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A Longitudinal Study of Sexual Function in Women With Newly Diagnosed Inflammatory Bowel Disease

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Abstract

Background: The literature provides conflicting data on sexual function in women with inflammatory bowel disease (IBD). We aim to describe sexual function at baseline and over time in a prospective inception cohort of adult women with IBD.

Methods: Women age 18 years or older enrolled in the Ocean State Crohn's & Colitis Area Registry (OSCCAR) with 2 years of prospective follow-up were included in the study. All subjects were enrolled within 1 year of IBD diagnosis. Female sexual function was assessed using the Female Sexual Function Index (FSFI). Linear mixed effects models were used to assess changes in FSFI by various demographic and clinical factors.

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Results: One hundred sixteen of 130 eligible women (89%) were included in the study. Ninety-seven percent of women had sexual dysfunction, defined as an FSFI score of <26.55, with a baseline mean FSFI score (SD) of 16.4 (8.4) overall (15.5 [8.6] in Crohn's disease, 17.4 [8.1] in UC, $P = 0.22$). Despite improvement in overall disease activity, there was no significant change in the FSFI score or individual domain scores over the entire 2-year study period. Among all women with IBD, older age, nonsingle marital status, lower Short Form Health Survey (SF-36) Physical Component Summary score, and the use of biologics were independent risk factors for sexual dysfunction.

Conclusions: Almost all women experienced sexual dysfunction that did not improve over time despite improvement in overall disease activity. Future studies are warranted to identify underlying mechanisms that explain the associations between demographic and clinical factors and sexual dysfunction among newly diagnosed women.

Keywords

ulcerative colitis; Crohn's disease; sexual function; quality of life

INTRODUCTION

The inflammatory bowel diseases (IBD), including Crohn's disease (CD) and ulcerative colitis (UC), are chronic and relapsing disorders that significantly impair various aspects of quality of life.[1] About half of IBD patients are diagnosed before the age of 35, when sexual and interpersonal identities are developing.[2] Therefore, it is not surprising that some of the main illness-related concerns expressed by IBD patients are directly related to sexuality.[3]

Over 20 years ago, Moody et al reported impaired sexual functioning in IBD patients via structured interviews of 50 women with CD compared with age-matched controls.[4] The results were striking: 24% of patients had either infrequent or no intercourse compared with 4% of controls. A subsequent study involving 188 IBD patients paired with matched controls reported that dyspareunia was more common among women with IBD.[5] Further research has confirmed the association between IBD and impaired sexual function in women. In 2010, Muller et al reported that 67% of women with IBD perceive their disease to negatively affect their sexual functioning.[6] The causes of impaired sexual function in women with IBD remain unclear but are likely to be multifactorial, with contributions from biological, psychological, and physical factors.

Factors that may mediate sexual function in women with IBD include age of diagnosis, disease duration, disease activity, depression, fatigue, corticosteroid use, biologic use, and surgery.[4, 5, 7–9] However, data regarding the association between these factors and sexual function in women with IBD vary across studies. Prior studies on sexual function in women with IBD are limited by several factors including cross-sectional design, low survey response rates, and lack of use of standardized study instruments. Therefore, in this study we sought to describe baseline characteristics and changes in sexual function in a prospective cohort of women with IBD diagnosed in the community. We previously reported that body image dissatisfaction in women with IBD remains diminished and stable over time despite improvements in overall disease activity.[10] Similarly for this study, we hypothesized that

sexual function in women with IBD is compromised at baseline and does not improve over time.

MATERIALS AND METHODS

Study Subjects

The Ocean State Crohn's & Colitis Area Registry (OSCCAR) is a community-based, prospective inception cohort of IBD patients in the state of Rhode Island.[2] Diagnosis of IBD was determined by signs and symptoms consistent with the diagnosis and confirmed by endoscopy, imaging, and/or pathology. Between January 1, 2008, and December 31, 2012, 408 patients were enrolled in OSCCAR. Most subjects were enrolled within 1 year of diagnosis, with a median time to enrollment of 60 days from diagnosis.

Women with CD or UC who enrolled within 1 year of IBD diagnosis, were 18 years or older, and had a minimum of 2 years of follow-up were eligible for this study. Those with insufficient data on sexual function (n = 52) were excluded from this study (eg, missing or incomplete baseline or follow-up sexual function scores).

