The Association Between Sustained Poor Quality of Life and Future Opioid Use in Inflammatory Bowel Disease

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Background: Inflammatory bowel disease (IBD) is associated with poor quality of life and disability. The short inflammatory bowel disease questionnaire (SIBDQ) is validated to determine patients quality of life at single time points, or improvement over time. Few studies have evaluated if sustained poor quality of life is associated with future healthcare utilization patterns.

Methods: We analyzed patients from a prospective IBD natural history registry with 4 consecutive years of follow-up. SIBDQ was measured at outpatient visits. Healthcare utilization data were temporally organized into a 2-year observation period, and 2-year follow-up period. Mean SIBDQ score <50 during the first 2 years was categorized as having "poor quality of life". Primary outcomes of interest were measures of unplanned healthcare utilization and opioid use.

Results: From a total of 447 participants (56.1% female, 66.1% Crohn's disease, 34.9% ulcerative colitis), 215 (48.1%) were classified as having poor quality of life. Poor quality of life was significantly associated with Crohn's disease ($P < 0.01$), history of IBD related surgery, and tobacco use (all $P < 0.01$). In the follow-up period, the same patients with poor quality of life were more likely to have abnormal biomarkers of inflammation, more telephone calls and office visits, experience unplanned care, and be exposed to opiates (all $P < 0.05$). After multivariable analysis, poor quality of life remained an independent predictor of future opiate use (odds ratio: 2.2, $P = 0.003$) and decreased time to first opiate prescription (hazard ratio: 1.67, $P = 0.019$) in the follow-up period.

Conclusions: IBD patients with sustained poor quality of life are at an increased risk of opiate use and decreased time to opiate exposure. Routine measurement of quality of life in the outpatient setting may provide insight into those at risk for narcotic use and healthcare utilization.

Key Words: quality of life, inflammatory bowel disease, healthcare utilization, opioids

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INTRODUCTION

Inflammatory bowel disease (IBD) is a chronic inflammatory condition often leading to poor quality of life and disability. In the United States, IBD is estimated to cost between $3.1 billion– $4.5 billion in both direct and indirect costs.[1,2] IBD impacts many facets of life and negatively affects overall well-being and quality of life compared to healthy controls.[3–5] Poor functional status and quality of life influences the indirect economic burden of IBD. Between 19%–22% of IBD patients are functionally disabled and no longer participate in social or work activities.[6] There are several ways in which disability and poor quality of life can be defined in routine medical care and research, including utility measurements and IBD-specific health-related quality of life measurements.[7] A widely available, validated, and routinely used measure of quality of life in IBD is the short inflammatory bowel disease questionnaire (SIBDQ), which was originally developed to help community physicians in the management of IBD.[8,9]

There has been a growing interest in patient-reported outcomes in clinical medicine and research, which has been accompanied by federal support and initiatives.[10–12] Measurement of patient-reported outcomes helps to ensure the results are both clinically and personally meaningful to the patient. Accordingly, there have been numerous studies evaluating the impact of medical and surgical intervention on quality of life outcomes in IBD patients.[13] Despite the popularity of using quality of life as an outcome measure of intervention success, there are relatively few studies investigating quality of life score as a predictor of future unplanned healthcare utilization or medication exposures.

The use of opioids has been associated with poor health outcomes and death. IBD is an independent risk factor for opioid dependence, even after controlling for comorbid psychiatric disease.[14] However, factors among IBD patients identifying those likely to be exposed to opiates in the future are poorly characterized.

We aimed to (A) understand if routine measurement of patient-reported health- related quality of life in the outpatient setting can identify patients with severe disease, and (B) to determine if prospectively identifying IBD patients with sustained poor quality of life could predict worse clinical outcomes, increased healthcare utilization, and opioid use.

