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The Impact and Interactions of Race and Gender on Healthcare Use and Spending Irritable Bowel Syndrome

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Abstract

Background & Aims: Studies examining the effects of social determinants of health on healthcare use in irritable bowel syndrome (IBS) are scarce. We aimed to assess healthcare spending among different racial/ethnic groups and genders in adults with IBS.

Methods: We performed a retrospective cohort analysis of adults diagnosed with IBS between 2016–2021 using Optum's de-identified Clinformatics® Data Mart Database. We analyzed total annual and IBS-specific costs, utilization and costs of individual services, and prescriptions. We compared outcomes across racial/ethnic groups and by gender after adjusting for covariates and examined race-gender interactions.

Results: Among 95,319 adults with IBS, healthcare spending varied significantly by race and gender. Total all-cause and IBS-specific costs were lower in men than in women and in Asian and Hispanic patients than in White patients. Compared to White patients, Black patients had higher total IBS-specific costs, all-cause prescriptions costs, IBS-related radiology and laboratory costs, and emergency department (ED) care whileAsian and Hispanic patients incurred lower costs for ED care, hospitalizations, and all-cause prescriptions. Endoscopy costs were lower in racial minority groups. Women had higher spending for most services compared to men, but gender differences in most IBS-related services were small. All-cause hospitalization and endoscopy costs were higher in men, but IBS-specific hospitalization and endoscopy costs were higher in women. Gender disparities in all-cause individual services also varied by race.

Conclusions: Overall and IBS-related spending is higher in women, but gender differences in IBS-related care are small. Racial/ethnic comparisons show reduced spending in Asian and Hispanic patients, increased ED care in Black patients, and variations in spending patterns. Gender disparities differ by race.

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Guarantor of the article: AS accepts full responsibility for the conduct of the study.

Keywords

disorders of gut-brain interaction; functional gastrointestinal disorders; sex; economic burden; irritable bowel syndrome

INTRODUCTION

Irritable bowel syndrome (IBS) is a leading physician diagnosis among gastrointestinal (GI) disorders in the United States (U.S.)[1] and is defined by recurrent abdominal pain and altered bowel patterns.[2] In addition to reduced quality of life,[3, 4] IBS accounts for increased healthcare spending.[5, 6] Although the socioeconomic burden of IBS is well recognized,[7] the impact of IBS on racial and ethnic minority populations is understudied. Studies have demonstrated that IBS prevalence varies across countries.[8] Variations in IBS prevalence may be related to cultural, socioeconomic, biological, and genetic factors but may also be related to social determinants of health (SDoH). Whether the burden and impact of IBS differs across racial/ethnic groups within a defined geographical region such as the U.S. has not been systematically examined. A few studies have reported racial differences in healthcare utilization and management recommendations, which may be influenced socioeconomic status, implicit bias, and patient-provider communication.[9–11] These observations are important as non-White race/ethnicity may be linked to unfavorable SDoH that exacerbate healthcare disparities.[12–14] In addition, women are more likely to have IBS, more severe symptoms, and comorbid conditions such as anxiety or depression.[15, 16] Gender is another important SDoH that may influence healthcare utilization. Research examining the effects of these key SDoH on healthcare use and spending in IBS has been scarce. We aimed to evaluate healthcare utilization and costs across racial/ethnic groups and by gender as well as the effect of race-gender interactions on spending patterns among U.S. adults with IBS.

METHODS

Study design and cohort:

We performed a retrospective cohort study using deidentified data from Optum's Clinformatics® Data Mart Database (CDM), which includes claims from ~67 million people with commercial insurance and Medicare Advantage plans from all 50 states. Race and ethnicity are reported using a proprietary algorithm based on geography and name.[17] Gender is defined based on self- or provider-reported data. Data spanning 2016–2021 from CDM were analyzed to capture ICD-10 codes and prescription claims. Individuals ≥18 years of age on the index data and with ≥12 months of continuous enrollment data before and after the index date (determined by first medical claim for an IBS diagnosis) were eligible. Participants with IBS were identified based on ≥two claims with ICD-10 codes for IBS in any position, occurring ≥30 days apart.[6] IBS subtypes, including IBS with constipation (IBS-C), IBS with diarrhea (IBS-D), and mixed IBS (IBS-M) were defined using mutually exclusive criteria (Supplemental Methods).

Outcomes:

We summarized total annual costs associated with all claims (all-cause) and IBS-specific claims (primary outcomes) as well as all-cause and IBS-related utilization rates and costs for individual services and prescriptions (secondary outcomes). Individual services included outpatient visits, emergency department (ED) visits, hospitalizations, laboratory testing, radiological testing, and endoscopic procedures. Costs of individual services were estimated among participants receiving services. Covariates included sociodemographic variables, medical comorbidities (Elixhauser comorbidity index),[18] coexistent non-IBS GI diagnosis, and extra-intestinal conditions associated with IBS[19–21] defined by ICD-10 codes. (Supplemental Methods).

Statistical Considerations:

Data were summarized as mean (standard deviation [SD]) or median (interquartile range [IQR]) values and as frequencies (%). Outcomes were compared across racial groups and by gender using quantile regression for medians of count/cost data and logistic regression for and binary data after adjusting for covariates. Comparisons across racial/ethnic groups were adjusted for gender and comparisons by gender were adjusted for race. The interaction between gender and race was included to evaluate whether gender differences varied by race; if significant, results from the model with gender-race interaction were reported and if nonsignificant, results from the model with main effects of gender and race were reported. Statistical analyses were conducted using SAS version 9.4 (SAS Institute Inc, Cary, NC).

