

# Cognitive-behavioral therapy for patients with irritable bowel syndrome: current insights

Sarah W Kinsinger

Behavioral Medicine for Digestive Health, Division of Gastroenterology and Nutrition, Loyola University Medical Center, Maywood, IL, USA

**Abstract:** Irritable bowel syndrome (IBS) is a chronic gastrointestinal (GI) condition associated with significant health care utilization and quality-of-life impairment. Latest research indicates that the brain–gut axis plays a key role in the disorder, and the presence of psychological factors and central processing deficits contribute to symptom severity and disability. Psychological therapies as a whole have demonstrated good efficacy in reducing the severity of IBS symptoms. Cognitive-behavioral therapy (CBT) has been tested most rigorously in multiple randomized controlled trials and consistently demonstrates significant and durable effects on IBS symptoms and quality of life. Various protocols for treating IBS have been developed, and most recent advances in the field include exposure-based treatments to target symptom-specific anxiety as well as modified delivery methods, including internet-based treatment models. Despite the well-documented advantages of CBT for IBS, it has been poorly disseminated and few patients have access to this treatment. The primary barrier to dissemination is the limited number of therapists with adequate training in GI psychology to provide this evidence-based intervention. Future developments in the field need to focus on training opportunities to equip more therapists to competently provide CBT for this population. Further efforts to develop telemedicine platforms for delivering this intervention will also improve accessibility for patients.

**Keywords:** irritable bowel syndrome, functional gastrointestinal disorders, cognitive-behavioral therapy

## Irritable bowel syndrome

Irritable bowel syndrome (IBS) is a highly prevalent condition affecting nearly 35 million Americans.<sup>1</sup> IBS is characterized by abdominal pain associated with altered gut motility causing diarrhea and/or constipation. The financial burden of the condition is high with health care utilization estimated to be equivalent to other chronic diseases, such as asthma, hypertension, and congestive heart failure.<sup>2</sup> In fact IBS consumes over \$20 billion in direct and indirect expenditures.<sup>3</sup> Additionally, the condition negatively impacts patients' quality of life and is associated with increased rates of psychological distress.<sup>4</sup>

Traditionally IBS has been considered a “functional” gastrointestinal (GI) condition, meaning that symptoms are not accounted for by structural or biochemical abnormalities. This is in contrast to “organic” conditions such as Crohn's disease or ulcerative colitis where physiological abnormalities can be identified (ie, ulcerations in gut mucosa or serum blood abnormalities indicate presence of disease). A “functional” diagnosis carries with it a certain degree of stigma and patients are accustomed to being dismissed by health care providers because of the implication that symptoms

Correspondence: Sarah W Kinsinger  
Division of Gastroenterology and Nutrition, Loyola University Medical Center, 2160 S. First Ave., Building, Room 54, Maywood, IL 60611, USA  
Tel +1 708 216 6858  
Fax +1 708 216 4113  
Email Sarah.Kinsinger@lumc.edu

are “psychosomatic” or “all in your head.” There have been considerable scientific advances in recent years that indicate the presence of true biological abnormalities that predispose individuals to IBS (eg, altered gut microbiome, low-grade intestinal inflammation, and immune dysfunction).<sup>5,6</sup> As a result, there is increased recognition that a dichotomous, functional versus organic view of GI illness is less useful. Experts in the field now view IBS as a “disorder of gut brain interaction” rather than a functional condition.<sup>7</sup> This focus on brain–gut interactions is important not only for destigmatizing the disorder, but also for supporting the use of psychological treatments for IBS.

