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The Impact of Somatization on the Use of Gastrointestinal Health-Care Resources in Patients with Irritable Bowel Syndrome

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BACKGROUND: It is unclear why patients with irritable bowel syndrome (IBS) consume a disproportionate amount of health-care resources *versus* matched controls. One possibility is the presence of comorbid somatization—a process marked by multiple unexplained somatic complaints that is highly prevalent in IBS. We sought to determine whether higher levels of somatization are associated with higher levels of gastrointestinal (GI) resource utilization in IBS.

METHODS: A total of 1,410 patients >18 yr with IBS were evaluated at a university-based clinic. Subjects completed a symptom questionnaire, the SCL-90R psychometric checklist, and the SF-36 Health Survey. We measured two outcomes: (1) a 1-yr direct GI health-care costs and (2) a 1-yr number of GI physician visits. Our primary regressor was somatization as measured by the somatization subscale of the SCL-90R. We performed regression analyses to measure the adjusted influence of somatization on GI resource utilization.

RESULTS: In the full sample of patients, there were no differences in the likelihood of expending *versus* not expending previous GI health-care costs among groups with varying levels of somatization. Similarly, there were no differences in either the likelihood of visiting a GI physician or the number of overall physician visits among patients with varying levels of somatization. However, in the subset of patients expending at least $1.00 in GI costs in the previous year (53% of cohort), there was a significantly higher cost of care for subjects with high *versus* low levels of somatization.

CONCLUSIONS: IBS patients with high levels of somatization are not more likely to seek GI care compared to patients with low levels of somatization. However, once they are evaluated for care, patients with high somatization expend significantly more GI health-care costs. This suggests that somatization is positively associated with health-care costs in IBS, and that the association may be driven more by physicians than patients.

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INTRODUCTION

Irritable bowel syndrome (IBS) is a chronic disorder of gastrointestinal (GI) function characterized by recurrent abdominal pain and altered bowel habits in the absence of detectable organic disease (1). IBS is a prevalent and expensive condition affecting 15% of the general adult population, resulting in 3.6 million physician visits annually, and costing over $20 billion per year in direct and indirect expenditures (2, 3). Moreover, patients with IBS consume over 50% more health-care resources than matched controls without IBS (4, 5). This suggests that the economic burden of IBS stems not only from the high prevalence of the disease but also from the disproportionate use of resources engendered by the disease.

It is unclear why patients with IBS consume a disproportionate amount of resources, especially in light of well-established data that diagnostic tests and procedures in IBS rarely detect alternative underlying conditions and do not change clinical management (6). Despite the dissemination of guidelines reinforcing these data (7–9), much of the cost of care in IBS arises from sequential diagnostic tests, invasive procedures, and abdominal surgeries (4, 10). For example, patients with IBS are three times more likely than matched controls to undergo cholecystectomy (10), despite knowledge that IBS symptoms almost invariably persist following the surgery. Similarly, IBS accounts for 10% of all colonoscopies performed in the United States (11) despite data that these procedures have a low diagnostic yield and that negative test

results fail to improve intestinal symptoms, do not augment health-related quality of life, and are unlikely to provide additional reassurance *versus* not performing colonoscopy (12). Taken together, these data suggest that the high resource utilization in IBS may be driven by variables other than medical need.

One possibility is that resource utilization in IBS is partly driven by the presence of comorbid somatization—a process marked by multiple unexplained somatic complaints and physical illnesses potentially related to underlying psychosocial distress (13). Between one fourth and one third of IBS patients in referral centers meet the Diagnostic and Statistical Manual (DSM) criteria for somatization disorder, and even more have somatization trait by virtue of exhibiting one or more related symptoms including unexplained faintness or dizziness, functional chest pain, generalized weakness, and recurrent unexplained numbness or tingling (14, 15). Whereas somatization disorder represents the extreme end of a continuum of psychological responses to physical sensations, somatization trait is a less extreme yet more prevalent process in nonreferral IBS patients that involve increased cognitive (*e.g.*, hypervigilance), affective (*e.g.*, fear), and behavioral (*e.g.*, health care seeking) responses to physical sensations (16). Although mental health professionals are well versed in identifying and treating somatization and related complaints, medical physicians are largely unaware of somatization and, as a result, rarely make the diagnosis (14). One potential consequence is that patients with somatization are misclassified as having multiple underlying organic conditions and are subjected to sequential diagnostic tests, procedures, and treatments over the course of repeated physician visits. If this was true then it might help explain why patients with IBS undergo a disproportionate number of diagnostic tests (4), and why IBS patients have three times more physician visits for *non-GI* somatic complaints than that of matched controls (17). Moreover, because comorbid somatization is linked with excessive resource utilization in a range of health-care settings and diseases (18–20), there is *a priori* reason to believe that IBS patients with somatization also consume more health-care resources than IBS patients without somatization, all else being equal.