RESULTS

Participant Characteristics:

We identified 95,319 adults (n=75,325 non-Hispanic White, n=8,575 non-Hispanic Black, n=2,064 Asian, n=9,355 Hispanic, 78.1% women) with IBS (Figure S1) with a mean age (±SD) of 60.6 (±18.1) years. All clinical and sociodemographic characteristics except presence of other GI conditions differed across racial/ethnic groups and by gender (Tables 1 and 2). Annual median (IQR) total and IBS-specific all-cause costs were $13,360 (5,344–37,107) and $1,125 (369–5,541).

Total all-cause and IBS-specific healthcare use:

Unadjusted costs comparisons by race and gender are summarized in the Supplement (Tables S1 and S2). Race-gender interactions for total all-cause and total IBS-specific costs were not statistically significant (i.e., effect of gender did not differ by race). Using quantile regression (Table 3), we observed no significant differences in total all-cause costs between White and Black patients, but IBS-specific costs were higher in Black patients ($P<.001$). Total all-cause and IBS-specific costs were lower in Asian and Hispanic patients than in White and Black patients (all $P<.001$). In comparisons by gender using quantile regression (Table S2), median (95% confidence interval [CI]) annual total all-cause and IBS-specific costs were $489.06 and $74.79 lower for men than women (both $P<.001$).

Costs of all-cause individual services differ by race:

Adjusted comparisons of all-cause individual services demonstrated statistically significant differences (Figure 1, Table 3) in spending patterns. Differences between racial groups for these specific services were not further modified by gender (p=ns for race-gender interactions). Black patients were more likely to have ED visits ($P<.001$) than White patients while Asian ($P<.001$) and Hispanic ($P=.042$) patients were less likely. Compared to White patients, Hispanic patients had a slightly lower median number of annual hospitalizations ($P<.001$), a shorter median length of hospital stay by 0.6 days ($P<.008$), and hospitalization costs that were $1936.80 ($P<.032$) lower. Likelihood of laboratory testing was slightly higher for Asian or Hispanic patients compared to White patients (both OR=1.1, $P<.001$). Laboratory testing costs were $42.48 higher for Hispanic patients than White patients ($P<.001$). Radiological testing was more likely in Hispanic patients (odds ratio [OR]=1.11, $P<.001$) and less likely in Asian patients (OR=0.86, $P<.004$) than in White patients. Endoscopy costs were $70.65, $291.49, and $177.18 lower for Black ($P<.001$), Asian ($P<.001$), and Hispanic ($P<.001$) patients compared to White patients, respectively (Table 3). Compared to White patients, prescription medications were more likely in all racial minority groups; median per-patient prescription costs were $159.85 ($P<.001$) higher for Black patients but $74.08 ($P<.015$) and $76.59 ($P<.001$) lower for Asian and Hispanic patients, respectively.

Costs of all-cause individual services differ by gender:

Significant differences between men and women (Figure 2, Tables 4) were observed for several services, irrespective of race. Men were less likely to have outpatient visits (OR=0.732, $P<.001$) and radiological testing (OR=0.72, $P<.004$), use prescription medications (OR=0.9, $P<.001$), and had lower median costs for laboratory testing ($35.81, $P<.001$) and prescriptions ($74.15, $P<.001$) than women. Median hospitalization costs were $1476.95 higher for men than women ($P=.025$). Annual median endoscopy costs were $53.42 ($P<.003$) higher in men than in women.

Gender differences in all-cause costs of some individual services vary by race:

Significant interactions (Table S3) were observed between race/ethnicity and gender for the number and costs of outpatient visits (both $P<.001$), costs of ED visits ($P=.015$), likelihood of hospitalizations ($P<.006$), costs of radiological testing ($P<.007$), likelihood of endoscopy (p=0.034). Both median number (all $P<.001$) and costs of outpatient visits (all $P<.05$) were lower for men than women among White, Black, and Asian patients. Gender disparities in outpatient visits (number and costs) were larger among Asian patients compared to White (both $P<.001$), Black (both $P<.05$), or Hispanic (both $p\leq0.001$) patients. ED costs were $83.22 (95% CI: 6.82, 159.61) higher in White men than White women, but $703.18 (95% CI: −1201.77, −204.58) lower in Asian men than Asian women. Similarly, gender disparities in ED costs were larger among Asian patients compared to White ($P<.005$), Black ($P=.006$), and Hispanic (p=0.022) patients. Black men were more likely to be hospitalized than Black women, while Asian men were less likely to be hospitalized than Asian women (both $P=.043$). For radiological testing, median costs were $183.50 lower in Asian men than Asian

women (*P*<.003). White men were slightly more likely to undergo endoscopy than White women (OR=1.1, *P*=.004).

IBS-specific costs for individual services differ by race or gender:

There were no statistically significant race-gender interactions in IBS-specific costs of individual services. IBS-related hospitalizations were $4086 (*P*=.005) and $4273 (*P*<.001) less costly in Asian and Hispanic patients than in White patients, respectively (*P*<.001) (Table 3). Similarly, IBS-related costs of endoscopy were $319 and $207 (both *P*<.001) lower in Asian and Hispanic patients compared to White patients, respectively. Racial/ethnic differences in IBS-specific costs for other individual services (e.g., outpatient, radiologic tests, prescriptions) were relatively small although significant. Comparisons by gender demonstrated that IBS-related hospitalizations costs were about $2033 lower in men than in women (Table 4). Annual median per-patient IBS-related outpatient, radiology tests, and endoscopy costs were significantly lower in men compared to women, but differences were small.