The ROME diagnostic criteria are considered the gold standard in diagnosing IBS. They are symptom-based criteria developed by a group of experts from around the world specializing in functional gastroenterology. The first set of ROME criteria were released in 1989 and several revisions have been made since that time with the most recent version (ROME IV criteria) published in 2016. To be diagnosed with IBS an individual must report recurrent abdominal pain, on average, at least 1 day per week in the last 3 months and is related to defecation and associated with a change in frequency or form of stool.<sup>7</sup> Patients can be classified into three main subtypes, diarrhea-predominant, constipation-predominant, or with mixed bowel habits. Although not included in the diagnostic criteria, symptoms of bloating are common, especially among women.<sup>8</sup> Symptoms of nausea, incomplete evacuation, and urgency are also commonly reported by patients. In the absence of biological markers or alarm signs (eg, weight loss, nocturnal symptoms, blood in stools, history of antibiotic use, and family history of colon cancer), current guidelines recommend a symptom-based diagnostic approach with limited medical testing.<sup>9,10</sup>

## Biopsychosocial model of IBS

The exact etiology of IBS is unknown and research indicates that there are multiple complex factors that interact to contribute to the onset and exacerbation of the illness. The biopsychosocial framework is a helpful model for conceptualizing the disorder as it accounts for the interaction between biological abnormalities of the gut and central processing mechanisms. The biopsychosocial model was first applied to IBS by Doug Drossman, MD.<sup>11,12</sup> This model emphasizes interactions between biology (eg, genetic predisposition, disordered gut motility, altered gut microbiota, low-grade inflammation), behavior (eg, illness behaviors, symptom avoidance), cognitive processes (eg, brain–gut dysregulation, visceral anxiety, coping skills), and environment (eg,

trauma, stressful life events). A key component of this model that contributes to symptom exacerbation is dysregulation of the brain–gut axis. The brain–gut axis refers to the complex, bidirectional communication between the brain and the gut.<sup>12</sup> The enteric nervous system communicates directly with the brain via numerous nerve pathways. Stress and psychological factors can directly influence gut functioning (motility, visceral pain levels) via this pathway, contributing to IBS symptoms.

## Cognitive affective processes

Research has identified several psychological and central processing mechanisms that contribute to brain–gut dysregulation, including visceral hypersensitivity, central processing deficits, and visceral anxiety. These central processes contribute to the development and maintenance of the disorder, and psychological treatments targeting these cognitive processes can directly influence the brain–gut axis and lead to symptom improvement.

Visceral hypersensitivity is one of the hallmark features of IBS and refers to an increased tendency to experience pain or discomfort in response to clinically normal bowel functions. This has been demonstrated in research studies during which IBS patients have much lower pain tolerance for rectal balloon distension than healthy controls.<sup>13,14</sup> Nerves of the enteric nervous system in patients with IBS send amplified pain signals to the brain in response to normal GI functioning. This is why normal amounts of gas in the intestines or muscle contractions of the colon can be perceived as highly painful for someone with IBS.

This visceral pain sensitivity reported in patients with IBS is attributed in part to abnormal pain processing in the central nervous system.<sup>15,16</sup> Recent research utilizing brain imaging techniques has identified abnormalities in central sensory processing among IBS patients. Namely, patients with IBS demonstrate greater activation of emotional arousal networks than healthy controls in response to visceral stimulation. Furthermore, during these studies, healthy controls activate brain regions responsible for downregulating pain (medial prefrontal cortex), whereas patients with IBS do not.<sup>16</sup> These central processing differences contribute to symptom severity in patients with IBS.

The GI tract is highly susceptible to the effects of stress, and stress is a significant contributor to brain–gut dysregulation in IBS. Research has shown that stress is associated with the onset of IBS and with more severe symptoms.<sup>17,18</sup> Stress can influence visceral pain perceptions and directly influence gut motility.<sup>19</sup> Furthermore, research indicates that patients

with IBS may have abnormalities in autonomic nervous system functioning, which can contribute to disruptions in brain–gut pathways.<sup>20,21</sup>

Comorbid psychological factors and coping mechanisms also predispose individuals to IBS and play an important role in symptom exacerbation. Patients with IBS have increased rates of anxiety and somatization compared to healthy controls.<sup>22</sup> However, it appears that particular patterns of anxiety rather than generalized distress or worry are most relevant for the disorder. Visceral anxiety and catastrophizing are common in this population and are key predictors of symptom severity.<sup>23,24</sup> Visceral anxiety refers to the fear of and hypervigilance to bowel symptoms and associated avoidance of situations where symptoms may occur.<sup>24</sup> For example, patients develop fear of social situations where bathrooms are not readily available, worry about eating in public, and misinterpret normal digestive processes as dangerous. For many patients, symptoms themselves become a stressor and this creates a viscous cycle where symptom-related anxiety contributes to gut pain sensitivity and altered motility, which then causes worsening GI symptoms, elevated anxiety, and isolation.

