Predictors of High Health Care Utilization in Patients With Inflammatory Bowel Disease Within 1 Year of Establishing Specialist Care

Kenechukwu Chudy-Onwugaje, MBBS, MPH, Alexander P. Mamunes, MD,† David A. Schwartz, MD,‡ Sara Horst, MD,‡ and Raymond K. Cross, MD, MS**

Background: A small proportion of patients with inflammatory bowel disease (IBD) consume a disproportionate amount of health care resources, with most of these spent on unplanned care in emergency room (ER) and hospital visits. Interventions in those at high risk in the outpatient setting could reduce the need for future inpatient care. We sought to describe the characteristics predictive of high health care utilization within 1 year after an initial IBD clinic encounter.

Methods: This was a retrospective study of new IBD patients seen at the outpatient clinics of 2 tertiary IBD centers in the United States. Baseline sociodemographic and clinical characteristics were collected, and the number of IBD-related ER and hospital visits were recorded over the 1-year period after the initial clinic encounter. Patients with ≥2 visits (high utilizers) were compared with those with no visits.

Results: Of the 735 patients included in the final analysis, 106 (14.4%) were high utilizers, and they had a mean of 2.9 visits (maximum = 10) in the 1 year after their initial encounter. In multivariate analysis, insurance coverage through medical assistance (odds ratio [OR] 3.57; 95% confidence interval [CI], 1.38–9.20), steroid use (OR 1.83; 95% CI, 1.11–3.04), short inflammatory bowel disease questionnaire score <50 (OR 2.29; 95% CI, 1.23–4.27), and current ostomy (OR 4.82; 95% CI, 1.51–15.37) were independently associated with high utilization.

Conclusions: Multidisciplinary care and resources should be preferentially channeled towards new clinic patients with severe disease and on medical assistance, as this could reduce future inpatient visits and result in cost savings.

Key Words: health care utilization, inflammatory bowel disease, emergency room visit, hospitalization, costs

INTRODUCTION

Inflammatory bowel disease (IBD), comprised of Crohn's disease (CD) and ulcerative colitis (UC), is a chronic gastrointestinal condition that exerts a significant burden on health care spending.[1] Affected patients have a higher than average rate of emergency room (ER) visits and hospitalizations, and the direct cost associated with IBD in the United States (US) has continued to rise over the last 2 decades.[2] A recent study using administrative claims data revealed that the annual mean health care cost for a patient with IBD was more than 3 times higher than that for an individual without IBD ($23,000 vs $7000).[3] Costs were highest within the first year after initial diagnosis, and the greatest contributors to spending included ER visits and hospitalizations. Among IBD patients, a small fraction consumes a disproportionate amount of resources.[4] Upon comparison of financial charges in a registry analysis at a tertiary US center, researchers found that the median charge in the high charge group was $691,081 compared with $14,322 in the median charge group.[5]

A proportion of the hospitalizations and ER visits that occur within a short span after establishment of IBD care are arguably preventable, and a reduction in unplanned care could potentially lead to better health outcomes and major health care savings. An understanding of the characteristics that predispose to ER and hospital visits after an initial encounter with a provider is vital, as it can inform the triage, assessment, and care plan for IBD patients. With appropriate risk stratification, identification of high utilizers, and preemptive deployment of multidisciplinary resources, the likelihood of future ER and hospital visits could be reduced.

The purpose of this study was to identify the baseline sociodemographic and clinical factors associated with an increased risk of ER visits and hospitalizations within 1 year of an initial encounter in new patients presenting to the outpatient

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From the *Division of Gastroenterology and Hepatology, Department of Medicine, University of Maryland School of Medicine, Baltimore, MD; †Department of Medicine, Vanderbilt University, Nashville, TN; ‡Division of Gastroenterology, Hepatology and Nutrition, Department of Medicine, Vanderbilt University, Nashville, TN

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Address correspondence to: Raymond K. Cross, MD, MS, 685 West Baltimore Street, Suite 8-00, Baltimore, MD 21201, USA. E-mail: rcross@som.umaryland.edu.

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IBD practices of 2 tertiary referral centers in the United States. Although there is a large body of research on health care utilization and financial charges in various contexts in IBD, there is a gap in our understanding of the baseline patient-level factors that predict health care use immediately after a new outpatient encounter—a period during which interventions can potentially lead to a reduction in the future need for unplanned care.[6–11] We hypothesized that patients with severe disease and psychiatric comorbidities would be more likely to utilize the ER or require hospitalization within 1 year of a first clinic encounter.

