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Article type : Original Article

Title: Nuances of the psychogastroenterology patient: A predictive model for gastrointestinal quality of life improvement

Short Title: Nuances of the psychogastroenterology patient

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This is the author manuscript accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the [Version of Record](#). Please cite this article as doi: [10.1111/NMO.13663](https://doi.org/10.1111/NMO.13663)

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Abstract:

Background: Gastrointestinal conditions are multifactorial in nature and certain patients can benefit greatly from brain-gut psychotherapies delivered by mental health professionals who specialize in psychogastroenterology. This study aimed to identify features associated with improvements in GI-specific quality of life scores following behavioral health interventions (BHI). The second aim was to create a psychogastroenterology referral care pathway incorporating identified characteristics for greatest benefit from GI-specific behavioral therapy.

Methods: We performed a prospective observational study of 101 (63 women; median age, 45 years) gastroenterology patients referred for psychogastroenterology consultation at a single center. Patients attended an average of 7 sessions with a single GI psychologist where evidence-based brain-gut psychotherapies were employed. GI-specific quality of life (IBS-QOL) and psychological distress (BSI-18) were assessed before and after BHI. Patients completed self-reported questionnaires. We performed a multivariable analysis to determine predictors associated with IBS-QOL score improvement.

Key Results: 53 (52.5%) patients experienced improvement in IBS-QOL score. Patients with improved IBS-QOL scores had significantly higher baseline BSI general domain T-scores (61.9 vs. 56.9, $p=0.002$). Female gender (odds ratio [OR], 3.2), pre-treatment BSI Somatization T-score ≥ 63 (OR, 3.7), and a diagnosis of depression (OR, 4.2) were associated with greater odds of IBS-QOL score improvement following BHI.

Conclusions & Inferences: We identified factors associated with response to GI-specific BHI to aid in optimizing the utilization of psychogastroenterology services and provide referring providers with information to inform treatment recommendations. Female patients with disorders of gut-brain interaction (DGBIs), high somatization and depression should be considered a priority for brain-gut psychotherapies.

Keywords: Disorders of Gut-Brain Interaction (DGBIs); Inflammatory Bowel Disease (IBD); Cognitive Behavioral Therapy (CBT); Gut-directed hypnotherapy; Psychogastroenterology

KEY POINTS

- Gastrointestinal conditions are multifactorial in nature and certain patients can benefit greatly from brain-gut psychotherapies delivered by mental health professionals who specialize in psychogastroenterology.
- Females with disorders of gut-brain interaction, high somatization and depression should be considered priority for brain-gut psychotherapies. Behavioral health outcomes were not limited to disease; IBD patients should be routinely considered for referral.
- Optimizing utilization of GI-specific behavioral health specialists for the best outcomes can maximize quality of life and disease experience, but also improve value-based care.

INTRODUCTION

In patients with disorders of gut-brain interaction (DGBIs), co-morbid depression and anxiety disorders occur in approximately 30% and 50% of patients, respectively.¹ Crohn's disease and ulcerative colitis have a similar prevalence of mood disorders compared to those with DGBIs.²

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Brain-gut psychotherapies are effective for improving quality of life and disease experience for a wide range of GI conditions targeting the multifactorial nature of DGBIs,^{3,4} upper GI conditions⁵ (e.g. heartburn, dysphagia and globus) and inflammatory bowel disease (IBD).^{2,6} As a result, “psychogastroenterology” has organically emerged as an effective treatment modality necessary for holistic GI care.⁷

At present, access to integrated psychogastroenterology providers remains limited. While enthusiasm for referrals makes it clear that gastroenterologists and patients recognize the value of psychogastroenterology services, the patient phenotype most likely to benefit from these services has not been fully elucidated. As individualized care pathways emerge and behavioral health is incorporated into treatment algorithms, both medical specialists and patients will benefit from clear guidance regarding the best psychologic resource to be used at a given time.