Finally, individuals with IBS appear to engage in particular patterns of coping that may increase stress. A study by Cheng et al found that patients with IBS were more likely to engage in problem-focused coping irrespective of whether a problem is controllable or uncontrollable in comparison to healthy controls and patients with arthritis.<sup>25</sup> Patients have a deficit in using emotion-focused coping techniques, an important coping mechanism for managing uncontrollable stressors such as pain and illness.

## Psychological treatments for IBS

Given the importance of brain–gut interactions and cognitive affective processes in IBS, it is not surprising that psychological interventions are an effective treatment option for the condition. Psychological interventions are considered an important component of treatment for patients with moderate-to-severe symptoms or those with comorbid psychological factors that have not responded to initial pharmacological treatments.<sup>26</sup>

There has been extensive research over the past 30 years examining the efficacy of psychological treatments for functional GI disorders. In fact, 41 randomized controlled trials (RCTs) have evaluated the effect of psychological therapies on IBS.<sup>27</sup> Several meta-analyses have concluded that psychological treatments as a group are moderately effective for relieving symptoms of IBS and that these

effects are durable over time.<sup>27,28–30</sup> The primary endpoint in these studies is improvement in bowel symptoms (not psychological functioning), and studies have consistently demonstrated that psychological treatments are effective in reducing GI symptoms (pain, bowel functioning). Interestingly, these interventions seem to directly improve IBS symptoms, independent of any effect on psychological factors.<sup>30,31</sup> Psychological distress and quality of life typically improve as well, but likely in part due to improvement in bowel functioning.<sup>31</sup>

Several modalities of psychotherapy have been examined in these trials, including cognitive-behavioral therapy (CBT), gut-directed hypnotherapy, psychodynamic psychotherapy, and mindfulness. However, CBT has been the most rigorously tested psychological treatment for IBS with at least 20 published RCTs.<sup>27</sup> These studies consistently demonstrate CBT as an effective treatment for alleviating IBS symptoms and these gains are maintained for at least 1 year after treatment.<sup>27,30</sup>

## Components of CBT treatment for IBS

CBT refers to a short-term, skills-based therapy approach that focuses on modifying behaviors and altering dysfunctional thinking patterns to influence mood and physiological symptoms. The actual techniques and focus of this approach can vary greatly within a CBT framework; however, most CBT treatments for IBS include some combination of the techniques listed below.

### Psychoeducation

Psychoeducation is a key component of treatment and involves educating the patient on IBS, dispelling myths about IBS, explaining the brain–gut axis, the physiological stress response, and rationale for behavioral treatment. This education increases the patient's likelihood of “buying in” to CBT treatment and can increase the patient's insight into the possible role of stress or lifestyle factors on symptoms. Patients typically appreciate the education and find it helpful for understanding why standard medical treatments have been ineffective at adequately treating symptoms and why a behavioral treatment approach is warranted.

### Relaxation strategies

Relaxation strategies are typically introduced in one of the first few sessions and are aimed at teaching the patient skills to regulate autonomic arousal. The most common relaxation technique used is diaphragmatic breathing. Sufficient edu-

ation is needed to explain the rationale for this technique (eg, diaphragmatic breathing engages the parasympathetic nervous system, which can downregulate pain thresholds and normalize gut motility), otherwise patients may be dismissive of breathing exercises being too simplistic. Relaxation training can also be used to increase patients' awareness of physical tension that may be contributing to symptoms. Patients are encouraged to practice these skills daily. Additional techniques such as progressive muscle relaxation or guided imagery are included for patients that would benefit from further practice.