METHODS

Design and Study Population

This was a retrospective study of new patients who were seen in the adult outpatient IBD practices at the University of Maryland Medical School of Medicine in Baltimore, Maryland, and at Vanderbilt University Medical Center in Nashville, Tennessee. Patients (aged 16 years or older) with an established diagnosis of IBD based on standard clinical, endoscopic, radiographic, and pathologic criteria, and who had a first clinic visit at either of the 2 centers between November 1, 2012, and December 31, 2015, were eligible for inclusion.[12] The sources of referral included surrounding hospitals, primary care and gastroenterology practices, and self-referral. The primary providers that saw these patients in the practices at both institutions were board-certified gastroenterologists who specialized mainly in the care of IBD patients. Allied clinical staff that also interacted with patients during their visits included gastroenterology fellows, advanced practice providers, psychologists, social workers, nurses, pharmacists, and dieticians. The study cohort was finalized after a manual review of the electronic health records of eligible participants. Those with incomplete information on diagnoses and those with an alternate diagnosis, such as microscopic, ischemic, or infectious colitis, were excluded from the study.

Data Collection

The baseline clinical and sociodemographic data of study participants were extracted from the electronic medical record and entered into a secure electronic database. Information was collected on age, sex, race, and ethnicity. Details on health insurance status were obtained, with patients either having no insurance or having coverage through a commercial provider, Medicare, or via a medical assistance program (enrolled in Medicaid). Clinical data were obtained on IBD type, comorbid conditions, smoking history, disease duration, family history of IBD, and disease phenotype as per the Montreal classification.[13] Information was also collected on IBD-related surgery, history of *Clostridioides difficile* infection, extraintestinal manifestations, and current narcotic and IBD-related medication use. Crohn's disease and UC disease activity were assessed with the Harvey-Bradshaw Index (HBI) and the Simple Clinical Colitis Activity Index (SCCAI), respectively, and relevant baseline laboratory markers such as C-reactive protein (CRP) were recorded.[14, 15] Depression was assessed using the Patient Health Questionnaire 9 (PHQ9); a score of 10 or greater was considered to represent moderate to severe depression.[16] Disease-specific quality of life (QoL) was measured with the Short Inflammatory Bowel Disease Questionnaire (SIBDQ).[17] Resting heart rate and body mass index (BMI) at the initial clinical encounter were also recorded.

Measurement of Health Care Utilization

We measured health care utilization by the total number of IBD-related emergency room visits and/or hospitalizations in the 12-month period after a patient's first visit to the practice. Medical records of all patients were manually reviewed, and ER and hospital visits were recorded. Visits were considered to be IBD-related if IBD diagnoses were listed as a primary or secondary diagnosis. Using electronic records, we were able to reliably measure outcomes for each patient by accessing their data at multiple hospitals within the larger health care systems of both medical centers. Statewide and multistate health information exchanges shared with neighboring states were also interrogated. Patients who may have sought care at distant medical institutions were identified on manual review of clinic notes from their subsequent visits.

A combined tally of ER visits and hospital admissions was kept for each patient, and based on this, the study population was divided into 3 health care utilization groups. Those in the high utilization group had a total of 2 or more ER visits and/or hospital admissions in the 12-month period after the first clinic visit, whereas those in the low utilization group had no visits. An intermediate utilization group was made up of patients with only 1 visit.

Statistical Analysis

Predictors of high health care utilization were evaluated by comparing those in the high utilization group with those in the low utilization group. Subjects in the intermediate group were excluded from analysis. Baseline characteristics were compared between subjects in the high and low utilization groups. Categorical variables were expressed as proportions, and the mean and standard deviation (SD) were estimated for continuous variables. Comparisons were made between the high and low utilization groups using the Student t test and the Pearson χ^2 test for continuous and categorical variables, respectively. Univariate logistic regression was conducted to determine the factors associated with high health care utilization. Variables with $P < 0.10$ were included in a multivariate logistic regression model to determine the factors that were independently associated with high health care utilization. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated for these factors.

The primary multiple regression model included 735 IBD patients and evaluated various baseline sociodemographic and clinical characteristics for their association with increased health care utilization. The final multivariate model included insurance status, BMI, IBD type (CD, UC), personal history of IBD-related surgery, current ostomy, history of *C. difficile* infection, presence of moderate to severe depression, poor quality of life score, tachycardia at the clinic visit, CRP, and the current use of steroids, antibiotics, and narcotics. Subsequently, regression models were constructed for UC and CD patients separately. There were 454 CD patients, and the final multivariate CD model included insurance coverage, smoking status, CD phenotype (inflammatory, stricturing, penetrating), family history of IBD, history of *C. difficile* infection, poor quality of life score, HBI score, CRP, and the use of steroids and narcotics. There were 281 UC patients, and the final UC multivariate model included BMI, age, UC location (left-sided, extensive), history of *C. difficile* infection, poor quality of life score, tachycardia at the initial clinic visit, presence of moderate to severe depression, and antibiotic use. All statistical analyses were performed using SAS 9.3 for Windows (SAS Institute Inc., Cary, NC), and P values <0.05 were considered statistically significant.

Ethical Considerations

The study was approved by the institutional review boards at both study sites.