Sexual Function Measurement

The Female Sexual Function Index (FSFI) is a brief, 19-item, self-reported, multidimensional scale that assesses sexual function in women.[11] The FSFI has been validated in women with mixed sexual dysfunctions, including female sexual arousal disorder (FSAD), hypoactive sexual desire disorder (HSDD), female sexual orgasm disorder (FSOD), dyspareunia/vaginismus (pain), and multiple sexual dysfunctions.[12] A value of 26.55 has been set as the optimal cut score for differentiating between women with and without sexual dysfunction.[12] The FSFI has been used in more than 4000 studies and translated into numerous languages. Scores range between 1.2 and 36, with higher scores representing better sexual function. The scale consists of 6 domains: desire, arousal, lubrication, orgasm, satisfaction, and pain. The FSFI has been shown to have good construct validity, internal consistency, (Cronbach's alpha values of 0.82 or higher) and test-retest reliability.[11]

Patient-Reported Outcomes

At predefined intervals, subjects in OSCCAR were administered instruments to measure quality of life, disease-related symptoms, psychological well-being, medication use, and surgery. Additional data elements were also recorded by standardized chart review of the subjects' medical record. Standardized study instruments used in this study were the Personal Health Questionnaire Depression Scale (PHQ-8), the Functional Assessment of Chronic Illness Therapy-Fatigue (FACIT-F) Scale, the Inflammatory Bowel Disease Questionnaire (IBDQ) and the Short Form Health Survey (SF-36).[13–24]

The study protocol was approved by the Icahn School of Medicine at Mount Sinai and Lifespan/Rhode Island Hospital institutional review boards. Approval for use of SF-36 was obtained from Optum.

Statistical Analysis

For descriptive analysis of demographic and clinical variables, we calculated mean with standard deviation for continuous variables and counts with percentages for categorical variables. The differences between CD and UC were assessed using a *t* test for continuous variables, and the Fisher exact test was used for categorical variables.

In the assessment of changes of the primary outcome for this study (FSFI and its domains) during the 2 years of follow-up, we used linear mixed-effects models with year as a fixed effect and a random intercept for each patient with an AR(1) correlation structure. This approach is less biased and more powerful than a complete case analysis. Change over time in the binary variable of prevalence of sexual dysfunction was modeled with a logistic regression model with generalized estimating equations, taking into account unconstrained correlation within patients.

Association between covariates and the outcome variable—FSFI score—were evaluated using data available from all years. A mixed-effects model was used adjusting the covariates (either categorical or continuous, described in Table 2) and time as fixed effect and a random intercept for each patient. *P* values were adjusted for false discovery rate (FDR) using the Benjamini-Hochberg approach.

In the multivariable analysis, the same mixed-effects model approach was used initially considering all variables with $P < 0.2$ from the univariate analysis as fixed effects. Because missing values in the covariates were present in a sizeable 31% of the observations, a sensitivity analysis was carried out using multiple imputation procedure (k = 7). To this end, we used the Multivariate Imputations by predictive mean matching available in R's "mice" package.[25, 26] The final model was estimated by pooling the mixed-effect estimates obtained in each of the k imputations.

All analyses were conducted using R (version 3.3.2).

RESULTS

Study Population

Of the 130 eligible subjects, 116 (89%) women completed the FSFI (60 CD, 56 UC) at baseline during the first 2 years of follow-up. We compared FSFI questionnaire completers and noncompleters and found no difference in age or disease activity scores. Baseline demographic and clinical characteristics are summarized by disease type in Table 1. Compared with UC, a greater proportion of women with CD were younger, married, experienced abdominal pain, and had lower SF-36 PCS scores.

At baseline, the mean FSFI score (SD) was 16.4 (8.4) overall (15.5 [8.6] in CD, 17.4 [8.1] in UC; $P = 0.22$) (Table 1). One hundred twelve (97%) women had sexual dysfunction, defined as an FSFI score of less than 26.55 (results not shown). Prevalence of sexual dysfunction at baseline was similar in CD and UC (58 [97%] CD patients, 54 [96.4%] UC patients; $P = 1.00$) and remained unchanged throughout the 2-year duration of the study ($P = 0.99$) (results not shown). This was also the case for the individual domains of the FSFI (Fig. 1).