### Cognitive restructuring

Cognitive restructuring skills are necessary for addressing symptom-related anxiety and hypervigilance. Education is provided to increase patients' awareness of the connection between distorted thinking patterns, stress, and digestive symptoms. The therapist provides examples of symptom catastrophizing and explains how these cognitive appraisals contribute to stress and symptom exacerbation (eg, fear of passing gas at a party can increase anxiety, which results in hyperarousal of the gut and increased likelihood of GI symptoms). Patients use worksheets to track automatic thoughts associated with symptoms and stressful events and the therapist highlights patterns of catastrophizing and probability overestimation. Cognitive restructuring techniques are then used to assist patients in generating more accurate and balanced perspectives regarding stress and symptoms. Patients continue to practice these skills using a thought log until eventually the new cognitive styles become automatic and integrated into daily life.

### Problem-solving skills

Problem-solving techniques or coping skills training is included to encourage more flexible coping and use of emotion-focused coping strategies. As mentioned earlier in this article, patients with IBS tend to rely more heavily on problem-focused coping regardless of the controllability of the stressor. Some CBT approaches incorporate coping skills training to help patients identify uncontrollable stressors and practice implementing emotion-focused coping strategies (eg, acceptance, diaphragmatic breathing, cognitive restructuring, exercise, social support). IBS itself can be used as an example of an uncontrollable stressor (eg, no known cure, unpredictable symptoms) and the use of emotion-focused strategies such as acceptance encourage patients to shift from a "solution-focused" approach to a self-management approach for coping with this chronic condition.

### Exposure techniques

Avoidance and "safety" behaviors are common among patients with IBS and can maintain symptom-related anxiety and contribute to symptom severity. For example, many patients avoid situations where they do not have easy access to a restroom, restrict their eating in attempt to control symptoms, or rely unnecessarily on medications when traveling. These behaviors can be addressed through the use of exposure therapy techniques or behavioral experiments. Exposure involves facing situations the patient is avoiding because of fear of symptoms (eg, long road trip, eating at restaurants). This is typically done in a graduated fashion, often using an exposure hierarchy. Some interventions also incorporate interoceptive exposure (IE) exercises to reduce fear of GI sensations. IE involves incorporating behaviors likely to trigger GI symptoms (eg, tightening the stomach, eating feared foods). As patients practice these exposure exercises, avoidance behaviors decrease and appraisals of symptoms as being harmful or threatening are reduced, thus leading to increased self-efficacy. Behavioral experiments can also be useful for addressing safety behaviors. For example, patients can gather data regarding the amount of time they can delay responding to an urge to have a bowel movement and use this data to challenge misperceptions about "urgency" of symptoms and increase a sense of control when away from home.

### The evolution of CBT treatments for IBS

Some of the earliest CBT trials for IBS utilized a general stress management approach, which included a variety of CBT skills. This approach was based on the conceptualization that stress exacerbates IBS symptoms and that symptom relief could be achieved with the use of stress reduction techniques.<sup>32-34</sup> These interventions involved a 10-session treatment model including education on the contribution of stress to IBS, self-monitoring of stress and IBS symptoms, relaxation skills, cognitive restructuring, modifying core beliefs, and problem-solving skills. This treatment model has demonstrated positive outcomes in multiple studies.<sup>30,32</sup> For example, Vollmer & Blanchard compared a group CBT intervention with individual CBT and waitlist control. They found that both group and individual treatments resulted in significant IBS symptom reduction (64% vs 55% of patients, respectively) compared to the control condition.<sup>33</sup>

Later models of CBT focused more specifically on cognitive affective processes and coping skills deficits identified in this population.<sup>35</sup> Specifically, this treatment protocol included psychoeducation on IBS, diaphragmatic breathing

training, decatastrophizing skills, flexible problem-solving techniques, and core belief work. Lackner et al tested this protocol in an RCT comparing 10-session therapist-administered CBT with 4-session patient-administered CBT and a waitlist control group. Patients in both CBT groups reported significant reductions in IBS symptoms following treatment in comparison with the control group. Specifically 72% of patients in the self-administered CBT group reported adequate relief of IBS symptoms compared to 60% in the therapist-administered group and 7.4% in the control group.<sup>36</sup>

