HHS Public Access

Author manuscript

*West J Nurs Res*. Author manuscript; available in PMC 2019 November 01.

Published in final edited form as:

*West J Nurs Res*. 2018 November ; 40(11): 1698–1720. doi:10.1177/0193945917727705.

# Effects of Self-Management Interventions in Patients with Irritable Bowel Syndrome: Systematic Review

**Xiaomei Cong, PhD, RN**,

Associate Professor, School of Nursing, University of Connecticut, 231 Glenbrook Road, Storrs, CT 06269-4026, Institute for Systems Genomics, University of Connecticut, Farmington, Connecticut

**Mallory Perry, BSN, RN**,

School of Nursing, University of Connecticut, 231 Glenbrook Road, Storrs, CT 06269-4026

**Katherine M. Bernier, BSN, RN**,

School of Nursing, University of Connecticut, 231 Glenbrook Road, Storrs, CT 06269-4026

**Erin E. Young, PhD**, and

Assistant Professor, School of Nursing, University of Connecticut, 231 Glenbrook Road, Storrs, CT 06269-4026

**Angela Starkweather, PhD, RN, ACNP-BC, CNRN, FAAN**

Director, Center for Advancement in Managing Pain, Director, P20 Center for Accelerating Precision Pain Self-Management, Professor, University of Connecticut School of Nursing, School of Nursing, University of Connecticut, 231 Glenbrook Road, Storrs, CT 06269-4026

## Abstract

Irritable bowel syndrome (IBS) is a prevalent and costly condition, with expenditures exceeding $21 billion annually. As there is no known cure for IBS, treatment is focused on symptom self-management strategies. The purpose of this systematic review was to investigate the efficacy and overall effect of self-management interventions for patients with IBS. Of the 64 publications that were identified, 20 were included in the systematic review. Self-management interventions were found in diverse formats, including web-based, self-training booklets, individual and/or group interventions with healthcare providers, and cognitive behavioral therapy or exercise-based interventions. Different symptom measures were used across the studies, whereas measurement of quality of life was more standardized. Overall, there is robust evidence supporting self-management interventions for improving short-term symptom management and improving quality of life, whereas longer-term outcomes are variable. Further studies are needed to use standardized symptom measures and tailor interventions for pediatric populations, and tracking longer-term outcomes.

---

Irritable bowel syndrome (IBS) is common with prevalence reaching over 20% in some regions of the world, and affects more women than men (Canavan, West, & Card, 2014; Lacy, Chey, & Lembo, 2015; Longstreth et al., 2006). Direct costs of care and lost

Corresponding author: Telephone: 860-486-2694, xiaomei.cong@uconn.edu.

productivity in the U.S. exceed $21 billion annually, and individuals with IBS utilize more healthcare services than the general population, including outpatient visits, diagnostic testing and over-the-counter and prescription medications (Longstreth et al., 2003; Tang, Yang, Liang, et al., 2012; Tang, Yang, Wang, & Lin, 2012). Intense, recurrent abdominal (visceral) pain is a predominant symptom of IBS, a functional gut disorder that typically manifests in the early adult years (Lacy et al., 2015; Longstreth et al., 2006). While women report more severe IBS-related pain, both younger men and women report more severe pain compared to older adult cohorts (Tang, Yang, Liang, et al., 2012; Tang, Yang, Wang, et al., 2012). Individuals with IBS-related pain report that pain is the most distressing symptom and has the greatest impact on quality of life (Lacy et al., 2015). Although pharmacological interventions are available, individuals often endure a long and frustrating course of learning how to manage pain on their own accord (Frissora & Koch, 2005).