Effect of race on spending differs by IBS subtype:

Evaluation of healthcare spending by IBS subtype (Table S4) demonstrated significant interactions between race and IBS subtype (*P*<.001 for all interaction terms). Largest racial disparities were observed in in IBS-C. Total all-cause costs were significantly lower for Asian and Hispanic patients compared to White patients across all IBS subtypes except IBS-M. Total all-cause costs did not differ between Black and White patients across IBS subtypes.

Total IBS-specific costs were significantly lower for Hispanic patients compared to White patients across all IBS subtypes (all *P*<.05). These costs were lower for Asian patients compared to White patients with IBS-C (*P*<.001) and IBS-U (*P*=.005). Total IBS-specific costs were higher in Black patients with IBS-C compared to White patients (*P*<.001). Racial disparities in total IBS-specific costs were largest in IBS-C relative to other subtypes.

Effect of gender on spending differs by IBS subtype:

Total all-cause costs were lower in men than in women for IBS-M and IBS-U (all *P*<.001). Total IBS-specific costs were lower in men for all IBS subtypes except IBS-D. Gender disparities were larger in IBS-M relative to other IBS subtypes (all *P*<.05).

DISCUSSION

In this study, we analyzed administrative claims of >95,000 adults with IBS to demonstrate that healthcare utilization and spending varies by race/ethnicity and gender, even after accounting for socioeconomic status, household income/size, medical comorbidities, and presence of other non-IBS GI diagnoses. Differences are particularly notable in IBS-C. In general, both total all-cause and IBS-specific costs are lower in men than in women and lower in Asian and Hispanic patients than in Black or White patients. Total IBS-specific costs were higher in Black patients than in White patients. Except for IBS-related outpatient visits and prescriptions, most IBS-related services were less costly in Asian and Hispanic

patients. Evaluation of individual medical services demonstrated differences by race and gender across service categories. In several categories, there were race-gender interactions for all-cause but not IBS-specific care. Gender disparities were particularly notable among Asian patients.

While racial disparities in access to healthcare and health outcomes are well-described,[11–13, 22] the impact of race/ethnicity may vary by the clinical condition that is studied and may also be influenced by the interaction between race and other SDoH.[23] There is growing awareness of gender-related healthcare disparities and the intersection between structural sexism and race/ethnicity. However, only a few studies[9, 10] have examined racial disparities in IBS and there has been surprisingly little work examining variations in U.S. healthcare spending by gender, despite a higher prevalence of IBS and comorbidities in women,[8, 15] and data suggesting that women with IBS may seek healthcare for GI and non-GI symptoms more frequently than men.[24]

Asians and Hispanic patients generally exhibited lower rates of healthcare use and spending across all categories except laboratory testing, IBS-specific outpatient visits, and rates of prescription use. Discordant results for some categories may offer additional insights. For example, lower costs despite similar or higher utilization of certain services (e.g., radiology, endoscopy, prescriptions) in Asian or Hispanic patients could suggest racial disparities in testing indications (e.g., screening vs. diagnostic), complexity of services (e.g., interventions), efficiency of care (e.g., number of tests), or treatment types (e.g., less costly medications). Meanwhile, higher costs despite similar utilization (e.g., outpatient visits) could suggest differences in the types of providers seen or complexity of visits. Although claims-based data may not reliably distinguish diagnostic from screening exams,[25] others have demonstrated racial disparities in colorectal cancer screening including highest screening rates in White patients and racial differences in the relative uptake of colonoscopy as a screening modality over time.[26] These prior data suggest that lower endoscopy costs in racial minority groups are not necessarily explained by rates of screening vs. diagnostic procedures. Silvernale et al. recently found that minority patients with IBS were more likely to receive GI procedures than White patients with IBS, although associated costs and indications were not assessed.[10] While access and spending are correlated, race and gender may influence other aspects of healthcare spending such as quality or level of care. Our findings suggest that detailed investigation of GI procedures including procedure types and interventions could shed light on whether cost disparities are driven by clinical needs, differences in resource allocation, or other systematic inequities that extend beyond access-related barriers or socioeconomic factors. We did observe significant racial/ethnic differences across U.S. regions with more Black and Hispanic patients living in the South and having lower education level and household income than White and Asian patients. However, we demonstrated differences in healthcare spending after adjusting for these confounders. Our results to suggest that these factors do not fully explain observed racial/ethnic disparities in healthcare utilization and costs. Further work will be required to identify factors (i.e., implicit bias, communication gaps, cultural barriers) that perpetuate disparities.

Comparisons between Black and White patients demonstrated that prescription medication rates, prescription costs, IBS-related radiology costs, and ED visits were higher among

Black patients while costs of endoscopy were lower. Higher prescription rates for Black patients with IBS have recently been reported by others.[9] To date, no other study has evaluated both all-cause and IBS-specific healthcare costs in patients with IBS by race/ethnicity and gender. However, larger studies of U.S. healthcare spending across various settings have described increased per-patient spending on inpatient and ED care in Black individuals,[12, 13] suggesting that disparities in the quality of preventative care observed in other health conditions may extend to Black patients with IBS. Further research is needed to determine the effects of race/ethnicity on the equitable delivery IBS care, the factors (e.g. medical racism, mistrust, perceptions) that may be linked to underutilization of primary or preventative care services, and strategies that could be implemented to reduce disparities.