The most recent iteration of CBT for IBS was developed by Craske et al and targets visceral anxiety by utilizing exposure-based techniques.<sup>37</sup> This treatment was modeled after the panic literature and was developed to specifically target visceral anxiety contributing to symptoms. The rationale for an exposure-based treatment is based on the understanding that patients with IBS experience hypersensitivity and hypervigilance to GI symptoms that is similar to fear and avoidance of bodily sensations seen in panic disorder. The authors hypothesized that treatment outcomes could be further improved if CBT interventions specifically target visceral anxiety. Many components of this intervention are similar to prior models, including psychoeducation, self-monitoring, and cognitive restructuring. However, what differentiates it from other approaches is the interoceptive and in vivo exposure exercises. Similar to other published interventions, this is a 10-session protocol. Craske et al examined the efficacy of this protocol in a RCT comparing CBT with IE with a stress management intervention and an attention control group. Results indicated that all three groups experienced improvements in bowel symptoms, but with superior results for the IE condition on some of the outcomes.<sup>37</sup>

Additional advances in CBT treatment for IBS include efforts to make these interventions more accessible to patients and viable in the real world. A primary criticism of CBT for IBS is its limited clinical utility because of multiple barriers, including practical limitations. Many of the CBT protocols require patients to commit to 10 hour-long appointments with a therapist, which can be costly and time consuming for many patients. One approach to improve accessibility and reduce patient burden has been to utilize alternative delivery methods for these CBT protocols. Lackner et al developed a minimal contact (MC) treatment model with a combination of one-on-one sessions with a therapist and patient self-study materials.<sup>37</sup> This MC approach demonstrated equivalence to a 10-week approach for reducing symptom severity.<sup>37</sup> Another approach to increase the availability of CBT for IBS has

been to offer this intervention via the internet. Ljotsson et al developed a 10-session Internet-delivered CBT (ICBT) for IBS.<sup>38</sup> Their protocol includes an exposure-based treatment model that also incorporates mindfulness techniques. The content was provided to patients as a text-based self-help manual and treatment also included contact with a therapist via an online messaging system. This treatment modality has demonstrated positive results in RCTs.<sup>38,39</sup> For example, compared to a control condition (online discussion forum), participants in the ICBT group reported significant decreases in IBS symptoms (42% patients vs 12% of patients).<sup>38</sup>

To date there have been no studies comparing the efficacy of these various CBT protocols. Until a dismantling study is conducted, there is no way to know if there are specific components of treatment that are more or less effective and if there are differences in efficacy between these CBT approaches.

## Future directions

It is clear that CBT is an effective treatment option for patients with IBS, and the use of behavioral interventions to treat this disorder is becoming more widely accepted. In fact, the American Gastroenterological Association recommends psychological interventions for patients with moderate-to-severe IBS or who do not respond to standard medical care, and for whom psychological factors exacerbate their symptoms.<sup>40</sup> However, despite the demonstrated benefits of CBT, very few patients have access to this specialized treatment approach. IBS is the most frequently diagnosed disorder in gastroenterology practices, yet most patients do not have the option of seeing a psychologist for CBT.<sup>41</sup> A primary barrier to disseminating treatment is the lack of behavioral providers adequately trained in this intervention. To establish CBT as standard of care for patients with IBS we need to increase its availability by offering training opportunities for clinicians to learn how to apply CBT in this population.

Advancements are also needed to establish models of integrated care into medical practices. Ideally, CBT would be provided in an integrated manner with the psychologist collaborating with the treating gastroenterologist. This interdisciplinary approach is often necessary for patients with IBS, especially those with more severe symptom profiles.<sup>42</sup> Additionally, further research into web-based CBT applications will improve access to care. There is some evidence that internet-based interventions are efficacious in this population; however, these interventions are not available to the general public, and other psychological approaches have not been evaluated using a telemedicine platform.<sup>39</sup>



Web-based treatments could be particularly beneficial in this population given the limited number of psychologists equipped to treat IBS, but we need to increase the availability of telemedicine platforms, and further research is needed to evaluate their efficacy.