We therefore sought to measure the association between levels of somatization and resource utilization in a large cross-sectional sample of patients with IBS. We hypothesized that higher levels of somatization would be associated with higher levels of GI resource utilization.

METHODS

Subjects

Consecutive patients aged 18–49 yr with Rome I or II positive IBS were evaluated at the University of California at Los Angeles Center for Neurovisceral Sciences and Women's Health between January 1, 1995 and December 31, 2002. The Rome criteria provide a valid and reproducible definition of IBS and are the most stringent criteria for accurately diagnosing IBS (1). The clinical arm of the Center for Neurovisceral Sciences and Women's Health is a university-based specialty clinic that focuses on the evaluation and treatment of patients with disorders of GI function. One third of the patients evaluated at the Center are self-referred and two thirds are referred by primary care providers, community gastroenterologists, and academic gastroenterologists. All subjects evaluated in this study completed a GI symptom questionnaire that included questions regarding health-care services used for evaluation and treatment of IBS, a psychological symptom checklist (SCL-90R) (21), and the SF-36 Health Survey (22). The questionnaire was administered by mail prior to the first clinical evaluation in the Center. The study was approved by the University of California at Los Angeles Institutional Review Board and was conducted in accordance with the institutional guidelines regulating human subjects research.

Study Outcome Measures

GI HEALTH-CARE COSTS. Patients with IBS consume a wide range of GI resources including noninvasive imaging tests, invasive diagnostic procedures, abdominal surgeries, and subspecialist physician visits (4). In light of the high GI health-care costs in IBS, our primary outcome measure was the 1-yr aggregated costs for a range of prespecified GI resources (Table 1). We conducted the analysis from the perspective of a third party payer and only included direct health-care costs. We obtained costs for physician services and endoscopic, radiographic, and surgical procedures from the 2004 American Medical Association Current Procedural Terminology codebook and the 2004 Medicare Fee Schedule. We derived the 1-yr GI resource costs by tabulating the number and type of resources consumed over the previous year per patient and then summing the assigned costs for each resource (Table 1). As each patient completed the questionnaire prior to the first clinical evaluation at the Center, we did not include the subsequent the Center visit in the cost calculation.

OUTPATIENT GASTROENTEROLOGY PHYSICIAN VISITS. For patients with IBS to consume health-care resources, they must generally first visit a physician. Although we included previous GI physician visits in the overall GI health-care cost outcome, it is relevant to examine GI physician visits separately since they serve as the portal of entry for subsequent GI resource utilization. Examining both outcomes separately might provide more insight into the relationship between somatization and resource use than examining either outcome individually. For example, if high somatization was associated with high overall GI resource utilization, but not with high GI physician visits, then it might suggest that patients with high somatization are not more likely to seek care, but once evaluated by physicians they are more likely to receive a disproportionate amount of resources (arguably implicating physicians as the driver of resources). In contrast, if high somatization was associated with high overall GI resource use *and* high

Table 1. Gastrointestinal (GI) Resources and Cost Estimates Included in Health-Care Resource Outcome

Gastrointestinal Health-Care Resource	Assigned Cost ($)
Gastroenterologist office visit	52
Diagnostic colonoscopy or upper endoscopy	
Endoscopist's consultation fee	160
Endoscopist's procedure fee	231
Facility fee	433
Total cost	824
Flexible sigmoidoscopy	
Endoscopist's procedure fee	125
Facility fee	200
Total cost	325
Endoscopic retrograde cholangiopancreatography (ERCP)	
Endoscopist's consultation fee	160
Endoscopist's procedure fee	620
Facility fee	433
Total cost	1,213
Abdominal x-ray series or barium enema or upper GI seriesor abdominal ultrasound	
Radiologist's consultation fee	160
Radiologist's procedure fee	231
Facility fee	150
Total cost	541
Abdominal ultrasound	
Radiologist's consultation fee	160
Radiologist's procedure fee	231
Facility fee	150
Total cost	541
Cost of elective abdominal surgery	
Medicare DRG for abdominal surgery without comorbid conditions	13,531
Initial surgical consultation	97
Surgeon's fee	710
Anesthesiologist's fee	299
Surgeon's follow-up visit	53/day × 5 follow-up days
Total cost	14,902

Note: Each resource was assigned a cost based on the medicare reimbursement scheme and Current Procedural Terminology Codebook. The 1-yr GI resource costs were derived for each patient by tabulating the number and type of resource consumed over the previous year and summing the relevant costs.

