Published in final edited form as:

Am J Gastroenterol. 2012 March ; 107(3): . doi:10.1038/ajg.2011.377.

Gastrointestinal and Psychological Mediators of Health-Related Quality of Life in IBS and IBD: A Structural Equation Modeling Analysis

Bruce D. Naliboff, PhD^{1,2,3,4,5}, Sharon E. Kim, MD^{1,4}, Roger Bolus, PhD^{1,2,6}, Charles N. Bernstein, MD⁷, Emeran A. Mayer, MD^{1,2,3,8,9}, and Lin Chang, MD^{1,2,6}

¹Center for Neurobiology of Stress, David Geffen School of Medicine at UCLA, Los Angeles, California, USA

²Department of Medicine, David Geffen School of Medicine at UCLA, Los Angeles, California, USA

³Department of Psychiatry and Biobehavioral Sciences, David Geffen School of Medicine at UCLA, Los Angeles, California, USA

⁴Department of Medicine, Greater Los Angeles Veterans Administration Medical Center, Los Angeles, California, USA

⁵Department of Psychiatry, Greater Los Angeles Veterans Administration Medical Center, Los Angeles, California, USA

⁶UCLA/VA Center for Outcomes Research and Education, Greater Los Angeles Veterans Administration Medical Center, Los Angeles, California, USA

⁷Department of Internal Medicine and IBD Clinical and Research Centre, University of Manitoba Winnipeg, Manitoba, Canada

⁸Department of Physiology, David Geffen School of Medicine at UCLA, Los Angeles, California, USA

⁹Brain Research Institute, David Geffen School of Medicine at UCLA, Los Angeles, California, USA

Abstract

Objective—Inflammatory bowel disease (IBD) and irritable bowel syndrome (IBS) are chronic gastrointestinal (GI) syndromes in which both GI and psychological symptoms have been shown to negatively impact health-related quality of life (HRQOL). The objective of this study was to use structural equation modeling (SEM) to characterize the interrelationships among HRQOL, GI, and psychological symptoms to improve our understanding of the illness processes in both conditions.

© 2012 by the American College of Gastroenterology

Correspondence: Lin Chang, MD, Center for Neurobiology of Stress, David Geffen School of Medicine at UCLA, 10833 LeConte Avenue, CHS 42-210, Los Angeles, California 90095-7378, USA. linchang@ucla.edu.

Conflict of interest: Guarantor of the article: Lin Chang, MD.

Specific author contributions: Concept and design, analysis and interpretation of data, and manuscript preparation: Bruce D. Naliboff manuscript preparation: Sharon E. Kim; data analysis, manuscript preparation, and review: Roger Bolus; patient recruitment and manuscript review: Charles N. Bernstein; concept and design, patient recruitment, manuscript review, and financial support: Emeran A. Mayer; patient recruitment, data analysis, and manuscript preparation: Lin Chang.

Financial support: NIH R24 AT002681.

Potential competing interests: None.

Methods—Study participants included 564 Rome positive IBS patients and 126 IBD patients diagnosed via endoscopic and / or tissue confirmation. All patients completed questionnaires to assess bowel symptoms, psychological symptoms (SCL-90R), and HRQOL (SF-36). SEM with its two components of confirmatory analyses and structural modeling were applied to determine the relationships between GI and psychological symptoms and HRQOL within the IBS and IBD groups.

Results—For both IBD and IBS, psychological distress was found to have a stronger direct effect on HRQOL (−0.51 and −0.48 for IBS and IBD, respectively) than GI symptoms (−0.25 and −0.28). The impact of GI symptoms on psychological distress was stronger in IBD compared with IBS (0.43 vs. 0.22; $P < 0.05$). The indirect effect of GI symptoms on HRQOL operating through psychological distress was significantly higher in IBD than IBS (−0.21 vs. −0.11; $P < 0.05$).

Conclusions—Psychological distress is less dependent on GI symptom severity in IBS compared with IBD even though the degree that psychological distress impacts HRQOL is similar. The findings emphasize the importance of addressing psychological symptoms in both syndromes.

Introduction

Inflammatory bowel disease (IBD) and irritable bowel syndrome (IBS) are both chronic syndromes, which are associated with fluctuating gastrointestinal (GI) symptoms, altered bowel habits, and a significant impact on a patient's health-related quality of life (HRQOL) (1). The syndromes differ in the etiology of symptoms, with those in IBD patients, resulting from objective mucosal inflammation, while generally accepted inflammatory, biochemical, or structural abnormalities, which have a causative role in symptoms have not been consistently identified in IBS.

The literature suggests that both GI symptom severity and psychological factors are related to HRQOL in IBS and IBD (2–4). A recent systematic review of the HRQOL literature in IBS concluded that there was good evidence of a significant decrement in HRQOL in IBS patients, which was associated with greater GI symptom severity, but not predominant bowel habit (5). Also, HRQOL in IBS patients was associated with the presence of extra intestinal symptoms such as fatigue, poor sexual function, and ineffective coping styles, independent of GI symptoms (6,7). A significant number of IBS patients have overlapping psychiatric disorders, such as affective disorders, somatization disorders, and anxiety (8,9).