Analyses were performed at the group level in gastroenterology patients with DGBIs. We aimed to identify features associated with improvements in psychologic function and GI-specific quality of life (QOL) using validated measures, as well as patient reported mental health improvements following behavioral health interventions.

METHODS

Study Population:

Patients seen in our university-based outpatient gastroenterology clinic were referred for GI Behavioral Health Intervention (BHI) utilizing the our BHI referral criteria: patients with DGBIs, those lacking severe psychiatric comorbidity, those with insight into the role of stress on their GI functioning, and those motivated to address their GI symptoms using brain-gut psychotherapy. Exclusion criteria were untreated moderate to severe psychiatric comorbidity and poor insight or motivation. Patients presented for the management of DGBIs, however some patients had a relevant co-diagnosis of IBD, chronic pain conditions and upper GI complaints. Referred patients were consecutively approached for participation in the study; those providing informed consent completed validated questionnaires prior to and at the

completion of BHI. Patient self-reported medical and prescription data was augmented and verified by review of electronic medical records.

Measures:

Psychosocial checklist. Patients were asked to review a list of 36 current or past psychosocial stressors and identify which they have experienced. Key psychosocial stressors listed include: work problems, caregiver stress, difficulties with communication, loss of a loved one, anxiety, nightmares, sexual dysfunction, chronic pain, thoughts of self-harm, abuse/trauma, eating disorder, and addiction.

Demographic and clinical information. Patients provide their name, age, occupation, highest level of education completed, weight, height and type of GI diagnosis.

Concomitant treatment form. Patient is asked to list medical and/or psychiatric conditions they currently have including psychiatric diagnoses and treatment history. Chronic pain conditions including chronic migraines or headaches, fibromyalgia, temporomandibular joint syndrome (TMJ), and interstitial cystitis (IC). The use of psychoactive prescription medications including tricyclic anti-depressants and atypical antipsychotic agents. Opioids, benzodiazepines, and illicit substance used for the 12 months preceding BHI referral was also collected.

Rating of symptom severity. Patients self-reported the severity of their last GI symptoms flare-up on a 10-point Likert scale with higher scores indicating greater symptom severity.

Irritable Bowel Syndrome Quality of Life questionnaire (IBS-QOL). This is a 34-item self-report instrument that measures health related QOL with 8 symptom dimensions on a five-point response scale: dysphoria, health worry, social reaction, interference with activity, sexual impact, body image, and relationships.⁸ Items are summed and averaged for a total score which is transformed to a 0-100 scale with higher scores indicating better IBS-specific QOL. Clinically significant QOL improvement is defined as an increase of 14 or more points.⁹

*Brief Symptom Inventory-18 (BSI-18).*¹⁰ Is an 18-item reliable measure of general psychological distress in medical populations with four domains graded on a 5 point Likert scale including: Somatization (the psychological tendency to experience a multitude of non-specific body symptoms), Depression, Anxiety, and Global Severity Index (GSI). Subscale scores range from 0 to 72 and are converted to T-scores. A BSI T-score ≥ 63 , which is greater than the 90th percentile

of the reference population, is considered significantly distressed.¹¹ A T-score < 63 is within the normal range.

Psychosocial Clinical Interview. All patients completed the initial psychological evaluation by a single GI psychologist (MER) to further determine if behavioral health treatment is appropriate for their current medical complaints and to assess whether a psychiatric comorbidity takes precedence. Insight into the manner in which psychological factors can impact the GI symptom experience, in addition to patient's motivation to engage in BHI was assessed. At the conclusion of the interview, appropriate patients were provided with a treatment plan with a target of 7 sessions.

Behavioral Health Intervention:

Given that there is not a single standardized protocol for using CBT for gastrointestinal symptoms, our study consistently incorporated the application of CBT and gut-directed hypnotherapy interventions which were appropriate for patients presenting complaints.³ Patient progress or willingness to proceed impacted the total number of sessions.

