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Irritable Bowel Syndrome, Health Care Use, and Costs: A U.S. Managed Care Perspective

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OBJECTIVE: We performed an evaluation of patient symptoms, health care use, and costs to define the burden of illness of irritable bowel syndrome (IBS) and the relation to the severity of abdominal pain/discomfort in a large health maintenance organization.

METHODS: All 6500 adult health maintenance organization members who had undergone flexible sigmoidoscopy in the year 2000 were mailed a questionnaire that elicited Rome I symptom criteria and severity ratings for abdominal pain/discomfort. Multiple health care use measures were obtained from various administrative databases. IBS patients were compared with a control group of non-IBS subjects, and analyses were adjusted for age and sex.

RESULTS: We received 2613 (40.2%) responses. Compared with non-IBS subjects over 2 yr, IBS patients had more outpatient visits (medical, surgery, and emergency, $p < 0.05$), were hospitalized more often ($p < 0.05$), and had more total outpatient prescriptions ($p < 0.05$) and IBS-related prescriptions ($p < 0.05$). Over 1 yr, total costs were 51% higher in IBS patients, who also had higher costs for outpatient visits, drugs, and radiology and laboratory tests ($p < 0.05$). Total costs were increased by 35%, 52%, and 59% in IBS patients with mild, moderate, and severe symptoms of abdominal pain/discomfort compared with non-IBS subjects ($p < 0.05$).

CONCLUSIONS: Using Rome I symptom criteria, we found that IBS is associated with a broad pattern of increased health care use and costs. The severity of abdominal pain/discomfort is a significant predictor of health care use and costs for patients with IBS compared with non-IBS subjects. (Am J Gastroenterol 2003;98:600–607. © 2003 by Am. Coll. of Gastroenterology)

INTRODUCTION

Irritable bowel syndrome (IBS) is a common disorder characterized by abdominal pain/discomfort and altered bowel function. IBS has been shown to significantly impact quality of life (1, 2). Up to 20% of the U.S. population reports symptoms consistent with IBS, and the disorder is more prevalent among women than men (2). Although IBS accounts for approximately 2.4–3.5 million physician visits annually (3), only 25% of affected individuals actually seek medical treatment for this condition (2). The large potential economic impact lends importance to studies defining the determinants of health care use and the cost of illness of this disorder (4, 5).

Studies on the economic burden of IBS are limited. Total annual costs (direct and indirect) of IBS in the United States have been estimated to be approximately $30 billion, excluding prescription and over-the-counter drug costs (6). Talley *et al.* used a billing database to compare outpatient and inpatient charges, excluding outpatient drugs, for community subjects with and without IBS and found patients with IBS generated higher charges (7). A claims database from 20 managed care plans revealed that charges for patients with IBS were similar to those incurred by patients with asthma (8). Levy *et al.* reported that in a health maintenance organization (HMO), costs were higher for patients diagnosed with IBS than for controls, and the costs were comparable with those for patients with gastroesophageal reflux disease (9).

With the exception of two studies (7, 10), none of the previously published economic analyses have used validated symptom criteria to identify IBS. Administrative claims or physician diagnoses have been taken into account despite the potential that these approaches may yield a biased sample of "high-use" IBS patients. Moreover, no study has correlated use or costs with severity of abdominal pain/discomfort. Our objective was to comprehensively assess the health care use and costs for IBS patients in an HMO identified by meeting the Rome I symptom criteria for IBS (11) compared with non-IBS controls. We also investigated whether there was a relationship between health care use and severity of abdominal pain/discomfort in this managed care setting.

Table 1. Use of Outpatient Services

Use Measure	Mean IBS (n = 578)	Mean Non-IBS (n = 1854)	Unadjusted Mean Difference (95% CI)	Adjusted* Mean Difference (95% CI)
Number of outpatient visits	25.40	20.16	5.24 (3.60–6.96)	6.05 (4.39–7.79)
Number of medical visits	16.84	13.28	3.56 (2.39–4.83)	4.31 (3.12–5.55)
Number of surgical visits	2.55	1.98	0.57 (0.20–0.95)	0.79 (0.42–1.78)
Number of OB/GYN visits	1.03	0.55	0.48 (0.25–0.74)	0.19 (−0.03–0.43)
Number of emergency department visits	0.78	0.49	0.29 (0.14–0.46)	0.32 (0.17–0.51)
Number of other visits	4.19	3.87	0.32 (−0.22–0.98)	0.42 (−0.14–1.10)

OB/GYN = obstetrics/gynecology.
* Adjusted for age and sex.