Finally, advances in CBT for IBS should involve efforts to better customize treatment to improve outcomes and efficiency. As outlined in this article, several models of CBT have demonstrated efficacy for improving IBS symptoms, some of which involve different combinations of techniques. Although not covered in the current paper, gut-directed hypnotherapy is also a behavioral treatment for IBS with very good efficacy.<sup>43</sup> We are fortunate to have several effective psychological treatment approaches to choose from, but it is unclear for which patients and under which circumstances a particular treatment might perform better. In clinical settings, a therapist often uses a combination of techniques to best match an individual patient's needs. Given the complexity of IBS and multitude of biopsychosocial factors contributing, the psychological needs of each patient may vary. For example, a patient with heightened visceral anxiety and avoidance behaviors might benefit from an exposure-based treatment approach, whereas a patient with less severe anxiety, but heightened pain sensitivity might benefit more from hypnotherapy. By customizing CBT for the individual patient and selecting appropriate treatment targets, we may be able to make these interventions more efficient (4–5 sessions rather than standard 10-session model), improve outcomes, and also improve patient satisfaction. Research suggests that many IBS patients respond to CBT in as little as four sessions and a four-session model is common in clinical settings, supporting the use of a brief treatment approach.<sup>44,45</sup>

## Conclusions

IBS involves dysregulation of the brain–gut axis and psychological processes play an important role in the development and maintenance of the disorder. This is a chronic, difficult-to-treat condition and patients often feel dismissed and frustrated because of the lack of effective medical interventions. Psychological interventions are well-established, effective treatments for IBS, and CBT in particular has been rigorously tested in clinical trials and consistently demonstrates significant and long-lasting symptom improvement. Despite the clear benefits of CBT for IBS, very few patients have access to this specialized approach. Future efforts should focus on training mental health providers on behavioral interventions for IBS and further developing telemedicine models to improve access to care.

## Disclosure

Sarah W Kinsinger is a consultant for Abbvie and Metame Health. The author reports no other conflicts of interest in this work.