Cognitive Behavioral Therapy (CBT). This approach is routinely tailored to patients with GI conditions by providing psychoeducation about the body's stress response and how it can impact gastrointestinal functioning, address health-specific mood symptoms, improve coping skills and increase medical adherence.^{4, 6, 12} Learning how to reduce physiological arousal and attenuate hypervigilance through the practice of relaxation skills (e.g. diaphragmatic breathing, muscle relaxation, self-hypnosis) augments the patient's capability to maximally participate in CBT exercises.

Gut-directed hypnotherapy. This intervention has several evidence-based benefits, specifically targeting the down-regulation of unpleasant GI sensations by normalizing pain processing and perception via the brain-gut axis. It is successfully used in patients with functional abdominal and bowel complaints to improve health outcomes of visceral sensitivity, gut motility, central processing, and overall psychological status.¹³⁻¹⁵ This study used the North Carolina Protocol, a 7-session scripted protocol designed for patients with IBS or IBD.^{13, 16, 17} In patients with co-morbid upper GI complaints, appropriate modifications were made utilizing tailored hypnotic suggestions.¹⁸

Outcome Assessment:

Our primary outcome assessment was improved IBS-QOL score post-BHI. A clinically significant improvement in GI-specific QOL was defined as an increase in IBS-QOL score ≥ 14 points post-BHI treatment.⁹ At termination of BHI treatment, participants also completed BSI survey and self-reported patient outcome measures including: perceived degree of improvement in GI symptom experience (excellent, moderate, slight, no improvement, worse), reduction in on demand medication use for symptom relief, and the use of BHI skills at the completion of therapy (CBT, diaphragmatic breathing, self-hypnosis).

Statistical Analysis:

Demographic, clinical, and survey reply features prior to the start of BHI were compared between patients who experienced an improvement in IBS-QOL of 14 or more points and those without an IBS-QOL improvement. Univariate analysis was performed using the student's t-test, Chi-squared test, or the Fisher Exact test in the setting of low frequency categorical events. Multivariable logistic regression model building utilized a backward variable selection process with forced inclusion of age, gender, and IBD deemed relevant *a priori*. Continuous variables were also explored as categorical variables (with and without ordinal features) to provide the best model fit. Analysis of maximum likelihood estimates provided hazard ratios and confidence limits for each parameter within the model. Univariate analyses considered a p -value of ≤ 0.01 as statistically significant after applying Bonferroni correction to control for Type 1 error due to multiple comparisons; regression analyses retained a statistical significance of $p < .05$. All statistical analyses were conducted using SAS 9.4 (Cary, NC).

RESULTS

Patient Characteristics

101 patients with DGBIs enrolled for prospective observation while undergoing BHI from 2015 to 2018. The overall population was 62.4% female, with 27.7% having co-morbid depression, 42.6% had co-morbid anxiety, 22.8% had underlying IBD and 22.8% had current psychotropic therapy use. The overall mean age was 45.1 years with a range of 18.1-80.4 years of age, and no difference in age was observed by QOL score improvement. The population baseline BSI general score was 53.6 (SD 7.9) and baseline IBS-QOL score was 54.0 (SD 16.5). Fifty-three

patients (52.3%) experienced a clinically meaningful improvement in IBS-QOL scores. Separating the overall study population by QOL improvement following BSI, positive predictors for clinically meaningful improvement in IBS-QOL scores were a higher baseline BSI score ($p=0.003$) and the absence of upper tract symptoms ($p=0.007$, Table 1). Males comprised 37.6% of the cohort and male vs. female sex and exhibited a non-significant trend of non-response to BHI (63.3% vs. 38.1%, $p=0.018$). The presence of upper tract GI symptom complaints occurred in 20 study subjects and were associated with non-response to BHI (31.2% vs 9.4%, $p=0.007$). Twenty-one of 101 patients had IBD, 10 with Crohn's disease and 11 with ulcerative colitis. The presence of IBD was not associated with achieving a clinically meaningful improvement in IBS-QOL scores ($p=0.482$). Co-existing chronic pain conditions were also not associated with responsiveness to BHI ($p=0.673$). Use of psychoactive medications, benzodiazepines, or opioids within the prior year were not associated with BHI response ($p=0.714$). No report of suicidal ideation and formal eating disorder diagnoses occurred in this cohort.