MATERIALS AND METHODS

Study Population

The study was conducted in the San Diego service area of the Kaiser Permanente Medical Care Plan. This group-model HMO with about 500,000 members has extensive computerized diagnosis and health care use data. Institutional Review Board approval was obtained on November 21, 2000 to survey the symptoms of health plan members and examine computerized data on their health care use and its costs. We mailed a questionnaire to all 6500 members who were at least 18 yr of age and had undergone flexible sigmoidoscopy during the year 2000. This study population was selected because the data were available in an electronic format, and a majority of the flexible sigmoidoscopies in this health care setting are performed for colon cancer screening rather than diagnostic evaluation. The survey instrument elicited the Rome I symptom criteria for IBS (11). The severity of abdominal pain/discomfort was assessed with the question: "How much of a problem was your abdominal pain and discomfort over the last 3 months?" Respondents answered with a 6-point Likert scale: absent, very mild, mild, moderate, severe, and very severe. There was no financial incentive for patients to respond. We excluded respondents who: 1) were not continuously enrolled in the HMO during the entire 2-yr study period (January 1, 1999, to December 31, 2000); and 2) had an inpatient International Classification of Diseases, 9th Revision, Clinical Modification code for a disease typically causing symptoms that can confound the diagnosis of IBS, such as malignant neoplasm of digestive organs and peritoneum (150.0–159.9), inflammatory bowel disease, Crohn's disease, ulcerative colitis (555.0–558.9), or diverticulitis (562.01, 562.03, 562.11, 562.12, or 562.13).

Use Measures

We collected health care use data from administrative databases on outpatient visits, hospital stays, outpatient prescription drug use, and radiology and laboratory services during the 2-yr study period.

We identified outpatient visits from the HMO proprietary coding system and grouped them by department type. The department categories were predefined in the database as medical (family practice, internal medicine, pediatrics, ophthalmology, dermatology, and allergy), surgical, obstetrics and gynecology, emergency department, or other (*e.g.*, physical therapy, speech therapy, dietary counseling). We also examined the visits that included a diagnostic or therapeutic GI procedure: esophagogastroduodenoscopy, colonoscopy, anoscopy, liver biopsy, hemorrhoidectomy, polypectomy, and small bowel biopsy. Sigmoidoscopy was excluded because all patients underwent sigmoidoscopy during the year 2000.

We identified subjects who had at least one hospitalization of any type, those who had at least one GI-related stay, and those who had at least one inpatient GI diagnostic procedure. Hospitalizations with a Major Diagnostic Category from the Diagnosis Related Group prospective payment system of 06 (digestive system) or 07 (hepatobiliary system and pancreas) were classified as GI related. We identified 11 GI procedures using the following codes: operations on the digestive system (42.0–54.99), biliary tract x-ray (87.51–87.59), other x-ray of the digestive system (87.61–87.69), soft tissue x-ray of the abdomen (88.01–88.19), other x-ray of the abdomen (88.11–88.19), abdominal arteriography (88.47), diagnostic ultrasound of digestive system (88.74), diagnostic ultrasound of abdomen and retroperitoneum (88.76), esophageal manometry (89.32), radioisotope liver scan and function study (92.02), and radioisotope GI scan and function study (92.04).

We analyzed outpatient prescriptions for drugs of potential use for IBS symptoms (2) (antispasmodics, anxiolytics, bile sequestrants, diphenoxylate, laxatives, loperamide, nonsteroidal anti-inflammatory drugs, opioids, promotility agents, selective serotonin-reuptake inhibitors, and tricyclic agents) using a proprietary pharmacy database. We also examined use of more general drug groups, which were predefined in the database: anti-infective, antineoplastic, endocrine, metabolic, cardiovascular, respiratory, GI, genitourinary, central nervous system, neuromuscular, and hematological drugs, as well as analgesics, anesthetics, nutritional products, and topical preparations. We defined drug use as at least one prescription during the study period.

We identified GI radiology procedures from Current Procedural Terminology codes: barium radiography of the colon, barium small bowel radiography, small bowel enteroclysis examination, plain abdominal x-ray examination,

Table 2. Hospital Use

	n (%) IBS	n (%) Non-IBS	Unadjusted OR (95% CI)	Adjusted* OR (95% CI)
Percentage with one or more hospital stays (all stays)	142 (24.6)	400 (21.6)	1.18 (0.95–1.48)	1.32 (1.05–1.65)
Percentage with one or more GI-related stays	26 (4.5)	64 (3.5)	1.32 (0.83–2.1)	1.37 (0.85–2.21)
Percentage with one or more inpatient GI-related procedures	21 (3.6)	62 (3.3)	1.09 (0.66–1.81)	1.19 (0.71–2.00)

* Adjusted for age and sex.

abdominal computerized tomography, and abdominal magnetic resonance imaging.

We used a proprietary laboratory database to count the number of laboratory procedures performed.