METHODS

Study Design and Participants

The study was conducted as a part of the University of Pittsburgh Medical Center (UPMC) IBD registry, which has been described in detail.[15] Briefly, IBD patients are consented and enrolled in a prospective, longitudinal, natural history registry. All data from the registry are derived from the electronic medical record and systematically processed and transformed for research. In this study, we included all IBD patients in the UPMC IBD registry with at least 4 consecutive years from 2010–2015 of clinical follow-up. Clinical follow-up was defined as a minimum of 1 physician visit or telephone encounter per calendar year. The study period was divided into a 2-year baseline observation period, and a 2-year follow-up period to assess future clinical outcomes. Eligible participants with at least 2 SIBDQ measurements included in the initial 2-year observation period were included (Fig. 1). Participants were excluded if follow-up was not in consecutive years or if they did not complete a quality of life questionnaire in the first 2 years of the study. Our primary outcomes of interest included opioid use and measures of healthcare utilization in the 2-year follow-up period, with an emphasis on unplanned acute care (hospitalization, emergency room visits, and surgery).

Data Collection and Organization

All data are prospectively collected as a part of routine healthcare visits in any UPMC affiliated hospital or clinic.[15] SIBDQ scores were collected during clinical visits to the UPMC Digestive Disorders Clinic and entered into the electronic medical record as a part of routine care. Participants also prospectively completed disease activity measures including the Harvey-Bradshaw index (HBI) for Crohn's disease (CD) and ulcerative colitis activity index (UCAI) for ulcerative colitis (UC).[16,17] Active disease was defined as mean UCAI score ≥4 or mean HBI scores ≥5 during the study period. Disease characterization was performed using the Montreal classification at initial presentation.[18] All IBD-related healthcare utilization including telephone encounters, clinic visits, hospitalizations, emergency room visits, and IBD-related surgeries were derived from the registry and temporally organized by calendar year. Data on laboratory biomarkers were organized by calendar year and dichotomized as normal or abnormal based on local laboratory standards. Outpatient electronic prescriptions were organized annually for each patient over the 4-year study period. Patients were designated as having a medication exposure if they had 1 or more prescriptions within the 2-year time periods used in the study. Mean SIBDQ during the 2-year observation period was calculated for all patients, and those with a mean SIBDQ score of <50 were designated as having "poor quality of life" as this cutoff has been previously shown to detect patients at risk of functional disability.[19]

Statistical Analysis

Baseline comparisons

We assessed differences between those with poor quality of life (SIBDQ <50) to those with a higher mean SIBDQ (≥ 50) during the 2-year baseline observational period using the Student's *t* test for continuous parametric data, the Wilcoxon-rank sum for continuous non-parametric data, and chi-square tests for categorical data.

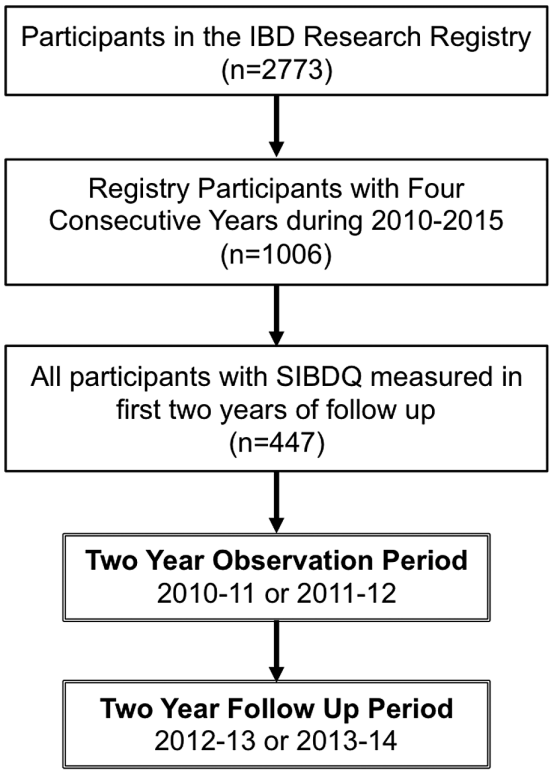

FIGURE 1. Flow diagram of study eligibility and analysis. Participants from the IBD research registry assessed for study eligibility and included in the study.