In analyses by gender, we observed higher utilization rates and costs of all-cause services in women for most categories except for hospitalizations and endoscopy which were higher in men. However, gender differences in IBS-specific costs for individual services were often small to non-existent, except for higher costs of IBS-specific hospitalization and endoscopy. Findings suggest that higher spending in women with IBS may be driven by non-IBS related needs. Results also suggest that spending for IBS-specific care is similar between men and women for most services except inpatient services and endoscopy. Interestingly, while all-cause spending for hospitalizations and endoscopy were higher for men., the opposite pattern was observed for IBS-related hospitalizations and endoscopy where costs were higher in women. Our findings are consistent with data from a survey study demonstrating that individuals with IBS who reported consulting a doctor were predominantly women.[24] However, the discordance gender disparities for all-cause vs. IBS-related hospitalizations and endoscopy could indicate that diagnostic evaluation for alternative (non-IBS conditions) may be more commonly pursued in men or that there are differences in the degree or level of comorbidities in men compared to women. Whether gender-associated care-seeking behaviors, differences in the management of men and women with IBS, or other clinician- or patient-related factors explain the impact of gender on IBS-related costs for hospitalizations or endoscopy warrants further probing.

Our study is novel as it is the first to examine the effects of race-gender interactions as well as interactions of race or gender with IBS subtypes on healthcare spending. We found gender disparities vary by race for certain outcomes including ED costs, rates of hospitalizations, and radiology costs. In Asian patients, men had significantly lower costs and rates of healthcare use than women. In contrast, White men had higher ED costs and rates of endoscopy than White women and Black men had higher hospitalizations rates then Black women. Gender disparities were pronounced in IBS-M and racial disparities were greatest for IBS-C. Our previous research indicated that healthcare spending is highest in IBS-C.[27] Others have demonstrated that hospitalizations and ED visits are major cost drivers for patients with IBS-C in Europe, which may involve a predominantly White population, though the study did not specify the racial distributions.[28] We were able delineate health disparities in the U.S. based by IBS subtype to find higher all-care and IBS-related costs in White patients than Asian and Hispanic patients but lower costs compared to Black patients within the IBS-C group. We observed notable differences in hospitalization costs by race as well as race/gender interactions for ED costs. Our findings suggest that racial disparities in IBS-C may be exacerbated by high inpatient or ED spending.

Limitations include possible misclassification of IBS patients or race due to reliance on claims-based data; lack of comprehensive clinical characteristics (e.g., symptom severity, duration of illness, diet); heterogeneity withing broad racial categories,[29] the possibility that some cost components included as IBS-related care could be related to other non-IBS GI diseases that share common features with IBS, and the inability to determine if radiology or endoscopic procedures were specifically performed for IBS since claims data may not reliably capture the direct indication for the test.[30] CDM includes only patients with commercial insurance or Medicare Advantage, limiting generalizability to uninsured individuals. We minimized these factors by requiring two separate ICD-10 codes for IBS verification as described by others,[31] restricting our cohort to those diagnosed after 2016 to reduce coding inconsistencies that may have occurred during the ICD-9 to ICD-10 transition,[1] identifying IBS-related care according to hallmark IBS features, and considering key confounders (e.g., demographics, socioeconomic status, education, comorbidities, other GI conditions). Ongoing evaluation of derivation methods will be needed to ensure that race and ethnicity data are accurate and reliable.

In summary, healthcare utilization and costs in patients with IBS differ by race/ethnicity and gender. We observed higher overall and IBS-related healthcare spending among women, but apart from hospitalizations and endoscopy, differences in IBS-related spending between men and women were small. Comparisons between racial groups demonstrated reduced overall and IBS-related spending among Asian and Hispanic patients, higher ED-related care and IBS-related spending in Black patients, and differences in how spending is distributed across services. Variations suggest differential biological and social effects of race/ethnicity and gender on care-seeking (i.e., use) and care-implementation (i.e., cost) in IBS. Importantly, the impact of gender is not uniform across racial groups. Further research is needed to understand these differences including variations across disaggregated racial/ethnic groups, address unique racial disparities in IBS care, and explore the interplay between race and gender on health outcomes in IBS.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Conflict of interest:

AS has served on the Ardelyx Scientific Communications Advisory Board for irritable bowel syndrome with constipation. LC has consulted with Ardelyx, Atmo, Bausch Health, Food Marble, Ironwood, Trellus Health and Vibrant. She has received research support from Arena, AnX Robotica, and Ironwood. She has stock options with Food Marble, ModifyHealth and Trellus Health. AC is a scientific advisor for Yamaha Motors Corporation and has received research support from Danone: Research and Innovation.

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Data Sharing Statement:

The datasets generated and analyzed during this study are available through requests made directly to Optum.