A separate analysis by disease type (CD and UC) revealed the same findings (results not shown).

Age and Marital Status

Univariate analysis of sexual function with respect to various patient and clinical factors was performed, showing that younger age was significantly associated with better sexual function (Table 2). For every additional decade of age, the FSFI score decreased by 1.5 points (Table 2). In the final multivariable model, age was an independent predictor of sexual function (Table 3).

Compared with women who were married, divorced/separated, or widowed, women who were single or cohabitating with a partner had higher FSFI scores, according to the unadjusted *P* value (unadjusted $P = 0.006$, adjusted $P = 0.07$) (Table 2).

Disease Activity and Fatigue

Figure 1 shows the mean scores of study measurements across all 3 time points. Colors represent the estimated mean for each time point and have been normalized for each score. Red represents higher scores, and blue represents lower scores. Overall, disease activity was mild. Among women with CD, mean HBI scores at baseline, year 1, and year 2 were 4.0, 2.7, and 2.9, respectively. There was a significant change between baseline and year 1 ($P = 0.005$) and year 2 ($P = 0.02$), which is indicated with asterisks in Figure 1. Among women with UC, mean Simple Clinical Colitis Activity Index (SCCAI) scores at baseline, year 1, and year 2 were 2.9, 2.6, and 2.6, respectively. There was no significant change between baseline and the other 2 time points. Throughout the duration of the study, disease activity improved in CD and UC (Fig. 1). In women with CD, Harvey Bradshaw Index (HBI) scores significantly decreased over time ($P = 0.011$ for time effect) (Fig. 1). Although not statistically significant, SCCAI scores among UC women decreased after the first year but remained stable during the second year ($P = 0.47$) (Fig. 1). Across all 3 measured time points, there was no association between disease activity and sexual function ($P = 0.64$ for CD, $P = 0.50$ for UC) (Table 2). Similarly, a lack of association was observed for all individual domain scores of the FSFI.

FACIT-F scores increased significantly throughout the study, corresponding to a decrease in fatigue ($P = 0.03$). There was no association between FACIT scores and FSFI scores ($P = 0.46$ in all women, $P = 0.63$ in CD, $P = 0.31$ in UC).

Medication Use

Over the course of the study, women were treated with biologic therapy (20% at years 1 and 2), systemic steroids (44% at year 1, 23% at year 2), immunomodulator therapy (15% at year 1, 18% at year 2), and budesonide (14% at year 1, 11% at year 2) (results not shown).

From the multivariable analysis, the use of biologics was independently associated with lower FSFI scores (Table 3). This finding was similar to the multivariable analysis in CD patients ($P < 0.05$) but not in UC patients (0.84, before running the model with a backward selection).

Among all women, there was no significant association between sexual function and the use of IV or oral corticosteroids or budesonide (Table 2). The results remained unchanged on analysis by IBD subtype.

IBD-specific Symptoms

Women with CD who reported stool incontinence over the past 4 weeks had lower FSFI scores compared with those who did not report stool incontinence ($P = 0.049$) (results not shown). This association was not seen in women with UC ($P = 0.34$). Neither abdominal pain nor diarrhea over the past four weeks were associated with changes in sexual function ($P = 0.24$, $P = 0.40$, respectively, in all women) (Table 2).

Only 3 women with CD had anal fistulas. The presence of fistulas in women with CD was associated with lower FSFI scores ($P = 0.043$) and correlated with a nearly 6-point reduction in FSFI score.

Quality of Life (SF-36 PCS and IBDQ)

Among all women in the study, there was a positive association between sexual function and the SF-36 Physical Health Component Score (SF-36 PCS) ($P = 0.03$), but it did not remain significant after FDR adjustment ($P = 0.19$). However, multivariable analysis showed SF-36 PCS to be independently associated with sexual dysfunction (Table 3). There was no significant association between SF-36 Mental Health Component Score (SF-36 MCS) on univariate analysis ($P = 0.57$).

Throughout the entire study, IBDQ scores increased significantly ($P < 0.001$). There was a significant association between sexual function and IBDQ scores in women with UC ($P = 0.032$), but this association no longer remained significant after FDR adjustment ($P = 0.31$). Among women with UC, domain analysis showed a significant association between lower IBDQ scores and lower arousal ($P = 0.039$), lubrication ($P = 0.039$), satisfaction ($P = 0.009$), and desire ($P = 0.016$); none of these associations remained significant after FDR adjustment.

