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Telephone Encounters Predict Future High Financial Expenditures in Inflammatory Bowel Disease Patients: A 3-Year Prospective Observational Study

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Abstract

Background—Telephone activity is essential in management of complex chronic diseases including inflammatory bowel disease (IBD). Telephone encounters logged in the electronic medical record have recently been proposed as a surrogate marker of disease activity and impending healthcare utilization; however, the association between telephone calls and financial expenditures has not been evaluated.

Study—We performed a three-year prospective observational study of telephone encounters logged at a tertiary referral IBD center. We analyzed patient demographics, disease characteristics, comorbidities, clinical activity, and healthcare financial charges by telephone encounter frequency.

Results—Eight-hundred-one patients met inclusion criteria (52.3% female, mean age 44.1 years), accounted for 12669 telephone encounters, and accrued \$70,513,449 in charges over three years. High telephone encounter frequency was associated with female gender ($p=0.003$), anxiety/depression ($p<0.001$), prior IBD surgery ($p<0.001$). High telephone encounter categories had

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Author Contributions

Benjamin Click: Study concept and design, acquisition of data, analysis and interpretation of data, drafting of the manuscript, statistical analysis, tables and figures production, and obtaining funding

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Ioannis E. Koutroubakis: Study concept and design, critical revision of manuscript, study supervision

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significantly more hospitalizations ($p<0.001$), IBD surgery ($p<0.001$), worse quality of life ($p<0.001$), more corticosteroid ($p<0.001$), biologic ($p<0.001$), and opiate prescriptions ($p<0.001$). High telephone encounter frequency patients amassed higher total available charges in each year ($p<0.001$) and over the three-years ($p<0.001$). Telephone encounters in 2009 ($p=0.02$) and 2010 ($p<0.001$) were significantly associated with financial charges the following year after controlling for demographic, utilization, and medication covariates.

Conclusions—Increased telephone encounters are associated with significantly higher healthcare utilization and financial expenditures. Increased call frequency is predictive of future healthcare spending. Telephone encounters are a useful tool to identify patients at risk of clinical deterioration and large financial expense.

Keywords

Inflammatory bowel disease; telephone; Crohn's disease; ulcerative colitis; cost; healthcare utilization

Introduction

Inflammatory bowel disease (IBD) is a chronic inflammatory condition resulting from dysregulated immune response to intestinal microflora in genetically susceptible individuals^{1, 2}. IBD patients, with Crohn's disease (CD) or ulcerative colitis (UC), often experience a relapsing and remitting clinical course, which can result in significant morbidity and poor quality of life³. The cost of IBD care has risen dramatically^{4, 5} due to the increasing prevalence of IBD^{6, 7} as well as the increasing cost of invasive procedures, surgical interventions, and expensive biologic therapies^{8–13}.

IBD patient care often requires communication through telephone encounters and email. We recently demonstrated that telephone encounter volume predicted near-term hospital admission, suggesting that telephone encounters can identify patients at risk for medical complications¹⁴. To further explore the utility of telephone encounters, a non-invasive clinical parameter, we sought to determine the association of telephone encounter activity with financial expenditures. Moreover, we evaluated whether telephone encounter activity could predict future financial spending, distinct from inpatient hospital care.

Materials and Methods

Study Cohort

We utilized a prospective, consented, natural history registry of adult (> 18 years) IBD patients maintained at the University of Pittsburgh Medical Center (UPMC). All patients enrolled in the registry having at least one clinic visit annually for the years 2009–2011 were included. Patients were excluded if they were not enrolled in the registry, did not carry a diagnosis of CD, UC, or IBD-unclassified (IBD-U), or did not have an annual clinic visit in 2009–2011.

Demographic and Clinical Data

Clinical data for patients enrolled in the registry were systematically exported from the electronic medical record (EMR) through the Center for Assistance in Research using the EMR, an Information Technology support group at UPMC. Data was then organized in a temporal fashion. Demographic data included patient characteristics, type of IBD (CD, UC, or IBD-U), duration of disease (years), history of IBD surgeries, disease characteristics according to Montreal Classification¹⁵, and medical comorbidities derived from ICD-9 code and EMR problem list including psychiatric comorbidity (anxiety and/or depression), hypertension, hyperlipidemia, coronary artery disease, and migraine headaches. Median household income was approximated by zip code (<http://www.psc.isr.umich.edu/dis/census/Features/tract2zip/>). Clinical data included annual number of clinic encounters, emergency department (ED) visits, IBD surgeries verified by manual review of operative reports, and hospitalizations. Medication exposures were estimated using outpatient or discharge electronic prescriptions. Prospective measures of disease activity and disease specific health-related quality of life were measured at every outpatient clinic visit starting in 2009. The Harvey Bradshaw Index¹⁶ (HBI) was used for CD clinical activity metric and the ulcerative colitis activity index (UCAI) for UC¹⁷. Quality of life was approximated using the IBD-validated Short Inflammatory Bowel Disease Questionnaire (SIBDQ)¹⁸. Total SIBDQ scores range from 10 (poor quality of life) to 70 (excellent quality of life). Mean disease activity indices and SIBDQ were calculated for each calendar year.