IBS-related pain is associated with sensitization of the central nervous system, and approximately half of all patients with IBS have visceral hypersensitivity (Frissora & Koch, 2005; Kanazawa, Hongo, & Fukudo, 2011; Whitehead, Palsson, & Jones, 2002). These alterations in pain processing escalate pain perception in individuals with IBS, and can increase vulnerability to other comorbid pain disorders, including fibromyalgia, chronic fatigue syndrome and chronic pelvic pain (Hulisz, 2004). As a predominant symptom of IBS, mechanisms of visceral pain have been studied, including neuro-endocrine-immune alterations and dysregulation of the gut microbiota (Hughes et al., 2013; Kerckhoffs et al., 2009; Rajilic-Stojanovic et al., 2011; Simren et al., 2013). Although the findings from these studies have not been conclusive, it is known that the IBS subtype (based on the individual's bowel pattern) can influence the severity, frequency and duration of pain (Saad et al., 2010).

Treatment for IBS is based on the dominant bowel-related symptoms, which is categorized by the following subgroups: IBS with diarrhea (IBS-D), IBS with constipation (IBS-C) and IBS with mixed or alternating diarrhea and constipation (IBS-M) (Saad et al., 2010). However, regardless of subgroup type, which often fluctuates over time (Saad et al., 2010), individuals with IBS exhibit heightened awareness of pain and alterations in pain processing that directly influence pain perception, the most distressing symptom associated with this condition.

As there is no known cure for IBS, treatment is aimed at symptom self-management (Agency for Healthcare Research and Quality [AHRQ], 2014). In general, treatment consists of medications to decrease cramping, bloating, diarrhea, constipation, anxiety and depression, as well as dietary modifications, exercise and stress-reduction (Chang, Lembo, & Sultan, 2014; Trinkley & Nahata, 2014). Symptom self-management (SM) plays a large role in helping individuals with IBS to effectively adapt and improve their quality of life. However, SM programs differ regionally and among institutions, which may lead to outcome variability. In addition, it is currently unclear which components of an SM program are most effective for improving SM behaviors, including symptom SM. Therefore, we performed a systematic review of available publications on SM interventions for IBS in order to answer the following questions: 1) What theoretical models have been used to design SM programs for IBS? 2) What components of SM have shown effectiveness in reducing IBS pain and

associated symptoms? 3) How have SM behaviors been measured? and 4) What outcomes have been evaluated in response to IBS SM programs?

## Methods

The systematic review was guided by the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) statement (Moher, Liberati, Tetzlaff, Altman, & PRISMA Group, 2009). An extensive literature search of *CINAHL, PubMed, PsychINFO* databases was conducted to identify primary research articles that focused on evaluating SM programs for IBS patients. Terms used to identify relevant research articles included: “Irritable Bowel Syndrome”, “IBS”, “chronic abdominal pain”, “self-management”, and “self-efficacy.” The MeSH terms “Irritable Bowel Syndrome” and “Irritable Bowel Syndrome/prevention and control” were included in the search on *PubMed*. Inclusion criteria included: a.) primary research articles, b.) published within the last ten years (2006–2016) which was a time span in which SM emerged in the research literature, c.) articles focused on evaluation of SM programs for individual with IBS, d.) confirmed diagnosis of IBS from the research participant’s healthcare provider, and, e.) written in English. There was no limit put on age, duration of IBS symptoms, or country in which the research was conducted. Articles were excluded if they were a secondary analysis reporting on a previously reported study sample, reviews, study protocols which have yet to yield results, theses and/or case studies. To reduce review bias, the 2nd and 3rd authors independently searched, screened and extracted studies in compliance with eligibility criteria. The other primary review members (the 1st and 5th authors) were asked to arbitrate and independently assessed each included study for evaluating risk of bias.

Search results are depicted in Online Supplementary Figure 1 in concordance with PRISMA guidelines. Upon initial search of the databases 62 articles were found. Of the 62 articles, 4 were duplicates and 58 were identified as being relevant to the proposed research questions by preliminary review. Upon full inspection of the abstracts, 20 did not meet the prescribed inclusion criteria and were thus excluded. Upon careful inspection of each article, 18 did not meet inclusion criteria and were thus eliminated as well. Methodological appraisal was performed and of the 20 articles that remained all had sufficient strength and appropriate rigor. In total, there were 20 articles included within this systematic review (Online Supplementary Figure 1 and Tables 1 – 4).