DISCUSSION

There is a paucity of knowledge about the effect of inflammatory bowel disease on sexual function in women. Using a well-validated instrument, we found that 97% of women newly diagnosed with IBD have sexual dysfunction. This is substantially more than the general population, in which 50% of women in the United States have sexual dysfunction[27] per the FSFI, which classifies 88.1% of sexually functional women correctly.[9] Numerous epidemiologic studies show an association between chronic conditions and decreased sexual function in women. Comparing our results with those studies, it appears that sexual dysfunction is more severe and prevalent in IBD compared with other chronic conditions, including fibromyalgia, Behcet disease, coronary artery disease, diabetes type 1 and type 2, rheumatoid arthritis, and hypertension.[28–34] This difference may be due to the fact that our patients had newly diagnosed disease and that sexual function may be particularly low at diagnosis.

Our study found no significant relationship between sexual function and disease activity at baseline or over time. In our cohort, sexual dysfunction persisted despite improvement in overall disease activity. Two German studies published by Timmer et al had conflicting findings regarding the relationship between female sexual function and IBD activity.[7, 8] The first reported impaired function in sexual activity, independent of disease activity.[7] In the second, although disease activity was associated with decreased self-reports of feeling attractive and feminine and decreased satisfaction with bodily appearance, no relationship was found between disease activity and sexual function, as measured by the Brief Index of Sexual Function in Women.[8] In contrast to our study, both studies by Timmer et al included patients with a mean disease duration of about 10 years. Neither of these studies used the FSFI to measure sexual function.

At baseline, 23% of women had evidence of depression, defined as a PHQ-8 score of 10 or greater. This is higher than the rate reported in a variety of other chronic conditions and in the general population (8.6%) and remained stable throughout the duration of the study ($P = 0.659$).[11, 35] We found no significant association between depression and sexual function in women with IBD, a finding that differs from numerous studies reported in literature.[7–9, 36, 37] This difference may be due to study design because all the previous studies included patients who had been diagnosed for many years, whereas our study had an inception cohort design with 2-year follow-up.

Older age is known to be associated with decreased sexual functioning in women in the general population[27, 36] and among those with IBD.[7–9, 37] In the general population, FSFI scores increase up to the age of 44, after which time the risk of sexual dysfunction triples.[27, 38]Although our findings suggest a similar trend with worsening sexual function beyond the age of 45, we found sexual dysfunction was present in all age groups.

The reason for persistent sexual dysfunction over time remains unclear. The stability of sexual dysfunction in our cohort is unlikely to be a result of inadequate study duration because significant intra-individual variations of FSFI scores have been shown even in time frames as short as 6 weeks.[39] A new IBD diagnosis is likely to bear a stress that negatively affects sexual function, as stress has been associated with lower FSFI scores.[39] It is conceivable that the ability to cope with the stress of being diagnosed with IBD occurs only slowly over years. Previously reported data regarding the association between disease duration and sexual function vary. In one study of 217 survey responders with IBD, disease duration was not significantly associated with body image, sexual activity, or libido. However, patients with disease duration of greater than 3 years were 2.59 times more likely to report an adverse effect on libido.[7] In another study, disease duration of more than 10 years was not a determinant of low sexual function.[8]

Literature suggests that patients perceive a negative impact of IBD medications on sexual functioning. Muller et al reported that 40% of IBD patients felt that their IBD medications negatively affected their libido or sexual activity and, thus, nearly 10% of IBD patients sometimes or frequently omitted medications.[6] Additionally, Marin et al reported an association between biologics and sexual impairment in Spanish women who had long-standing IBD, but this was seen only on univariate analysis.[9] Our findings support an

association between biologic use and sexual dysfunction in women with newly diagnosed IBD, independent of disease activity. In this inception cohort, biologic therapy was initiated close to the time of initial IBD diagnosis. Perhaps rapidly developing moderate-severe IBD necessitating the early use of biologic is the main driving factor for sexual dysfunction.

Our findings differ from cross-sectional studies from Spain and Germany that reported use of corticosteroid to be independently associated with sexual dysfunction in women.[8, 9] In the current study, we found no significant association between steroid use and sexual function. This may be due to the different study design and sample sizes.