Cost Calculation

We calculated costs for the year 2000 using the HMO proprietary rates. The cost data comprise the fixed and overhead costs of providing services and are not representative of individual claims that would be paid by third-party payers, a procedure that seldom occurs in the HMO because services are covered under capitated payment arrangements. These data may underestimate surgical costs because the cost estimates for surgical patients do not include operating room costs, supply costs, physician costs, and other professional costs related to surgery. Separate aggregated data were available for radiology and laboratory services, which combined outpatient and inpatient costs. Costs were not linked to specific procedures or service sites.

Statistical Analysis

We compared subjects with IBS and without IBS on all use measures. Comparisons were also made within the IBS group by severity of abdominal pain/discomfort after responses were collapsed into three categories: mild (absent, very mild, mild), moderate, and severe (severe and very severe). Costs were also evaluated across all the subject groups using a model that incorporated severity of abdominal pain/discomfort.

The number of services was calculated for outpatient visits, radiology, and laboratory services, and cost data were calculated as overall and service category totals. Hospital stays, GI-related procedures, and pharmacy use are expressed as the proportion of patients with at least one of these measures. We expressed the data for continuous variables as the mean ± SEM. The data for binary outcomes comprised the proportion of subjects with at least one of the assessed stays or procedures, as well as the ORs. For all measures, use is reported for the 2-yr study period. The α level for determining statistical significance was 0.05.

To account for skewed cost and use data, we employed bootstrapping to estimate the association of cost and use variables with IBS status. In each instance, 5000 samples were drawn from the original data. For each sample, we estimated the parameters of a multiple linear regression model with IBS status, age, and sex as predictors in addition to crude differences. Ninety-five percent confidence limits for the IBS status variable were then determined from the resulting distribution of estimates.

Logistic regression was used to estimate the association of IBS status with binary variables. All regression equations used to estimate adjusted associations included age, sex, and IBS status as predictors.

RESULTS

We received questionnaires from 2613 of the 6500 (40.2%) subjects who were sent the survey instrument. There was a significant difference between those who returned the survey and those who did not. Respondents were older than nonrespondents (mean age 64.2 *vs* 58.7 yr, $p < 0.05$). The percentage of women returning the survey was higher among respondents than among nonrespondents (55.1% *vs*

Table 3. Pharmacy Use: At Least One Outpatient Prescription

Drug Category	n (%) IBS	n (%) Non-IBS	Unadjusted OR (95% CI)	Adjusted* OR (95% CI)
Anti-infective	453 (78.4)	1251 (67.5)	1.75 (1.4–2.18)	1.76 (1.41–2.21)
Antineoplastic	20 (3.5)	47 (2.5)	1.38 (0.81–2.35)	1.27 (0.74–2.18)
Endocrine and metabolic	384 (66.4)	906 (48.9)	2.07 (1.70–2.52)	1.51 (1.20–1.89)
Cardiovascular	324 (56.1)	1033 (55.7)	1.01 (0.84–1.22)	1.39 (1.13–1.70)
Respiratory	347 (60)	880 (47.5)	1.66 (1.38–2.01)	1.61 (1.32–1.95)
GI	387 (67)	973 (52.5)	1.84 (1.51–2.23)	2.30 (1.86–2.85)
Genitourinary	118 (20.4)	263 (14.2)	1.55 (1.22–1.97)	1.19 (0.92–1.53)
Central nervous system	292 (50.5)	575 (30.9)	2.28 (1.89–2.76)	2.00 (1.64–2.43)
Analgesics and anesthetics	412 (71.3)	1062 (57.3)	1.85 (1.51–2.27)	1.81 (1.47–2.22)
Neuromuscular	150 (26)	273 (14.7)	2.03 (1.62–2.55)	1.81 (1.43–2.28)
Nutritional products	68 (11.8)	167 (9)	1.35 (1.0–1.82)	1.42 (1.04–1.93)
Hematological	46 (8)	141 (7.6)	1.05 (0.74–1.49)	1.36 (0.95–1.96)
Topical products	337 (58.3)	964 (52)	1.29 (1.07–1.56)	1.36 (1.12–1.66)

* Adjusted for age and sex.

Table 4. Pharmacy Use: At Least One Prescription for Drugs That Have Been Used to Treat IBS*