## Results

### Description of Study Locations and Designs

Of the identified studies, ten were conducted in the United States (Dorn et al., 2015; Hunt, Moshier, & Milonova, 2009; Jarrett et al., 2009, 2016; Labus et al., 2013; Lackner et al., 2008; Sanders, Blanchard, & Sykes, 2007; Shahabi, Naliboff, & Shapiro, 2016; van Tilburg et al., 2009; Zia, Barney, Cain, Jarrett, & Heitkemper, 2016), four in the United Kingdom (Everitt et al., 2013; Kennedy et al., 2013; Moss-Morris, McAlpine, Didsbury, & Spence, 2010; Robinson et al., 2006), three in Sweden (Ljotsson et al., 2010, 2011; Ringstrom, Storsrud, & Simren, 2012), one in Iran (Ghiyasvandian, Ghorbani, Zakerimoghadam, Purfarzad, & Kazemnejad, 2016), one in the Netherlands (Oerlemans, van Cranenburgh,

Herremans, Spreeuwenberg, & van Dulmen, 2011), and one in Denmark (Pedersen, 2015). The studies include one descriptive cohort study (Zia et al., 2016), two quasi-experimental studies (Dorn et al., 2015; Shahabi et al., 2016), and 17 randomized controlled trials, with a range of sample sizes from 28 to 1419.

### What theoretical models have been used to design SM programs for IBS?

Most of the studies identified did not refer to an extant theory or framework from which the intervention was designed. The SM process has been referred as an overarching theory in the studies, but they do not provide specifics on the mechanisms that are being targeted by the intervention. For instance, Moss-Morris et al. (2010) developed a manualized SM intervention, but no further details are provided on the content or mechanisms (i.e., self-efficacy, self-regulation skills, monitoring, etc.). Pedersen et al. (2015) specified the SM intervention as targeting patient education, adherence to medication and access to care providers. Dorn et al. (2015) developed their web-based intervention from a patient needs assessment, interviews with experts and patients, and a systematic review of SM interventions. Jarrett and colleagues (2016; 2009) refer to their intervention as based on a biobehavioral theory with components of education and reassurance, diet, relaxation and cognitive behavioral therapy (CBT). Kennedy et al. (2013) used the normalization process theory to implement a systems-level SM program for IBS. Ljotsson et al. (2010; 2011) based their intervention on exposure and mindfulness with the focus on acceptance of symptoms, while Ringstrom et al. (2012) refer to the self-efficacy theory and Shahabi et al. (2016) used the social cognitive theory of self-regulation in their interventions.

### What components of SM have shown effectiveness in reducing IBS pain and associated symptoms?

**Internet-Based Interventions—**Studies have used web-based intervention to promote SM behaviors and reduce IBS symptoms (Table 1). The SM interventions delivered using a web-based platform over 5 weeks (Hunt et al., 2009), 6 weeks (Everitt et al., 2013; Pedersen, 2015), or 10 weeks (Ljotsson et al., 2010, 2011) were associated with significant improvement in IBS related symptoms or overall symptoms. Hunt et al. (2009) tested a web-based intervention consisting of five modules and homework and covered management of symptoms and stress, catastrophic thinking, and exposure therapy and showed a significant improvement in symptoms, quality of life, and anxiety in the intervention group compared to the wait list control group. Everitt et al. (2013) found that symptom severity score decreased and enablement scores increased at follow-ups in the web-based intervention group and the group received nurse-support by phone. Pedersen (2015) monitored IBS symptoms using a web-based platform and found a significant decrease in overall symptoms. Ljotsson et al. (2010; 2011) reported that internet-delivered exposure-based treatment with stress management reduced patients' pain, visceral sensitivity, overall symptoms and disability with increased quality of life. A web-based intervention focused on IBS-related knowledge has been also found to increase patients' knowledge from baseline, but with no effects on self-efficacy or quality of life (Dorn et al., 2015).