2-year follow-up period comparisons

We used univariable logistic regression to evaluate the association between the quality of life category and biomarkers of inflammation, medication exposures, and future healthcare utilization (surgery, hospitalization, and emergency room visit) in the 2-year follow-up period. To compare differences in healthcare utilization measures such as phone encounters, office visits, and radiologic procedures, we used the Wilcoxon-rank sum test. Empirically, we wanted to control for patient-reported active disease when assessing our primary outcomes. We then utilized multivariable logistic regression to control for significant baseline covariates ($P < 0.10$) in assessing our primary outcomes of opioid use and unplanned healthcare utilization, defined as a composite outcome of any IBD-related surgery, emergency room visit, or hospitalization. All significant baseline covariates were included in the initial model. We used the likelihood ratio test to evaluate the contribution of factor variables and removed variables with $P > 0.10$. We then used backward stepwise regression with a significance cutoff of $P = 0.10$ to remove remaining nonsignificant predictors and define the most parsimonious regression model. The poor quality of life designation remained in the model regardless of significance, as it was our primary predictor of interest.

Time to event analysis

All participants were assessed from the date of their last SIBDQ measurement in the 2-year observational period, which marked time 0 in the time to event analysis. We compared participants designated as having poor quality of life (mean SIBDQ in the 2-year observation period <50) to those with a mean SIBDQ ≥ 50. We measured the days to first hospitalization or first emergency room visit or surgery (as a composite outcome) and days to first opioid prescription, and we compared the survival curves between groups using the log-rank test for equality of survivor functions. Empirically, we wanted to control for active disease and used the stratified log-rank test to account for the dichotomous variable of patient-reported active disease at baseline. To control for all significant baseline covariates ($P < 0.10$) associated with poor quality of life. we used a Cox proportional hazards model. All significant baseline covariates were tested for their association with survival outcomes using the log-rank test for dichotomous variables and the Cox proportional hazard model for factor and continuous variables. Variables with $P < 0.10$ on univariate survival analyses were included in final model building. We subsequently used backward stepwise regression with a significance cutoff of $P = 0.10$ to determine the most parsimonious model. Poor quality of life designation remained in the model regardless of significance. The proportionality assumption of the final model was tested using time dependent covariates, and models were stratified as necessary.

All statistical tests were evaluated with an alpha = 0.05 and were completed in StataSE (v.14 College Station, TX: StataCorp LP).

Ethical Considerations

All participants were enrolled in the IBD Research Registry using informed consent. The IBD Research Registry (Protocol #0309054, renewal approved January 5, 2017) and the current analysis (Protocol #15010214, renewal approved October 24, 2016) were both approved by the University of Pittsburgh Institutional Review Board.

RESULTS

Study Population

There were 1006 IBD Research Registry participants followed for 4 consecutive years, from 2010–2014 or from 2011–2015, who were included in the eligible study cohort (Fig. 1). Of those with 4 years of follow-up, 44.4% of patients had SIBDQ data available during the first 2 years. The final study population consisted of 447 eligible participants. Study participants completed a median of 4 SIBDQ measurements per patient in the 2-year observation period, and average patient-specific standard deviation in SIBDQ total score was 5.88 points. On average, 78.8% of patient visits included an SIBDQ measurement.

Over half (56.2%) of the study participants were female, and the average age at baseline was 39.4 ± 14.9 years (Table 1). The majority of participants were employed full time or self employed, married, and reported never smoking tobacco. The majority (64.7%) of subjects had CD (Table 1). Just under half (n = 215, 48.1%) of patients were classified as having an average SIBDQ <50 in the first 2 years of the study, constituting the "poor quality of life" category for analysis. The remaining participants (n = 232) had an average SIBDQ score of ≥50 (Table 1).

Baseline 2-year Observation Period

Over the 2-year baseline period, age, gender, and marital status were similar between the 2 quality of life groups (Table 1). However, baseline unemployment and active smoking were significantly associated with lower quality of life. Poor quality of life was significantly associated with CD ($P = 0.001$), inflammatory CD behavior, and a history IBD surgery before 2010 (Table 1). During the baseline observation period, the poor quality of life group had significantly increased exposure to biologics (43.7% vs 28.5%, $P = 0.001$), systemic steroids (61.4% vs 36.2%, $P < 0.001$), opiates (41.4 vs 16.8%, $P < 0.001$), and antidepressants (41.4% vs 18.1%, P < 0.001) over the same time period. Similarly, those with poor quality of life also had more active disease as measured by disease activity indices and elevated serum biomarkers of inflammation (Table 1).