Telephone Encounter Data

Patients contacted the clinic via telephone with questions or concerns regarding their care and health status (5). Telephone encounters were logged into the EMR for the years 2009 – 2011 and exported into the IBD registry. Patients were stratified by quartiles of annual rates of telephone encounters: 0–1 telephone encounters per year, 2–5 telephone encounters per year, 6–10 telephone encounters per year, and >10 telephone encounters per year. Patients were also categorized by cumulative three-year telephone encounters: 0–6 telephone encounters, 7–15 telephone encounters, 16–25 telephone encounters, and >25 telephone encounters.

Financial Charge Data

Financial charge data for all healthcare services provided within the UPMC system (20 hospitals and >500 clinics) during 2009–2011 was obtained for all IBD registry patients and was manually verified then categorized by inpatient hospital charges, professional service charges for surgery, anesthesia, endoscopy, pathology, radiology, outpatient clinic visits, and other procedures (e.g. echocardiogram, bronchoscopy). Charges for labs, vaccinations, and gender-specific healthcare (e.g. mammogram) were grouped into a single “other” category. Outpatient medication charges were not included in the charge data obtained. Thus, annual biologic therapy charges were imputed based on 2009–2011 Medicare maximal allowance data (available at <http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Part-B-Drugs/McrPartBDrugAvgSalesPrice/index.html>) using conservative standard dosing guidelines (infliximab: 5 mg/kg every 8 weeks, adalimumab 40 mg every 2 weeks, certolizumab: 400 mg every 4 weeks) to approximate mean annual biologic cost. If a patient switched biologic

therapy in a year, then the average cost of the two biologic therapies was applied to that subject for that year. As it is known telephone encounter activity is predictive of near-term hospitalization, to evaluate financial charges distinct from hospitalizations we excluded inpatient admission charges from further analysis. Telephone encounters do not incur a financial charge, and therefore are not reflected in the charge data. All charges are measured in United States dollars and were indexed for base year 2011 by Consumer Price Index (http://www.bls.gov/data/inflation_calculator.htm).

Statistical Analyses

Measures of centrality were calculated using mean and standard deviation for normally distributed parameters and median and interquartile range (IQR) for parameters violating normality. Categorical variables were expressed as a proportion. Fisher's exact test was used to assess association for categorical variables. One-way analysis of variance was utilized to test means of normally distributed continuous variables. Kruskal-Wallis and Wilcoxon rank-sum tests were used for nonparametric comparisons. All tests were 2-sided, with statistical significance considered at level $p < 0.05$.

To determine predictive ability of 2009 telephone activity on future charges, multiple linear regression of natural log-transformed charge values was performed. Natural log-transformed charges were used to maintain normality. Stepwise method of multiple regression was used to determine variables for inclusion into multivariate model. Variables with significance of $p < 0.1$ in univariate regression were included in final model. Data were analyzed using Stata Statistical Software (Version 13; StataCorp.).

Ethical Considerations—This study was approved by the University of Pittsburgh Institutional Review Board (Protocol # 15050055).

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Results

Cumulative Telephone Activity & Patient Demographics (2009–2011)

Over the period 2009 to 2011, there were a total of 12669 phone encounters by 801 patients. There were 254 patients (31.7%) who accumulated between 0–6 telephone encounters in the three-year period, 274 patients (34.2%) between 7–15 encounters, 125 patients (15.6%) between 15–25 encounters and 148 patients (18.5%) >25 telephone encounters (TABLE 1). Over the three years of the study 20.5% patients remained in the same annual frequency category (10.7% between 0–1 encounters annually, 5.5% between 2–5 encounters, 1.0% between 6–10 calls, 3.2% >10 calls) while the remaining 79.5% fluctuated in annual frequency category.