Pre-BH Intervention BSI Scores and Association with IBS-QOL score improvement

Those with clinically meaningful improvements in IBS-QOL scores had significantly higher baseline BSI general domain T-scores (61.9 vs. 56.9, $p=0.002$). Higher pre-treatment BSI Somatization T-scores ($p < .001$) were associated with an improvement in IBS-QOL score (Table 2). Unsurprisingly, following BHI, Anxiety ($p=0.015$), Depression ($p=0.005$), and Somatization ($p < 0.001$) BSI subscores all improved relative to baseline values, defined as a T-Score ≥ 63 .

Multivariable Model for Predicting QOL Improvement Following BH Intervention

Adjusted analysis identified several pre-treatment predictors of IBS-QOL score improvement following BHI (Table 3). Females were more than 3 times as likely as males to experience clinically meaningful improvements in IBS-QOL score. Those with a pre-treatment BSI Somatization T-score of 63 or greater (upper quartile of the cohort) had a 3.7 fold greater odds of experiencing a clinically meaningful improvement in IBS-QOL score following BHI. Those with a pre-treatment BSI general score of 63 or greater also had greater odds of successful response to BHI (OR 2.3, 95% CI 1.2, 4.1), but this was not retained in the final model due to co-linearity with the BSI-Somatization. A diagnosis of depression (OR 4.20, 95%CI 1.22, 14.47) but not anxiety was associated with greater odds of meaningful IBS-QOL score improvement following

BHI. Psychoactive medication, narcotic, nor benzodiazepine were risk factors for failure of BHI. The diagnosis of IBD ($p=0.942$) or chronic pain conditions ($p=0.869$) were not risk factors for BHI failure. Finally, the presence of upper tract symptoms (which could co-occur with lower tract symptom complaints) significantly reduced the odds of experiencing a meaningful improvement in IBS-QOL score (OR 0.15, 95% CI 0.04, 0.59) on adjusted analysis.

Patient Reported Improvements and Self-Directed Use of Behavioral Health Techniques

The vast majority of patients reported continued use of behavioral health skills, with 91% indicating continued diaphragmatic breathing use and 96% reporting continued CBT skill set use at the completion of their therapy course. Those patients who had an improved IBS-QOL score reported reduced use of on-demand medications for GI symptom relief (66.0% vs. 34.0%, $p=0.007$). Additionally, subjective patient self-report of improvement following BHI demonstrated poor agreement with objective IBS-QOL scores ($k=0.26$). Overall, of the 45/101 patients self-reporting moderate or better improvement following BHI, only 37.8% (17/45) demonstrated a 14 point or greater improvement on the IBS-QOL instrument ($p=0.008$) (Figure 1).

DISCUSSION

In summary, we identify several factors associated with GI behavioral health interventions that successfully improve GI-specific QOL scores. Female patients with high somatization scores appear to have the most potential for improvement following BHI for FGIDs. Alternatively, male patients and those presenting with co-occurring upper GI tract functional symptoms appear to be less responsive to BHI. Finally, a co-diagnosis of IBD, a history of opioid, benzodiazepine, or psychoactive medication use do not appear to impact success of BHI. Understanding these features may help providers encourage patients with a high probability of response to undergo BHI.