2-year Follow-up Period

Univariable analysis

In the 2-year follow-up period, participants classified as having poor quality of life in the baseline observation period were significantly more likely to have elevated inflammatory biomarkers including C-reactive protein (CRP) (40.5% vs 30.6%, $P = 0.03$) and erythrocyte sedimentation rate (ESR) (29.3% vs 15.1%, $P < 0.001$), and increased patient-reported disease clinical activity scores (Table 2). Routine healthcare utilization including the number of telephone encounters (median: 9 vs 6, $P < 0.001$) and clinic visits (median: 5 vs 4, $P < 0.001$) was significantly elevated in the poor quality of life group, whereas the number of radiology procedures did not differ significantly in the follow-up period (Table 2). Patients in the poor quality of life group also were significantly more likely to experience inpatient hospitalization or emergency room visits and have IBD-related surgery (Table 2). Those who experienced poor quality of life were 1.5 times as likely to be exposed to systemic steroids, and 3.54 times as likely to be exposed to opioids in the follow-up period (Table 2). However, patients with poor quality of life were significantly less likely to be exposed to immunomodulators and 5-aminosalicylic acid agents in the same time frame, and there was no significant difference between the 2 SIBDQ groups in risk of exposure to biologics during follow-up (Table 2).

Multivariable analysis

After empirically controlling for patient-reported active disease and then subsequently all significant baseline predictors with multivariable logistic regression, poor quality of life at baseline was not significantly associated with the composite outcome of unplanned care (Table 3). Baseline covariates that remained associated with future unplanned care were age, gender, prior IBD surgery, active disease, antidepressant use, opiate exposure, and abnormal ESR (all $P < 0.05$) (Table 3).

Poor quality of life category remained a significant predictor of opiate use in the 2-year follow-up period after multivariable analysis. When controlling empirically for active disease, poor quality of life was associated with future opioid use (OR: 3.0, $P < 0.001$). Upon multivariable regression, those with poor quality of life were 2.20 times as likely ($P = 0.003$) to be exposed to opioids in the follow-up period (Table 3), after controlling for significant baseline covariates of opioid exposure, abnormal ESR, and prior IBD surgery. Baseline opioid exposure was also highly predictive for future opioid use (OR: 8.0, $P < 0.001$), after controlling for all other covariates including poor quality of life.

Time to Event Analysis

From the date of the last recorded SIBDQ measurement, those in the poor quality of life group had significantly reduced time to unplanned care ($P < 0.001$) (Fig. 2) on univariate analysis. This association remained significant after empiric stratification for active disease at baseline ($P = 0.032$). However, after multivariable Cox regression, poor quality of life did not remain a significant predictor of time to unplanned care [hazard ratio (HR): 1.10, 95%CI (0.78 – 1.57)]. Younger age, prior IBD surgery, active disease, abnormal CRP, opioid use, and antidepressant use were significantly associated with decreased time to unplanned care (all $P < 0.05$) (Supplemental Table).

Poor quality of life was significantly associated with opioid-free survival (Fig. 2), which remained significant after stratification for patient-reported active disease ($P < 0.001$). After multivariable Cox regression, poor quality of life was significantly associated with opioid-free survival [HR: 1.67, 95%CI (1.09 – 2.58)]. Other significant covariates included prior IBD surgery, steroid exposure, baseline opioid use, and employment status (**Supplemental Table**).

DISCUSSION

In this study of 477 IBD patients were followed at a tertiary referral center over a consecutive 4-year period, nearly half of patients experience poor disease-related quality of life over a 2-year period. Poor quality of life is associated with active disease and increased healthcare utilization. Sustained poor quality of life was independently associated with future opioid prescriptions and time to first opioid prescription in the follow-up period. Together, these findings suggest that

TABLE 1: Baseline Demographics and Disease Characteristics from Baseline 2-Year Observation Period of IBD Patients with Poor Quality of Life Compared to Those with Normal Quality of Life