GI physician visits, then it might suggest that patients with high somatization are more likely to seek care *and* consume disproportionate resources compared to patients with low somatization (arguably implicating patients as the driver of resources). Although these causal relationships cannot be definitively answered in a cross-sectional study, conducting separate analyses for both outcomes may generate useful hypotheses for future research. Therefore, we performed a second analysis measuring the number of gastroenterologist physician visits over the previous year.

Somatization Measure

Our objective was to determine the association between levels of somatization and resource utilization in IBS. We adopted the somatization subscale of the SCL-90R (21) as our operational definition of somatization. The SCL-90R is a widely used, validated, generic psychometric checklist composed of nine subscales. The somatization subscale, which has been used extensively in previous studies in IBS (23–30), is based on the weighted sum of seven items including (1) faintness or dizziness (2), pains in heart or chest (3), nausea or upset stomach (4), trouble catching breath (5), hot or cold spells (6), numbness or tingling in parts of the body, and (7) feeling weak in parts of the body. Each self-reported item is rated on a scale between 0 ("not at all distressed" by the item) and 4 ("extremely distressed" by the item). The raw scores on the somatization subscale are linearly transformed to *t*-scores across a 0–100 range with higher scores indicating higher levels of somatization (21). The somatization subscale is not a criterion measure of the DSM-IV somatization disorder, but is instead a continuous measure of somatization trait—a marker of increased cognitive, affective, and behavioral responses to physical sensations. Although somatization trait does not reflect a unique diagnosis, the typical symptoms of somatization trait comprise a measurable psychological dimension marked by a heightened perception of bodily function. The items of the SCL-90R somatization subscale were identified by factor analysis to jointly capture a definable psychological dimension that is distinct from the psychiatric diagnosis of somatization disorder (21). Therefore, although somatization trait may be the end product of other underlying medical, psychological, or social conditions (*i.e.*, an "epiphenomenon"), it nonetheless behaves as a reproducible and definable construct.

Conceptual Model

Because resource utilization is a composite measure that depends upon several factors, we developed a conceptual model to specify the relevant variables that might affect the relationship between somatization and resource utilization (including cost of care and physician visits). We based our conceptual model upon *a priori* hypotheses guided by empirical data from the literature. Table 2 lists the variables in the conceptual model, indicates the hypothesized directional effect of each variable on resource utilization, and provides a rationale supporting each hypothesis. Because we deemed each of the variables to be important based upon *a priori* hypotheses, we included all the variables in the final regression model rather than performing a potentially arbitrary stepwise regression analysis.

Analysis

Because many patients expend no health-care costs at all, yet a small number expend large health-care costs, our primary outcome measure (GI health-care costs) has a nonnormal distribution. Specifically, health-care costs often have a large proportion of "zero values" and a right-skewed distribution. This type of distribution may be analyzed using a "two-part regression model" (32). Figure 1 portrays the mechanics of our two-part model. The two-part model is appropriate in this instance because it acknowledges that somatization may impact the choice of whether or not to consume *any* health-care resources differently from the way it impacts the amount of

Table 2. Conceptual Model Specification

Variable Grouping	Theoretical Variable	Measured Variable in Database	Hypothesized Direction of Effect	Rationale Supporting Hypothesized Direction of Effect
Disease-specific patient variables	Disease severity	Severity of predominant abdominal symptom (0–20 scale, 20 = most severe)	↑	Symptom severity is a significant predictor of resource utilization in IBS patients *vs* non-IBS subjects, and data indicate that higher severity is associated with higher resource utilization (4).
	Disease duration	Duration of IBS symptoms (yr)	↓	Patients with longstanding IBS are more likely to be acclimated to their symptoms *vs* patients with new-onset disease, and therefore less likely to require diagnostic and therapeutic resources.
	Disease subtype	Diarrhea predominant *vs* constipation-predominant IBS	↔	Patients with diarrhea-predominant and constipation-predominant IBS have similar functional statuses and quality of life decrements, and will have similar resource utilization (23).
	Symptom frequency	IBS flares per week	↑	Patients with frequent symptoms have a lower physical quality of life than those with less frequent symptoms, and will therefore have higher resource utilization (31).
	Presence of pain	Primary abdominal symptom is pain *vs* discomfort	↑	Patients with pain-predominant IBS have a lower physical quality of life than those with discomfort-predominant IBS, and will therefore have higher resource utilization (31).
	Symptom annoyance	Primary abdominal symptom is "annoying" *vs* "not annoying"	↑	There are no empirical data to support the hypothesized direction. However, there is *a priori* reason to believe that patients with self-perceived "annoying" symptoms are more likely to seek care and use resources than those without "annoying" symptoms.
Non-disease-specific patient variables	Compulsiveness	SCL-90R Obsessive subscale	↑	Compulsive patients are more likely to ruminate about their symptoms and follow-up on care *vs* non-compulsive patients, and will therefore have higher resource utilization.
	Anxiousness	SCL-90R General Anxiety subscale	↑	Anxious patients are more likely to have disease-specific fears and concerns *vs* non-anxious patients, and therefore more likely to use resources in an effort to demystify their symptoms.
	Depression	SCL-90R Depression subscale	↑	Depressed patients with IBS are more likely to receive abdominal surgery than non-depressed patients with IBS, and will therefore also have higher overall resource utilization (10).