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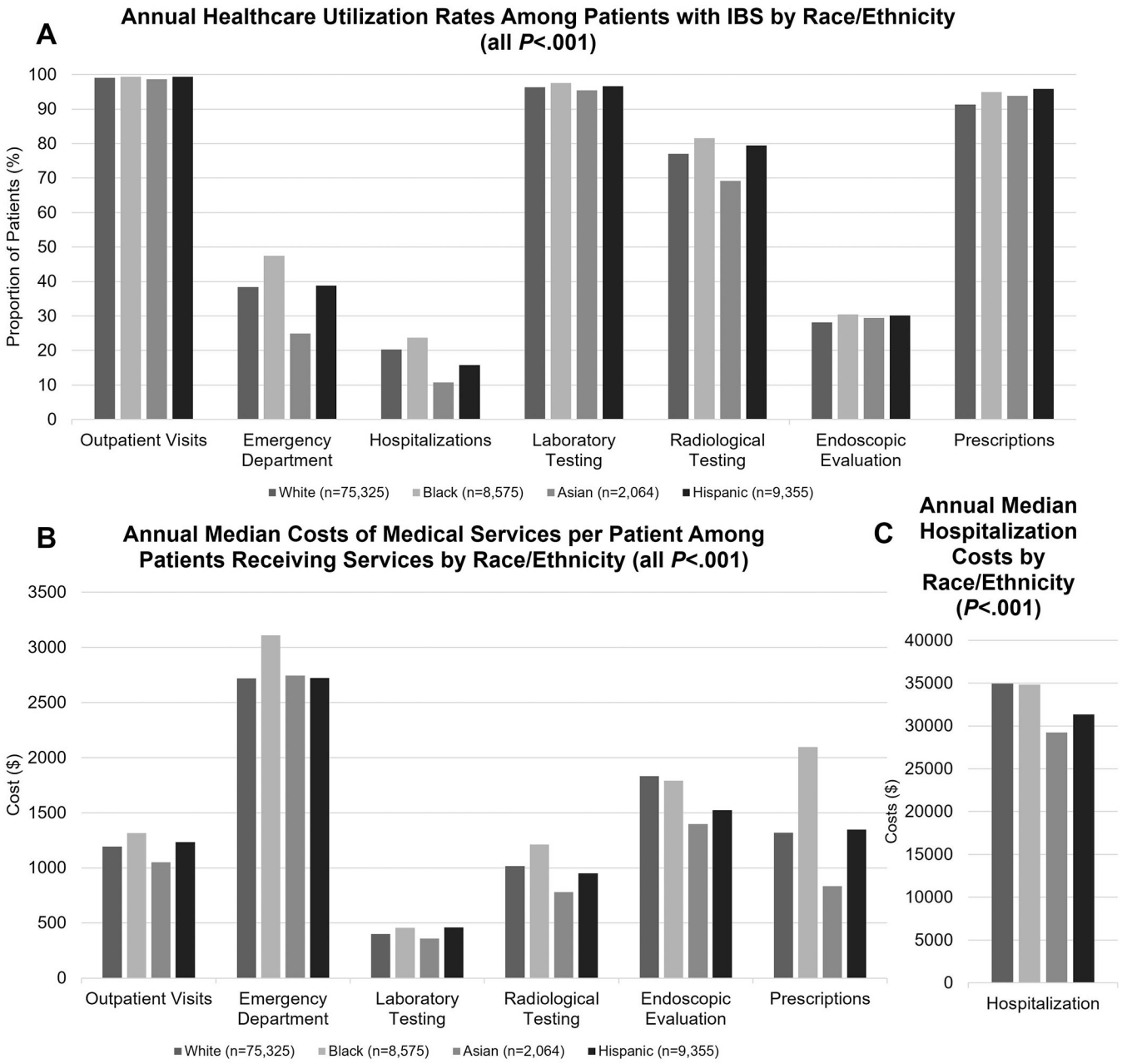

Figure 1:

Unadjusted All-Cause Healthcare Utilization Rates (A) and Median Costs (B and C) of Medical Services by Race/Ethnicity in Patients with Irritable Bowel Syndrome (IBS)