High cumulative telephone encounter count (>25 encounters in three-year period) was significantly associated with female gender ($p=0.003$), history of psychiatric disease ($p<0.001$), extensive UC ($p=0.04$), and history of IBD-related surgery ($p<0.001$) (TABLE 1).

High cumulative telephone users had significantly more ED use ($p<0.001$), clinic visits ($p<0.001$), hospitalizations ($p<0.001$), more IBD-related surgical procedures ($p<0.001$), higher disease activity scores (HBI: $p<0.001$; UCAI: $p<0.001$), worse quality of life ($p<0.001$), more corticosteroid ($p<0.001$), biologic ($p<0.001$), and opiate prescriptions ($p<0.001$) compared to lower telephone encounter groups over the three-year study period (TABLE 2).

Total Available Financial Charges (2009–2011)

The total available financial charges recorded for all patients over the course of the study were \$70,513,449. The majority of charges were hospitalization-related (67.8%) (FIGURE 1). After exclusion of hospitalization charges, the major contributors to charges were biologic medications (39.7%), surgery (19.3%), and endoscopy including pathology (18.7%).

Telephone Encounter Frequency and Financial Charges (2009–2011)

Patients with more telephone encounters from 2009–2011 incurred higher median total available healthcare expenditures over the course of the study ($p<0.001$) (FIGURE 2A). Patients with >25 telephone encounters had a median cumulative charge of \$37,882 (IQR \$58,690) for the years 2009–2011 compared to \$28,265 (IQR \$40,742) for 16–25 encounters, \$11,557 (IQR \$22,760) for 7–15 encounters, and \$6,705 (IQR \$12,554) for 0–6 telephone encounters. Furthermore, patients who logged >25 cumulative telephone encounters from 2009–2011 had significantly higher median total available annual charges for each year compared to patients with fewer telephone encounters ($p<0.001$ for all years) over the study period (FIGURE 2B).

Telephone Encounter Rate and Future Charges

Increased telephone encounter count in 2009 was associated with significantly increased median cumulative three-year charges ($p<0.001$) (FIGURE 3A). Additionally, patients calling more than 10 times in 2009 had significantly increased median total available expenditures in both 2010 and 2011 (both $p<0.001$) (FIGURE 3B). Furthermore, these patients had significantly increased spending in biologic medications, surgery, endoscopy and pathology, outpatient clinic visits, as well as procedures and radiology in 2010 compared to patients with fewer than 10 telephone encounters in 2009 (all $p<0.01$) (FIGURE 4A). These significant differences in charges based on 2009 telephone encounter rates extended into 2011 expenditures as well (all $p<0.01$) (FIGURE 4B). These findings were replicated when examining 2010 telephone encounter counts and 2011 financial charge categories (all $p<0.01$) (FIGURE 4C).

Multiple linear regression of financial charges controlling for significant demographic, medication, and healthcare utilization covariates demonstrated that telephone encounter category in 2009 was significantly predictive of total available expenditures in 2010 ($p=0.02$) and 2011 ($p=0.04$) (APPENDIX TABLES 1 AND 2). Similarly, telephone encounter category in 2010 was significantly predictive of total available charges in 2011 ($p=0.001$).

Persistently High Telephone Encounters Population

From 2009 to 2011, 26 patients (3.2%) remained in the high telephone encounter (>10 encounters) category each year. In this group, 69.2% were female with a mean age of 38.1 ± 12.7 years, and 65.4% had a history of depression and/or anxiety (APPENDIX TABLE 3). Most patients (80.8%) had CD. Patients in the persistently high telephone encounter grouping had a significantly lower quality of life (median SIBDQ 40.5 vs. 54.0; $p<0.001$), higher proportion of ED use (73.1% vs. 30.7%; $p<0.001$), hospitalization (61.5% vs 35.9%; $p=0.01$), and more aggressive medical management (corticosteroids 76.9% vs. 37.0%; $p<0.001$ and biologics 53.8% vs. 26.2%; $p=0.003$) compared to patients who had fewer telephone encounters.

The persistently high telephone encounter group of 26 patients (3.2%) accounted for \$1,948,675 (9.2%) of total available charges from 2009 to 2011. The majority of the healthcare charges resulted from biologic agents (35.1%), surgery (19.3%), and endoscopy and pathology (18.2%).

DISCUSSION

In this three-year prospective study, we demonstrate that patients with increased telephone encounter volume accrue significantly higher healthcare financial charges. Furthermore, telephone encounter volume can predict future healthcare spending in the following years. Together these findings suggest that telephone encounter monitoring can identify patients for targeted intervention.