(continued)

Table 2. Continued

Variable Grouping	Theoretical Variable	Measured Variable in Database	Hypothesized Direction of Effect	Rationale Supporting Hypothesized Direction of Effect
	Physical functioning	SF-36 Physical Component Score	↓	Patients with high physical functioning are less likely to require assistance and support *vs* patients with low physical functioning, and will therefore have lower resource utilization.
	Sexual abuse history	Sexual dysfunction	↑	Patients with a history of sexual abuse are more likely to have somatization disorder *vs* patients without an abuse history, and will therefore have higher resource utilization (14). Because the data set did not contain a variable for sexual abuse, "sexual dysfunction" was selected as a surrogate, given the association between sexual abuse history and subsequent sexual dysfunction.
	"Physician hopping"	Number of different physician visited within the last year	↑	Patients who seek care from multiple different physicians are more likely to have fractured plans of care and repeated diagnostic tests *vs* patients who seek care from fewer different physicians, and will therefore have higher resource utilization.
	Medical comorbidities	Variable not included in database	N/A	Patients with multiple comorbidities have higher medical needs *vs* patients with fewer comorbidities, and would therefore have higher overall resource utilization.
Demographic variables	Age	Age in years	↑	Older patients have more comorbidities *vs* younger patients, and will therefore have higher resource utilization.
	Gender	Female *vs* male	↑	Female patients with IBS are over twice as likely to receive abdominal surgeries *vs* male patients with IBS, and will therefore also have higher overall resource utilization.
	Black, non-Hispanic ethnicity	"African American"	↓	Black patients are less socioeconomically privileged, on average, *vs* non-white patients, and will therefore have lower access to health care and higher overall resource utilization.
	Asian	"Asian/Pacific Islander"	↔	It is unclear how Asian ethnicity will impact resource utilization in IBS.
	Other race	"Native American," or "Northern European," or "Other"	↔	Because this group is heterogeneous, it is difficult to hypothesize a direction of effect.
	White, non-Hispanic	"White" = Reference group	↑	White patients are more socioeconomically privileged, on average, *vs* non-white patients, and will therefore have better access to health care and higher overall resource utilization.

	Education	Variable not included in database	↑	Patients with higher education are more likely to have health insurance and more likely to have health knowledge *vs* patients with no degree, and will therefore have higher resource utilization.
	Income	Variable not included in database	↑	Patients with higher income are more likely to have health insurance and access to health care, more likely to be educated, and more likely to have health knowledge *vs* patients with lower income, and would therefore have higher resource utilization.
	Insurance status	Variable not included in database	↑	Patients with health-care insurance are more likely to access health care *vs* patients without insurance, and would therefore have higher resource utilization.
	Marital status	Married *vs* unmarried	↓	Patients who are married are more likely to have adequate social support *vs* patients who are unmarried. Because the presence of social support may help to minimize the psychosocial impact of IBS symptoms, married patients will have less resource utilization.
Physician variables	Physician age	Variable not included in database	↑	Older *vs* younger physicians are less likely to know recent data that diagnostic tests rarely impact outcomes in IBS, and would therefore order the use of more GI resources.
	Specialization	GI specialist *vs* non-GI specialist	↑	GI specialists are more likely to recommend the use of diagnostic tests in their purview *vs* non-GI specialists, and would therefore order the use of more GI specific resources.
	"Testing proclivity"	Variable not included in database	N/A	Physicians with a high *vs* low proclivity to order diagnostic tests to complement their clinical acumen would by definition order the use of more resources.
	IBS knowledge	Variable not included in database	N/A	Physicians with high *vs* low knowledge about IBS are more likely to know recent data that diagnostic tests rarely impact outcomes in IBS, and would therefore order the use of less GI resources.
	IBS beliefs	Variable not included in database	N/A	Physicians who believe that IBS is primarily a psychosocial disorder are less likely to order the use of GI resources *vs* physicians who believe IBS is primarily an organic disorder.

Note: The table lists all prespecified theoretical variables that might influence the relationship between somatization and gastrointestinal (GI) resource utilization. Each theoretical variable is matched to an actual measured variable in the database. Theoretical variables without matching variables in the database are potential sources of omission bias that are addressed in the "Discussion" section. The model suggests that GI resource utilization in IBS is determined by 3 groups of variables and 23 individual variables. The hypothesized direction of effect on GI resource utilization is presented for each variable, along with a rationale supporting each individual hypothesis.