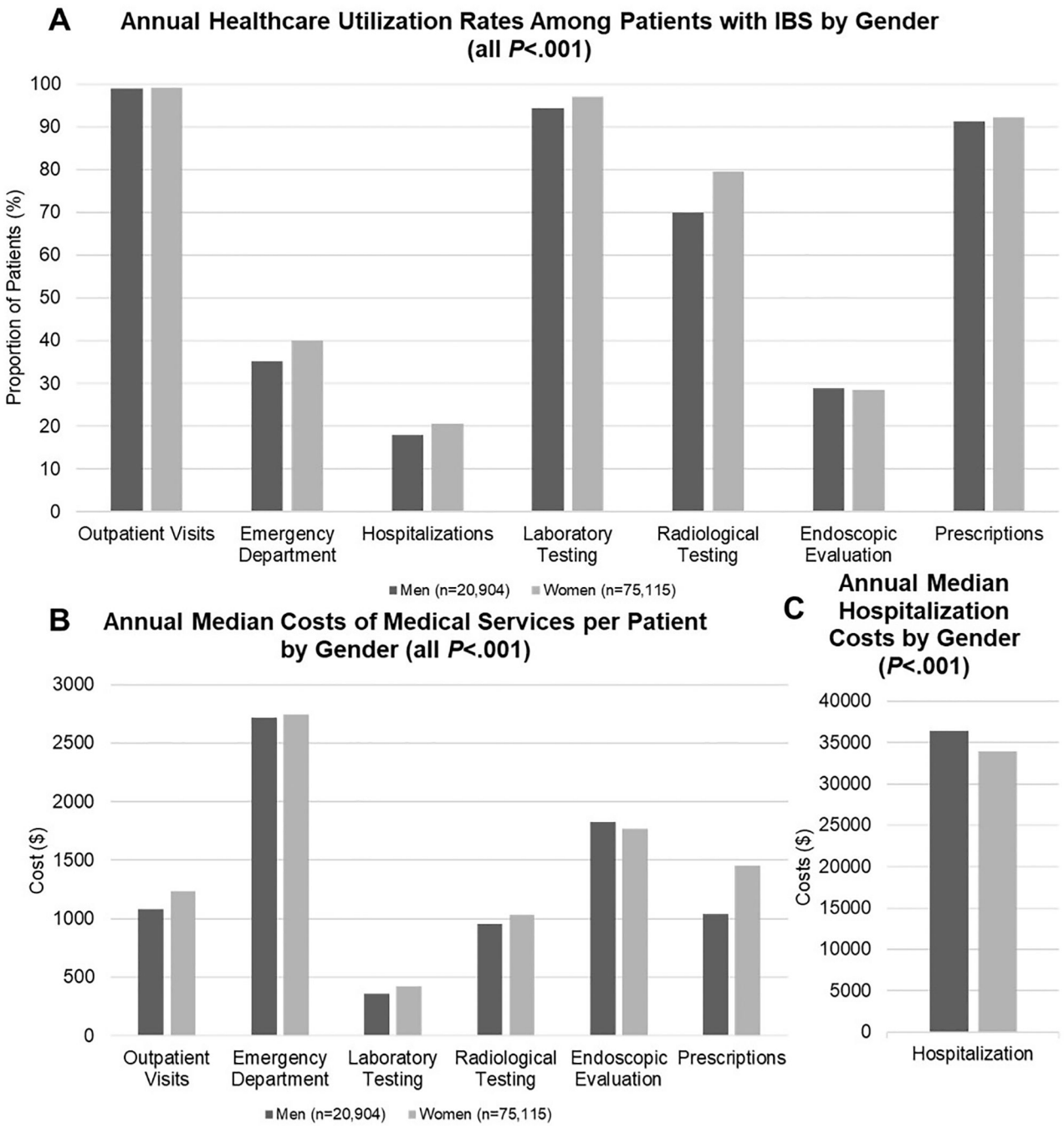

Figure 2:

Unadjusted All-Cause Healthcare Utilization Rates (A) and Median Costs (B and C) of Medical Services Among Men and Women with Irritable Bowel Syndrome (IBS)

Table 1:

Sample Characteristics by Race/Ethnicity in Adults with Irritable Bowel Syndrome (IBS)

	White (N = 75,325)	Black (N = 8,575)	Asian (N = 2,064)	Hispanic (N = 9,355)
IBS subtype				
IBS-C	16,317 (21.7%)	2,741 (32.0%)	462 (22.4%)	2,484 (26.6%)
IBS-D	25,642 (34.0%)	2,488 (29.0%)	627 (30.4%)	2,797 (29.9%)
IBS-M	13,446 (17.9%)	1,386 (16.2%)	316 (15.3%)	1,588 (17.0%)
IBS-U	19,920 (26.4%)	1,960 (22.9%)	659 (31.9%)	2,486 (26.6%)
Age (years), mean (SD)	60.7 (18.3)	61.1 (16.4)	55.7 (19.0)	59.9 (18.0)
Female	58,686 (77.9%)	7,091 (82.7%)	1,391 (67.4%)	7,247 (77.5%)
Census region				
Midwest	19,174 (25.5%)	1,273 (14.8%)	260 (12.6%)	626 (6.7%)
Northwest	9,908 (13.2%)	543 (6.3%)	389 (18.8%)	925 (9.9%)
South	30,974 (41.1%)	6,268 (73.1%)	720 (34.9%)	5,409 (57.8%)
West	15,269 (20.3%)	491 (5.7%)	695 (33.7%)	2,395 (25.6%)
Medicare Advantage	43,830 (58.2%)	5,673 (66.2%)	905 (43.8%)	5,487 (58.7%)
Education				
≤High School	14,721 (19.5%)	3,566 (41.6%)	248 (12.0%)	3,389 (36.2%)
<Bachelor's Degree	44,267 (58.8%)	4,366 (50.9%)	996 (48.3%)	4,819 (51.5%)
Bachelor's Degree+	16,337 (21.7%)	643 (7.5%)	820 (39.7%)	1,147 (12.3%)
Household income				
<$40K	18,276 (24.3%)	4,208 (49.1%)	319 (15.5%)	2,974 (31.8%)
$40K-$59K	11,535 (15.3%)	1,688 (19.7%)	269 (13.0%)	1,954 (20.9%)
$60K-$74K	8,459 (11.2%)	837 (9.8%)	228 (11.0%)	1,108 (11.8%)
$75K-$99K	12,426 (16.5%)	871 (10.2%)	319 (15.5%)	1,378 (14.7%)
$100K+	24,629 (32.7%)	971 (11.3%)	929 (45.0%)	1,941 (20.7%)
No. of children in household				
0	67,883 (90.1%)	7,978 (93.0%)	1,682 (81.5%)	8,316 (88.9%)
1–2	6,325 (8.4%)	514 (6.0%)	344 (16.7%)	896 (9.6%)
3+	1,117 (1.5%)	83 (1.0%)	38 (1.8%)	143 (1.5%)
Elixhauser sum of conditions, mean (SD)	3.1 (2.9)	4.0 (3.3)	2.5 (2.8)	3.4 (3.1)
Presence of other GI conditions*	5,041 (6.7%)	612 (7.1%)	128 (6.2%)	590 (6.3%)
Other comorbid conditions				
Migraine	6,213 (8.2%)	727 (8.5%)	113 (5.5%)	684 (7.3%)
Fibromyalgia	5,045 (6.7%)	697 (8.1%)	74 (3.6%)	609 (6.5%)
Anxiety	22,005 (29.2%)	2,448 (28.5%)	391 (18.9%)	2,385 (25.5%)

P-values are obtained based on Kruskal-Wallis test for continuous variables and Pearson's chi-square test for categorical variables. All P<.001 except for *presence of other gastrointestinal (GI) conditions (p=0.13). No.=number, SD=standard deviation, IBS-C=IBS with constipation, IBS-D=IBS with diarrhea, IBS-M=mixed IBS, IBS-U=IBS unsubtyped

Table 2:

Sample Characteristics by Gender in Adults with Irritable Bowel Syndrome (IBS)