**Self-Training Booklet Interventions—**Self-care booklets, self-administered manuals, **and** self-help guidebooks have been found to be effective in reducing severity of symptoms

of IBS, increasing quality of life, and promoting work and social functioning (Table 2). Ghiyasvandian et al. (2016) used a training booklet, relaxation CD, individual training sessions, and follow-up phone calls in the intervention, and found a significantly reduced severity of symptoms and increased quality of life in the intervention group. Moss-Morris et al. (2010) tested a manualized program in conjunction with face-to-face therapy and phone sessions and reported that more patients in the experimental group experienced symptom relief. Robinson et al. (2006) examined a SM guidebook with focus group meeting or with self-help group meetings, and at one year, they found that patients in both guidebook groups had a significant reduction in primary care consultations and perceived symptom severity. Sanders et al. (2007) also examined the effects of a self-help treatment via reading a book based on CBT and normalization of IBS symptoms and found decreased symptom severity at 3-months post-intervention, but with no effect on quality of life. However, one study reported no appreciable differences in self-efficacy or quality of life among patients randomized to receive SM support (self-help guidebook and community resources) for IBS and the wait-list control group (Kennedy et al., 2013).

**Individual and Group Interventions—**Individual SM interventions delivered either in person or by phone were found to be effective in reducing symptom severity and improving quality of life (Jarrett et al., 2009, 2016; Zia et al., 2016) (Table 3). Jarrett et al. (2009; 2016) reported that individual sessions incorporating themes of education, diet, relaxation strategies, and CBT significantly reduced patients' abdominal pain and gas, overall symptom severity and work loss, as well as improved their quality of life. Zia et al. (2016) performed a one-year assessment on the cohort of participants who received the intervention and found that the majority of the participants were still using the strategies learned during the program and adhering to diet composition recommendations and lifestyle behaviors.

Group-based SM interventions were also examined and have been found to reduce IBS symptom severity, depression and catastrophizing (Labus et al., 2013; Ringstrom et al., 2012). Labus et al. (2013) found that a 5-week group intervention including the bio-psychosocial model of IBS and cognitive-behavioral exercises decreased patients' symptom severity, depression and catastrophizing, and increased self-efficacy and quality of life. Ringstrom et al. (2012) tested a long version of a SM intervention (6x 2 hour sessions) led by a multidisciplinary team versus a nurse-led short version (3x 2 hour sessions) in group format. Although there was no difference over time between groups on the IBS symptom severity, the participants that received the long version had a sustained decrease in depression and anxiety compared to the short version.

**Cognitive Behavioral Therapy or Exercise-based Interventions—**CBT, yoga, guided imagery and other intervention have also been examined as strategies to improve IBS outcomes (Table 4). Lackner et al. (2008) examined a standard 10-week CBT group with a minimal contact 4-week self-administered CBT group and found that both groups had decreased symptom severity and increased quality of life compared to the wait-list control group. Oerlemans et al. (2011) examined a 4-week CBT intervention delivered on a digital device and reported that the intervention group had significant improvements in pain,

catastrophizing thoughts, and quality of life, but only improvements in catastrophizing thoughts persisted at 3 months.

Therapeutic yoga has been also compared with walking on symptom severity and quality of life. Shahabi et al. (2016) reported that both yoga and walking were significantly effective in reducing severity of IBS symptoms at short-term, while, at 6-months, the walking group showed significant decreases in overall symptoms and was more adherent to self-regulation home practice compared to the yoga group. van Tilburg et al. (2009) tested a home-based guided imagery intervention over 6 weeks in children with IBS and showed significant effects on reducing pain and disability.