## References

1. IBS [webpage on the Internet]. American Gastroenterological Association; 2017. Available from: <https://gastro.org/patient-care/conditions-diseases/irritable-bowel-syndrome>. Accessed June 30, 2017.
2. Cash B, Sullivan S, Barghout V. Total costs of IBS: employer and managed care perspective. *Am J Manag Care*. 2005;11(1 Suppl):S7–S16.
3. Brandt LJ, Chey WD, Foxx-Orenstein AE, et al; American College of Gastroenterology Task Force on Irritable Bowel Syndrome. An evidence based systematic review on the management of irritable bowel syndrome. *Am J Gastroenterol*. 2009;104(Suppl 1):S1–S35.
4. Lea R, Whorwell PJ. New insights into the psychosocial aspects of irritable bowel syndrome. *Curr Gastroenterol Rep*. 2003;5(4):343–350.
5. Gwee K, Leong YL, Graham C, et al. The role of psychological and biological factors in postinfective gut dysfunction. *Gut*. 1999;44(3):400–406.
6. Kennedy PJ, Cryan JF, Dinan TG, Clarke G. Irritable bowel syndrome: a microbiome-gut-brain axis disorder? *World J Gastroenterol*. 2014;20(39):14105–14125.
7. Lacy BE, Mearin F, Chang L, et al. Bowel disorders. *Gastroenterology*. 2016;150:1393–1407.
8. Park HJ, Jarrett M, Cain K, Heitkemper M. Psychological distress and GI symptoms are related to severity of bloating in women with irritable bowel syndrome. *Res Nurs Health*. 2008;31(2):98–107.
9. Chey WD, Kurlander J, Eswaran S. Irritable bowel syndrome: a clinical review. *JAMA*. 2015;313(9):949–958.
10. Begtrup LM, Engsbro AL, Kjeldsen J, et al. A positive diagnostic strategy is noninferior to a strategy of exclusion for patients with irritable bowel syndrome. *Clin Gastroenterol Hepatol*. 2013;11(8):956–962. e1.
11. Drossman DA. Presidential address: gastrointestinal illness and the biopsychosocial model. *Psychosom Med*. 1998;60(3):258–267.
12. Van Oudenhove L, Levy RL, Crowell MD, et al. Biopsychosocial aspects of functional gastrointestinal disorders: how central and environmental processes contribute to the development and expression of functional gastrointestinal disorders. *Gastroenterology*. 2016;150:1355–1367.
13. Ritchie J. Pain from distension of the pelvic colon by inflating a balloon in the irritable colon syndrome. *Gut*. 1973;14(2):125–132.
14. Mertz H, Naliboff B, Munakata J, Niazi N, Mayer EA. Altered rectal perception is a biological marker of patients with irritable bowel syndrome. *Gastroenterology*. 1995;109(1):40–52.
15. Mertz H, Morgan V, Tanner G, et al. Regional cerebral activation in irritable bowel syndrome and control subjects with painful and nonpainful rectal distension. *Gastroenterology*. 2000;118:842–848.
16. Tillisch K, Mayer EA, Labus JS. Quantitative meta-analysis identifies brain regions activated during rectal distension in irritable bowel syndrome. *Gastroenterology*. 2011;140(1):91–100.
17. Bennett EJ, Tennant CC, Piesse C, Badcock CA, Kellow JE. Level of chronic life stress predicts clinical outcome in irritable bowel syndrome. *Gut*. 1998;43(2):256–261.
18. Whitehead WE. Psychosocial aspects of functional gastrointestinal disorders. *Gastroenterol Clin N*. 1996;25:21–34.
19. Posserud I, Agerforz P, Ekman R, Bjornsson ES, Abrahamsson H, Simren M. Altered visceral perceptual and neuroendocrine response in patients with irritable bowel syndrome during mental stress. *Gut*. 2004;53(8):1102–1108.
20. Salvioli B, Pellegatta G, Malacarne M, et al. Autonomic nervous system dysregulation in irritable bowel syndrome. *Neurogastroenterol Motil*. 2015;27(3):423–430.
21. Tougas G. The autonomic nervous system in functional bowel disorders. *Gut*. 2000;47 (Suppl 4):iv78–iv80.
22. Drossman DA. Do psychosocial factors define symptom severity and patient status? *Am J Med*. 1999;107(5A):41S–50S.