	Women (N = 75,115)	Men (N = 20,904)
IBS subtype		
IBS-C	17,895 (24.0%)	4,109 (19.7%)
IBS-D	23,919 (32.1%)	7,635 (36.5%)
IBS-M	13,676 (18.4%)	3,060 (14.6%)
IBS-U	18,925 (25.4%)	6,100 (29.2%)
Age (years), mean (SD)	61.4 (17.7)	57.6 (19.2)
Race		
White	58,686 (78.9%)	16,639 (79.6%)
Black	7,091 (9.5%)	1,484 (7.1%)
Asian	1,391 (1.9%)	673 (3.2%)
Hispanic	7,247 (9.7%)	2,108 (10.1%)
Census region		
Midwest	16,647 (22.4%)	4,686 (22.4%)
Northwest	8,799 (11.8%)	2,966 (14.2%)
South	34,201 (46.0%)	9,170 (43.9%)
West	14,768 (19.8%)	4,082 (19.5%)
Medicare Advantage	45,362 (61.0%)	10,533 (50.4%)
Education		
≤High School	17,394 (23.4%)	4,530 (21.7%)
<Bachelor's Degree	42,765 (57.5%)	11,683 (55.9%)
Bachelor's Degree Plus	14,256 (19.2%)	4,691 (22.4%)
Household income		
<$40K	21,651 (29.1%)	4,126 (19.7%)
$40K-$59K	12,125 (16.3%)	3,321 (15.9%)
$60K-$74K	8,137 (10.9%)	2,495 (11.9%)
$75K-$99K	11,548 (15.5%)	3,446 (16.5%)
$100K+	20,954 (28.2%)	7,516 (36.0%)
Number of children in household		
0	67,752 (91.0%)	18,107 (86.6%)
1–2	5,728 (7.7%)	2,351 (11.2%)
3+	935 (1.3%)	446 (2.1%)
Elixhauser sum of conditions, mean (SD)	3.3 (3.0)	2.9 (3.0)
Presence of other gastrointestinal conditions *	4,938 (6.6%)	1,433 (6.9%)
Other comorbid conditions		
Migraine	6943 (9.3%)	794 (3.8%)
Fibromyalgia	6174 (8.3%)	251 (1.2%)
Anxiety	22845 (30.7%)	4384 (21.0%)

* p=ns; all other P<.001; P-values are obtained based on Wilcoxon rank sum test for continuous variables and Pearson's chi-square test for categorical variables. SD=standard deviation, IBS-C=IBS with constipation, IBS-D=IBS with diarrhea, IBS-M=mixed IBS, IBS-U=IBS unsubtyped

Table 3:

Parameter Estimates of Logistic and Quantile Regression for Comparisons of Healthcare Use and Spending by Racial/Ethnic Group in Adults with Irritable Bowel Syndrome (no significant interaction between gender and race/ethnicity)

	Total All-Cause Costs		**Total IBS-related Costs ($)**			
	Estimate (95% CI)	**p-value**	**Estimate (95% CI)**	**p-value**		
White	*reference*		*reference*			
Black	317.04 (−1,54.12, 788.20)	.19	138.92 (64.37, 213.47)	<.001		
Asian	−1,554.2 (−1,894.47, −1,214.01)	<.001	−135.23 (−194.66, −75.79)	<.001		
Hispanic	−1,450.6 (−1,736.69, −1,164.44)	<.001	−244.85 (−286.19, −203.51)	<.001		
	Likelihood of outpatient visits		**IBS-related outpatient costs ($)**			
	OR (95% CI)	**p-value**	**Estimate (95% CI)**	**p-value**		
White	*reference*		*reference*			
Black	1.0 (0.8, 1.4)	.79	7.93 (2.28, 13.57)	.006		
Asian	0.8 (0.5, 1.1)	.18	39.48 (29.28, 49.69)	<.001		
Hispanic	1.2 (0.9, 1.6)	.18	40.80 (35.14, 46.45)	<.001		
	Likelihood of ED visits		**No of ED visits**		**IBS-related ED costs ($)**	
	OR (95% CI)	**p-value**	**Estimate (95% CI)**	**p-value**	**Estimate (95% CI)**	**p-value**
White	*reference*		*reference*		*reference*	
Black	1.1 (1.1, 1.2)	<.001	0.1 (0.0, 0.2)	.001	1.68 (−16.71, 20.08)	.86
Asian	0.7 (0.6, 0.7)	<.001	0.0 (−0.1, 0.1)	.8	−2.61 (−22.18, 16.97)	.79
Hispanic	0.95 (0.91, 0.998)	.042	0.0 (−0.1, 0.0)	.1	−7.41 (−14.26, −0.55)	.034
	No. of Hospitalizations		**Hospitalization LOS (days)**			
	Estimate (95% CI)	**p-value**	**Estimate (95% CI)**	**p-value**		
White	*reference*		*reference*			
Black	0.0 (−0.03, 0.03)	.51	0.0 (−0.4, 0.4)	.97		
Asian	0.0 (−0.1, 0.0)	.22	−0.1 (−1.2, 0.9)	.81		
Hispanic	−0.1 (−0.11, −0.04)	<.001	−0.6 (−1.1, −0.2)	.008		
	Hospitalization costs ($)		**IBS-related hospitalization costs ($)**			
	Estimate (95% CI)	**p-value**	**Estimate (95% CI)**	**p-value**		
White	*reference*		*reference*			