### What outcomes have been evaluated in response to the IBS SM program?

**SM Behaviors—**Most of the studies measured SM behaviors using a daily diary (Jarrett et al., 2009, 2016; Ljotsson et al., 2010, 2011; Oerlemans et al., 2011). van Tilburg et al. (2009) measured health care utilization and school attendance.

**IBS Symptoms—**All of the studies identified viewed IBS symptoms as an outcome measure. Dorn et al. (2015) used the Functional Bowel Disorder Severity Index (FBSDI), Hunt et al. (2009) and Ljotsson et al. (2010; 2011) used the Gastrointestinal Symptom Rating Scale-IBS (GSRS-IBS), Robinson et al. (2006) used the Global Impression Scale and van Tilburg et al. (2009) used the Abdominal Pain Index (API). The Cognitive Scale for Functional Bowel Disorders (CSFBD) was used by Jarrett et al. (2016; 2009) and Oerlemans et al. (2011). Most of the studies used the Irritable Bowel Syndrome Symptom Severity Scale (IBS-SSS) to measure IBS related pain, abdominal distension, stool consistency, and general interference with life (Everitt et al., 2013; Ghiyasvandian et al., 2016; Lackner et al., 2008; Moss-Morris et al., 2010). All of the studies measured quality of life using the IBS-QOL, except for five of the studies that did not use the IBS disease-specific tool (Ljotsson et al., 2010, 2011; Moss-Morris et al., 2010; Shahabi et al., 2016; van Tilburg et al., 2009). Several studies also measured co-morbidities of IBS, such as anxiety, depression, and somatization levels using the Brief Symptom Inventory (BSI) (Jarrett et al., 2009, 2016; Sanders et al., 2007).

**Biomarker Measures—**Jarrett, et al., (2016) measured biomarkers at baseline, including heart rate variability, salivary cortisol, interleukin-10, and lactulose/mannitol ratio to evaluate whether they predicted improvements in the primary IBS outcomes. Heart rate variability has been found to be a significant predictor for SM effects on abdominal pain.

## Discussion

The majority of the reviewed studies used a randomized controlled trial design to investigate SM related interventions on improving IBS outcomes. While some of the studies incorporated interventions that were designed according to well-established behavioral change theories, most of the studies did not mention a theoretical framework, therefore, it was difficult to identify the mechanisms targeted by the interventions and whether it was successful in improving it. For instance, few studies have measured self-regulation although

several interventions were developed to improve the self-regulation process. In addition, measurement of health behavior change was not common across studies.

Several groups have developed and tested IBS-SM programs and have found that process factors (IBS knowledge) increase after web-based, individual or group, and telephone interventions (AHRQ, 2014; Chang et al., 2014; Trinkley & Nahata, 2014), however, not all have been shown to improve IBS-related pain or SM behaviors for managing symptoms and quality of life (Chang et al., 2014). In particular, interventions that target mechanisms of IBS-related pain that are individualized to the context and process of pain SM have been recommended (Moher et al., 2009). Contextual factors of IBS-related pain can influence the individual's SM skills and abilities. Particular to the context of IBS-pain, increased stress, pain catastrophizing and reactivity reduce the ability to engage in pain SM behaviors (physical activity), and due to inability to manage symptoms, result in increased cost of health care services.

SM interventions have been examined in a variety of delivery methods, including internet-based interventions, self-administered training books, and clinician-guided, individual or group treatment, as well as different amount of time (dose-effect) of the intervention, from 2 to 12 months. Online therapeutic interventions have been found to be efficacious in improving IBS-symptoms (Everitt et al., 2013; Pedersen, 2015). However, whether improvement in IBS symptoms is accompanied by improvements in psychosocial functioning and decreased healthcare costs remains to be seen. Longer-term studies of online interventions for IBS are needed. While online interventions are often more convenient for patients, it may be more difficult to keep the individual engaged in the content and the benefits of social support may not be as accessible (Beatty & Lambert, 2013). However, they are less costly and may be ideal for improving IBS knowledge and strengthening SM skills. Innovation in the delivery of SM interventions, such as incorporating web-based content delivery with minimal contact as used by Labus et al. (2013) may enhance translation to clinical practice and improve sustainability of SM intervention delivery in healthcare systems. Identifying strategies to personalize the interventions for patients with or without access to computers or mobile devices, or who may prefer individual versus group sessions would also be a method for improving patient-centered outcomes.