Drug Type	n (%) IBS	n (%) Non-IBS	Unadjusted OR (95% CI)	Adjusted† OR (95% CI)
Antispasmodics	37 (6.4)	31 (1.7)	4.02 (2.47–6.54)	3.58 (2.17–5.92)
Loperamide	10 (1.7)	13 (.7)	2.49 (1.09–5.71)	2.52 (1.07–5.92)
Diphenoxylate	24 (4.2)	33 (1.8)	2.39 (1.40–4.08)	2.25 (1.30–3.89)
Laxatives	167 (28.9)	619 (33.4)	0.81 (0.66–0.99)	1.03 (0.81–1.31)
Promotility agents	21 (3.6)	35 (1.9)	1.96 (1.13–3.39)	1.99 (1.13–3.50)
Opioid	289 (50)	645 (34.8)	1.87 (1.55–2.26)	1.88 (1.55–2.29)
Tricyclic compound	89 (15.4)	128 (6.9)	2.46 (1.84–3.28)	2.05 (1.53–2.75)
SSRI	137 (23.7)	200 (10.8)	2.57 (2.02–3.27)	2.16 (1.69–2.77)
NSAID	280 (48.4)	696 (37.5)	1.56 (1.30–1.89)	1.45 (1.19–1.75)
Bile sequestrants	7 (1.2)	23 (1.2)	0.98 (0.42–2.29)	1.15 (0.48–2.74)
Other anxiolytics	135 (23.4)	269 (14.5)	1.80 (1.43–2.26)	1.62 (1.27–2.05)

NSAID = nonsteroidal anti-inflammatory drugs; SSRI = selective serotonin reuptake inhibitors.
* From Horwitz and Fisher (2001), Ref. 2.
† Adjusted for age and sex.

52.6%, $p < 0.05$). A total of 181 subjects who responded met exclusion criteria, leaving 2432 subjects for analysis. Of these, 578 (23.8%) subjects met the Rome I criteria for IBS. The IBS group was younger than the subjects without IBS (62.2 ± 12.1 yr *vs* 64.8 ± 10.4 yr, $p < 0.0001$) and had a higher proportion of women (71.4% *vs* 50.1%, $p < 0.0001$).

Five hundred fifty-eight of the 578 (96.5%) subjects with IBS provided data on the severity of abdominal pain/discomfort: mild (n = 165, 29.6%), moderate (n = 255, 45.7%), and severe (n = 138, 24.7%). The proportions of women in the three severity groups were 66.1%, 75.3%, and 68.8%, respectively.

Health Care Use

Patients with IBS had more total outpatient visits than those in the non-IBS group ($p < 0.05$) (Table 1). The majority of outpatient visits were to the medical department category. The mean numbers of medical, surgery, and emergency room visits were significantly higher for the IBS group ($p < 0.05$). Outpatient GI procedures were performed in 74 (12.8%) IBS patients *versus* 207 (11.2%) subjects in the non-IBS group (p = ns).

Compared with non-IBS subjects, the IBS group had a greater proportion of patients with at least one hospital stay ($p < 0.05$) (Table 2). There was a trend toward more GI-related stays and GI inpatient procedures in the IBS group, but these events were relatively infrequent.

Across all reported drug types, IBS patients had an average of 40.4 ± 1.6 prescriptions *versus* 27.7 ± 0.6 prescriptions for non-IBS subjects ($p < 0.0001$). IBS subjects had statistically significant increased use in 10 of the 13 major drug categories ($p < 0.05$) and a trend toward increased use in the remaining three categories (Table 3). The differences were greatest for endocrine and metabolic and central nervous system drugs.

IBS patients were more likely than non-IBS subjects to have at least one prescription for a drug typically used to treat IBS: 502 (86.9%) *versus* 1374 (74.1%), $p < 0.0001$. IBS subjects were more likely to have a prescription for at least seven of the nine drugs or drug types used for IBS ($p < 0.05$), and there was a trend toward their increased use of the remaining two types (Table 4).

Use of radiological procedures and laboratory tests was higher in IBS patients than in subjects without IBS ($p < 0.05$) (Table 5). The number of GI radiology procedures was small and similar in the groups.

Use data on outpatient visits, outpatient prescriptions, radiology procedures, laboratory tests, and hospital stays were stratified according to the severity of abdominal pain/discomfort (Table 6). We compared each IBS abdominal pain/discomfort severity group with the non-IBS group, and found that use was significantly higher ($p < 0.05$) by IBS patients in all severity groups for all but two comparisons: use of prescription medications and laboratory tests were similar for those with mild abdominal pain/discomfort and the non-IBS group. Multiple regression analysis of health care use among IBS patients by the severity of abdominal pain/discomfort, using those with mild severity as the reference group, revealed that patients with moderate abdominal pain/discomfort experienced significantly more outpatient visits, and patients with moderate or severe abdominal

Table 5. Radiology and Laboratory Use

	Mean IBS (n = 578)	Mean Non-IBS (n = 1854)	Unadjusted Mean Difference (95% CI)	Adjusted Mean Difference* (95% CI)
Number of radiology procedures	5.01	3.64	1.36 (0.99–1.76)	1.19 (0.81–1.60)
Number of GI-related radiology procedures	0.01	0.02	−0.01 (−0.02–0.01)	−0.003 (−0.02–0.01)
Number of laboratory tests	35.18	28.42	6.76 (3.37–10.37)	9.25 (5.64–13.06)

* Adjusted for age and sex.