23. Hunt MG, Milonova M, Moshier S. Catastrophizing the consequences of gastrointestinal symptoms in irritable bowel syndrome. *J Cogn Psychother*. 2009;23:160–173.
24. Labus JS, Mayer EA, Chang L, Bolus R, Naliboff BD. The central role of gastrointestinal-specific anxiety in irritable bowel syndrome: further validation of the visceral sensitivity index. *Psychosom Med*. 2007;69(1):89–98.
25. Cheng C, Hui W, Lam S. Perceptual style and behavioral patterns of individuals with functional gastrointestinal disorders. *Health Psychol*. 2000;19(2):146–154.
26. Simren M, Tornblom H, Palsson OS, Whitehead WE. Management of the multiple symptoms of irritable bowel syndrome. *Lancet Gastroenterol Hepatol*. 2017;2(2):112–122.
27. Laird KT, Tanner-Smith EE, Russell AC, et al. Short-term and long-term efficacy of psychological therapies for irritable bowel syndrome: a systematic review and meta-analysis. *Clin Gastroenterol Hepatol*. 2016;14(7):937–947.
28. Ford AC, Talley NJ, Schoenfeld PS, Hollon SD, Walker LS. Efficacy of antidepressants and psychological therapies in irritable bowel syndrome: systematic review and meta-analysis. *Gut* 2009;58:367–378.
29. Ford AC, Quigley EM, Lacy BE, et al. Effect of antidepressants and psychological therapies, including hypnotherapy, in irritable bowel syndrome: systematic review and meta-analysis. *Am J Gastroenterol*. 2014;109(9):1350–1366.
30. Lackner JM, Mesmer C, Morley S, Dowzer C, Hamilton S. Psychological treatments for irritable bowel syndrome: a systematic review and meta-analysis. *J Consult Clin Psychol*. 2004;72(6):1100.
31. Lackner JM, Jaccard J, Krasner SS, Katz LA, Gudleski GD, Blanchard EB. How does cognitive behavioral therapy for IBS work? A mediational analysis of a randomized controlled trial. *Gastroenterology*. 2007;133:433–444.
32. Blanchard EB, Scharff L, Payne A, Schwarz SP, Suls JM, Malamood H. Prediction of outcome from cognitive-behavioral treatment of irritable bowel syndrome. *Beh Res Ther*. 1992;30(6):647–650.
33. Vollmer A, Blanchard EB. Controlled comparison of individual versus group cognitive therapy for irritable bowel syndrome. *Behav Ther*. 1999;29:19–33.
34. Drossman DA, Toner BB, Whitehead WE, et al. Cognitive-behavioral therapy versus education and desipramine versus placebo for moderate to severe functional bowel disorders. *Gastroenterology*. 2003;125(1):19–31.
35. Lackner JM. *Controlling IBS the Drug-Free Way: A 10-Step Plan for Symptom Relief*. New York, NY: Stewart, Tabori, Chang; 2007.
36. Lackner JM, Jaccard J, Krasner SS, Katz LA, Gudleski GD, Holroyd K. Self-administered cognitive behavioral therapy for moderate to severe irritable bowel syndrome: clinical efficacy, tolerability, feasibility. *Clin Gastroenterol Hepatol*. 2008;6(8):899–906.
37. Craske MG, Wolitzky-Taylor KB, Labus J, et al. A cognitive-behavioral treatment for irritable bowel syndrome using interoceptive exposure to visceral sensations. *Behav Res Ther*. 2011;49(6–7):413–421.
38. Ljotsson B, Falk L, Vesterlund AW, et al. Internet-delivered exposure and mindfulness based therapy for irritable bowel syndrome – a randomized controlled trial. *Beh Res Ther*. 2010;48(6):531–539.
39. Ljotsson B, Andersson G, Andersson E, et al. Acceptability, effectiveness, and cost-effectiveness of internet-based exposure treatment for irritable bowel syndrome in a clinical sample: a randomized controlled trial. *BMC Gastroenterol*. 2011;11:110.
40. Drossman DA, Camilleri M, Mayer EA, Whitehead WE. AGA technical review on irritable bowel syndrome. *Gastroenterology*. 2002;123(6):2108–2131.
41. Everhart JE, Renault PF. Irritable bowel syndrome in office based practice in the United States. *Gastroenterology*. 1991;100(4):998–1005.
42. Reed-Knight B, Claar RL, Schurman JV, van Tilburg MA. Implementing psychological therapies for functional GI disorders in children and adults. *Expert Rev Gastroenterol Hepatol*. 2016;10(9):981–984.
43. Peters SL, Muir JG, Gibson PR. Review article: gut-directed hypnotherapy in the management of irritable bowel syndrome and inflammatory bowel disease. *Aliment Pharmacol Ther* 2015;41(11):1104–1115.
44. Lackner JM, Gudleski GD, Keefer L, Krasner SS, Powell C, Katz LA. Rapid response to cognitive behavior therapy predicts treatment outcome in patients with irritable bowel syndrome. *Clin Gastroenterol Hepatol*. 2010;8(5):426–432.
45. Kinsinger SW, Ballou S, Keefer L. Snapshot of an integrated psychosocial gastroenterology service. *World J Gastroenterol*. 2015;21(6):1893–1899.

## Psychology Research and Behavior Management

### Publish your work in this journal

Psychology Research and Behavior Management is an international, peer-reviewed, open access journal focusing on the science of psychology and its application in behavior management to develop improved outcomes in the clinical, educational, sports and business arenas. Specific topics covered in the journal include: Neuroscience, memory and decision making; Behavior

modification and management; Clinical applications; Business and sports performance management; Social and developmental studies; Animal studies. The manuscript management system is completely online and includes a very quick and fair peer-review system, which is all easy to use. Visit <http://www.dovepress.com/testimonials.php> to read real quotes from published authors.

Submit your manuscript here: <https://www.dovepress.com/psychology-research-and-behavior-management-journal>

Dovepress