Symptom severity and disease-specific quality of life measures were fairly uniform across studies, with most studies utilizing IBS specific symptom assessments. Interestingly, few studies employed biological measures as outcomes. Several secondary analyses were published (not included in the review) to examine differences in biological measures between participants that received the SM intervention and the control group. In IBS patients receiving the SM intervention, urine cortisol (Deechakawan, Cain, Jarrett, Burr, & Heitkemper, 2013) and urine epinephrine and norepinephrine (Deechakawan, Heitkemper, Cain, Burr, & Jarrett, 2014) did not show any appreciable differences despite having lower levels of depression, anxiety and pain in the experimental groups compared to control groups. Patients with lower nighttime high frequency heart rate variability (vagal modulation) and increased low frequency/high frequency ratio (sympathovagal balance) had less benefit from SM on abdominal pain, while, salivary cortisol, IL-10, and lactulose/mannitol ratio were not statistically significant in predicting SM benefit (Jarrett et al., 2016).

Although most of the studies evaluated short-term outcomes over weeks to months, Robinson et al. (2006), Jarrett et al. (2009) and Ringstrom et al. (2012) included one-year follow-ups that showed some support for long-term improvement in IBS-related outcomes. A follow-up cohort study by Zia et al. (2016) reported on specific behaviors that were being used by the participants after the study team's well executed SM intervention. Other IBS outcomes have also shown improvement after IBS SM interventions. In a secondary analysis by the same team, they showed a significant improvement in sexual quality of life of women with IBS (Eugenio, Jun, Cain, Jarrett, & Heitkemper, 2012). In another secondary analysis, food intake was assessed by Hsueh et al. (2011) who reported increases in fiber and fruit intake with a trend toward increased vegetable intake over one year in the intervention group.

Only one study focused on pediatric IBS patients (van Tilburg et al., 2009). IBS has been diagnosed in 6% – 11% of middle school and high school students using Rome I criteria and according to Rome II criteria, IBS was found in 22%–45% of children aged 4–18 years presenting to tertiary care clinics (Rasquin et al., 2006). In a Sri Lankan study, 6.23% of school children aged 10–16 years were diagnosed with IBS symptoms as per Rome III criteria with a higher rate in girls (Rajindrajith & Devanarayana, 2012). The prevalence of functional gastrointestinal disorders, including IBS, remains unclear in pediatric populations and empirical validation of the Rome IV criteria for pediatric patients is needed to address this issue (Schurman, Karazsia, & Friesen, 2017). Identification of successful management of IBS symptoms to improve school performance and social function in pediatric population would be a significant step forward in pediatric and adolescent populations.

Consistent with the reported prevalence of IBS in the general population, a majority of the identified studies included adults with predominantly more females across all samples. The review findings support that most SM interventions are effective in improving IBS health outcomes including increased quality of life and reduced severity of symptoms. Theory-driven studies are needed to further investigate mechanisms involved in SM knowledge and behavioral changes. Biomarkers, genetic characteristics, and gut microbiome patterns and functions may provide additional information to tailor interventions and evaluate SM intervention effectiveness. Lastly, pediatric IBS population (and their family members) need to be included in future SM interventional studies.

Some limitations should be considered in evaluating the findings from this review. The included studies were highly heterogeneous in study design, sample sizes, interventions, outcome measures and follow-up duration. Some of the studies did not have a control group, had a small sample size, and/or had a low recruitment rate and high attrition rate, which may have influenced the reported findings. The content and format of the SM intervention program and outcome measurements in the reviewed studies were also diverse, with very few studies reporting on the different types of medical or alternative treatment(s) being used by participants. While it may be assumed that SM interventions are adaptable across different IBS populations, there is not enough evidence to support a specific IBS SM program recommendation in clinical practice.