	Quality of Life Category			
	Total	SIBDQ < 50	SIBDQ ≥ 50	*P*value
Age (mean years ± SD)[a]	39.4 ± 14.9	39.8 ± 14.2	38.9 ± 15.5	0.520
Female, no. (%)	251 (56.2)	127 (59.1)	124 (53.5)	0.231
Race/Ethnicity, no. (%)				
White	425 (95.1)	204 (94.9)	221 (95.26)	0.839
Black	12 (2.7)	7 (3.3)	5 (2.2)	
Asian	3 (0.7)	1 (0.5)	2 (0.9)	
Other or unknown	7 (1.6)	3 (1.4)	4 (1.7)	
Hispanic/Latino	2 (0.5)	2 (0.9)	0 (0.0)	0.291
Marital Status, no. (%)				
Married or significant other	250 (55.9)	118 (54.9)	132 (56.9)	0.559
Single	164 (36.7)	78 (36.3)	86 (37.1)	
Divorced, widowed, separated	30 (6.7)	18 (8.4)	12 (5.2)	
Unknown	3 (0.7)	1 (0.5)	2 (0.9)	
Employment status (no., %)				
Fulltime or self employed	232 (51.9)	102 (47.4)	130 (56.0)	**0.001**
Full-time student	40 (9.0)	14 (6.5)	26 (11.2)	
Parttime	15 (3.4)	5 (2.3)	10 (4.3)	
Retired	34 (7.6)	15 (7.0)	19 (8.2)	
Not employed	85 (19.0)	59 (27.4)	26 (11.2)	
Unknown	41 (9.2)	20 (9.3)	21 (9.1)	
Smoking tobacco use, (no., %) n = 440				
Never	251 (57.1)	99 (47.1)	152 (66.1)	**<0.001**
Former smoker	84 (19.1)	45 (21.4)	39 (17.0)	
Current smoker	105 (23.9)	66 (31.4)	39 (17.0)	
Disease category (no., %), n = 439				
CD	284 (64.7)	147 (70.3)	137 (59.6)	**0.001**
UC	146 (33.3)	54 (25.8)	92 (40.0)	
IBD unclassified	9 (2.1)	8 (3.8)	1 (0.4)	
Disease characteristics[18], (no., %)				
CD location, n = 284				
Ileal (L1)	74 (26.1)	40 (27.2)	34 (24.8)	0.646
Colonic (L2)	66 (23.2)	29 (19.7)	27 (27.0)	0.147
Ileocolonic (L3)	155 (54.6)	80 (54.4)	75 (54.7)	0.956
Upper GI (L4)	12 (4.2)	7 (4.8)	5 (3.7)	0.642
CD behavior, n = 284				
Inflammatory (B1)	129 (45.4)	58 (39.5)	71 (51.8)	**0.036**
Stricturing (B2)	117 (41.2)	68 (46.3)	49 (35.8)	0.073
Penetrating (B3)	73 (25.7)	39 (26.5)	34 (24.8)	0.741
Perianal disease, n = 284	68 (23.9)	39 (26.5)	29 (21.2)	0.290
UC extent, n = 174				
Proctitis (E1)	6 (3.5)	2 (2.8)	4 (3.9)	0.684
Left-Sided (E2)	51 (29.3)	18 (25.0)	33 (32.4)	0.294
Extensive (E3)	89 (51.2)	38 (52.8)	51 (50.0)	0.718
History of IBD-related surgery[b] (n = 436)	147 (33.7)	87 (41.6)	60 (26.4)	**0.001**
Medication use (n, %)[c]				
Immunomodulators	210 (41.0)	99 (46.1)	111 (47.8)	0.70
Biologics	160 (35.8)	94 (43.7)	66 (28.5)	**0.001**

