clinical opinion leaders. Efforts directed toward patient education that would provide feedback to physicians (in the form of patient demand for adherence to best practices) might be an additional strategy.

Screening or treatment for *H pylori* infection was accepted in this study as documentation of the practitioner’s awareness of the current cause of peptic ulcer disease. Currently, it is recommended that patients be treated for *H pylori* infection only if they have a positive test result for diagnosis and an appropriate pathologic lesion. The automatic ordering of antibiotic drug therapy for patients with peptic ulcer disease ignores the diagnostic implications of negative *H pylori* confirmation test results. Patients who have peptic ulcer disease and a negative test result for *H pylori* infection could have occult NSAID use, Zollinger-Ellison syndrome, or gastric malignant neoplasms.

Peptic ulcer disease induced by NSAID use is also well studied and is a major cause of upper GI tract bleeding. In the present study, NSAID use screening was performed more often than *H pylori* infection screening (73.4% vs 55.6%). This may reflect the increased awareness of NSAID-related peptic ulcer disease and increased experience with treatment of complications of NSAID use by practicing physicians.

Risk factors for peptic ulcer disease also affect strategy for treatment as well as prevention of recurrence. Infection with *H pylori* confers a 5 to 7 times likelihood for the development of peptic ulcer disease. Cigarette smoking doubles the risk. Use of NSAIDs raised the risk by a factor of 10 to 20. Results of the present study reveal documentation of NSAID avoidance when possible and education about alcohol and tobacco avoidance in 70.9% of cases nationally. This percentage also correlates closely with the 5-state sample. The effect of NSAID use in patients with *H pylori* infection has not been documented as synergistic toward the development of peptic ulcers.

Prevention of recurrence of peptic ulcer disease is an excellent strategy to reduce hospitalization rates and to reduce long-term drug costs. One would expect morbidity from complications of peptic ulcer disease, including GI tract bleeding, perforation, gastric outlet obstruction, and the prevalence of *H pylori* infection, to also decline. Results of this study reveal opportunities to improve care for the Medicare population. Educational initiatives have been launched by the Centers for Disease Control and Prevention, the American Digestive Health Foundation, and the Health Care Financing Administration for the prevention of recurrence of peptic ulcer disease. Peer review organization resources are being used to implement interventions in hospitals located in the 5 project states. These interventions were strategically designed to effect a paradigm shift in the treatment of peptic ulcer disease and have the potential to improve care to all such hospitalized patients.

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Reprints: Hugh Hood, MD, Alabama Quality Assurance Foundation, One Perimeter Park South, Suite 200 North, Birmingham, AL 35243-2354 (e-mail: Hhood@AQAF.com).

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