The clinical course of IBD is highly variable across individuals with disease activity that may fluctuate between remission and flaring (10). Even during periods of minimally active inflammation, IBD patients have impaired HRQOL (10). Increased fatigue (11), psychological factors (2), presence of IBS-like symptoms (12), and mood disorders (12) have been hypothesized to have a role in maintaining impaired HRQOL in patients with quiescent disease. In terms of disease severity, IBD patients with active disease tend to have lower psychological well-being, less perceived control over symptoms, and higher distress, resulting in poorer HRQOL compared with IBD patients with non-active disease (13). In a study that compared HRQOL in IBD and IBS, IBD patients tend to express fair-to-poor general physical well-being, while IBS patients tend to report poorer mental health in HRQOL assessment (14). While both GI and psychological symptoms impact HRQOL in IBS and IBD, an appropriate model for describing these relationships has not been determined. Quantifying this relationship may help improve our understanding of the illness processes in IBD and IBS, which may ultimately result in more effective management of disease symptoms and psychological factors and improvement of overall well-being.

In the current study, we aimed to (i) test explicit models of how GI symptom severity, psychological symptoms, and HRQOL interact; (ii) utilize the statistical approach of

structural equation modeling (SEM), which allows for simultaneous development of summary factors that improve the measurement of each primary construct (psychological distress, symptom severity, and HRQOL) that is being tested in the hypothesized models; and (iii) include both IBS and IBD patients to allow comparison of the relationships across these populations. Using SEM, we tested the following hypotheses: (i) both GI symptom severity and degree of psychological distress are directly associated with impaired HRQOL in IBS and IBD; (ii) GI symptom severity indirectly impacts HRQOL through its association with increased psychological distress; and (iii) GI symptom severity will have a stronger direct association with HRQOL in IBD patients, and psychological distress will be more important in IBS.

Methods

Participants

Subjects with a diagnosis of IBS or IBD who were invited to participate in this study were ambulatory adults, age 18 years or older who were seen at either the UCLA (University of California, Los Angeles) Digestive Disease Center, Harbor-UCLA Medical Center or the University of Manitoba IBD Clinical and Research Centre in Manitoba, Canada. In addition, IBS patients were recruited in Los Angeles through advertisements in local newspapers. Individuals excluded from participation were those unable to read and understand English or those refusing to provide written informed consent. IBS was diagnosed using the Rome I criteria (15) and was confirmed by one of the three gastroenterologists who specialize in functional bowel disorders. IBD patients were diagnosed with either ulcerative colitis (UC) or Crohn's disease (CD) by one of the investigators by the usual clinical, endoscopic, and radiologic criteria.

Measures / instruments

All patients completed a bowel symptom questionnaire, a psychological symptom questionnaire (SCL-90R) (16) and a quality of life questionnaire (SF-36) (17).

Bowel symptom questionnaire—In addition to recording age and marital status, the questionnaire included separate questions regarding the intensity of recent overall GI symptoms over the past week (rated on a 0–20 numerical scale anchored by “no symptoms” and “most intense symptoms imaginable”), the intensity of GI pain over the past week on a similar 21-point scale, the usual frequency of symptoms (a five-point scale rating of symptoms occurring from “<once per month” to “daily”), and usual symptom severity (a five-level scale from “none” to “very severe”).

Psychological distress / symptom questionnaire—Current psychological distress and symptoms were assessed using the SCL-90R symptom checklist (16), which assesses acute psychological symptom severity in a variety of domains. The following scales were chosen *a priori* for inclusion in the present study due to their associations with IBS: phobic anxiety, depression, interpersonal sensitivity, obsessive-compulsive, and somatization (18,19). The raw scores were converted to standard T scores, on a 0–100 scale, using the gender stratified non-psychiatric patient normative group (SCL-90R) (16)

Health-related quality of life—HRQOL was assessed using the SF-36 checklist, which assesses health status in a variety of functional areas. The SF-36 is a generic measure and was chosen because unlike the disease-specific measures used for IBS and IBD, it is valid for both illness populations. For the purpose of this analysis, four scales representing illness impact on physical functioning (physical functioning and role physical) and social /

emotional functioning (social functioning and role emotional) were chosen *a priori*. The raw scores were converted to a 0–100 scale scores as recommended by the scale manual (17).

Statistical analyses

Initial analyses compared the two patient samples on demographic and clinical variables using *t*-tests or χ^2 tests. SEM, employing AMOS 4.01 (20), was used as the primary method for examining the relationships among the multiple measures of symptoms, psychological distress, and HRQOL. Applying the methods recommended by Kline (21), the analysis preceded in two stages. The first stage (confirmatory factor analysis) was used to determine how well the individual scales of each category could be combined to represent the three primary constructs of GI symptom severity, psychological distress, and HRQOL. The second stage (structural modeling) examined the relationships among these constructs and tested specific hypotheses regarding similarities and differences across IBD and IBS.

Confirmatory factor analysis—The confirmatory factor analytic component of SEM derives the statistically strongest weighting combination of the individual variables in each category to form a latent variable (GI symptoms, psychological distress, or HRQOL) for use in the structural modeling. Confirmatory factor analytic models were applied and tested in a stepwise manner for each of the three latent variables separately within the IBS sample. First, individual parameters within each of the construct models (e.g., factor loadings) were evaluated for significance at the $P < 0.05$ level. Minor adjustments were applied to the models to arrive at a final factor structure for each of the three constructs. To test the similarity of the factor structure found in the IBS sample to that in the IBD patients, multi-group modeling procedures were used. This procedure applied the paths and parameters derived within the IBS group to the observed measurements within IBD patients. Model testing was conducted and tested using goodness-of-fit tests (22). A better fit would suggest that the relative importance of the scales within each construct or latent variable were equivalent for both IBS and IBD patients.