TABLE 1: Continued

	Quality of Life Category			
	Total	SIBDQ < 50	SIBDQ ≥ 50	*P*value
Systemic steroids	216 (48.3)	132 (61.4)	84 (36.2)	**<0.001**
5-aminosalicylic acids	186 (41.6)	76 (35.4)	110 (47.4)	**0.01**
Opioids	128 (28.6)	89 (41.4)	39 (16.8)	**<0.001**
Antidepressants	131 (29.3)	89 (41.4)	42 (18.1)	**<0.001**
Average Total SIBDQ [median, (IQR)]	50.75 [18.7]	41.5 [10.3]	60.25 [8.8]	--
Disease activity metrics [median, (IQR)]				
Harvey-Bradshaw Index, no. = 324	3.81 [4.8]	5.75 [5.3]	1.75 [3.0]	**<0.001**
UCAI, n = 175	3 [4.6]	5.3 [4.7]	1.62 [2.7]	**<0.001**
Biomarkers of inflammation, no. (%)				
Elevated CRP	190 (42.5)	108 (50.2)	82 (35.3)	**0.001**
Elevated ESR	146 (32.7)	87 (40.5)	59 (25.4)	**0.001**

P values are bolded if significant, <0.05. SD – standard deviation; SIBDQ – short inflammatory bowel disease questionnaire; IBD, inflammatory bowel disease; GI, gastrointestinal; IQR – interquartile range; UCAI – ulcerative colitis activity index; CRP – C-reactive protein; ESR – erythrocyte sedimentation rate

[a] Comparison of means by Student's *t* test.

[b] History of any gastrointestinal surgery before 2010.

[c] Immunomodulators include 6-mercaptopurine, azathioprine, and methotrexate. Biologics include anti-tumor necrosis factor agents (infliximab, adalimumab, and certolizumab) and anti-integrin therapy (vedolizumab and natalizumab).

a substantial portion of IBD patients report poor quality of life and it is independently contributing to the risk of opioid exposure.

Disease-related quality of life reflects multiple aspects of a person's social, emotional, and physical well-being in addition to their ability to participate fully at work and in society. Quality of life metrics are viewed favorably by patients and help providers identify and communicate with patients who are struggling.[20,21] Quality of life is not routinely measured in outpatient IBD clinics, but it is more traditionally used as an outcome measure in intervention trials. This study demonstrates that routine measurement of disease-related quality of life in the outpatient setting is a helpful tool in identifying a patient population at risk for poor pain control and future opioid exposure.

Participants with sustained poor quality of life were significantly more likely to become hospitalized, visit the emergency room, or have IBD-related surgery in the follow-up period. Inpatient and emergency room care are significant drivers of healthcare costs in IBD.[22,23] After controlling for disease activity, patients with low quality of life continue to have unplanned care episodes. This may reflect a psychosomatic component to healthcare utilization such as mental health disorders or pain issues captured within the quality of life measurement.[22] It is recognized that active depression is associated with worse quality of life.[24,25] Measures aimed at identifying active psychosomatic issues and coping will help reduce unplanned care in this patient population once disease activity is controlled.

Patients with poor quality of life were much more likely to be exposed to opioids in the follow-up period. This association remained significant after multivariate analysis controlling for opioid use at baseline, inflammation, and prior surgery. Opioid use has been associated with poor quality of life in other studies that were designed to explore narcotic use in IBD, irrespective of disease activity.[26,27] Our findings confirm the previous literature and suggest you can use poor quality of life scores to identify for a population that is at high risk for opioid exposure and potentially chronic use. We also know that opiate exposure is an independent predictor of high healthcare expenditures in both CD and UC and is an important factor in predicting future unplanned care and high cost care in the following year among all IBD patients.[22,28] Furthermore, opioid use has been associated with mortality among IBD patients.[14] Measuring disease-related quality of life in the outpatient setting is a way in which we can identify those at risk for future opioid use and perhaps alleviate some of the associated consequences of opiate exposure including costly unplanned care and even death.

This was an observational study derived from prospectively collected data from the electronic medical record. There may be limitations in generalizability and bias in enrollment, as those participating have chosen to join the IBD research registry at a tertiary care center, and may not reflect the general IBD population. Our data generated from the electronic medical record may be missing events that occur outside of our care system. However, all data was simultaneously processed and curated, which minimizes biases with data handling. Additionally, our outpatient medical record includes events that occur at all affiliated outside hospitals and care centers (>20 hospitals and >500 clinic sites), which decreases the likelihood that we missed external care events. Each participant

TABLE 2: Risk of Future Disease Severity and Health Care Utilization in Follow-Up Period by Quality of Life Category