RESULTS

Study Population

In total, 735 IBD patients were included in the final analysis. Ninety-seven patients were excluded because they were in the intermediate utilization group. Among the patients included in the final analysis, 625 (85%) were white, and 414 (56%) were women (Table 1). The mean age was 38.2 years (SD 15.2), and mean BMI was 26.3 (SD 6.5). There were 454 (62%) patients with Crohn's disease, and the mean disease duration was 9.7 years (SD 10.3). Previous IBD-related surgery was recorded in 170 subjects (23%), and 20 (3%) had an active ostomy at the time of the initial office visit. Fifteen percent (n = 108) of patients reported a history of IBD in a first-degree relative. Mean CRP was 11.7 (SD 20.6).

Of the 454 patients with CD, 265 (58%) were women, 51 (11%) were current smokers, and 81 (18%) were former smokers. Among those with known extent of CD involvement, there was ileal, ileocolonic, and colonic disease in 147 (35%), 181(42%) and 100 (23%) subjects, respectively. Only 78 (17%) CD patients had perianal disease. The mean HBI score was 5.4 (SD 5.4). In the subset of patients with UC (n = 281), women constituted 53% of the population (n = 149), and disease involvement was extensive in 40% (n = 113). Mean SCCAI was 5.3 (SD 4.9).

Health Care Utilization in all IBD Patients

Fourteen percent (n = 106) of the study population was in the high utilization group, and this population had a mean of 2.9 ER and/or hospital admissions over the 12-month study period. Thirteen subjects within the high utilization group (12.3%) were super-users, having between 5 and 10 ER and/or hospital admissions. Upon comparison of the high utilization with the low utilization group, there were no differences in age, race, or gender distribution. However, those in the high utilization group were more likely to have Crohn's disease (74.5% vs 59.6%, P = 0.004), a history of cigarette use (37.7% vs 25.4%, P = 0.008), BMI <18.5 (13.2% vs 5.9%, P = 0.02), and health insurance coverage through a medical assistance program (11.4% vs 2.4%, P = 0.0001). Additionally, significantly more patients in the high utilization group were on narcotics (36.2% vs 15.7%, P < 0.0001), steroids (43.3% vs 29.4%, P = 0.004), and antibiotics (16.2% vs 8.5%, P = 0.013) at baseline. Moderate to severe depression was more prevalent in the high utilization group (44.3% vs 26.4%, P = 0.0002), and they were more likely to have had *Clostridium difficile* infection in the past (15.1% vs 6.9%, P = 0.004). Additionally, they had higher CRP levels (P < 0.0001), worse disease activity scores (HBI, P = 0.008; SCCAI, P < 0.0001), and poor IBD-specific quality of life (SIBDQ, P < 0.0001). They also had a greater likelihood of having tachycardia (heart rate >100/min) at their first clinic visit (P = 0.0009).

In the multivariable model adjusting for insurance coverage, BMI, IBD type, IBD-related surgery, current ostomy, history of *C. difficile* infection, quality of life scores, presence of depression, tachycardia, medications (steroids, narcotics, and antibiotics), CRP, steroid use (OR 1.83; 95% CI, 1.11–3.04; P = 0.02), poor IBD-specific QoL (SIBDQ <50; OR 2.29; 95% CI, 1.23–4.27; P = 0.004), current ostomy (OR 4.82; 95% CI, 1.51–15.37; P = 0.008), and health insurance coverage through a medical assistance program (OR 3.57; 95% CI, 1.38–9.20; P = 0.008) were independently associated with high health care utilization (Table 2). On the other hand, obesity (BMI >30; OR 0.46; 95% CI, 0.23–0.89; P = 0.02) protected against high health care utilization.

Health Care Utilization in Patients with CD

For patients with CD, there was no difference between the high and low utilization groups with respect to age, gender, and race. Disease location was not associated with high utilization (P = 0.32). In comparison with the inflammatory phenotype, CD patients with stricturing (27.3% vs 16.7%, P = 0.01) and penetrating (18.2% vs 11.5%, P = 0.04) disease behavior were more likely to have high utilization. Additionally, narcotic use (P < 0.0001), steroid use (P = 0.002), poor IBD-specific QoL (P = 0.001), health insurance coverage through medical assistance (P < 0.0001), HBI score of greater than or equal to 4 (P = 0.03), a history of *C. difficile* infection (P = 0.04), and

TABLE 1. Baseline Demographics, Comorbidities, Disease, and Clinical Characteristics of Study Cohort of 735 IBD Patients by Health Care Utilization Group