This study had several limitations. First, we were not able to directly compare sexual function in our cohort to a contemporaneous control group. Nevertheless, we used an instrument to measure female sexual function that is well-validated in both healthy and disease populations and that has well-established thresholds to define normal sexual function. Second, a small number of patients had perianal disease and surgeries, which underpowered our analyses for any potential relationships between these parameters and sexual function. Third, accurate assessment of sexual functioning in women may be limited by discomfort in reporting such a private aspect of one's personal life. Fourth, we did not have access to patients' non-IBD medications, including narcotics and anti-depressant medications, which may have played a role in sexual function. Of the currently available measures (including objective tools such as vaginal photoplethysmography or Duplex ultrasound), validated questionnaires are deemed the most reliable tools in the assessment of female sexual function and accurately reflect the subjective experience of sexuality.[40] However, there are limitations to the use of the FSFI in this specific population of women with IBD. Although the FSFI is considered the gold standard for the measurement of female sexual dysfunction overall, it may not address sexual concerns specific to IBD itself. In recognition of this limitation, the IBD-specific Female Sexual Dysfunction Scale (IBD-FSDS) has been recently developed but was not available at the time of our study.[41]

Because our study cohort consists of women in a community population rather than from tertiary care centers, it is likely to be more representative of the general population of patients with IBD. However, an additional potential limitation is that most of our patients were from Rhode Island, which may limit the generalizability of our findings to other parts of the United States.

Despite the limitations, our study benefits from several unique strengths, including its prospective, longitudinal design and examination of newly diagnosed IBD women—a population that has never been examined with respect to sexual function. Another important strength is the relatively high response rate (89%). Additionally, the patient population in OSCCAR is stable and had only an 11% dropout rate during the study period. Also, a greater variety of clinical and disease-specific outcome measures were used than in any other prior studies evaluating female sexual function in IBD. Moreover, we used the FSFI, which is the most accepted tool for the evaluation of sexual function in women and was not used in many prior studies.

Currently, there is no publication available to recommend therapy for IBD-associated sexual dysfunction. In 2010, Basson et al published guidelines for the clinical management of sexual dysfunction within the context of chronic illness.[42] A multidisciplinary assessment via a structured interview of both partners (together and individually) is the key first step in addressing sexual dysfunction.[42] Therapy should target concurrent psychiatric disease and specific physical disease-related factors that may contribute to the pathophysiology of sexual dysfunction.[42] Gastroenterologists should ask IBD patients about their sexual function and consider referring selected patients to a sexual health specialist.

CONCLUSION

In conclusion, in a community-based incident cohort of women with IBD followed longitudinally, we found that nearly all women experienced sexual dysfunction, which did not improve over time despite improvement in overall disease activity. The lack of significant association between most disease characteristics and patient-reported outcomes prevents clinicians from using such indicators to screen for sexual dysfunction. This underscores the importance of heightened awareness of the pervasive nature of female sexual dysfunction among women with IBD and the need for multidisciplinary treatment of this patient population.