	Total	Quality of Life Category		
		SIBDQ < 50	SIBDQ ≥ 50	OR [95% CI]
Biomarkers of Severity, no. (%)				
Elevated CRP	158 (35.4)	87 (40.5)	71 (30.6)	**1.54 [1.04 – 2.28]**
Elevated ESR	98 (21.9)	63 (29.3)	35 (15.1)	**2.33 [1.47 – 3.71]**
Unplanned or inpatient care, no. (%)				
Composite outcome	177 (39.6)	102 (47.4)	75 (32.3)	**1.89 [1.29 – 2.77]**
Hospitalization	129 (28.9)	80 (37.2)	49 (21.1)	**2.21 [1.46 – 3.37]**
IBD-related surgery	59 (13.2)	39 (18.1)	20 (8.6)	**2.91 [1.32 – 4.17]**
ER visit	147 (32.9)	88 (40.9)	59 (25.4)	**2.03 [1.35 – 3.04]**
Medications[a], n (%)				
Biologics	178 (39.8)	90 (41.9)	88 (37.9)	1.17 [0.81 – 1.72]
Immunomodulators	181 (40.5)	72 (33.5)	109 (47.0)	**0.57 [0.39 – 0.83]**
Prednisone	167 (37.4)	92 (42.8)	75 (32.3)	**1.57 [1.06 – 2.30]**
5-aminosalicylic acids	149 (33.3)	55 (25.6)	94 (40.5)	**0.50 [0.34 – 0.76]**
Opioids	118 (26.4)	83 (38.6)	35 (15.1)	**3.54 [2.25 – 5.56]**
Disease activity[b], [median, (IQR)]				*P*-value[c]
HBI (CD), n = 313	3.2 [4.8]	5.4 [4.9]	1.3 [2.7]	**<0.001**
UCAI (UC), n = 149	2 [4.2]	4.5 [7]	1 [2.5]	**<0.001**
HealthCare utilization, [median (IQR)])				*P*-value[c]
Telephone calls	7 [10]	9 [13]	6 [7]	**<0.001**
Office visits	4 [3]	5 [4]	4 [2]	**<0.001**
Radiologic studies	2 [3]	2 [3]	2 [2]	0.053

Abbreviations: SIBDQ – short inflammatory bowel disease questionnaire; CRP – C-reactive protein; ESR – erythrocyte sedimentation rate; SD – standard deviation; ER – emergency room; OR – odds ratio (univariate); CI – confidence interval; IBD – inflammatory bowel disease; HBI – Harvey- Bradshaw Index; UCAI – Ulcerative colitis activity index
Bolded odds ratios are statistically significant ($P < 0.05$), IQR – interquartile range

[a] Immunomodulators include 6-mercaptopurine, azathioprine, and methotrexate. Biologics include anti-tumor necrosis factor agents (infliximab, adalimumab, and certolizumab) and anti-integrin therapy (vedolizumab and natalizumab).

[b] Disease severity measured by the HBI [16] for patients with CD and the UCAI in patients with UC .[17]

[c] Wilcoxon-rank sum test to compare groups.

TABLE 3: Multivariable Logistic Regression of Risk of Unplanned Care and Opioid Use in the Follow-Up Period

	Unplanned Care[a] OR [95% CI]	*P*value	Opioid Use OR (95% CI)	*P* value
Poor quality of life[b]	1.05 [0.65 – 1.68]	0.860	2.20 [1.31 – 3.70]	0.003
Age (years)	0.98 [0.97 – 1.00]	0.016		
Female	1.63 [1.06 – 2.52]	0.027		
Surgery before 2010	2.00 [1.28 – 3.12]	0.002	1.93 [1.15 – 3.23]	0.013
Active disease[c]	1.79 [1.10 – 2.93]	0.020		
Opiate use	1.68 [1.03 – 2.74]	0.038	8.00 [4.81 – 13.31]	<0.001
Abnormal ESR	1.67 [1.05 – 2.65]	0.029	1.75 [1.03 – 2.98]	0.039
Antidepressant use	1.77 [1.10 – 2.84]	0.003		

[a] Unplanned care defined as hospitalization, emergency room visit, or IBD- related surgery in the 2-year follow-up period.