	High Utilizers (n = 106)	Low Utilizers (n = 629)	*P*
Sex, n (%)			0.57
Female	57 (53.8)	357 (56.8)	
Male	49 (46.2)	272 (43.2)	
Age group in years, n (%)			0.66
16–30	43 (40.6)	226 (35.9)	
31–50	41 (38.7)	264 (42.0)	
51 and older	22 (20.7)	139 (22.1)	
Race, n (%)			0.51
White	91 (85.9)	534 (84.9)	
Black	11 (10.4)	53 (8.4)	
Asian	2 (1.9)	7 (1.1)	
Hispanic	1 (0.9)	14 (2.2)	
Other/unknown	1 (0.9)	21 (3.4)	
Insurance coverage, n (%)			0.0001
Commercial	81 (77.1)	508 (89.3)	
Medicare	11 (10.5)	42 (7.4)	
Medical assistance	12 (11.4)	14 (2.4)	
None	1 (1.0)	5 (0.9)	
Smoking status, n (%)			0.04
Never smoked	66 (62.3)	464 (74.0)	
Former smoker	28 (26.4)	111 (17.7)	
Current smoker	12 (11.3)	52 (8.3)	
Body mass index, n (%)			0.02
<18.5	14 (13.2)	37 (5.9)	
18.5–24.9	47 (44.3)	256 (40.7)	
25.0–29.9	26 (24.5)	191 (30.4)	
30 and greater	19 (18.0)	145 (23.0)	
Comorbidities, n (%)			
Hypertension	19 (17.9)	96 (15.3)	0.49
Cardiac disease	8 (7.5)	58 (9.2)	0.58
Diabetes mellitus	5 (4.7)	26 (4.1)	0.89
Psychiatric disease	27 (25.5)	121 (19.3)	0.14
Disease type, n (%)			0.004
Crohn's disease	79 (74.5)	375 (59.6)	
Ulcerative colitis	27 (25.5)	254 (40.4)	
Disease duration in years, mean (SD)	8.9 (7.8)	9.2 (9.6)	0.88
Crohn's disease location, n (%)			0.32
Ileal	31 (41.9)	116 (32.8)	
Ileocolonic	28 (37.8)	153 (43.2)	
Colonic	15 (20.3)	85 (24.0)	
Upper GI involvement in Crohn's, n (%)	11 (14.3)	44 (11.9)	0.55
Perianal disease in CD, n (%)	17 (21.7)	61 (16.3)	0.25
Crohn's disease behavior, n (%)			0.012
Inflammatory	42 (54.5)	263 (71.9)	
Stricturing	21 (27.3)	61 (16.7)	
Penetrating	14 (18.2)	42 (11.4)	
Ulcerative colitis, extent, n (%)			0.13

TABLE 1. Continued

	High Utilizers (n = 106)	Low Utilizers (n = 629)	*P*
Proctitis	0	26 (11.9)	
Left-sided	7 (35.0)	93 (42.5)	
Extensive	13 (65.0)	100 (45.7)	
Extraintestinal manifestation, n (%)	44 (41.5)	235 (37.4)	0.41
IBD in first degree relative	19 (18.4)	89 (14.8)	0.35
History of IBD-related surgery, n (%)	33 (31.1)	137 (21.8)	0.03
Current ostomy, n (%)	10 (10.1)	10 (1.8)	<0.0001
Current IPAA, n (%)	4 (4.0)	19 (3.4)	0.73
History of *C. difficile* infection, n (%)	16 (15.1)	43 (6.9)	0.004
Current medications, n (%)			
Aminosalicylates	38 (36.5)	257 (40.9)	0.39
Steroids	46 (43.3)	185 (29.4)	0.0041
Biologics	36 (34.0)	208 (33.1)	0.86
Immunomodulators	26 (24.5)	124 (19.7)	0.25
Antibiotics	17 (16.2)	53 (8.5)	0.013
Narcotics	38 (36.2)	98 (15.7)	<0.0001
PHQ-9 score at first visit, n (%)			0.0002
<10 (none to mild depression)	59 (55.7)	463 (73.6)	
≥10 (moderate to severe depression)	47 (44.3)	166 (26.4)	
SIBDQ score at first visit, n (%)			<0.0001
<50	86 (81.1)	369 (58.7)	
≥50	20 (18.9)	260 (41.3)	
Tachycardia (Heart rate > 100/min) at initial visit, n (%)	22 (20.8)	61 (9.7)	0.0009
C-reactive protein, mean (SD)	23.4 (29.9)	10.0 (18.3)	<0.0001
Serum albumin, g/dL			0.58
<3.5	34 (32.1)	219 (34.8)	
3.5 and greater	72 (67.9)	410 (65.2)	
Disease activity scores, mean (SD)			
HBI	6.9 (6.7)	5.0 (5.2)	0.008
SCCAI	9.9 (6.5)	4.8 (4.5)	<0.0001

Abbreviations: GI, gastrointestinal; IQR, interquartile range

former cigarette use ($P = 0.003$) were associated with high utilization in CD. In the multivariable model adjusting for insurance coverage, smoking status, disease phenotype, family history of IBD, history of *C. difficile* infection, CRP, HBI score, medications (narcotics and steroids), quality of life score, narcotic use (OR 2.40; 95% CI, 1.25–4.59; $P = 0.009$), steroid use (OR 2.18; 95% CI, 1.20–3.94; $P = 0.01$), poor IBD-specific QoL (OR 2.08; 95% CI, 1.01–4.29; $P = 0.046$), CRP >3 (OR 2.11; 95% CI, 1.14–3.89; $P = 0.017$), insurance coverage through a medical assistance program (OR 5.03; 95% CI, 1.79–14.12; $P = 0.002$), former smoking (OR 2.18; 95% CI, 1.05–4.52; $P = 0.04$), and penetrating (OR 3.60; 95% CI, 1.56–8.26; $P = 0.003$) and stricturing (OR 3.40; 95% CI, 1.66–6.97; $P < 0.001$) disease phenotypes were independently associated with high health care utilization in CD patients (Table 3).