Structural modeling—After establishing the underlying structure of the latent constructs, a hierarchical structural modeling strategy (21) was used to test hypothesized relationships among the constructs for both groups. In total, four path models were run for the IBS and IBD samples; each model intending to serve either as a reference point for evaluating other models, or as a test of a specific hypothesis regarding the relationship between GI symptoms, psychological distress, and HRQOL. The overall objective of the modeling was to develop a relatively parsimonious representation of the information that would maximize the model fit while judiciously utilizing available degrees of freedom.

Model 1: “All Path” model: In this model, both GI symptoms and psychological distress were hypothesized to have a direct effect on HRQOL. Further, GI symptoms were also hypothesized to have an indirect effect on HRQOL that operates through its impact on psychological distress. The model was evaluated for both IBS and IBD patients separately, and since it contains all the paths of interest it served as the reference model for testing alternative hypotheses.

Model 2: No impact of psychological distress on HRQOL: A more restrictive version of model 1 was tested if GI symptoms had a direct effect on HRQOL (and psychological symptoms) while psychological distress did not. This model was constructed by constraining the path between psychological symptoms and HRQOL to 0 for both IBS and IBD patients, and comparing the difference in goodness-of-fit to that found in model 1.

Model 3: No impact of GI symptoms on HRQOL: This alternative to model 1 constrained the direct path from GI symptoms to HRQOL to 0 and tested the hypothesis that while psychological distress may directly impact HRQOL, GI symptoms do not, and any effects that symptoms may have on HRQOL are indirect through psychological distress.

Model 4: Equivalence of structural relationships in IBS and IBD: As a more constrained and parsimonious version of model 1, this model tested the hypothesis that the structural relationships observed between GI symptoms, HRQOL, and psychological distress operate in a similar manner in patients with IBS and those with IBD.

All models were estimated using the Maximum Likelihood method. Since quality of the fit of SEM models are known to be affected by sample size, multiple model fit indicators were assessed including χ^2 , the ratio of the χ^2 to degrees of freedom (CMIN / DF) (22), the normed fit index (NFI) method (22), and *P*-ratio. For the ratio of χ^2 to degrees of freedom index, a value of <4.0 is generally considered to represent a reasonable model fit to the data. For the NFI, which ranges from 0 to 1.0, values >0.9 represent reasonable structural representations of the data.

Models 1–4 represent “nested” or “hierarchical” models. It was possible to statistically evaluate each of the nested, more restrictive models against the broader models to determine the relative impact of either eliminating relationships or assuming relationships were equivalent. In those instances, the alternative models were evaluated for improvement (or decrement) in fit by examining the χ^2 difference test (22). Finally, the relative strength of the coefficients in the full model containing all direct effects was evaluated to compare the relative impact of GI symptoms vs. psychological distress on HRQOL and group differences in this impact.

Results

Clinical characteristics

The IBS group consisted of 564 patients who met Rome I diagnostic criteria (15) and in which the diagnosis of IBS was confirmed by one of three gastroenterologists experienced in functional GI disease and by excluding organic disease. The IBD group consisted of 126 patients with either UC (39.3%) or CD (60.7%) who had been diagnosed by a gastroenterologist at the time of study entry. Demographic, symptom, psychological, and HRQOL variables for the IBS and IBD groups are shown in Table 1. Significant demographic differences between the two groups included a higher mean age, proportion of women, and non-white population in the IBS group compared with IBD group. IBS patients reported greater overall symptom and pain severity, and symptom frequency than the IBD patients. However, the IBS and IBD groups did not differ in disease duration, psychological symptoms, or HRQOL measures.

Confirmatory factor analyses

The models used to separately develop the constructs representing psychological distress, GI symptoms, and HRQOL all resulted in an excellent fit to the observed correlations. Further, the resultant factor structures were found to be equivalent in both the IBS and IBD samples. Table 2 summarizes each of the model fit parameters and the overall model fit.

To illustrate this process, Figure 1 shows in detail the final model developed for the HRQOL construct. A single, common construct was found to underlie each of four scales of the SF-36. Factor loadings (0.60, 0.83, 0.55, and 0.74) were all statistically significant and roughly equivalent in value. Error variances associated with some of the SF-36 scales were

found to be moderately correlated, suggesting that the self-report format of questions had some shared method variance.

Structural models

A summary of the models and associated goodness-of-fit indices are presented in Table 3. Model 1 (“all path” model) included the direct paths and the indirect path from GI symptoms through psychological distress, and provided an excellent fit to the data (the χ^2 and CMIN/DF were 435.9 and 3.46, respectively, and NFI was 0.925). Model 2, which hypothesizes that GI symptoms, but not psychological distress, was directly related to HRQOL showed a poor fit to the data (CMIN/DF exceeded 5 and the NFI fell below the 0.9 threshold). Model 3, which hypothesized that psychological distress but not GI symptoms has a direct impact on HRQOL provided a reasonably good fit to the data (the CMIN/DF was 3.85 and the NFI exceeded the threshold of 0.9). Thus, the tests of the two restrictive models (i.e., models 2 and 3) suggested a greater direct impact of psychological distress than GI symptom severity in predicting HRQOL. A test was then performed to directly compare each of these restrictive models with model 1, which incorporates direct effects of both GI symptoms and psychological distress on HRQOL. The χ^2 difference tests between model 1 and model 2 (χ^2 difference 224.5, 2 df; $P < 0.0001$) and model 1 and model 3 (χ^2 difference 57.1, 2 df; $P < 0.0001$) indicated a statistically significant improvement of model 1 over model 2 and model 3. Thus, improvement in fit was obtained when including both GI symptom severity and psychological symptoms as direct determinants of HRQOL.