The reasons for difference in gender response to BHI remain unclear and could be linked to fundamental aspects of bowel symptom experience that are uncaptured by existing measures of therapeutic response and QOL. Further evidence of shortcomings in understanding treatment response may be linked to limitations in how we measure response. In our study, despite the IBS-QOL being an established measure, a bidirectional discrepancy was present

between patients' subjective perception of improvement and their IBS-QOL score improvement. This suggests that patient perceptions of QOL and therapeutic benefit, at least in the context of GI BHI, are impacted by unmeasured variables. One consideration of this discrepancy is that some patients consciously or unconsciously, may have been skewed toward more positive responses given they were returning treatment completion forms to the office of the single provider. While a limitation, it is a reality of this objective study.

Prior work has demonstrated that upper GI tract digestive complaints are more resistant to BHI.^{5, 19} While our analysis found them less likely to respond to BHI, this indicates comorbid bowel and esophageal complaints likely require more intensive therapy and further customized BHI regimens.

Not surprisingly, patients reporting clinically significant somatization were found to be highly successful in behavioral therapy. We must also acknowledge that in a GI patient population, the BSI somatization score may be a measure of GI symptom severity; therefore we may anticipate those patients with the worst GI symptoms at baseline, may be more likely to respond to BHI. This supports previous reports where hypnotherapy was superior to other intervention for reducing bothersome non-GI symptoms in DGBIs.²⁰⁻²²

These results should be interpreted in the context of several limitations. First, we used the IBS-QOL, which is a QOL measurement tool validated in IBS patients, as our primary measure of improvement of DGBIs following BHI. This tool has not been validated in IBD or upper tract symptoms and as such the instrument conceivably may perform differently in patients with non-IBS diagnoses. While we acknowledge a lack of patient characterization, all referred patients had functional bowel complaints as the primary reason for referral and we elected to use a single instrument to minimize patient reporting burden. Second, while all patients received gut-directed hypnotherapy and CBT interventions, the lack of standardized treatment for every patient introduced an uncontrolled variable that this study was not designed to evaluate and should be part of future controlled interventional studies. Further, therapy was administered by a single GI behavioral health psychologist whose individual characteristics administering care could influence results. However, this limitation also underscores the importance of training GI psychologists as there is a current shortage of available providers.

Finally, over the course of the study, referring gastroenterologists' likely improved their patient selection for BHI referral as they received both psychologist and patient feedback. While potentially impacting results, if gastroenterologist referral pattern changes improved overall patients' BHI success, this would demonstrate the potential for improving patient selection practices. While the limitations highlighted preclude a conclusion of BHI effectiveness for improving functional bowel symptoms in patients with important co-diagnoses, the results support investment in more rigorous studies.

Our findings are consistent with other investigations of behavioral health utilization in gastroenterology. We propose a preliminary schema to aid gastroenterology providers in identifying patients for BHIs with a higher likelihood of symptomatic response and IBS-QOL score improvements (Figure 2). Referring patients with the most to gain from BHIs may not only maximize population-level improvements in QOL and disease experience, but additionally could increase the overall value of outpatient gastroenterology services.

Finally, in the case of patients with IBD, functional complaints have been associated with higher healthcare utilization and costs.²³ Psychiatric co-morbidity has also been associated with hospital readmissions and unnecessary, costly diagnostic testing in this population.^{24, 25} We found that behavioral health outcomes were not limited to disease and therefore it is important to consider patients with IBD for brain-gut psychotherapies despite limited research.⁶

Recognizing the positive impact on many digestive diseases, both gastroenterologists and patients are increasingly seeking psychogastroenterology services. Incorporation of a validated complexity measure would be helpful in further developing a risk stratification model for the dissemination of GI behavioral health services. Future work will be aimed at evaluating economic factors such as changes in health care utilization and cost-effectiveness analyses when a more select group of GI patients are prioritized for behavioral health care. With improved pathways to care, our capacity to provide comprehensive care for digestive diseases will continue to improve.