Telephone communication between patients and providers is essential to modern medical care, and is particularly important to the management of chronic illness^{19, 20}. Patients call providers for a variety of reasons from clinical symptoms, medication refills or questions. Telephone encounters logged in the EMR are a non-invasive measure of patient activity. In this study, patients with high telephone encounters had higher rates of severe disease, healthcare utilization, aggressive medical therapy, and worse quality of life.

Relatively few studies have examined telephone call data in chronic illness and how it relates to patient phenotype. In the current study, patients with increased telephone encounter volume had significantly higher rates of anxiety and/or depression. Characterization of high frequency telephone callers in patients with Parkinson's disease²¹, a specialty headache clinic²², an epilepsy hotline²³, and general counseling service²⁴ have demonstrated similar association with mental health comorbidities and telephone activity. Furthermore, we identified a small proportion of patients who have persistently high telephone activity and who contributed disproportionately to expenditures. Over half of the patients in this subgroup had comorbid depression and pain (prescription opiate use). This may suggest impaired coping ability in this patient population and potential benefit from IBD coping and mental health interventions²⁵.

This analysis also determined the majority (68%) of available healthcare expenses resulted from hospitalization, which correlates with prior studies^{8, 9, 13, 26}. Prior work from our group demonstrated the high telephone activity was associated with increased risk of near-term

hospitalization¹⁴. In the current study, even after exclusion of inpatient-related charges, patients with higher telephone encounter activity had significantly increased financial charges. Telephone activity was also predictive of future spending after controlling for significant demographic, utilization, and medication factors. These findings suggest telephone activity may function as a low cost and noninvasive way to monitor IBD patients and selectively target patients for interventions.

There are several limitations to this study. This study was conducted in a tertiary referral IBD center and thus this study sample may not be representative of other IBD populations. Information bias is also of concern as we were dependent on EMR logging for telephone encounters and inappropriate or absent logging would result in skewed data and misclassification. Additionally, this study did not include alternative methods of patient-provider communication such as email or online EMR patient portal contact. During the time period of the study, enrollment in the EMR online patient portal was not mandatory and was infrequently utilized. Thus, inclusion of this data would have introduced significant enrollment and information biases. Financial charge data was used in this study at a single institution and charges vary widely by hospital, institution, and geographic location. Thus the exact charge values in this study may not be representative of other hospital centers. Additionally, as the charges stemmed from within healthcare system utilization only, outside sources of healthcare and their ensuing charges were not accounted for in this study. We attempted to limit this impact by only including patients with at least one annual outpatient clinic visit, ensuring some degree of care continuity. Biologic costs were imputed in this analysis and thus the impact of other medical therapies was not measured. We utilized this approach as biologics are overwhelmingly responsible for the majority of annual medication charges in IBD patients. We used financial charges as opposed to cost data to limit the influence of insurance status (i.e. insured population sees little to no cost as a result of insurance coverage). Conversely, uninsured patients may amass larger than normal healthcare services as a result of limited access to outpatient care and delayed care. We did not observe any association of insurance coverage to telephone activity. Lastly, healthcare financial charges are not directly translatable to costs as traditionally perceived from a payer or societal perspective due to insurance adjustments, deductibles, and rebates. However, it is conceivable that higher healthcare charges are likely to translate into higher costs compared to lower charges, even after claims or adjustments.

There are several strengths to this study. It was performed using prospectively collected data on a large cohort of IBD patients, without a change in patient behavior as a result of enrollment or recall bias, and thus accurately reflects pattern of disease and patient activity. Financial charges in this study were for all available healthcare expenses, including non-gastrointestinal illness. This is a strength as IBD affects not only in the gastrointestinal tract, but also psychological well-being^{27, 28}, bone and nutritional health^{29–33}, hematologic profiles^{34, 35}, and rheumatologic processes^{36–38}. All-inclusive financial charges capture all relevant effects.

Telephone encounters represent a universal, non-invasive marker that can be tracked at other institutions with limited additional training, personnel, or cost. Most importantly, early

identification of at-risk patients can provide a mechanism for implementing strategies to prevent costly future healthcare utilization.

In conclusion, telephone encounters represent a marker of at-risk patients for high healthcare expenditures. Telephone encounters represent a novel disease phenotype that accurately identifies high-utilization patients. Prospective interventional studies targeted to patients with high telephone encounter frequency should be considered to determine if the cost of IBD care could be reduced.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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FIGURE 1.