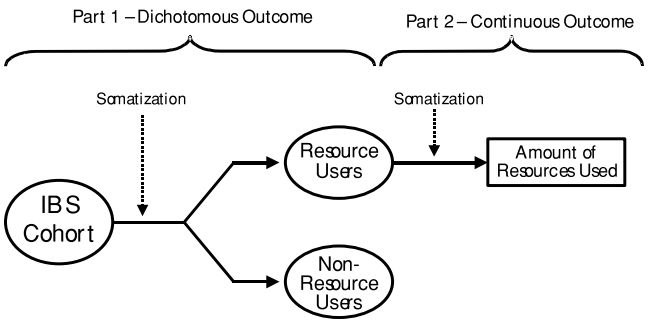

Figure 1. Portrayal of the two-part regression model. The regression model starts by measuring the association between somatization and *any* resource utilization. In this first step, the outcome is dichotomous: use of any GI resource *versus* use of no GI resource in the previous year. The second step is limited only to resource users. In this second step, the outcome is continuous: amount of resources used. The advantage of this design is to acknowledge that somatization may impact the use of *any* GI resources differently from its impact on the amount of resources consumed in the subgroup using resources. Two-part models are recommended in this circumstance because they provide higher resolution in understanding the conditional impact of a risk factor on an outcome, rather than the "one size fits all" approach of one-step linear regression (32).

resources consumed in the subgroup of patients that actually use resources (32).

The first part of our two-part model consisted of a logistic regression analysis using the full sample to measure the adjusted association between somatization and previous GI health care use (defined as expending *vs* not expending $\geq$\$1.00 of GI costs in the previous year). We also measured the adjusted association between somatization and whether or not each patient previously visited a GI physician. The second part of our two-part model focused solely on the subset of patients that used prior GI resources. In this analysis, we conducted a linear regression model to evaluate the influence of somatization on GI health-care costs in the subset of patients expending at least \$1.00 in GI resources. We then calculated the mean differences in yearly health-care costs between IBS patients with varying levels of somatization and patients with average somatization. We calculated bootstrap 95% confidence intervals around the point estimate using 1,000 sampling iterations (33). We used Stata Statistical Software Release 8.0 (Stata Corporation, College Station, TX, USA) for all the analyses.

RESULTS

There were 1,410 patients with Rome-positive IBS who completed the study questionnaire. The mean age was 47 $\pm$ 15 yr and 68% of the cohort was female. Table 3 displays the descriptive statistics for each of the measured variables specified in the conceptual model.

Figure 2 demonstrates the distribution of 1-yr GI health-care costs for the sample. The distribution appeared heavily right-skewed and nonnormal (mean = \$3,280.8; median = \$0.00) with 47.7% of the cohort expending at least \$1.00 in GI resources in the previous year. In light of the high proportion of nonresource users in the sample, we conducted a two-part model, as described in Figure 1. The first part was a logistic regression model using the full set of data to evaluate the association between somatization and use *versus* nonuse of GI resources (dichotomous outcome). The model revealed no significant relationship between somatization and the odds of previously using *versus* not-using GI resources (adjusted odds ratio [OR] = 1.04; 95% CI = 0.99, 1.1). Refer to Table 4 for the full results of the logistic regression analysis. Similarly, we found no significant association between somatization and the odds of previously visiting *versus* not-visiting a GI physician (adjusted OR = 1.02; CI = 0.99, 1.04).

The second part of the model was a linear regression confined to the 53% subset of patients consuming at least \$1.00 in GI resources in the previous year. Figure 3 demonstrates the results of this model, stratified by varying levels of somatization. The data indicate that somatization significantly predicted resource utilization at all levels. For example, those with somatization 2 SD above the mean consumed \$2,481 (95% CI: \$2,220; \$2,633) more in GI resources *versus* patients with average somatization. In contrast, those with somatization 2 SD below the mean consumed \$1,699 (\$1,550; \$1,750) *less* in GI resources *versus* patients with average somatization.

DISCUSSION

This analysis reveals that IBS patients with high levels of somatization are not more likely to have visited a gastroenterologist within the previous year compared to patients with low levels of somatization, but they do expend significantly more GI health-care costs once evaluated for care. Specifically, whereas somatization did not predict whether IBS patients in our cohort had previously visited a gastroenterologist (OR = 1.04; 95% CI = 0.99, 1.1), somatization strongly predicted resource use among the group of patients who *had* received previous GI care. Because this retrospective analysis fails to capture several components of health-care costs, including GI pharmaceutical costs and a broad range of non-GI costs, this difference in health-care expenditures may underestimate reality. Taken together, these results suggest that somatization is an important driver of resource consumption in IBS, and that physicians may play a larger role than patients in mediating the relationship between somatization and costs.