Table 6. Two-Year Use by Severity of Abdominal Pain/Discomfort

Use Measure	Mild (n = 165)			Moderate (n = 255)			Severe (n = 138)			Mean Non-IBS (n = 854)
	Mean IBS	Unadjusted Mean Difference (95% CI)	Adjusted Mean Difference* (95% CI)	Mean IBS	Unadjusted Mean Difference (95% CI)	Adjusted Mean Difference* (95% CI)	Mean IBS	Unadjusted Mean Difference (95% CI)	Adjusted Mean Difference* (95% CI)	
Number of outpatient visits	22.46	2.24 (−0.72–5.78)	3.44 (0.53–6.94)	26.99	6.77 (4.34–9.35)	7.43 (4.94–9.98)	25.90	5.68 (2.80–8.74)	6.12 (3.31–9.08)	20.22
Number of prescriptions	30.88	3.18 (−1.02–7.86)	3.93 (−0.13–8.51)	45.41	17.81 (13.28–22.68)	17.55 (12.94–22.40)	44.10	16.40 (8.87–24.62)	16.16 (8.88–24.36)	27.70
Number of radiology procedures	4.44	0.79 (0.17–1.49)	0.76 (0.14–1.47)	5.34	1.69 (1.18–2.23)	1.44 (0.91–1.98)	5.05	1.40 (0.63–2.18)	1.21 (0.46–1.98)	3.65
Number of laboratory tests	30.62	2.06 (−3.22–7.97)	4.74 (−0.42–10.73)	36.48	7.92 (3.05–13.23)	10.40 (5.57–15.70)	37.45	8.89 (2.85–16.07)	10.64 (4.62–17.80)	28.56
Percent of patients having one or more hospital stays	43 (26.06)	1.29 (0.90–1.86)	1.47 (1.02–2.14)	61 (23.92)	1.15 (0.85–1.57)	1.28 (0.93–1.76)	36 (26.09)	1.29 (0.87–1.92)	1.38 (0.92–2.06)	400 (21.57)

* Adjusted differences are reported between the severity group and the non-IBS group. Adjusted for age and sex.

pain/discomfort had significantly more outpatient prescriptions ($p < 0.05$). Severity of abdominal pain/discomfort was not a statistically significant predictor of having at least one hospital stay.

Costs

The mean costs of all use measures over the 1-yr calculation period were 51% higher (based on the adjusted mean difference) in the IBS group than in the subjects without IBS (Table 7). Compared with the non-IBS group, IBS patients incurred greater costs for all services ($p < 0.05$). The greatest cost differentials were for outpatient visits and outpatient pharmacy use.

Total costs incurred by IBS patients with moderate and severe levels of abdominal pain/discomfort were significantly higher than in the non-IBS group ($p < 0.05$) (Table 8). Compared with the non-IBS group, total costs were increased by 35%, 52%, and 59% (based on the adjusted mean difference) in IBS patients with mild, moderate, and severe abdominal pain/discomfort, respectively. Costs for outpatient visits and laboratory procedures were higher for IBS patients with moderate and severe levels of abdominal pain/discomfort compared with non-IBS subjects ($p < 0.05$). Pharmacy costs were greater for the IBS patients with moderate or severe abdominal pain/discomfort compared with the non-IBS group ($p < 0.05$). Radiology costs were greater for IBS patients with moderate and severe abdominal pain/discomfort compared with the non-IBS group ($p < 0.05$), and inpatient costs did not differ between subjects with and without IBS of any severity level of abdominal pain/discomfort.

Multiple regression analysis of health care costs among IBS patients by the severity of abdominal pain/discomfort, using those with mild severity as the reference group, revealed no significant differences for any of the cost measures.

DISCUSSION

We performed a comprehensive analysis of the burden of illness associated with IBS in a U.S. HMO using the Rome I symptom criteria to identify patients with IBS and estimate the economic impact stratified by the severity of abdominal pain/discomfort. Our survey of HMO members who had undergone flexible sigmoidoscopy, adjusted for age and sex, revealed that respondents with IBS had higher use of outpatient visits, inpatient stays, outpatient prescriptions, and radiology and laboratory services than those without IBS. The total cost of caring for the IBS group exceeded the cost in the non-IBS subjects by 51%. Importantly, the cost of caring for IBS patients with mild abdominal pain/discomfort was 35% greater than for the non-IBS group, whereas the costs of caring for IBS subjects with moderate and severe abdominal pain/discomfort were more than 50% greater than for non-IBS subjects.