The final step in the model fitting process was to determine whether the magnitude of the paths representing effects for model 1 are equivalent in IBD and IBS. This was evaluated by developing model 4 that sequentially constrained each of the three paths between GI symptoms, psychological distress, and HRQOL to be equal across the groups, and subsequently comparing the results to model 1 in which none of the paths was constrained to be equal. Of the three model 4 variations, only the one which posited that the impact of GI symptoms on psychological distress was equivalent in IBS and IBD showed deterioration in fit to the data. Thus, it was concluded that the direct impact of GI symptoms and psychological distress on HRQOL is equivalent in both IBS and IBD; however, the relationship between GI symptoms and psychological distress varies.

Figure 2 illustrates the structural components of the final model. Statistical comparison of coefficients indicated that for both IBD and IBS, psychological distress had a much stronger direct effect on HRQOL (−0.51 and −0.48 for IBS and IBD, respectively) than GI symptoms (−0.25 and −0.28, respectively; P values < 0.05). The impact of GI symptoms on psychological distress, however, is significantly stronger in IBD compared with IBS (0.43 vs. 0.22; $P < 0.05$). Therefore, the indirect effect of GI symptoms on HRQOL operating through psychological distress is also significantly different between the IBS and IBD groups (−0.11 vs. −0.21; $P < 0.05$), leading to a total effect of GI symptoms on HRQOL for IBS and IBD of −0.36 and −0.49, respectively. This suggests that symptoms have a larger overall effect on HRQOL in IBD patients than it does in IBS patients; virtually equivalent to the total effect of distress.

Discussion

Although IBD and IBS differ in that IBD is a chronic inflammatory disorder of the gut with or without serious complications, while the pathology/physiology of IBS remains incompletely understood but by definition lacks evidence for structural, biochemical, or inflammatory disease (23), GI and psychological symptoms negatively impact HRQOL in both disorders (2–4,24). Our study is the first to use SEM to characterize the interrelationships among HRQOL, GI, and psychological symptoms in both disorders. By quantifying these

relationships, our main objective was to improve our understanding of the illness processes in IBD and IBS, which may ultimately result in more effective management of disease-specific GI and psychological symptoms with improvement of overall HRQOL.

We investigated three hypotheses. First, our hypothesis that both GI symptom severity and degree of psychological distress would be directly associated with impaired HRQOL in IBS and IBD was supported. Second, our hypothesis that GI symptom severity will also indirectly impact HRQOL through its association with increased psychological distress was confirmed. Last, and in contrast to prevailing clinical dogma, our third hypothesis that GI symptom severity will have a stronger direct association with HRQOL in IBD patients, and psychological distress will be more important in IBS was not as strongly supported as both IBS and IBD demonstrated similar positive correlations.

In our study, both IBS and IBD patients demonstrated similar negative correlations between psychological symptoms and HRQOL and between GI symptoms and HRQOL. The key difference between IBS and IBD was that while both patient groups showed positive correlations between GI symptom burden and psychological distress, there was a substantially greater association in IBD compared with IBS. In IBD patients, there was a significant indirect effect of GI symptom severity on HRQOL that was mediated by increased psychological distress. In contrast, there was less of a relationship between GI symptoms and psychological distress in IBS. Psychological distress was less dependent on GI symptom severity in IBS than IBD even though the degree that psychological distress impacted HRQOL was similar. These results suggest that psychological distress is related to worsening GI symptoms in IBD patients and therefore may improve with relief of GI symptoms.

Our finding of worsening GI symptoms being associated with psychological stress in IBD is supported by previous studies (10,25–27). These studies demonstrated a temporal relationship where psychological distress (10,25–27) and acute life stressors (10,27) or having high perceived stress (28) resulted in worsening of IBD symptoms and subsequently a disease flare. While our study used a statistically weighted latent composite variable to measure general GI symptoms, several studies assessing IBD symptom severity with validated disease-specific tools have found a comparable association of psychological factors and GI symptoms. A potentially important issue in IBD is that disease-related concerns or fears about disabling consequences such as colectomy or ileostomy, or cancer, can impact severity and psychological distress and this may be especially true for more severe patients. This may be a more significant factor in IBD patients due to the greater actual risk of serious consequences, although IBS patients also show significant illness-related fears that are significantly associated with global symptom ratings (29). Overall, life stress and psychological symptoms appear to positively correlate with GI symptom severity in IBD.

Interestingly, we found that psychological distress is less dependent on GI symptom severity in IBS compared with IBD. This implies that in IBS, other factors unrelated to GI symptoms probably have a stronger role in determining distress. The IBS literature suggests several possible explanations for this finding. There is an increased prevalence of psychiatric disorders in clinic patients with functional GI disorders (40–70%), such as IBS, compared with healthy controls (20%) and patients with organic GI disease, including IBD (25%) (18,30,31). Although the psychological disorders can occur at the same time as IBS, they often precede the onset, suggesting that they should not be considered as a response to IBS (18). Early life risk factors for the development of IBS include various forms of childhood adversity, such as increased socioeconomic stress during childhood (32), childhood physical and sexual abuse (15,33–38), low birth weight (39), and poor parental relationships such as