Although cross-sectional data are inadequate for confirming causal relationships, the two-part argument that somatization precedes resource utilization and that physicians may mediate the relationship is supported by several factors. First, there is ample evidence in other disorders that somatization precedes resource utilization and not the other way around (18–20). These data provide face validity for the hypothesis that high somatization leads to high resource utilization in

Table 3. Descriptive Statistics for Measured Variables Specified in the Conceptual Model

Variable	N	Mean	SD
Demographic variables			
Age (yr)	1,354	47.5	15.1
Gender (% female)	1,358	62.6	48.3
Ethnicity			
White (%)	1,410	62.6	48.3
Black (%)	1,410	5.1	22.0
Asian/Pacific Islander (%)	1,410	2.2	14.4
Other (%)	1,410	30.1	45.8
Education			
Non-high school graduate (%)	1,410	10.9	31.2
High-school graduate (%)	1,410	36.4	48.1
College graduate (%)	1,410	21.4	41.0
Professional school graduate (%)	1,410	31.3	46.3
Marital status (% married)	1,410	45.3	49.8
Disease-specific patient variables			
Disease severity (0–20 VAS, 20 = most severe)	770	11.8	4.4
Disease duration (% >2 yr)	1,359	43.2	44.1
Diarrhea-predominant IBS (%)	1,410	21.9	41.4
Disease frequency (% > "several flares per week")	1,410	18.3	29.4
Pain-predominant IBS (%)	1,410	21.4	41.0
Symptom annoyance (% with "annoying" symptoms)	1,410	8.4	27.8
Non-disease-specific patient variables			
Compulsiveness (SCL-90R Obsessive Scale Score)	1,061	57.8	11.8
Anxiousness (SCL-90R General Anxiety Scale Score)	1,057	55.9	13.0
Depression (SCL-90R Depression Scale Score)	1,057	59.5	11.4
Physical functioning (SF-36 Physical Component Score)	858	43.6	10.3
Sexual dysfunction (% "yes")	1,197	55.6	49.7
Primary regressor			
Somatization (SCL-90R Somatization Scale Score)	1,056	59.7	10.7
Outcome measures			
1-yr gastrointestinal health-care costs ($)	1,408	3,280.8	4,391.8
1-yr outpatient gastroenterology physician visits	1,410	0.71	2.51

N = number of observations per variable; SD = standard deviation; VAS = visual analog scale.

IBS. Second, GI symptoms are, by definition, part of somatization syndrome (34). Whether somatization is part and parcel of IBS or simply comorbid in many IBS patients is unclear (14), but what is more obvious is the potential relationship between developing GI symptoms and receiving GI tests, procedures, and surgeries. It is arguably less likely that high GI resource utilization leads to abdominal symptoms and somatization. Third, the observation that somatization does not predict physician visits but highly predicts expenditures once patients are evaluated argues that physicians may mediate the relationship more than patients. In contrast, if our analysis revealed that patients with high somatization were more likely to present themselves for care in the first place, then a reasonable conclusion might be that patients were driving physician visits and subsequent resource utilization—the opposite finding from this analysis.

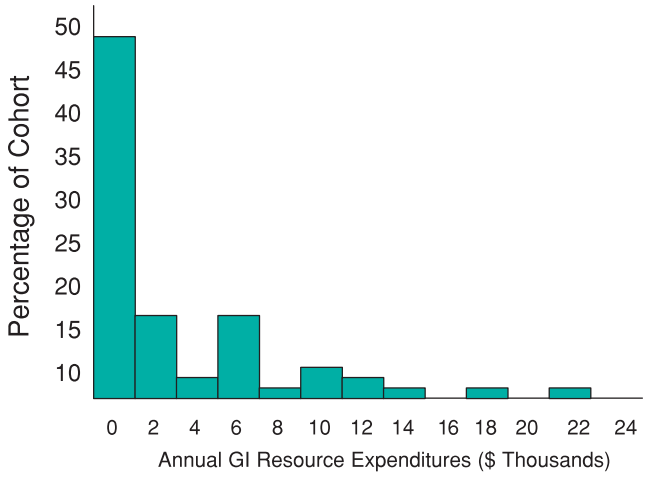

Figure 2. Distribution of 1-yr gastrointestinal (GI) health-care costs. The data indicate a "right-skewed" distribution. Forty-seven percent of the cohort had not used previous GI resources within the previous year.