Health Care Utilization in Patients with UC

Among patients with UC, there was no significant difference in age, gender, race, insurance coverage, smoking status, or disease duration between the 2 utilization groups. On univariate analysis, moderate to severe depression ($P < 0.0001$), a history of *C. difficile* infection ($P = 0.015$), poor IBD-specific quality of life ($P = 0.006$), resting heart rate >100/min at initial clinic visit ($P = 0.0002$), and current antibiotic use ($P = 0.001$) were associated with high health care utilization. In the multivariable model adjusting

TABLE 2. Univariate and Multiple Logistic Regression of Utilization Using Demographic, Disease, and Clinical Characteristics as Predictors of Utilization Among Cohort of 735 IBD Patients

	Univariate Analysis		Multivariate Analysis	
	Odds Ratio (95% CI)	***P***	**Odds Ratio (95%)**	***P***
Female sex	0.89 (0.59–1.34)	0.57	—	—
Age group				
16–30	Ref	Ref		
31–50	0.82 (0.51–1.29)	0.39	—	—
>50	0.83 (0.48–1.45)	0.52		
Race				
White	Ref	Ref		
Black	1.22 (0.61–2.42)	0.57	—	—
Asian	1.68 (0.34–8.19)	0.52		
Hispanic	0.42 (0.05–3.23)	0.40		
Other/unknown	0.28 (0.04–2.10)	0.22		
Insurance coverage				
Commercial	Ref	Ref	Ref	Ref
Medicare	1.64 (0.81–3.32)	0.17	1.29 (0.57–2.91)	0.54
Medical assistance	5.38 (2.40–12.0)	<0.0001	3.57 (1.38–9.20)	0.008
None	1.25 (0.14–10.87)	0.84	1.21 (0.12–11.99)	0.87
Body mass index				
Normal (18.5–24.9)	Ref	Ref	Ref	Ref
Underweight (<18.5)	2.06 (1.03–4.11)	0.04	1.19 (0.48–2.90)	0.71
Overweight (25.0–29.9)	0.74 (0.44–1.24)	0.25	0.67 (0.37–1.20)	0.18
Obese (>30)	0.71 (0.40–1.26)	0.25	0.46 (0.23–0.89)	0.02
Disease type				
Ulcerative colitis	Ref	Ref	Ref	Ref
Crohn's disease	1.98 (1.24–3.15)	0.0039	1.69 (0.95–3.01)	0.07
IBD-related surgery	1.62 (1.03–2.55)	0.03	0.94 (0.51–1.72)	0.84
IBD in first degree relative	1.29 (0.75–2.24)	0.35	—	—
Current ostomy	6.20 (2.51–15.32)	<0.0001	4.82 (1.51–15.37)	0.008
History of C. difficile infection	2.42 (1.31–4.47)	0.004	1.84 (0.86–3.96)	0.12
Current medications, n (%)				
Aminosalicylates	0.83 (0.54–1.27)	0.39	—	—
Steroids	1.84 (1.21–2.80)	0.004	1.83 (1.11–3.04)	0.02
Biologics	1.04 (0.67–1.61)	0.86	—	—
Immunomodulators	1.32 (0.82–2.15)	0.25	—	—
Antibiotics	2.08 (1.16–3.76)	0.013	1.21 (0.59–2.48)	0.60
Narcotics	3.05 (1.94–4.79)	<0.0001	1.70 (0.94–3.06)	0.08
Moderate to severe depression	2.22 (1.46–3.39)	0.0002	1.02 (0.58–1.78)	0.94
Poor Quality of life (SIBDQ <50)	3.03 (1.82–5.05)	<0.0001	2.29 (1.23–4.27)	0.009
Tachycardia (Heart rate>100/min)	2.44 (1.42–4.18)	0.0012	1.72 (0.88–3.35)	0.11
Elevated C-reactive protein (>3)	1.68 (1.09–2.59)	0.018	1.45 (0.87–2.43)	0.16
Hypoalbuminemia (< 3.5)	0.88 (0.57–1.37)	0.58	—	—

Abbreviation: HR, heart rate

for age, BMI, disease extent, history of *C. difficile* infection, quality of life score, tachycardia, depression, and antibiotic use, moderate to severe depression (OR 6.69; 95% CI, 1.97–22.67; $P = 0.002$), a history of *C. difficile* infection (OR 4.68; 95% CI, 1.25–17.47; $P = 0.022$), and resting tachycardia during the baseline clinic visit (OR 5.89; 95% CI, 1.50–23.13; $P = 0.01$) were independently associated with high health care utilization (Table 4).