losing one parent through death (40). This exposure to early life stress may result in persistence of childhood psychological distress into adulthood and therefore decrease the relative impact of current IBS symptoms on current psychological state. In IBD patients, there are much less data suggesting a role for early life psychological adversity, and more data showing physical risk and protective factors in IBD (38–40). However, it is important to note that few studies have systematically examined hypotheses of early psychological stress in IBD. A related issue is the clearly documented higher prevalence of psychiatric diagnoses such as major depression, anxiety disorder, and somatoform disorders in IBS patients, compared with that found in IBD (41–43). As with early life stress, this higher prevalence of comorbid psychiatric disorders in IBS may help explain the smaller influence of current GI symptoms on psychological distress since non-disease-related psychosocial factors may have a more significant impact on current psychological functioning in IBS compared with IBD patients for whom their symptoms may be more of the primary stressor in their life. Nonetheless, it has been shown that IBD patients are more likely to have diagnoses of mood disorders long antedating their disease diagnosis compared with healthy population controls (44). In addition, extraintestinal symptoms, such as fatigue, sleep disturbances, and sexual disturbances are commonly reported by IBS patients (45) and likely contribute to psychological distress, including somatization, independent of GI symptoms.

There were limitations to our study. We did not evaluate CD and UC separately, nor did we have biomarkers of IBD severity. It is questionable whether separating CD and UC would have made any difference in our study results as some previous studies show no difference in HRQOL and psychological distress between CD and UC (46), while others do (47,48). Within the IBS group, we did not separate IBS by predominant bowel habit. However, we do not suspect IBS sub-classification would have changed the final conclusions drastically as in a previous IBS study, GI and psychological symptom severity, and HRQOL did not differ in subtypes (49). Furthermore, we have previously shown that degree of psychological symptoms, and relationship between psychological symptoms and HRQOL did not vary greatly between IBS-C and IBS-D (50,51). Also, we did not test for current psychiatric diagnoses or chronicity of psychological symptoms in our two patient samples, which may have help explain the varied strength of correlation between GI and psychological symptoms. However, we assessed the presence of psychological symptoms with a validated questionnaire. Additionally, GI symptoms and HRQOL were not measured using disease-specific measures due to necessity of using a measure, which could be used in both illness groups. However, studies that used disease-specific instruments (52) found comparable associations between GI symptoms and HRQOL in both IBS and IBD (47,52). An advantage of the generic HRQOL measure is that it did not include specific GI symptoms as is true of many of the disease-specific measures in IBS and IBD and therefore it enabled a clearer examination of the relationships among the constructs.

In summary, our analysis demonstrates the importance of interrelationships among GI symptoms, psychological distress, and HRQOL in both IBD and IBS populations. The overall pattern of relationships was similar across the two groups including an important role of psychological distress as a mediator of HRQOL changes from GI symptoms. There was, however, a stronger positive correlation between GI symptoms and psychological distress in IBD than in IBS, suggesting that non-illness psychosocial variables may have a more significant role in determining HRQOL in IBS vs. IBD. These findings have several implications on the management of these two conditions. For patients with IBD, the finding of a significant role of psychological distress in determining HRQOL suggests that therapy directed at reducing intestinal inflammation and GI symptoms may result in less psychological distress and improvement of HRQOL but that also interventions directed at psychological distress may have a significant impact on HRQOL. In addition, if psychological distress remains high even with symptom improvement (for instance when

there is a high degree of fear of relapse), then it would be expected that HRQOL would not improve. In IBS patients, our findings suggest that a change in GI symptoms alone may not have the desired impact on HRQOL. Following the biopsychosocial model, treatment that addresses psychological distress both related and unrelated to current GI symptom severity are indicated in order to improve overall HRQOL.

Acknowledgments

We acknowledge Cathy Liu for managing this study's database and developing the figures.