The conclusion that physicians may increase resource utilization in the face of comorbid somatization in IBS suggests that one high-yield intervention to minimize expenditures may be to educate physicians about somatization. Whereas mental health professionals are more apt to identify and treat somatization, internists and gastroenterologists are less likely to recognize somatization and more likely to misclassify the symptoms as organic in etiology (14). The economic consequences of this misclassification are multiplied in light of data that up to one third of patients with IBS have somatization disorder and even more have somatization trait (14). Moreover, not only is the standardized Diagnostic Interview Schedule known to underestimate the prevalence of pure somatization disorder (14, 35), but also it is even more likely to underestimate the prevalence of more subtle yet more

Table 4. Logistic Regression Analysis Predicting Previous Use *vs* Non-Use of Gastrointestinal Resources. Somatization Did Not Independently Predict the Outcome When Adjusting for Other Variables

Variable	Odds Ratio	95% Confidence Interval	*p* Value
Somatization	1.04	0.98–1.1	0.13
Gender	2.02	0.75–5.44	0.16
Black	0.71	0.13–3.71	0.68
Non-black	0.68	00.21–2.12	0.39
High school education only	1.8	0.2–15.4	0.54
College education	1.65	0.52–5.3	0.85
Postgraduate education	4.88	1.23–19.36	0.02
Married	2.16	0.77–6.04	0.14
Age	1.02	0.98–1.06	0.24
Symptom severity	1.8	0.89–3.64	0.09
Pain predominance	0.43	0.16–1.17	0.1
Diarrhea *vs* constipation	1.18	0.35–4.0	0.27
Symptom frequency	1.1	0.39–3.04	0.19
Symptom annoyance	1.22	0.0.26–5.83	0.25
Anxiety	0.99	0.93–1.05	0.48
Obsession	1.01	0.97–1.05	0.70
Depression	1.01	0.94–1.08	0.32
Sexual dysfunction	0.89	0.32–2.42	0.81
SF-36 Physical Function	0.98	0.93–1.03	0.47

common somatoform disorders such as hypochondriasis and chronic pain disorders (14, 35). Because the prevalence of these disorders is high in IBS (and elsewhere), physicians should always consider the diagnosis early in the management of patients with multiple unexplained somatic complaints *in lieu* of instinctively ordering potentially unnecessary and expensive tests, procedures, and surgeries. Once somatization is identified, physicians should establish an effective and compassionate doctor–patient relationship, acknowledge patient suffering, provide appropriate reassurance, refer to a mental health professional when necessary, and stress long-term follow-up instead of short-term diagnostics and treatments (15).

There are several strengths to this analysis. First, the patients in this study were recruited from one of the largest functional-bowel disease specialty programs in the United States. This setting allows for a cohort that is not only demographically and geographically diverse, but also comprised patients from diverse practice settings. Moreover, there were over 1,400 patients in the study. This large sample size extends the generalizabiliy of the findings and reduces the probability of missing a true association. Second, we selected the variables for our regression model on the basis of *a priori* disease-specific hypotheses derived from previous research and clinical experience, and this itemization occurred prior to conducting the analysis. In this regard, our analysis is hypothesis-driven rather than hypothesis-generating. Third, in order to acknowledge that somatization may impact the use of *any* health-care resources differently from its impact on the amount of resources consumed in the subgroup using resources, we employed a two-part model to better characterize the impact of somatization on resource use. This procedure has the advantage of providing higher resolution in understanding the conditional impact of somatization than the "one size fits all" approach of ordinary linear regression (32).

This study has potential shortcomings as well. First, the university-based referral setting may not be generalizable to primary care settings. Although one third of the cohort was self-referred through advertising, two thirds of the cohort was referred from primary care providers, community gastroenterologists, and academic gastroenterologists. Therefore, many of the patients had already received and failed first-line therapies for IBS, and many also had high levels of somatization (mean SCL-90R somatization subscale = 59.7 ± 10.7). Although it may be hypothesized that disease severity and somatization are higher in a tertiary referral setting, the analysis adjusts for these covariates and essentially compares patients within the same cohort stratified by levels of somatization. Second, this analysis is a cross-sectional survey. Although this study design is capable of generating rich information at one point of time, it is unable to track trends longitudinally. Therefore, the identified relationship between somatization and resource utilization is limited to an observed association rather than a causation (despite the previous arguments), and is unable to predict resource utilization over time. Third, the analysis fails to account for several physician-related characteristics (Table 3) such as "testing proclivity" and knowledge, attitudes, and beliefs about IBS. For example, physicians who believe that IBS is primarily an organic rather than psychological disorder are probably more likely to order GI tests. In this circumstance, the estimate of somatization on resource utilization might be underestimated because both somatization and the belief that IBS is organic are positively associated with resource use and potentially negatively correlated with each other (*i.e.*, patients may be less likely to have somatization in IBS, if their physicians insist that the disease is organic and not psychological).