Table 7. Mean Cost by Use Type

Use Measure	Mean IBS (n = 578)	Mean Non-IBS (n = 1854)	Unadjusted Mean Difference (95% CI)	Adjusted* Mean Difference (95% CI)
Total	3729.04	2607.12	1121.92 (610.85–1671.91)	1340.55 (804.66–1925.58)
Outpatient	1963.31	1441.46	521.85 (257.48–823.64)	610.65 (337.23–910.04)
Inpatient	365.57	238.94	126.63 (−46.64–322.62)	191.93 (1.14–407.08)
Pharmacy	1053.76	652.40	401.36 (193.58–624.52)	463.44 (253.34–691.56)
Radiology	189.21	152.08	37.13 (15.64–59.38)	39.35 (16.89–62.66)
Laboratory	157.20	122.11	35.09 (16.20–56.36)	44.88 (23.90–68.56)

* Adjusted for age and sex.

Although increased use of medical resources has been documented previously in IBS patients (1, 7–9, 12–14), the widespread nature of the increased use is a notable finding from this study. The increased medical department visits and GI drug costs would be expected for patients with a functional GI disorder, but we also found increased surgery, emergency department visits, and hospitalization rates. IBS has been shown to predispose patients to abdominal and pelvic surgery (13, 15, 16). IBS patients sometimes present to the emergency department with severe pain, and physicians could mistake IBS symptoms for those of an organic disease needing surgery, such as appendicitis (17). Moreover, some IBS patients have psychological characteristics that could predispose them to excessive treatment, including surgery (1). Such tendencies could have contributed to the increased emergency visits and hospitalization seen in this study among the IBS group. The broad increased use of services among IBS patients may also be explained by the known association of IBS with other painful somatic (*e.g.*, fibromyalgia and headache) and psychiatric (*e.g.*, depression and anxiety) disorders (4, 12, 13). For example, the U.S. householder study identified four times as many physician visits for treatment of non-GI illnesses as GI illness among those with IBS (12). Levy *et al.* demonstrated that IBS patients incur increased costs for prescription medications, radiology services, and visits to primary, specialty, and mental health clinics, and documented the dominant role of non-GI-related costs for IBS patients (9, 18). Therefore, the cost differential for non-GI drugs and radiology procedures likely reflects the IBS patients' greater propensity to seek care not only for GI problems but for non-GI conditions as well. Because our findings suggest that increased use is related to the severity of abdominal pain/discomfort, our findings also support the hypothesis that associated painful somatic and psychiatric conditions may alter pain perception and affect whether subjects seek medical care.

A novel finding in this study is the relationship of the symptom severity of abdominal pain/discomfort to health care use. Although previous work has focused on the negative impact of IBS on quality of life (1, 10, 19), published studies of the role of severity of abdominal pain/discomfort on health care use are scarce. Although many of the symptom-based therapeutic strategies for IBS target improving bowel function, they do not specifically address abdominal pain/discomfort, which seems to be an area requiring further investigation in IBS management. In a group of IBS patients with a high prevalence of psychological symptoms, Hahn *et al.* found no significant association of health care use with the patients' estimation of symptom severity (19). However, there was a relationship between symptom severity and reduced quality of life, time spent in bed, and absence from work. The lack of association of symptom severity with use could be attributable to the investigators' dependence on patient reports of health care use, which is subject to recall bias. In British patients with refractory IBS, medical costs were not reliably predicted by severity of abdominal pain; disability unemployment was mainly associated with psychosocial distress, not IBS severity (10). Talley *et al.* found that abdominal pain was the most important factor associated with health care seeking (20), and Drossman *et al.* reported a relationship between the severity of functional bowel disorders and health care use (21). Specifically, use measures in this study increased for overnight admissions for GI problems of greater than 3 months duration, physician visits for GI and other symptoms of greater than 3 months duration, phone calls to physicians, and hospitalizations with the severity of painful functional bowel disorders. The correlation of both diverse health care use and associated costs with IBS pain/discomfort severity extends these observations. Indeed, these findings are consistent with other chronic conditions, such as migraine and fibromyalgia, in which symptom severity are critical drivers of health care use (22–28).

The strengths of this study include the use of Rome I symptom criteria supplemented with exclusion of organic diagnoses to identify IBS. Preliminary data indicate that many people with IBS, as defined by the widely used Rome criteria (29), are not diagnosed with the disorder by their physicians (18, 30). Therefore, reliance on an administrative claims-based or physician diagnosis of IBS to identify patients would likely bias a sample toward a more severe or "high-use" population. Another strength of the study is that we performed a comprehensive assessment of the incremental age/sex-adjusted use and costs of IBS patients compared with controls, rather than simply reporting costs.