TABLE 3. Univariate and Multiple Logistic Regression of Utilization Using Demographic, Disease, and Clinical Characteristics as Predictors of Utilization Among Cohort of 454 Patients with Crohn's Disease

	Univariate Analysis		Multivariate Analysis	
	Odds Ratio (95% CI)	***P***	**Odds Ratio (95%)**	***P***
Female sex	0.77 (0.48–1.26)	0.30	—	—
Age group				
16–30	Ref	Ref		
31–50	1.04 (0.61–1.78)	0.87	—	—
>50	0.89 (0.44–1.81)	0.75		
Race				
White	Ref	Ref		
Black	1.24 (0.59–2.61)	0.58	—	—
Asian	2.35 (0.42–13.09)	0.33		
Hispanic	0.59 (0.07–4.77)	0.62		
Other/unknown	NA	NA		
Insurance coverage				
Commercial	Ref	Ref	Ref	Ref
Medicare	1.92 (0.85–4.32)	0.12	1.12 (0.42–2.99)	0.82
Medical assistance	6.38 (2.63–15.49)	<0.0001	5.03 (1.79–14.12)	0.002
None	1.77 (0.18–17.36)	0.62	1.27 (0.11–15.00)	0.85
Smoking status				
Never smoked	Ref	Ref	Ref	Ref
Former smoker	2.42 (1.36–4.31)	0.003	2.18 (1.05–4.52)	0.04
Current smoker	1.68 (0.80–3.51)	0.17	1.02 (0.42–2.45)	0.97
Body mass index				
Normal (18.5–24.9)	Ref	Ref		
Underweight (<18.5)	1.75 (0.74–4.14)	0.19	—	—
Overweight (25.0–29.9)	0.76 (0.42–1.39)	0.38		
Obese (>30)	0.71 (0.37–1.37)	0.30		
Crohn's disease location				
Ileal	Ref	Ref		
Colonic	0.66 (0.34–1.29)	0.23	—	—
Ileocolonic	0.68 (0.39–1.21)	0.19		
Disease behavior				
Inflammatory	Ref	Ref	Ref	Ref
Stricturing	2.15 (1.19–3.89)	0.01	3.40 (1.66–6.97)	<0.001
Penetrating	2.08 (1.05–4.13)	0.04	3.60 (1.56–8.26)	0.003
IBD-related surgery	1.46 (0.88–2.41)	0.14	—	—
IBD in first degree relative	1.70 (0.93–3.11)	0.08	1.62 (0.79–3.34)	0.19
History of C. difficile infection	2.22 (1.01–4.87)	0.04	1.53 (0.56–4.14)	0.41
Current medications, n (%)				
Aminosalicylates	0.99 (0.58–1.69)	0.96	—	—
Steroids	2.21 (1.33–3.66)	0.002	2.18 (1.20–3.94)	0.01
Biologics	0.86 (0.51–1.44)	0.57	—	—
Immunomodulators	1.13 (0.64–2.00)	0.67	—	—
Antibiotics	1.39 (0.69–2.79)	0.34	—	—
Narcotics	3.38 (2.02–5.66)	<0.0001	2.40 (1.25–4.59)	0.009
Moderate to severe depression	1.51 (0.91–2.51)	0.11	—	—
Poor Quality of life (SIBDQ <50)	2.57 (1.45–4.56)	0.001	2.08 (1.01–4.29)	0.046

TABLE 3. Continued

	Univariate Analysis		Multivariate Analysis	
	Odds Ratio (95% CI)	***P***	**Odds Ratio (95%)**	***P***
Tachycardia (Heart rate>100/min)	1.71 (0.88–3.31)	0.11	—	—
Harvey-Bradshaw Index, ≥ 4	1.72 (1.04–2.84)	0.03	1.09 (0.57–2.08)	0.79
Elevated C-reactive protein (>3)	1.53 (0.92–2.55)	0.10	2.11 (1.14–3.89)	0.017
Hypoalbuminemia (< 3.5)	0.73 (0.43–1.26)	0.26	—	—

Abbreviation: HR, heart rate

DISCUSSION

In this study of new patients seen in the IBD practices at 2 tertiary referral centers, we identified the baseline demographic and clinical characteristics that increased the likelihood of hospitalizations and ER visits within the first year of an initial office encounter. The characteristics that we found to be independently associated with high health care utilization in IBD patients were current use of steroids, a history of cigarette smoking, the presence of a stoma, an SIBDQ score of less than 50, and insurance coverage through a medical assistance program. Among those with UC, a history of *C. difficile* infection, moderate to severe depression, and baseline tachycardia were predictive of increased health care utilization. In patients with CD, narcotic and steroid use, elevated serum CRP (>3), and penetrating and stricturing disease phenotypes were associated with excess use. Awareness of these at-risk characteristics is crucial for physicians and health systems and should weigh considerably in the clinical decision-making process during the initial outpatient encounter because prompt risk stratification and mobilization of multidisciplinary resources have the potential to reduce the likelihood of future ER and hospital visits—leading to significant health care savings.