[b] Stepwise models included covariates of poor quality of life, age, gender, employment status, smoking, disease category, history of IBD-related surgery, and baseline biologic use, steroid exposure, 5-aminosalyslic acid exposure, antidepressant use, opioid exposure, active disease, abnormal CRP, and abnormal ESR .

[c] Active disease was defined as mean UCAI score ≥4 or mean HBI scores ≥5 over the baseline time period.

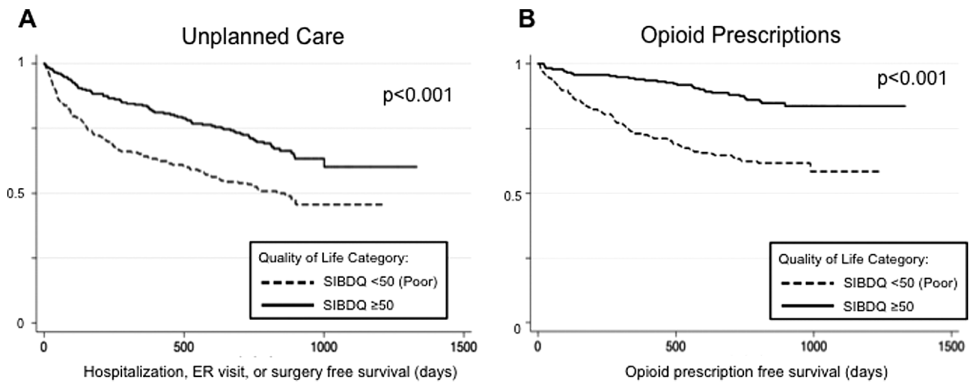

FIGURE 2. Time to unplanned care and opioid prescription comparing 2 quality of life groups. Participants were designated as having poor quality of life if their average SIBDQ in the 2-year observation period was <50 and were compared to those with an average higher SIBDQ (≥ 50). Time 0 is the date of each participants last SIBDQ in the 2-year observational period. We measured (A) the days to unplanned care (first hospitalization, emergency room visit, or surgery) (B) and first opioid prescription .

had SIBDQ measured an undefined number of times during routine clinic visits during the first 2 years, and all results were averaged. The number of times the SIBDQ was measured may affect the mean value. In an attempt to overcome the difficulty of multiple observations, we chose to use a long 2-year baseline observation period to average the scores and then dichotomize in an effort to overcome any large fluctuations or outliers in the patient experience, which may have placed a subject in 1 group or the other. We know depression can impact quality of life.[24,25] In our analysis, depression was inferred from outpatient prescription data, which may have included patients with pain or functional disorders. Additionally, prescription data does not distinguish between ongoing clinical depression, appropriately treated depression, or overall depression severity. Whereas measuring quality of life includes some components of depression, future studies could incorporate clinical depression scales to overcome the bias associated with using medication data as a proxy for psychiatric illness.

Our study is strengthened by the use of a validated and widely available published version of the SIBDQ to determine if consistently poor quality of life scores can predict future disease severity and health care utilization, and for that reason we have focused on simplicity of interpretation and the use of real-world data. All data for this study were derived from the electronic health record and routine clinical care, which provides insight into the real-world experience of patients. This suggests our findings may be applicable to other health care settings and readily translated into clinical practice. The ease of translation of this approach will ideally facilitate prospective validation of these findings in other health care settings to support our findings.

Measuring health-related quality of life is a noninvasive method of understanding a patient's overall well-being and may increase provider awareness of those struggling with their disease. We have shown that routine measurement of quality of life in the outpatient clinic setting over time can provide information about disease status and the risk of future opiate exposure. Those that report sustained poor quality of life over a 2-year period may benefit from additional psychosocial care, pain management, or more aggressive medical management of their disease in hope of preventing opiate exposure and subsequently unplanned care. Future research can evaluate whether timely multidisciplinary intervention can reduce opiate prescriptions and future unplanned care in patients with persistent poor quality of life.

SUPPLEMENTARY DATA

Supplementary data are available at *Inflammatory Bowel Diseases* online.

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