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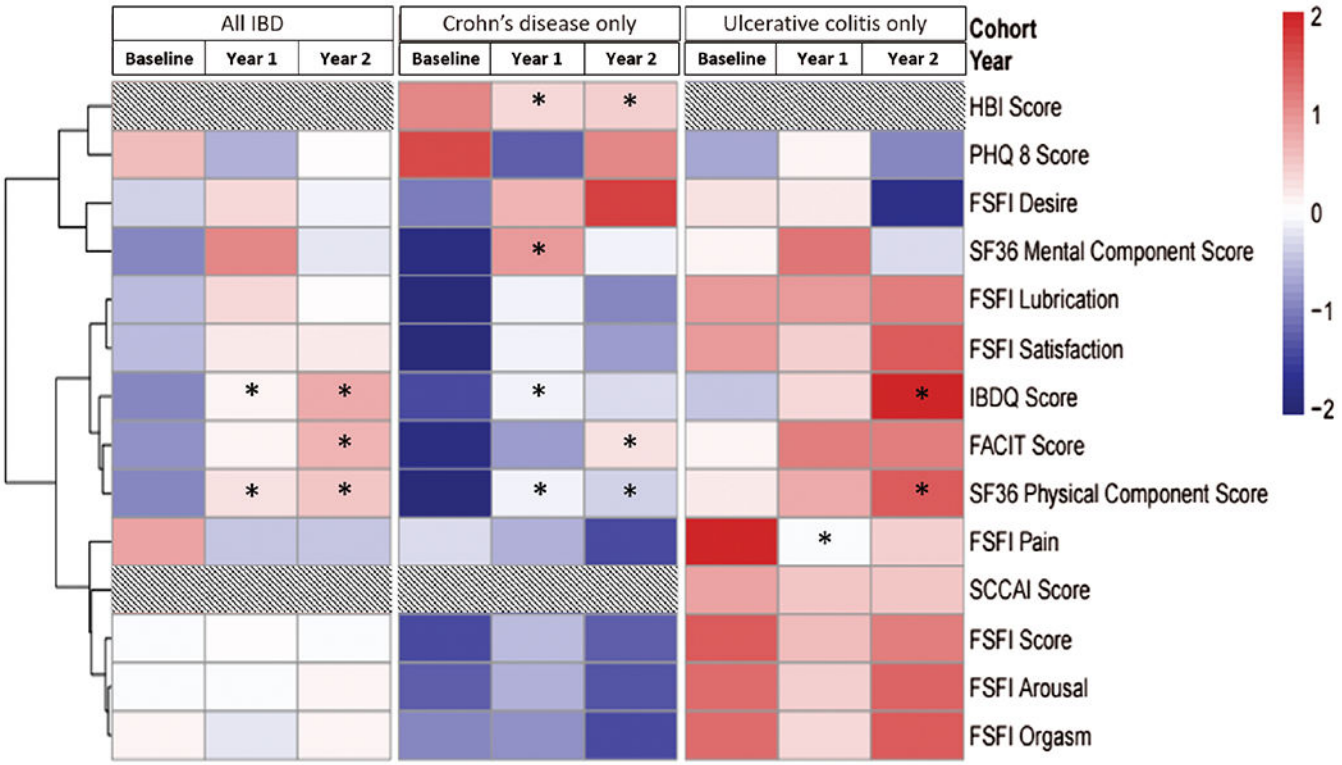

FIGURE 1.

Heat map and dendrogram of relative changes in FSFI, disease and quality of life scores over time, according to IBD type. $*P < 0.05$. The heat map is a graphical representation of the mean of various clinical factors assessed in the study (in rows) at each time point overall and by disease subtype (columns). Colors represent the estimated mean for each time point and have been normalized for each score. Red represents higher scores, and blue represents lower scores. Stars indicate that a significant increase from baseline was observed for that timepoint and patient subgroup. The dendrogram, represented by the tree-structured graph on the left of the figure, shows the result of unsupervised hierarchical clustering of the clinical variables whose change in time was studied. The heatmap is thus ordered by the relative distance between the variables so that factors with similar changes over time are kept in close proximity and belong to the same cluster. The overall similarity of the cluster is indicated by height of the dendrogram corresponding to a cluster branch.

TABLE 1.

Baseline Patient Demographics, Disease Characteristics, and History

	Crohn's disease (n = 60)	Ulcerative colitis (n = 56)	*P*
Mean age at enrollment (SD)	37.5 (14.7)	43.4 (16.3)	0.045
Age categories			0.04
18–29, n (%)	22 (37)	12 (21)	
30–44, n (%)	19 (32)	21 (38)	
45–65, n (%)	17 (28)	15 (27)	
>65, n (%)	1 (2)	8 (14)	
Race			0.69
White, n (%)	53 (88)	51 (91)	
African American, n (%)	3 (5)	2 (3)	
More than one race, n (%)	0 (0)	1 (2)	
Other, n (%)	2 (3)	2 (3)	
Refused or unknown, n (%)	2 (3)	0 (0)	
Hispanic or Latino origin			0.40
No, n (%)	54 (90)	54 (96)	
Yes, n (%)	5 (8)	2 (4)	
Unknown, n (%)	1 (2)	0 (0)	
Marital status			0.02
Married, n (%)	25 (42)	11 (20)	
Single/never married, n (%)	17 (28)	32 (57)	
Divorced/separated, n (%)	11 (18)	6 (11)	
Cohabitating, n (%)	4 (7)	4 (7)	
Widowed, n (%)	3 (5)	3 (5)	
Smoking status			0.25
Never smoked, n (%)	28 (47)	26 (46)	
Former smoker, n (%)	18 (30)	23 (41)	
Current smoker, n (%)	14 (23)	7 (13)	
Mean BMI (SD)	27.7 (8)	28.3 (16)	0.79
Mean FSFI (SD)	15.5 (8.6)	17.4 (8.1)	0.22
Disease activity			
HBI, mean score (SD)*a*	4.0 (3.8)	NA	NA
SCCAI, mean score (SD)*b*	NA	2.9 (2.3)	NA
Symptoms			
Abdominal pain, n (%)	55 (92)	41 (73)	0.02
Diarrhea, n (%)	47 (78)	47 (84)	0.63
Stool incontinence, n (%)	14(23)	19 (34)	0.22
Medication use			
Prednisone or IV corticosteroids, n (%)	7 (12)	10 (18)	0.43
Biologics, n (%)	0 (0)	1 (2)	0.48
Quality of Life Measures			