ACKNOWLEDGEMENTS, FUNDING, AND DISCLOSURES

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MER: study concept and design, analysis and interpretation of data, drafting and critical revision of manuscript; JAK: study concept and design, analysis and interpretation of data, drafting and critical revision of manuscript; WDC: analysis and interpretation of data, critical revision of the manuscript; RWS: study concept and design, statistical analysis, analysis and interpretation of data, drafting and critical revision of manuscript

No funding declared

MER: None; JAK: Advisory board for Abbvie, Janssen and Pfizer; WDC: Consultant for Allergan, Biomerica, IM Health, Ironwood, Salix, Shire; Research Funding from Biomerica, Commonwealth Diagnostics International, Ironwood, Nestle, Salix, Zespri; RWS: Consultant for Abbvie, Merck and Janssen

Competing Interests: the authors have no competing interests.

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ABBREVIATIONS

BHI, behavioral health intervention; BSI-18/BSI, Brief Symptom Inventory-18; CBT, cognitive behavioral therapy; DGBIs, disorders of gut-brain interaction; GI, gastrointestinal; GSI, Global Severity Index; IBD, inflammatory bowel disease; IC, interstitial cystitis; IBS, irritable bowel syndrome; IBS-QOL, Irritable Bowel Syndrome Quality of Life; QOL, quality of life; TMJ, temporomandibular joint syndrome

Table 1. Patient Characteristics

| | Post Intervention QOL Change | | p |
|----------------------------------|-------------------------------------|--------------------|----------|
| | No Improvement | Improvement | |
| <i>n</i> = | 48 | 53 | |
| Age, years (SD) | 47.4 (16.5) | 42.9 (15.3) | 0.181 |
| Gender, female (%) | 24 (50) | 39 (73.6) | 0.018 |
| Lower Tract Symptoms (%) | 40 (83) | 50 (92.4) | 0.112 |
| Upper Tract Symptoms (%) | 15 (31.9) | 5 (9.8) | 0.007 |
| Co-Diagnoses | | | |
| IBD Co-Diagnosis (%) | 9 (18.8) | 13 (24.5) | 0.482 |
| Depression (%) | 8 (16.7) | 20 (37.7) | 0.018 |
| Anxiety (%) | 20 (41.7) | 23 (47.7) | 0.578 |
| Migraine (%) | 7 (14.6) | 13 (24.5) | 0.210 |
| Fibromyalgia (%) | 6 (12.5) | 9 (17.0) | 0.527 |
| Interstitial Cystitis (%) | 7 (14.6) | 8 (15.1) | 0.943 |
| TMJ (%) | 6 (12.5) | 10 (18.9) | 0.381 |
| Medication Use | | | |
| Benzodiazepine Use Hx (%) | 5 (10.6) | 6 (11.8) | 0.860 |
| Narcotic Use Hx (%) | 1 (2.1) | 5 (9.8) | 0.113 |
| Psychotropic Use (%) | 12 (25.5) | 11 (21.6) | 0.644 |
| Patient Reported Symptoms | | | |
| Psychosocial Stressors (SD) | 3.2 (0.7) | 3.5 (0.7) | 0.190 |
| GI Sx Severity Rating (SD) | 7.2 (1.6) | 7.7 (1.6) | 0.151 |

Table 2. Brief Symptom Inventory Scores Before and After Behavioral Health Interventions