Our study also has limitations. Although we related costs and use to severity of abdominal pain/discomfort, that anal-

Table 8. One-Year Use Costs (in Dollars) by Severity of Abdominal Pain/Discomfort

Use Measure	Mild (n = 165) Mean IBS	Unadjusted Mean Difference (95% CI)	Adjusted* Mean Difference (95% CI)	Moderate (n = 255) Mean IBS	Unadjusted Mean Difference (95% CI)	Adjusted* Mean Difference (95% CI)	Severe (n = 138) Mean IBS	Unadjusted Mean Difference (95% CI)	Adjusted* Mean Difference (95% CI)	Mean Non-IBS (n = 1854)
Total	3324.61	698.75 (−246.96–1849.24)	926.47 (−24.87–2105.38)	3783.09	1157.23 (487.56–1879.38)	1376.73 (706.80–2129.53)	4015.75	1389.89 (472.49–2463.06)	1546.32 (631.45–2629.15)	2625.86
Outpatient	1739.26	294.76 (−106.14–773.66)	395.24 (−13.61–882.39)	1995.82	551.32 (199.04–960.42)	628.19 (268.36–1044.55)	2224.05	779.55 (163.67–1590.22)	833.71 (231.46–1635.58)	1444.50
Inpatient	341.59	90.10 (−195.62–482.07)	151.34 (−144.64–556.10)	315.34	64.85 (−130.46–290.83)	132.18 (−68.37–377.14)	345.91	95.42 (−149.70–404.90)	144.09 (−100.11–458.38)	250.49
Pharmacy	943.70	289.14 (−89.69–786.67)	341.00 (−31.80–830.41)	1113.89	459.33 (199.82–754.61)	525.05 (269.47–821.31)	1083.62	429.06 (79.38–871.65)	477.12 (134.06–912.64)	654.56
Radiology	162.10	9.58 (−20.34–39.33)	14.88 (−15.19–44.66)	196.99	44.47 (10.40–82.63)	45.30 (11.15–84.47)	205.91	53.39 (13.79–95.70)	53.60 (14.49–96.03)	152.52
Laboratory	148.34	25.13 (−12.62–72.36)	35.49 (−3.37–83.88)	151.87	28.66 (6.49–52.32)	37.58 (15.04–61.97)	166.68	43.47 (18.24–70.86)	49.89 (24.18–77.29)	123.21

* Adjusted for age and sex.

ysis is limited by the fact that severity was self-reported at only one point in time (estimated over 3 months in 2001), yet correlated to use over a 2-yr study period. Although severity of abdominal pain/discomfort typically varies over time (1), our study design did not enable us to capture this variability. Another limitation is that, although we adjusted use and cost data for age and sex, we did not control for specific comorbidity. Because IBS is a symptom-based diagnosis, and the symptoms may arise from other disorders, it is difficult to determine the causal nature or correlation between comorbidities and IBS. Thus, controlling for comorbid conditions may introduce bias into economic analyses (31). There are other confounding factors, which we were unable to control. The questionnaire did not collect demographic data, such as household income and educational attainment, so we could not control for socioeconomic status. Finally, we did not survey all patients seeking care for IBS symptoms or study a group representative of the overall HMO membership; rather, we identified patients from a large cohort who had undergone a sigmoidoscopy for any reason. Although data on the indications for the procedure are unavailable, the advanced mean age of both the IBS and non-IBS groups is likely attributed to the HMO promotion of flexible sigmoidoscopy for colorectal cancer screening beginning at 50 yr of age. Some of the subjects undoubtedly had flexible sigmoidoscopy for symptoms, but we excluded patients with an organic GI diagnosis likely to cause IBS-type symptoms. The prevalence rate of IBS in the respondents was somewhat higher than has been reported from most population surveys, especially in older patients. Thus, the high IBS prevalence, advanced age of the respondents, and the potential response bias call for caution in extrapolating the absolute values for use and cost to other populations. However, we believe the comparisons between IBS and non-IBS groups and the results related to severity of abdominal pain/discomfort should be relevant to physicians and health services researchers.

In this era of increased financial pressure on health care organizations, implementing strategies to improve the effectiveness and efficiency of care is critical. Understanding the economic burden of illness and incremental costs attributable to specific conditions may enable organizations to prioritize their resource allocation and quality of practice improvement efforts. Additional research is needed to further refine our understanding of the patterns of health care use by IBS patients with varying predominant symptoms and managed with different strategies. In particular, the increased use across a diverse variety of services implies that treating patients' IBS symptoms with the pharmacological agents currently available is an inadequate approach to controlling use and costs. It seems that a multidisciplinary, collaborative effort is required to manage these patients in a cost-effective manner.