	Crohn's disease (n = 60)	Ulcerative colitis (n = 56)	*P*
Mean SF-36 Physical Component Summary(SD)[c]	42.7 (10)	49 (8)	0.002
Mean SF-36 Mental Component Summary(SD)[d]	42.6 (13)	44.7 (11)	0.40
Mean IBDQ score (SD)[e]	156.7 (36)	165 (31)	0.17
Mean FACIT-F score (SD)	33 (12)	36 (12)	0.13
Mean PHQ8 score (SD)[f]	6.6 (6)	5.9 (5.4)	0.56
CD Location per Montreal Classification[g]			NA
L1 ileal	15 (25)	NA	
L2 colonic	27 (45)	NA	
L3 ileocolonic	17 (28)	NA	
L4 isolated upper disease[h]	14 (23)	NA	
CD Behavior per Montreal Classification[g]			NA
B1 nonstricturing, nonpenetrating	49 (82)	NA	
B2 stricturing	7 (12)	NA	
B3 penetrating	3 (5)	NA	
P perianal disease modifier	8 (13)	NA	
UC Location per Montreal Classification			NA
E1 Proctitis	NA	25 (45)	
E2 Left-sided colitis	NA	14 (25)	
E3 Pancolitis	NA	17 (30)	
Extraintestinal manifestations[i]			NA[j]
Sacroiliitis	1 (2)	0 (0)	
Ocular	3 (5)	0 (0)	
Dermatologic	0 (0)	0 (0)	

[a] Four subjects with missing scores.

[b] Three subjects with missing scores.

[c] Sixteen and 14 subjects with missing scores in CD and UC, respectively.

[d] Fifteen and 14 subjects with missing scores in CD and UC, respectively.

[e] One UC subject with missing score.

[f] Four and 7 subjects with missing scores in CD and UC, respectively.

[g] Missing 1 subject for Montreal Classification.

[h] Thirty-six subjects missing.

[i] Two subjects with missing scores in CD.

[j] Sample size inadequate for statistical analysis.

Abbreviations: NA, not applicable.

TABLE 2.

Associations Between FSFI Total and Domain Scores and Various Factors Among All Women Across 2 Years: Univariate Analysis