References

1. Gralnek IM, Hays RD, Kilbourne A, et al. The impact of irritable bowel syndrome on health-related quality of life. *Gastroenterology*. 2000; 119:654–60. [PubMed: 10982758]
2. Simren M, Axelsson J, Gillberg R, et al. Quality of life in inflammatory bowel disease in remission: the impact of IBS-like symptoms and associated psychological factors. *Am J Gastroenterol*. 2002; 97:389–96. [PubMed: 11866278]
3. Pizzi LT, Weston CM, Goldfarb NI, et al. Impact of chronic conditions on quality of life in patients with inflammatory bowel disease. *Inflamm Bowel Dis*. 2006; 12:47–52. [PubMed: 16374258]
4. Pace F, Molteni P, Bollani S, et al. Inflammatory bowel disease versus irritable bowel syndrome: a hospital-based, case-control study of disease impact on quality of life. *Scand J Gastroenterol*. 2003; 38:1031–8. [PubMed: 14621276]
5. El-Serag HB, Olden K, Bjorkman D. Health-related quality of life among persons with irritable bowel syndrome: a systematic review. *Aliment Pharmacol Ther*. 2002; 16:1171–85.
6. Spiegel BM, Gralnek IM, Bolus R, et al. Clinical determinants of health-related quality of life in patients with irritable bowel syndrome. *Arch Intern Med*. 2004; 164:1773–80. [PubMed: 15364671]
7. Spiegel BMR, Gralnek IM, Mayer EA, et al. Clinical determinants of health-related quality of life in irritable bowel syndrome. *Gastroenterology*. 2003; 124:A398.
8. Lydiard RB, Fossey MD, Marsh W, et al. Prevalence of psychiatric disorders in patients with irritable bowel syndrome. *Psychosomatics*. 1993; 34:229–34. [PubMed: 8493304]
9. Tkalcic M, Hauser G, Stimac D. Differences in the health-related quality of life, affective status, and personality between irritable bowel syndrome and inflammatory bowel disease patients. *Eur J Gastroenterol Hepatol*. 2010; 22:862–7. [PubMed: 19701092]
10. Singh S, Graff LA, Berstein CN. Do NSAIDs, antibiotics, infections, or stress trigger flares in IBD? *Am J Gastroenterol*. 2009; 104:1298–313. quiz 1314. [PubMed: 19337242]
11. Minderhoud IM, Oldenburg B, van Dam PS, et al. High prevalence of fatigue in quiescent inflammatory bowel disease is not related to adreno-cortical insufficiency. *Am J Gastroenterol*. 2003; 98:1088–93. [PubMed: 12809832]
12. Farrokhyar F, Marshall JK, Easterbrook B, et al. Functional gastrointestinal disorders and mood disorders in patients with inactive inflammatory bowel disease: prevalence and impact on health. *Inflamm Bowel Dis*. 2006; 12:38–46. [PubMed: 16374257]
13. Graff LA, Walker JR, Clara I, et al. Stress coping, distress, and health perceptions in inflammatory bowel disease and community controls. *Am J Gastroenterol*. 2009; 104:2959–69. [PubMed: 19755973]
14. Tang LY, Nabalum ba A, Graff LA, et al. A comparison of self-perceived health status in inflammatory bowel disease and irritable bowel syndrome patients from a Canadian national population survey. *Can J Gastroenterol*. 2008; 22:475–83. [PubMed: 18478133]
15. Drossman DA, Leserman J, Nachman G, et al. Sexual and physical abuse in women with functional or organic gastrointestinal disorders. *Ann Intern Med*. 1990; 113:828–33. [PubMed: 2240898]
16. Derogatis, LR. Symptom Checklist-90-R (SCL-90-R): Administration, Scoring and Procedures Manual. 3. National Computer Systems; Minneapolis: 1994.
17. Wald A, Hinds JP, Caruana BJ. Psychological and physiological characteristics of patients with severe idiopathic constipation. *Gastroenterology*. 1989; 97:932–7. [PubMed: 2777045]

18. Levy RL, Olden KW, Naliboff BD, et al. Psychosocial aspects of the functional gastrointestinal disorders. *Gastroenterology*. 2006; 130:1447–58. [PubMed: 16678558]
19. Jarcho JM, Chang L, Berman M, et al. Neural and psychological predictors of treatment response in irritable bowel syndrome patients with a 5-HT₃ receptor antagonist: a pilot study. *Aliment Pharmacol Ther*. 2008; 28:344–52. [PubMed: 19086332]
20. Arbuckle, JL. *Amos Users' Guide Version 3. 6*. SmallWaters; Chicago, IL: 1997.
21. Kline, R. *Principles and Practice of Structural Equation Modeling*. The Guilford Press: New York; New York: 1998. p. 354
22. Bentler PM, Bonnett DG. Significance tests and goodness of fit in the analysis of covariance structures. *Psychol Bull*. 1980; 88:588–606.
23. Grover M, Herfarth H, Drossman DA. The functional-organic dichotomy: postinfectious irritable bowel syndrome and inflammatory bowel disease-irritable bowel syndrome. *Clin Gastroenterol Hepatol*. 2009; 7:48–53. [PubMed: 18848909]
24. Bryant RV, van Langenberg DR, Holtmann GJ, et al. Functional gastrointestinal disorders in inflammatory bowel disease: impact on quality of life and psychological status. *J Gastroenterol Hepatol*. 2011; 26:916–23. [PubMed: 21214889]
25. Kiebles JL, Doerfer B, Keefer L. Preliminary evidence supporting a framework of psychological adjustment to inflammatory bowel disease. *Inflamm Bowel Dis*. 2010; 16:1685–95. [PubMed: 20155849]
26. Greene BR, Blanchard EB, Wan CK. Long-term monitoring of psychosocial stress and symptomatology in inflammatory bowel disease. *Behav Res Ther*. 1994; 32:217–26. [PubMed: 8155059]
27. Bitton A, Dobkin PL, Edwardes MD, et al. Predicting relapse in Crohn's disease: a biopsychosocial model. *Gut*. 2008; 57:1386–92. [PubMed: 18390994]
28. Bernstein CN, Singh S, Graff LA, et al. A prospective population-based study of triggers of symptomatic fares in IBD. *Am J Gastroenterol*. 2010; 105:1994–2002. [PubMed: 20372115]
29. Spiegel B, Strickland A, Naliboff BD, et al. Predictors of patient-assessed illness severity in irritable bowel syndrome. *Am J Gastroenterol*. 2008; 103:2536–43. [PubMed: 18637089]
30. Drossman DA, Camilleri M, Mayer EA, et al. AGA technical review on irritable bowel syndrome. *Gastroenterology*. 2002; 123:2108–31. [PubMed: 12454866]
31. Grover M, Drossman DA. Psychotropic agents in functional gastrointestinal disorders. *Curr Opin Pharmacol*. 2008; 8:715–23. [PubMed: 18760380]
32. Howell S, Talley NJ, Quine S, et al. The irritable bowel syndrome has origins in the childhood socioeconomic environment. *Am J Gastroenterol*. 2004; 99:1572–8. [PubMed: 15307879]
33. Koloski NA, Talley NJ, Boyce PM. A history of abuse in community subjects with irritable bowel syndrome and functional dyspepsia: the role of other psychosocial variables. *Digestion*. 2005; 72:86–96. [PubMed: 16127275]
34. Walker EA, Katon WJ, Roy-Byrne PP, et al. Histories of sexual victimization in patients with irritable bowel syndrome or inflammatory bowel disease. *Am J Psychiatry*. 1993; 150:1502–6. [PubMed: 8379554]
35. Ross CA. Childhood sexual abuse and psychosomatic symptoms in irritable bowel syndrome. *J Child Sex Abus*. 2005; 14:27–38. [PubMed: 15914403]
36. Salmon P, Skaife K, Rhodes J. Abuse, dissociation, and somatization in irritable bowel syndrome: towards an explanatory model. *J Behav Med*. 2003; 26:1–18. [PubMed: 12690943]
37. Talley NJ, Fett SL, Zinsmeister AR, et al. Gastrointestinal tract symptoms and self-reported abuse: a population-based study. *Gastroenterology*. 1994; 107:1040–9. [PubMed: 7926457]
38. Talley NJ, Boyce PM, Jones M. Is the association between irritable bowel syndrome and abuse explained by neuroticism? A population based study. *Gut*. 1998; 42:47–53.
39. Anand KJ, Runeson B, Jacobson B. Gastric suction at birth associated with long-term risk for functional intestinal disorders in later life. *J Pediatr*. 2004; 144:449–54. [PubMed: 15069391]
40. Hislop IG. Childhood deprivation: an antecedent of the irritable bowel syndrome. *Med J Aust*. 1979; 1:372–4. [PubMed: 470749]