Allocation of financial charges for 2009–2011. Cumulative available financial charges from 2009–2011 broken down by category. “Other” charges included outpatient labs, vaccinations, and gender-specific healthcare (e.g. mammogram).

FIGURE 2.

Median total available healthcare charges by three-year telephone frequency category. Median cumulative charges (2009–2011) by cumulative telephone encounter category from 2009–2011 (A). Median total available annual charges by cumulative telephone encounter category (B).

FIGURE 3.

Available healthcare charges by 2009 telephone encounter category. Median cumulative charges for 2009–2011 by 2009 telephone encounter category (**A**), and median annual charges by 2009 telephone encounter category (**B**).

FIGURE 4.

Annual mean charges by preceding year(s) telephone encounter category broken down by charge category. 2010 mean charges by 2009 telephone encounter category (A). 2011 mean charges by 2010 telephone encounter category (B) and by 2009 telephone encounter category (C).

Study cohort baseline demographics and inflammatory bowel disease history by cumulative (2009–2011) telephone encounter category.

TABLE 1

	0–6 telephone encounters	7–15 telephone encounters	16–25 telephone encounters	>25 telephone encounters	Trend p-value
N (% total)	254 (31.7)	274 (34.2)	125 (15.6)	148 (18.5)	--
Age, years mean $\pm$ SD	44.6 $\pm$ 14.9	45.0 $\pm$ 14.5	44.2 $\pm$ 15.7	41.5 $\pm$ 14.6	0.11
Female Gender, n(%)	111 (43.7)	146 (53.3)	71 (56.8)	91 (61.5)	0.003
Mean BMI, mean $\pm$ SD	26.9 $\pm$ 5.0	26.8 $\pm$ 5.5	26.0 $\pm$ 5.0	25.6 $\pm$ 5.2	0.04
Median Household Income, USD median (IQR)	48,687 (21,509)	46,723 (17,290)	50,366 (22,732)	48,636 (23,723)	0.008
Healthcare Insurance, n(%)	239 (94.1)	265 (96.7)	123 (98.4)	144 (97.3)	0.18
Comorbid, n(%)					
Psychiatric	40 (15.7)	74 (27.0)	36 (28.8)	67 (45.3)	<0.001
Disease	8 (3.1)	20 (7.3)	7 (5.6)	18 (12.2)	0.01
DM	31 (12.2)	35 (12.8)	8 (6.4)	21 (14.2)	0.18
HLD	3 (1.2)	4 (1.5)	2 (1.6)	6 (4.1)	0.24
CAD	14 (5.5)	24 (8.8)	12 (9.6)	12 (8.1)	0.39
Migraine					
Medications in 2009, n(%)					
Opiate	11 (4.3)	28 (10.2)	21 (16.8)	41 (27.7)	<0.001
SSRI	4 (1.6)	23 (8.4)	13 (10.4)	14 (9.5)	<0.001
SNRI	1 (0.4)	6 (2.2)	6 (4.8)	8 (5.4)	0.003
TCA	2 (0.8)	7 (2.6)	3 (1.9)	12 (8.1)	0.001
Corticosteroid	17 (6.7)	49 (17.9)	34 (27.2)	55 (37.2)	<0.001
Anti-TNF	18 (7.1)	39 (14.2)	25 (20.0)	42 (28.4)	<0.001
IM	62 (24.4)	98 (35.8)	34 (27.2)	61 (41.2)	0.001