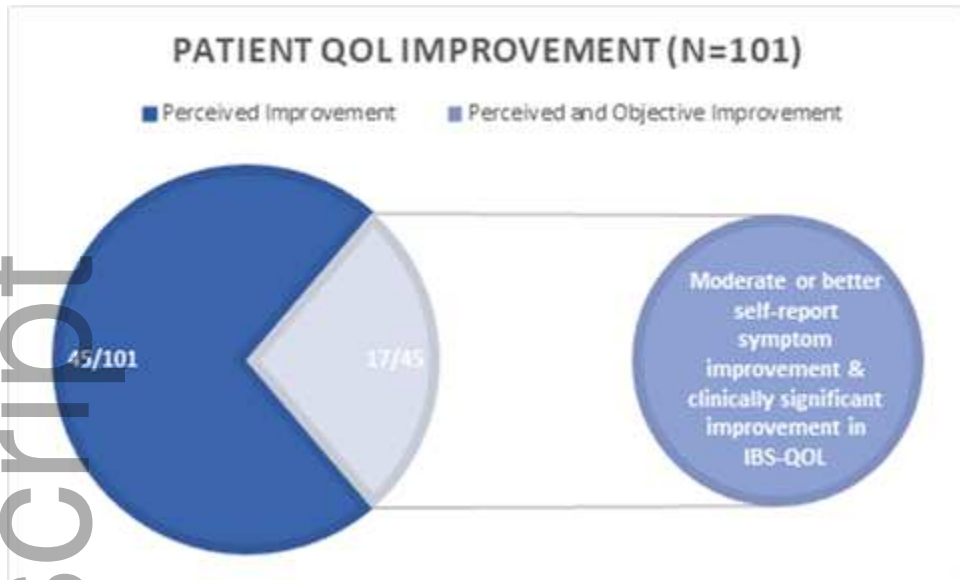
| n= | No Improvement | | Improvement | | p |
|---------------------------|----------------|-----|-------------|------|-------|
| | Value | SD | Value | SD | |
| | | 48 | | 53 | |
| BSI-GSI PreTx Score (Raw) | 13.7 | 9.7 | 20.5 | 12.0 | 0.003 |
| BSI-GSI PreTx ZScore | 57.0 | 8.5 | 61.9 | 8.7 | 0.006 |
| BSI-GSI PostTx Score | 53.3 | 8.1 | 53.3 | 7.9 | 0.966 |
| BSI-GSI Score Change | 3.4 | 7.1 | 8.6 | 7.4 | 0.001 |
| BSI-Dep PreTx Score (Raw) | 4.6 | 4.5 | 6.8 | 5.2 | 0.024 |
| BSI-Dep PreTx ZScore | 54.9 | 9.6 | 59.4 | 9.8 | 0.023 |
| BSI-Dep PostTx Score | 51.9 | 8.5 | 51.0 | 8.4 | 0.605 |
| BSI-Dep Score Change | 57.0 | 8.5 | 61.9 | 8.7 | 0.006 |
| BSI-ANX PreTx Score (Raw) | 4.8 | 3.4 | 6.5 | 4.7 | 0.039 |
| BSI-ANX PreTx ZScore | 55.1 | 9.0 | 58.2 | 9.9 | 0.102 |
| BSI-ANX PostTx Score | 51.6 | 7.4 | 51.1 | 7.5 | 0.741 |
| BSI-ANX Score Change | 3.4 | 7.1 | 7.1 | 7.7 | 0.015 |
| BSI-SOM PreTx Score (Raw) | 4.4 | 3.4 | 7.2 | 4.7 | 0.001 |
| BSI-SOM PreTx ZScore | 56.8 | 9.0 | 62.5 | 9.3 | 0.003 |
| BSI-SOM PostTx Score | 53.5 | 9.0 | 55.1 | 8.2 | 0.349 |
| BSI-SOM Score Change | 3.2 | 7.6 | 7.5 | 7.5 | 0.005 |

GSI: General Severity Index; DEP: Depression subscore; SOM: Somatization subscore; ANX: Anxiety Subscore