A robust body of research has accumulated on the benefits of SM interventions for improving IBS symptoms and quality of life over the short-term. Longer-term studies are needed to examine sustainability of IBS symptom SM, health behavior change and quality of life. Suggestions for improving the study of SM in individuals with irritable bowel syndrome include using standardized symptom measures, including measures of health behavior change, evaluating biological outcomes to identify mechanisms of symptom variations, expanding and tailoring interventions for pediatric and adolescent individuals with irritable bowel syndrome, and tracking longer-term outcomes, including quality of life and healthcare costs.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

## Acknowledgments

This publication was supported by the National Institute of Nursing Research of the National Institutes of Health (NIH-NINR) under award number: NIH-NINR 1P20NR016605-01, awarded to Drs. Starkweather, Cong and Young.

## References

Agency for Healthcare Research and Quality. Patient self-management support programs: An evaluation. 2014. Retrieved from http://www.ahrq.gov/research/findings/final-reports/ptmgmt/index.html

Beatty L, Lambert S. A systematic review of internet-based self-help therapeutic interventions to improve distress and disease-control among adults with chronic health conditions. Clinical Psychology Review. 2013; 33(4):609–622. DOI: 10.1016/j.cpr.2013.03.004 [PubMed: 23603521]

Canavan C, West J, Card T. The epidemiology of irritable bowel syndrome. Clinical Epidemiology. 2014; 6:71–80. DOI: 10.2147/CLEP.S40245 [PubMed: 24523597]

Chang L, Lembo A, Sultan S. American Gastroenterological Association Institute Technical Review on the pharmacological management of irritable bowel syndrome. Gastroenterology. 2014; 147(5): 1149–1172. e1142. DOI: 10.1053/j.gastro.2014.09.002 [PubMed: 25224525]

Deechakawan W, Cain KC, Jarrett ME, Burr RL, Heitkemper MM. Effect of self-management intervention on cortisol and daily stress levels in irritable bowel syndrome. Biological Research for Nursing. 2013; 15(1):26–36. DOI: 10.1177/1099800411414047 [PubMed: 21765120]

Deechakawan W, Heitkemper MM, Cain KC, Burr RL, Jarrett ME. Anxiety, depression, and catecholamine levels after self-management intervention in irritable bowel syndrome. Gastroenterology Nursing. 2014; 37(1):24–32. DOI: 10.1097/SGA.0000000000000017 [PubMed: 24476829]

Dorn SD, Palsson OS, Woldeghebriel M, Fowler B, McCoy R, Weinberger M, Drossman DA. Development and pilot testing of an integrated, web-based self-management program for irritable bowel syndrome (IBS). Neurogastroenterology and Motility. 2015; 27(1):128–134. DOI: 10.1111/nmo.12487 [PubMed: 25482042]

Eugenio MD, Jun SE, Cain KC, Jarrett ME, Heitkemper MM. Comprehensive self-management reduces the negative impact of irritable bowel syndrome symptoms on sexual functioning. Digestive Diseases and Sciences. 2012; 57(6):1636–1646. DOI: 10.1007/s10620-012-2047-1 [PubMed: 22290342]

Everitt H, Moss-Morris R, Sibelli A, Tapp L, Coleman N, Yardley L, … Little P. Management of irritable bowel syndrome in primary care: The results of an exploratory randomised controlled trial of mebeverine, methylcellulose, placebo and a self-management website. BMC Gastroenterology. 2013; 13:68.doi: 10.1186/1471-230X-13-68 [PubMed: 23602047]

Frissora CL, Koch KL. Symptom overlap and comorbidity of irritable bowel syndrome with other conditions. Current Gastroenterology Reports. 2005; 7(4):264–271. [PubMed: 16042909]