41. Whitehead WE, Palsson O, Jones KR. Systematic review of the comorbidity of irritable bowel syndrome with other disorders: what are the causes and implications? *Gastroenterology*. 2002; 122:1140–56. [PubMed: 11910364]
42. Graff LA, Walker JR, Bernstein CN. Depression and anxiety in inflammatory bowel disease: a review of comorbidity and management. *Inflamm Bowel Dis*. 2009; 15:1105–18. [PubMed: 19161177]
43. Miller AR, North CS, Clouse RE, et al. The association of irritable bowel syndrome and somatization disorder. *Ann Clin Psychiatry*. 2001; 13:25–30. [PubMed: 11465682]
44. Walker JR, Ediger JP, Graff LA, et al. The Manitoba IBD cohort study: a population-based study of the prevalence of lifetime and 12-month anxiety and mood disorders. *Am J Gastroenterol*. 2008; 103:1989–97. [PubMed: 18796096]
45. Chang, L.; Drossman, D. *Irritable Bowel Syndrome and Related Functional Disorders*. IASP Press; Seattle, Washington: 2009.
46. Casellas F, Arenas JI, Baudet JS, et al. Impairment of health-related quality of life in patients with inflammatory bowel disease: a Spanish multicenter study. *Inflamm Bowel Dis*. 2005; 11:488–96. [PubMed: 15867589]
47. Mnif L, Mzid A, Amouri A, et al. Health related quality of life in patients with inflammatory bowel disease: a Tunisian study. *Tunis Med*. 2010; 88:933–6. [PubMed: 21136364]
48. Larsson K, Loof L, Ronnblom A, et al. Quality of life for patients with exacerbation in inflammatory bowel disease and how they cope with disease activity. *J Psychosom Res*. 2008; 64:139–48. [PubMed: 18222127]
49. Mearin F, Balboa A, Badia X, et al. Irritable bowel syndrome subtypes according to bowel habit: revisiting the alternating subtype. *Eur J Gastroenterol Hepatol*. 2003; 15:165–72.
50. Schmulson M, Lee OY, Chang L, et al. Symptom differences in moderate to severe IBS patients based on predominant bowel habit. *Am J Gastroenterol*. 1999; 94:2929–35. [PubMed: 10520847]
51. Tillisch K, Labus JS, Naliboff BD, et al. Characterization of the alternating bowel habit subtype in patients with irritable bowel syndrome. *Am J Gastroenterol*. 2005; 100:896–904. [PubMed: 15784038]
52. Amouretti M, Le Pen C, Gaudin AF, et al. Impact of irritable bowel syndrome (IBS) on health-related quality of life (HRQOL). *Gastroenterol Clin Biol*. 2006; 30:241–6. [PubMed: 16565657]

Study Highlights

WHAT IS CURRENT KNOWLEDGE

- Both irritable bowel syndrome (IBS) and inflammatory bowel disease (IBD) negatively impact health-related quality of life (HRQOL).
- Gastrointestinal (GI) symptom severity and psychological factors are related to HRQOL in IBS and IBD.

WHAT IS NEW HERE

- Both irritable bowel syndrome (IBS) and inflammatory bowel disease (IBD) patients demonstrate similar negative correlations between psychological and gastrointestinal (GI) symptoms with health-related quality of life (HRQOL).
- While both IBD and IBS patients show positive correlations between GI symptom burden and psychological distress, there was a substantially greater association in IBD compared with IBS.
- In IBD patients, there was a significant indirect effect of GI symptom severity on HRQOL that was mediated by increased psychological distress.

Figure 1.

Health-related quality of life (HRQOL) for inflammatory bowel disease (IBD) and irritable bowel syndrome (IBS). A single construct of HRQOL was composed of four subscales of the SF-36: physical functioning, role functioning, social functioning, and role emotional. Numeric values of these four subscales are shown as 0.60, 0.83, 0.55, and 0.74, all statistically significant factor loadings. e1-e4 denote error variances that were moderately correlated, suggesting the presence of some shared method variance. Df, degrees of freedom; NFI, normed fit index.