As suspected, factors known to be correlated with greater IBD severity were found to be associated with excess health care utilization. Crohn's disease was associated with high utilization when compared with UC on univariate analysis, but this association did not persist on multivariate analysis. This trend has been reflected in several studies that have shown that in comparison with patients with UC, those with CD have a higher frequency of hospitalization and health care spending.[7, 11, 18, 19] Of the IBDs, CD is generally thought to result in a more severe disease course, with affected patients being more likely to require treatment with biologics and surgery.[20] The lack of association found in our study may be related to the referral center setting where patients with both UC and CD have higher disease severity. The presence of a stoma was independently predictive of increased utilization. This is also due to severe disease, as surgery is usually only resorted to when medical therapy has failed or is inappropriate. Low SIBDQ scores and elevated CRP were also found to be associated with increased utilization. These have previously been shown in a registry analysis to be associated with high financial burden in IBD patients.[11] Among those with CD, penetrating and stricturing disease phenotypes were predictive of greater health care use when compared with the inflammatory phenotype. Penetrating and stricturing disease behavior generally portend severe disease, with affected patients known to require more intense treatment due to their high risk for a disabling disease course.[21] Fistulas have previously been shown to be associated with increased IBD-related encounters and financial charges.[5–7] In those with UC, we found that a history of *C. difficile* infection was associated with greater utilization. This is a reflection of disease severity, as *C. difficile* infection has previously been shown to increase the risk of colectomy and death in UC patients.[22] Alternatively, *C. difficile* colonization may be associated with greater severity of UC. Depression was also noted to be associated with increased health care use in the present study. This supports prior data showing depression to be correlated with disease severity in IBD patients.[23]

We found that having health insurance through medical assistance (use of Medicaid) was independently associated with increased health care utilization. This may be a reflection of socioeconomic standing, as markers of socioeconomic disadvantage such as unemployment have previously been shown to negatively impact health care utilization in IBD patients.[5] In a cross-sectional study by Kappelman et al, those on Medicaid were significantly more likely to have excess ER visits despite having a similar number of outpatient visits when compared with those with commercial insurance.[19] They also found a trend toward increased hospitalization in Medicaid patients. We suspect that for patients on Medicaid, financial insecurity impacts their capacity to adhere to medical counsel and treatment in the outpatient setting, thus leading to a greater likelihood of accessing care through ER and hospital visits. In fact, IBD patients with low income have previously been shown to have less spending on nonacute care while having a disproportionately increased amount of expenditure on acute care.[8, 24] Additionally, excess health care use in IBD patients requiring medical assistance may also be due to increased disease severity, as those disabled by severe disease are more likely to be underemployed and/or need Medicaid.[25]

TABLE 4. Univariate and Multiple Logistic Regression of Utilization Using Demographic, Disease, and Clinical Characteristics as Predictors of Utilization Among Cohort of 281 Patients with Ulcerative Colitis