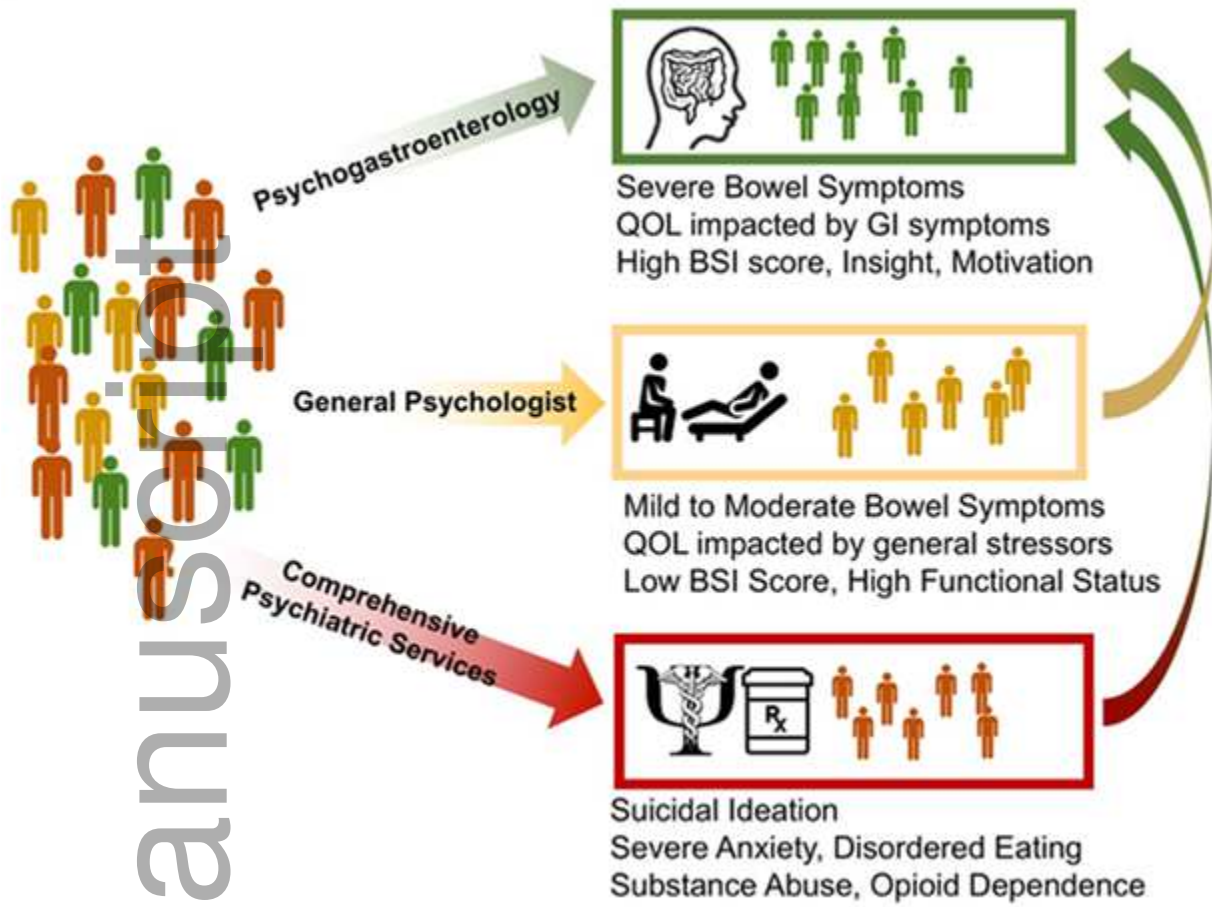
Commented [RM(ERP1): Decreased decimal places to 1 for Value and SD

Table 3. Multivariable Model of Achieving Quality of Life Improvement Following Behavioral Health Intervention

| Variable | Odds Ratio | 95% Confidence Limits | | p |
|------------------------------------------------|-------------|-----------------------|--------------|--------------|
| Age | 0.98 | 0.95 | 1.01 | 0.183 |
| Gender, Female | 3.25 | 1.13 | 9.35 | 0.029 |
| BSI SOM >63 | 3.74 | 1.19 | 11.72 | 0.024 |
| Diagnosis Major Depression | 4.20 | 1.22 | 14.47 | 0.023 |
| Diagnosis Anxiety Disorder | 0.37 | 0.11 | 1.18 | 0.092 |
| Absence of Upper GI Functional Symptoms | 6.48 | 1.70 | 24.74 | 0.006 |
| IBD Co-Diagnosis | 0.96 | 0.31 | 3.00 | 0.942 |



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