Figure 2.

Final model of structural relationship of gastrointestinal (GI) symptoms, psychological distress, and health-related quality of life (HRQOL) in irritable bowel syndrome (IBS) and inflammatory bowel disease (IBD) denoted by ovals. Specific GI symptoms, individual psychological distress symptoms, and four subscales of the SF-36 are represented in boxes. The values on the paths are regression coefficients representing the impact of one variable on another. Each of the coefficients are significant to the $P < 0.0001$ level and have been standardized to facilitate relative interpretations. Numeric values in parenthesis refer to the IBD sample, whereas others are for IBS. Negative coefficients between the symptom and HRQOL variables reflect the reversed scaling of HRQOL (greater values represent greater well-being). Df, degrees of freedom; NFI, normed-fit index.

Table 1
Demographics, disease-specific variables, and psychological distress indicators in IBS and IBD population

Variable	IBS		IBD		P value
	Mean	s.d.	Mean	s.d.	
Demographics					
Age (years)	46.7	13.7	40.5	13.3	<0.0001
Gender (% women)	69		53		<0.0001
Race / ethnicity					0.04
White (%)	79.9		89.9		
Black (%)	7.7		5.4		
Asian / Pacific Islander (%)	2.9		2.0		
Hispanic (%)	7.4		1.3		
Other (%)	2.1		1.3		
Education					0.09
Eighth grade or less (%)	0.2		0.7		
Some high school (%)	1.6		5.4		
High school graduate (%)	9.1		11.6		
Some college (%)	36.9		32.0		
College graduate (%)	23.1		27.2		
Any postgraduate work (%)	28.7		23.1		
Marital status (% married)	44.0		52.1		0.09
Disease-specific variables					
Overall GI symptom severity (0–20)	11.78	4.18	8.28	4.80	< 0.001
Duration of disease (%)					
< 2 years	15.8		12.4		0.27
2–10 years	36.9		35.2		
> 10 years	47.3		52.4		
Current intensity (1–4)	2.72	0.71	2.24	0.84	< 0.001
Amount of current abdominal pain (0–20)	10.95	4.73	7.87	5.12	< 0.001
Symptom frequency	3.84	1.04	3.05	1.34	< 0.001
Prednisone use during past 6 months (%)	N/A		30.5		

Variable	IBS		IBD		P value
	Mean	s.d.	Mean	s.d.	
Psychological distress indicators					
Somatization	59.06	9.34	57.59	10.83	0.59
Obsessive compulsive	56.86	10.84	55.40	11.60	0.29
Interpersonal sensitivity	54.40	11.68	55.72	11.39	0.16
Depression	58.30	10.36	58.78	11.58	0.28
Anxiety	54.10	11.89	53.08	12.61	0.51
Health-related quality of life indicators					
Physical functioning	80.71	18.89	80.22	22.34	0.61
Role physical	54.32	36.27	54.61	39.83	0.62
Role emotional	65.98	35.01	71.24	36.12	0.29
Social functioning	65.36	22.50	67.21	27.96	0.62

GI, gastrointestinal; IBS, irritable bowel syndrome; IBD, inflammatory bowel disease.

Table 2
Confirmatory factor analytic results for the development of psychological distress, GI symptoms, and HRQOL in IBS and IBD samples

	Psychological distress construct	GI symptoms construct	HRQOL construct
NFI	0.99	0.98	0.99
Df	12	6	5
χ^2	19.160	11.724	7.374
<i>P</i> value	>0.05	>0.05	>0.05
<i>λ (factor loadings)</i>			
Somatization	0.67		
Obsessive-compulsive	0.86		
Interpersonal Sensitivity	0.85		
Depression	0.90		
Anxiety	0.85		
Symptom frequency		0.11	
Recent pain severity		1.00	
Usual symptom severity		0.10	
Recent symptom severity		1.00	
Physical functioning			0.60
Role functioning			0.83
Role emotional			0.55
Social functioning			0.74

Df, degrees of freedom; GI, gastrointestinal; HRQOL, health-related quality of life; IBS, irritable bowel syndrome; IBD, inflammatory bowel disease; NFI, normed fit index.

Table 3
Alternative models comparing the structural relationships among GI symptoms, psychological distress, and health-related quality of life

Models	Fit measures		Model comparisons ^a			
	χ^2	Df	Parameters	χ^2 /Df	NFI	χ^2 difference P value difference
All path model	435.90	126.00	56.00	3.46	0.93	
No impact of distress on HRQOL	659.40	128.00	54.00	5.15	0.89	223.5 < 0.001
No impact of symptoms on HRQOL	493.00	128.00	54.00	3.85	0.92	57.1 < 0.001
<i>Equal effects in IBD and IBS</i>						
Symptoms on distress	439.80	127.00	57.00	3.46	0.92	3.90 < 0.05
Distress on HRQOL	436.00	127.00	57.00	3.43	0.93	0.10 NS
Symptoms on HRQOL	437.90	127.00	57.00	3.45	0.93	2.00 NS

Df, degrees of freedom; HRQOL, health-related quality of life; IBD, inflammatory bowel disease; IBS, irritable bowel syndrome; NFI, normed fit index.

^aNote: χ^2 difference tests are conducted relative to model 1, the all path model.