Black	−777.24 (−2640.05, 1,085.57)	.41	−101.97 (−1700.85, 1496.91)	.9		
Asian	−3346.4 (−6865.16, 172.36)	.062	−4086.0 (−6928.58, −1243.45)	.005		
Hispanic	−1936.8 (−3702.91, −170.67)	.032	−4272.8 (−5184.26, −3361.28)	<.001		
	Likelihood of Labs		**Lab costs ($)**		**IBS-related lab costs ($)**	
	OR (95% CI)	**p-value**	**Estimate (95% CI)**	**p-value**	**Estimate (95% CI)**	**p-value**
White	*reference*		*reference*		*reference*	
Black	1.2 (1.0, 1.3)	.89	4.59 (−8.26, 17.44)	.48	1.61 (0.72, 2.49)	<.001
Asian	1.1 (0.9, 1.3)	<.001	−14.72 (−37.11, 7.66)	.2	0.04 (−0.49, 0.57)	.89
Hispanic	1.1 (1.0, 1.2)	<.001	42.48 (28.85, 56.11)	<.001	−0.21 (−0.43, 0.00)	.052
	Likelihood of Radiology		**IBS-related radiology costs ($)**			
	OR (95% CI)	**p-value**	**Estimate (95% CI)**	**p-value**		
White	*reference*		*reference*			
Black	1.034 (0.97, 1.100)	.3	38.19 (10.56, 65.81)	.007		
Asian	0.863 (0.78, 0.954)	.004	1.96 (−13.48, 17.39)	.8		
Hispanic	1.110 (1.05, 1.175)	<.001	−14.34 (−22.88, −5.81)	<.001		
	Endoscopy costs ($)		**IBS-related endoscopy costs ($)**			
	Estimate (95% CI)	**p-value**	**Estimate (95% CI)**	**p-value**		
White	*reference*		*reference*			
Black	−70.65 (−123.08, −18.22)	.008	−71.23 (−163.57, 21.11)	.13		
Asian	−291.49 (−422.01, −160.96)	<.001	−318.55 (−454.41, −182.69)	<.001		
Hispanic	−177.18 (−228.40, −125.96)	<.001	−206.62 (−289.26, −123.98)	<.001		
	Prescription use		**Prescription costs ($)**		**IBS-related prescription costs ($)**	
	OR (95% CI)	**p-value**	**Estimate (95% CI)**	**p-value**	**Estimate (95% CI)**	**p-value**
White	*reference*		*reference*		*reference*	
Black	1.406 (1.27, 1.559)	<.001	159.85 (95.16, 224.55)	<.001	4.60 (2.72, 6.49)	<.001
Asian	1.282 (1.07, 1.543)	.008	−74.08 (−133.96, −14.21)	.015	0.35 (−0.43, 1.13)	.38
Hispanic	1.657 (1.49, 1.844)	<.001	−76.59 (−116.11, −37.06)	<.001	1.05 (0.24, 1.85)	.011

Table 4:

Parameter Estimates of Logistic and Quantile Regression for Comparisons of Healthcare Use and Spending By Gender in Adults with Irritable Bowel Syndrome (no significant interaction between gender and race/ethnicity)

	Total Costs ($)		**IBS-related Costs ($)**			
	Estimate (95% CI)	**p-value**	**Estimate (95% CI)**	**p-value**		
Women	*reference*		*reference*			
Men	−489.06 (−689.04, −289.08)	<.001	−74.79 (−105.22, −44.36)	<.001		
	Presence of outpatient visits		**IBS-related outpatient costs ($)**			
	OR (95% CI)	**p-value**	**Estimate (95% CI)**	**p-value**		
Women	*reference*		*reference*			
Men	0.7 (0.6, 0.8)	<.001	5.54 (1.31, 9.77)	.01		
	Likelihood of ED visits		**No. of ED visits**		**IBS-related ED costs ($)**	
	OR (95% CI)	**p-value**	**Estimate (95% CI)**	**p-value**	**Estimate (95% CI)**	**p-value**
Women	*reference*		*reference*		*reference*	
Men	1.0 (0.9, 1.0)	.14	0.03 (0.01, 0.06)	.003	−4.87 (−12.47, 2.72)	.21
	No. of Hospitalizations		**Hospitalization LOS (days)**			
	Estimate (95% CI)	**p-value**	**Estimate (95% CI)**	**p-value**		
Women	*reference*		*reference*			
Men	0.00 (−0.03, 0.03)	.91	−0.2 (−0.5, 0.1)	.2		
	Hospitalization costs ($)		**IBS-related hospitalization costs ($)**			
	Estimate (95% CI)	**p-value**	**Estimate (95% CI)**	**p-value**		
Women	*reference*		*reference*			
Men	1,476.95 (189.90, 2,763.99)	.025	−2032.8 (−2868.17, −1197.40)	<.001		
	Likelihood of Labs		**Lab costs ($)**		**IBS-related lab costs ($)**	
	OR (95% CI)	**p-value**	**Estimate (95% CI)**	**p-value**	**Estimate (95% CI)**	**p-value**
Women	*reference*		*reference*		*reference*	
Men	0.61 (0.57, 0.66)	<.001	−35.81 (−44.29, −27.33)	<.001	−0.15 (−0.33, 0.04)	.11
	Likelihood of Radiology		**IBS-related radiology costs ($)**			
	OR (95% CI)	**p-value**	**Estimate (95% CI)**	**p-value**		
Women	*reference*		*reference*			

Men	0.72 (0.69, 0.75)	<.001	−5.17 (−10.89, 0.54)	.076		
	Endoscopy costs ($)		**IBS-related endoscopy costs ($)**			
	Estimate (95% CI)	**p-value**	**Estimate (95% CI)**	**p-value**		
Women	*reference*		*reference*			
Men	53.42 (18.21, 88.63)	.003	−33.77 (−98.32, 30.78)	.31		
	Prescription use		**Prescription costs ($)**		**IBS-related prescription costs ($)**	
	OR (95% CI)	**p-value**	**Estimate (95% CI)**	**p-value**	**Estimate (95% CI)**	**p-value**
Women	*reference*		*reference*		*reference*	
Men	0.85 (0.80, 0.91)	<.001	−74.15 (−98.23, −50.06)	<.001	1.03 (0.63, 1.43)	<.001