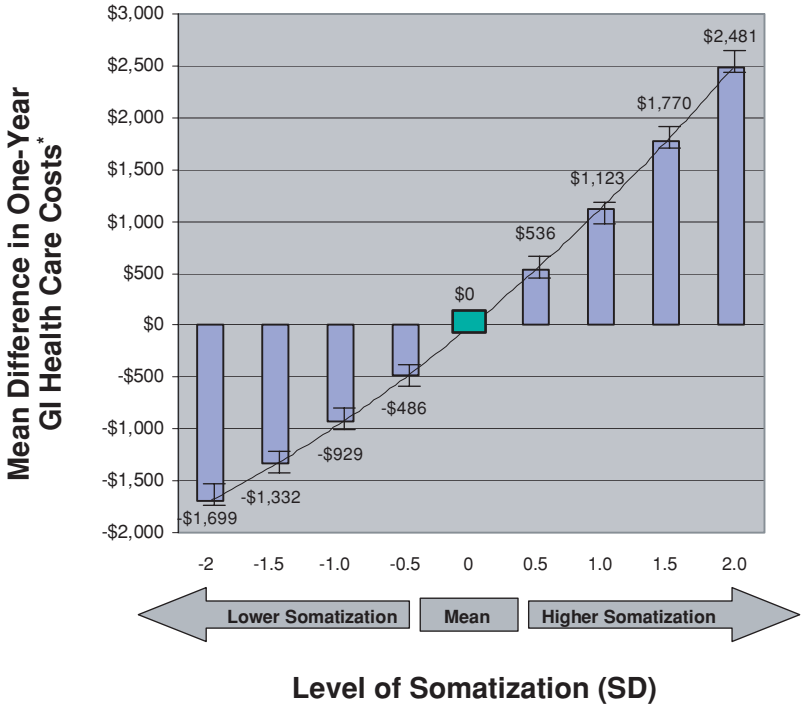

Figure 3. Analysis limited to previous gastrointestinal (GI) resource-users: association between somatization and amount of GI expenditures. The figure compares the adjusted mean difference in 1-yr GI health-care costs for each of eight different levels of somatization, each compared to the common baseline of patients with average levels of somatization (green bar). The data indicate that in patients with previous GI resource utilization, somatization levels significantly predict the amount of GI resources consumed. For example, patients with a level of somatization two standard deviations (SD) above the mean expended $2,481 more in GI resources than patients with average levels of somatization. All levels were statistically significant ($p < 0.05$), as was the slope of the trend line across the data (solid line).

Fourth, the analysis fails to capture and adjust for several important patient-level characteristics (Table 2), such as medical comorbidities, insurance status, and income. For example, patients with a high income are more likely to have health insurance and access to health care, more likely to be educated, and more likely to have health knowledge *versus* patients with lower income, and would therefore have higher resource utilization independent of somatization. In this circumstance, the estimate of somatization might also be underestimated. Therefore, if income and insurance were in the model then our results might potentially be even more robust. Fifth, the analysis does not perform cluster analysis by physician—a maneuver that would simultaneously control for all unmeasured physician-level characteristics. However, the impact of physician clustering is likely small since there are at least hundreds of treating physicians for the 1,410 patients in the cohort, and there are likely very few patients per physician.

An additional limitation is that we measured somatization trait (using the SCL-90) instead of somatization disorder (using the DSM-IV criteria). Because somatization trait represents a less extreme pathology than somatization disorder, measuring the trait might well underestimate the impact of true somatiform disorder on resource utilization in IBS. Nonetheless, we believe there are several advantages to focusing on somatization trait instead of somatization disorder. First, somatization trait is much more prevalent than somatization disorder in IBS patients (14, 15), and is therefore of higher everyday clinical relevance. Second, somatization trait represents an earlier stage along the psychological spectrum, and therefore represents a more modifiable stage than somatization disorder (*i.e.*, early identification of somatization trait may lead to early appropriate therapy). Third, as an early stage along a spectrum of severity, somatization trait is potentially more likely to go unrecognized—in contrast to the more explicit psychopathology of somatization disorder. For these reasons, we made an *a priori* decision to measure somatization trait in our study, and identified the SCL-90 a widely accepted measure of this construct.

In conclusion, this analysis found no association between somatization and either GI physician visits or use *versus* nonuse of GI health-care resources but revealed a significant and potentially important impact of somatization on costs in the subset of IBS patients receiving care. These data suggest that high levels of somatization may lead to high resource utilization, and that physicians may play a role in mediating the relationship. In light of these data, one potentially cost-effective intervention to minimize direct costs in IBS is to educate physicians regarding the timely identification and treatment of somatization in IBS. Future research should aim to prospectively measure the relationship between somatization

(both the trait and full disorder) and resource utilization in IBS.

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