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REFERENCES

1. Thompson WG, Longstreth GF, Drossman DA, et al. Rome II: The functional gastrointestinal disorders, 2nd ed. McLean, VA: Degnon Associates, 2000.
2. Horwitz BJ, Fisher RS. The irritable bowel syndrome. N Engl J Med 2001;344:1846–50.
3. Everhart JE, Renault PF. Irritable bowel syndrome in office-based practice in the United States. Gastroenterology 1991; 100:998–1005.
4. Camilleri M, Williams DE. Economic burden of irritable bowel syndrome. Proposed strategies to control expenditures. Pharmacoeconomics 2000;17:331–8.
5. Longstreth GF. Irritable bowel syndrome: A multibillion-dollar problem. Gastroenterology 1995;109:2029–31.
6. Sandler RS, Everhart JE, Donwitz M, et al. The burden of selected digestive diseases in the United States. Gastroenterology 2002;122:1500–11.
7. Talley NJ, Gabriel SE, Harmsen WS, et al. Medical costs in community subjects with irritable bowel syndrome. Gastroenterology 1995;109:1736–41.
8. Ricci JF, Jhingran P, McLaughlin T, et al. Costs of care for irritable bowel syndrome in managed care. J Clin Outcomes Manag 2000;7:23–8.
9. Levy RL, Von Korff M, Whitehead WE, et al. Costs of care for irritable bowel syndrome patients in a health maintenance organization. Am J Gastroenterol 2001;96:3122–9.
10. Creed F, Ratcliffe J, Fernandez L, et al. Health-related quality of life and health care costs in severe, refractory irritable bowel syndrome. Ann Intern Med 2001;134:860–8.
11. Thompson WG, Creed FH, Drossman DA. Functional bowel disorders and functional abdominal pain. Gastroenterol Int 1992;5:75–91.
12. Drossman DA, Li Z, Andruzzi E, et al. U.S. householder survey of functional gastrointestinal disorders. Prevalence, sociodemography, and health impact. Dig Dis Sci 1993;38: 1569–80.
13. Longstreth GF, Wolde-Tsadik G. Irritable bowel-type symptoms in HMO examinees. Prevalence, demographics, and clinical correlates. Dig Dis Sci 1993;38:1581–9.
14. Yawn BP, Locke GR, III, Lydick E, et al. Diagnosis and care of irritable bowel syndrome in a community-based population. Am J Manag Care 2001;7:585–92.
15. Longstreth GF. Irritable bowel syndrome and chronic pelvic pain. Obstet Gynecol Surv 1994;49:505–7.
16. Kennedy TM, Jones RH. Epidemiology of cholecystectomy and irritable bowel syndrome in a UK population. Br J Surg 2000;87:1658–63.
17. Creed F. Life events and appendicectomy. Lancet 1981;1: 1381–5.
18. Levy RL, Whitehead WE, Feld AD. Do patients with IBS receive a diagnosis of IBS, abdominal pain, constipation or diarrhea? Am J Gastroenterol 2001;96(suppl):S320 (abstract).
19. Hahn BA, Kirchdoerfer LJ, Fullerton S, et al. Patient-perceived severity of irritable bowel syndrome in relation to symptoms, health resource utilization and quality of life. Aliment Pharmacol Ther 1997;11:553–9.
20. Talley NJ, Zinsmeister AR, Melton LJ, III. Irritable bowel syndrome in a community: Symptom subgroups, risk factors, and health care utilization. Am J Epidemiol 1995;142:76–83.
21. Drossman DA, Whitehead WE, Toner BB, et al. What determines severity among patients with painful functional bowel disorders? Am J Gastroenterol 2000;95:974–80.
22. Hu TW, Rush AJ. Depressive disorders: Treatment patterns and costs of treatment in the private sector of the United States. Soc Psychiatry Psychiatr Epidemiol 1995;30:224–30.
23. Wolfe F, Anderson J, Harkness D, et al. A prospective, longitudinal, multicenter study of service utilization and costs in fibromyalgia. Arthritis Rheum 1997;40:1560–70.
24. Walen HR, Cronan PA, Bigatti SM. Factors associated with healthcare costs in women with fibromyalgia. Am J Manag Care 2001;7:SP39–SP47.
25. Lipton RB, Stewart WF, Von Korff M. Burden of migraine: Societal costs and therapeutic opportunities. Neurology 1997; 48:S4–S9.
26. Fishman P, Black L. Indirect costs of migraine in a managed care population. Cephalalgia 1999;19:50–7.
27. Simon GE, Revicki D, Heiligenstein J, et al. Recovery from depression, work productivity, and health care costs among primary care patients. Gen Hosp Psychiatry 2000;22:153–62.
28. Revicki DA, Simon GE, Chan K, et al. Depression, health-related quality of life, and medical cost outcomes of receiving recommended levels of antidepressant treatment. J Fam Pract 1998;47:446–52.
29. Fass R, Longstreth GF, Pimentel M, et al. Evidence- and consensus-based practice guidelines for the diagnosis of irritable bowel syndrome. Arch Intern Med 2001;161:2081–8.
30. Knight K, Higuchi K, Wilson A. Diagnosis of irritable bowel syndrome in managed care: Missed opportunity? Am J Gastroenterol 2001;96(suppl):S272 (abstract).
31. Lee DW, Meyer JW, Clouse J. Implications of controlling for comorbid conditions in cost-of-illness estimates: A case study of osteoarthritis from a managed care system perspective. Value Health 2001;4:329–34.