Variable	Unadjusted Estimate (95% CI)	Unadjusted *P*	Adjusted *Pa*	FSFI Domain(s) With Significant Associations (unadjusted *P*, adjusted *Pa*)
Age (continuous age with 1-year increments)	−0.15 (−0.23, −0.06)	<0.001	0.02	Arousal (0.002, 0.03) Desire (<0.001, 0.02) Lubrication (0.002, 0.03) Orgasm (0.006, 0.07) Satisfaction (<0.001, 0.004)
Single marital status[b]	3.74 (1.09, 6.38)	0.006	0.07	Arousal (0.009, 0.07) Lubrication (0.001, 0.02) Orgasm (0.001, 0.02) Pain (0.001, 0.005) Satisfaction (0.034, 0.26)
IBD subtype (UC vs CD)	1.37 (−4.10, 1.36)	0.32	0.75	
Disease activity				
HBI (CD only)	0.1 (−0.31, 0.5)	0.64	0.84	
SCCAI (UC only)	−0.16 (−0.62, 0.3)	0.50	0.81	Desire (0.05, 0.42)
Quality of life measures[d]				
IBDQ score	0.02 (−0.02, 0.05)	0.33	0.75	Pain (0.04, 0.22)
SF-36 Mental Component Summary	−0.02 (−0.09, 0.05)	0.57	0.81	Pain (0.03, 0.22)
SF-36 Physical Component Summary	0.11 (0.01, 0.2)	0.03	0.19	Arousal (0.002, 0.03) Lubrication (0.02, 0.14) Satisfaction (0.01, 0.13)
PHQ8 score[e]	−0.01 (−0.18, 0.17)	0.94	1.0	Pain (0.03, 0.22)
FACIT-F score	0.03 (−0.05, 0.11)	0.46	0.79	
Symptoms[f]				
Abdominal pain	1 (−0.66, 2.67)	0.24	0.79	
Diarrhea	−0.70 (−2.36, 0.95)	0.40	0.79	
Stool incontinence	−0.54 (−2.33, 1.25)	0.55	0.81	
Medication use				
Prednisone or IV corticosteroids	−0.85 (−2.53, 0.83)	0.32	0.75	
Biologics	−1.66 (−3.8, 0.49)	0.13	0.75	Orgasm (0.05, 0.4)
Budesonide	1.26 (−1.39, 3.90)	0.35	0.75	
CD Location per Montreal Classification (L1-3)[g]		0.76	0.84	
L1	16.83 (12.69, 20.96)			

Inflamm Bowel Dis. Author manuscript; available in PMC 2024 May 09.

Variable	Unadjusted Estimate (95% CI)	Unadjusted *P*	Adjusted *Pa*	FSFI Domain(s) With Significant Associations (unadjusted *P*, adjusted *Pa*)
L2	14.97 (11.86, 18.08)			
L3	16.1 (12.19, 20)			
CD Behavior per Montreal Classification (B1-3)		0.74	0.84	
B1	15.73 (13.44, 18.02)			
B2	14.65 (8.43, 20.86)			
B3	18.89 (9.74, 28.04)			
P perianal disease modifier	13.95 (2.8,25.1)			
UC Location per Montreal Classification (E1-E3)		0.34	0.75	
E1	18.67 (15.91, 21.44)			
E2	16.18 (12.44, 19.92)			
E3	15.71 (12.34, 19.08)			

For continuous variables, the estimate represents the change in FSFI score for each variable unit. For categorical variables, the estimate represents the estimated lsmeans between groups.

[a] *P* adjusted for false discovery rate.

[b] Sexual function by marital status analyzed as single or cohabitating vs married, divorced/separated and widowed.

[c] Data available for 53 subjects with UC.

[d] Data available for 115 subjects for IBDQ score, 87 subjects for SF-36 MCS and 86 subjects for SF-36 PCS.

[e] Data available for 105 subjects.

[f] Data available for 115 subjects for abdominal pain and diarrhea.

[g] Univariate analysis not performed for L4 isolated upper digestive disease given data for 36 subjects were missing

IBD, inflammatory bowel disease; HBI, Harvey-Bradshaw index; SCCAI, simple clinical colitis activity index; IBDQ, Inflammatory Bowel Disease Questionnaire; PHQ8, Personal Health Questionnaire Depression Scale; FACIT-F, Functional Assessment of Chronic Illness Therapy-Fatigue.

TABLE 3.

Associations Between Total FSFI Scores and Demographic and Clinical Factors: Multivariable Analysis With and Without Imputation

	With imputation		Without imputation	
	Estimate (95% CI)	***P***	**Estimate (95% CI)**	***P***
SF-36 PCS (every 10 points)	1.03 (0.12, 1.94)	0.03	0.10 (0.02, 1.88)	0.05
Use of biologics	−2.17 (−4.29, −0.04)	0.05	−2.38 (−4.70, −0.03)	0.05
Single marital status	4.01 (1.42, 6.61)	0.003	4.46 (1.43, 7.50)	0.006
UC diagnosis	0.62 (−2.03, 3.26)	0.65	0.96 (−2.10, 4.01)	0.55
Age (every 10 years)	−1.67 (−2.51, −0.83)	<0.001	−0.13 (−2.34, −0.30)	0.01