	0–6 telephone encounters	7–15 telephone encounters	16–25 telephone encounters	>25 telephone encounters	Trend p-value
5-ASA	76 (29.9)	80 (29.2)	46 (36.8)	37 (25.0)	0.21
Disease, n(%)					
CD	151 (59.4)	170 (62.0)	74 (59.2)	103 (69.6)	0.28
UC	101 (39.8)	101 (36.9)	49 (39.2)	42 (28.4)	0.12
IBD-U	2 (0.8)	3 (1.1)	1 (0.8)	3 (2.0)	0.71
Duration of Disease, years mean $\pm$ SD	16.2 $\pm$ 9.2	17.4 $\pm$ 10.3	17.6 $\pm$ 11.8	15.6 $\pm$ 9.9	0.20
CD Location [*] , n(%)					
Ileal (L1)	53 (35.1)	53 (31.2)	28 (37.8)	26 (25.2)	0.28
Colonic (L2)	34 (22.5)	35 (20.6)	17 (23.0)	19 (18.4)	0.87
Ileocolonic (L3)	70 (46.4)	92 (54.1)	39 (52.7)	61 (59.2)	0.16
Upper (L4)	8 (5.3)	6 (3.5)	4 (5.4)	5 (4.9)	0.84
Perianal	31 (20.5)	33 (19.4)	17 (23.0)	28 (27.2)	0.41
CD Behavior [†] , n(%)					
Inflammatory (B1)	57 (37.7)	79 (46.5)	29 (39.2)	39 (37.9)	0.37
Stricturing (B2)	64 (42.4)	73 (42.9)	32 (43.2)	50 (48.5)	0.69
Penetrating (B3)	44 (29.1)	34 (20.0)	20 (27.0)	32 (31.1)	0.13
UC Extent [‡] , n(%)					
Proctitis (E1)	7 (6.9)	6 (5.9)	0 (0)	1 (2.4)	0.16
Left-sided (E2)	38 (37.6)	30 (29.7)	18 (36.7)	11 (26.2)	0.14
Extensive (E3)	41 (40.6)	60 (59.4)	30 (61.2)	32 (76.2)	0.04
History of IBD-related Surgery, n(%)	72 (28.3)	113 (41.2)	47 (37.6)	74 (50.0)	<0.001

BMI: body mass index, USD: United States dollar, DM: diabetes mellitus, HLD: hyperlipidemia, CAD: coronary artery disease, SSRI: selective serotonin reuptake inhibitor, SNRI: serotonin norepinephrine reuptake inhibitor, TCA: tricyclic antidepressant, TNF: tumor necrosis factor, IM: immunomodulator, ASA: aminosalicylate, CD: Crohn's disease, UC: ulcerative colitis, IBD-U: inflammatory bowel disease unclassified, IBD: inflammatory bowel disease

* Location data missing in 26 patients.

Behavior data missing in 19 patients.
Extent data missing in 20 patients.

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Three-year (2009–2011) healthcare utilization, disease activity, and medication exposure defined by at least one prescription by cumulative (2009–2011) telephone encounter category.

TABLE 2

	0–6 telephone encounters	7–15 telephone encounters	16–25 telephone encounters	>25 telephone encounters	Trend p-value
ED n(%) Mean ± SD	56 (22.0) 0.5 ± 1.5	79 (28.8) 0.7 ± 1.8	45 (36.0) 1.7 ± 5.3	77 (52.0) 3.8 ± 9.1	<0.001 <0.001
Hospitalization n(%) Mean ± SD	54 (21.3) 0.4 ± 0.9	87 (31.8) 0.5 ± 1.1	56 (44.8) 0.8 ± 1.4	97 (65.5) 1.8 ± 2.8	<0.001 <0.001
Clinic Visits [*] , mean ± SD	3.3 ± 2.4	5.3 ± 3.0	7.7 ± 5.2	12.2 ± 8.6	<0.001
IBD Surgery, n(%)	36 (14.2)	63 (23.0)	42 (33.6)	68 (45.9)	<0.001
HBI, mean ± SD	2.9 ± 3.9	4.3 ± 3.7	5.2 ± 4.2	7.3 ± 5.3	<0.001
UCAI, mean ± SD	2.2 ± 2.9	4.2 ± 4.3	5.8 ± 5.1	5.3 ± 4.3	<0.001
SIBDQ, mean ± SD	56.8 ± 10.1	52.4 ± 11.7	48.7 ± 11.8	44.9 ± 11.9	<0.001
Biologics [†] , n(%)	31 (12.2)	65 (23.7)	54 (43.2)	71 (48.0)	<0.001
Immunomodulators [‡] , n(%)	99 (39.0)	140 (51.1)	71 (56.8)	95 (64.2)	<0.001
Corticosteroids, n(%)	53 (20.9)	92 (33.6)	67 (53.6)	95 (64.2)	<0.001
Opiates, n(%)	45 (17.7)	57 (20.8)	43 (34.4)	75 (50.7)	<0.001

ED: emergency department, IBD: inflammatory bowel disease, HBI: Harvey Bradshaw Index, UCAI: ulcerative colitis activity index, SIBDQ: short inflammatory bowel disease questionnaire

^{*} All patients seen in clinic at least once during 2009–2011.

[†] Biologic agents included infliximab, adalimumab, and certolizumab pegol.

[‡] Immunomodulators included azathioprine, methotrexate, and 6-mercaptopurine.