	Univariate Analysis		Multivariate Analysis	
	Odds Ratio (95% CI)	***P***	**Odds Ratio (95%)**	***P***
Female sex	1.12 (0.50–2.49)	0.78	—	—
Age group				
16–30	Ref	Ref	Ref	Ref
31–50	0.38 (0.13–1.05)	0.06	0.35 (0.08–1.45)	0.15
>50	0.85 (0.34–2.13)	0.72	1.39 (0.34–5.61)	0.65
Race				
White	Ref	Ref		
Black	0.60 (0.08–4.71)	0.62	—	—
Asian	NA	NA		
Hispanic	NA	NA		
Other/unknown	1.49 (0.17–12.91)	0.71		
Insurance coverage				
Commercial	Ref	Ref		
Medicare	0.99 (0.22–4.53)	0.99	—	—
Medical assistance	NA	NA		
None	NA	NA		
Smoking status				
Never smoked	Ref	Ref		
Former smoker	0.85 (0.31–2.36)	0.75	—	—
Current smoker	0.75 (0.09–6.06)	0.79		
Body mass index				
Normal weight (18.5–24.9)	Ref	Ref	Ref	Ref
Underweight (<18.5)	2.94 (0.91–9.53)	0.07	1.62 (0.22–12.18)	0.64
Overweight (25.0–29.9)	0.67 (0.24–1.87)	0.44	0.92 (0.23–3.63)	0.91
Obese (>30)	0.65 (0.20–2.12)	0.48	0.54 (0.11–2.60)	0.44
Disease extent				
Left-sided	Ref	Ref	Ref	Ref
Extensive	2.24 (0.86–5.82)	0.09	1.33 (0.43–4.08)	0.62
IBD-related surgery	0.84 (0.19–3.80)	0.82	—	—
IBD in first degree relative	0.24 (0.03–1.80)	0.13	—	—
History of C. difficile infection	3.32 (1.20–9.19)	0.015	4.68 (1.25–17.47)	0.02
Current medications, n (%)				
Aminosalicylates	0.95 (0.43–2.10)	0.89	—	—
Steroids	1.61 (0.72–3.57)	0.24	—	—
Biologics	1.49 (0.65–3.40)	0.35	—	—
Immunomodulators	1.77 (0.70–4.44)	0.22	—	—
Antibiotics	5.50 (1.73–17.52)	0.001	2.68 (0.44–16.27)	0.28
Narcotics	1.09 (0.31–3.86)	0.90	—	—
Moderate to severe depression	5.74 (2.49–13.23)	<0.0001	6.69 (1.97–22.67)	0.002
Poor Quality of life (SIBDQ <50)	5.64 (1.66–19.21)	0.006	1.35 (0.30–6.05)	0.69
Tachycardia (Heart rate >100/min)	5.21 (2.02–13.45)	0.0002	5.89 (1.50–23.13)	0.01
SCCAI ≥ 3	1.73 (0.75–4.01)	0.19	—	—
Elevated C-reactive protein (>3)	1.55 (0.70–3.45)	0.11	—	—
Hypoalbuminemia (< 3.5)	1.55 (0.70–3.45)	0.28	—	—

Abbreviations: HR, heart rate; NA, not applicable

Former cigarette smoking was independently associated with high health care utilization in CD patients. Interestingly, active smoking did not result in an increase in health care use, as was noted in a cross-sectional study of US veterans that examined the predictors of increased IBD-related encounters.[7] Tan et al found that current smoking—not prior smoking—was associated with higher health care utilization, and this effect was more pronounced in those with CD. Interestingly, another study found that prior smoking was associated with increased hospitalization days, but this was only in those with UC.[6] Our findings add to the mixed results seen in the body of literature on the effect of smoking on health care utilization in IBD.

Use of prescription steroids and narcotics at the time of the first clinic visit was predictive of increased health care use, especially in patients with CD. This confirms findings from prior studies on health care utilization in IBD patients and is likely a reflection of greater disease activity, given that these medications are typically used in the treatment of disease flares and significant pain.[5, 6] Although biologics are commonly used in moderate to severe disease, we did not find their use to be associated with increased health care use as has previously been described.[6, 11] It is also notable that age, gender, and race were not associated with increased health care utilization in our study. This contrasts with multiple studies which have shown that demographic factors affect health care use in IBD, with younger patients and African-Americans shown to utilize more resources.[5, 7, 19, 26, 27] Interestingly, obesity was protective against high health care utilization. Although obesity is generally associated with worse outcomes in many disease conditions, studies in IBD patients have found that obesity is not associated with increased disease-related complications and may even portend a more favorable disease course. In a retrospective study of 202 UC patients categorized according to BMI, those with low BMI had greater disease severity, and the obese had a lower prevalence of pancolitis and less severe disease.[28] Pringle et al reported less penetrating disease complications in adults with CD who were obese compared with those of normal BMI.[29]

This study has a few limitations and several strengths. First, our study was focused on patients seen at tertiary referral centers and may not be generalizable, as these patients likely have more severe disease compared with the general IBD population. Additionally, the retrospective design of this study limits the ability to attribute causality to any of these predictors. It is also possible that some patients may have had ER visits or hospitalizations at locations that were not captured. To reduce this likelihood of measurement bias, we searched intrastate and interstate health information exchanges to obtain information on any encounters that may have occurred within the study period. It is also possible that there are provider-level factors, such as trainee involvement, that were not collected but may have affected the likelihood of health care utilization. A major strength of our study is the large and diverse sample drawn from tertiary centers in 2 different states and the availability of extensive patient-level data. This allowed for evaluation of multiple predictor variables in the entire cohort and by disease subtype. Another important strength of this study is the means of measurement of health care utilization in this cohort. Though many studies have defined utilization in terms of financial charges, a definition based on frequency of ER and hospital visits is more robust, as charges often vary by location and institutions and may not always be comparable. Furthermore, information on financial charges may be incomplete as they are not always completely captured.

In conclusion, we have identified the need for medical assistance and several markers of severe disease as baseline factors that are associated with high health care utilization within 1-year of a new-patient clinic encounter in a tertiary center. Awareness of these factors, early risk stratification, and mobilization of appropriate resources after the first office visit can potentially reduce the likelihood of ER and hospital visits and result in cost savings. Further research should evaluate the impact of multidisciplinary risk-reduction interventions on health care utilization in IBD patients after establishment of specialist care.

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