Ghiyasvandian S, Ghorbani M, Zakerimoghadam M, Purfarzad Z, Kazemnejad A. The effects of a self-care program on the severity of symptoms and quality of life of patients with irritable bowel syndrome. Gastroenterology Nursing. 2016; 39(5):359–365. DOI: 10.1097/SGA.0000000000000229 [PubMed: 27684634]

Hsueh HF, Jarrett ME, Cain KC, Burr RL, Deechakawan W, Heitkemper MM. Does a self-management program change dietary intake in adults with irritable bowel syndrome? Gastroenterology Nursing. 2011; 34(2):108–116. DOI: 10.1097/SGA.0b013e31821092e8 [PubMed: 21455043]

Hughes PA, Zola H, Penttila IA, Blackshaw LA, Andrews JM, Krumbiegel D. Immune activation in irritable bowel syndrome: Can neuroimmune interactions explain symptoms? American Journal of Gastroenterology. 2013; 108(7):1066–1074. DOI: 10.1038/ajg.2013.120 [PubMed: 23649183]

Hulisz D. The burden of illness of irritable bowel syndrome: Current challenges and hope for the future. Journal of Managed Care Pharmacy. 2004; 10(4):299–309. DOI: 10.18553/jmcp.2004.10.4.299 [PubMed: 15298528]

Hunt MG, Moshier S, Milonova M. Brief cognitive-behavioral internet therapy for irritable bowel syndrome. Behaviour Research and Therapy. 2009; 47(9):797–802. DOI: 10.1016/j.brat.2009.05.002 [PubMed: 19570525]

Jarrett ME, Cain KC, Barney PG, Burr RL, Naliboff BD, Shulman R, … Heitkemper MM. Balance of autonomic nervous system predicts who benefits from a self-management intervention program for irritable bowel syndrome. Journal of Neurogastroenterology and Motility. 2016; 22(1):102–111. DOI: 10.5056/jnm15067 [PubMed: 26459461]

Jarrett ME, Cain KC, Burr RL, Hertig VL, Rosen SN, Heitkemper MM. Comprehensive self-management for irritable bowel syndrome: Randomized trial of in-person vs. combined in-person and telephone sessions. American Journal of Gastroenterology. 2009; 104(12):3004–3014. DOI: 10.1038/ajg.2009.479 [PubMed: 19690523]

Kanazawa M, Hongo M, Fukudo S. Visceral hypersensitivity in irritable bowel syndrome. Journal of Gastroenterology and Hepatology. 2011; 26(Suppl 3):119–121. DOI: 10.1111/j.1440-1746.2011.06640.x [PubMed: 21443723]

Kennedy A, Bower P, Reeves D, Blakeman T, Bowen R, Chew-Graham C, … Rogers A. Implementation of self management support for long term conditions in routine primary care settings: Cluster randomised controlled trial. BMJ. 2013; 346:f2882.doi: 10.1136/bmj.f2882 [PubMed: 23670660]

Kerckhoffs AP, Samsom M, van der Rest ME, de Vogel J, Knol J, Ben-Amor K, Akkermans LM. Lower Bifidobacteria counts in both duodenal mucosa-associated and fecal microbiota in irritable bowel syndrome patients. World Journal of Gastroenterology. 2009; 15(23):2887–2892. [PubMed: 19533811]

Labus J, Gupta A, Gill HK, Posserud I, Mayer M, Raeen H, … Mayer EA. Randomised clinical trial: Symptoms of the irritable bowel syndrome are improved by a psycho-education group intervention. Alimentary Pharmacology & Therapeutics. 2013; 37(3):304–315. DOI: 10.1111/apt.12171 [PubMed: 23205588]

Lackner JM, Jaccard J, Krasner SS, Katz LA, Gudleski GD, Holroyd K. Self-administered cognitive behavior therapy for moderate to severe irritable bowel syndrome: Clinical efficacy, tolerability, feasibility. Clinical Gastroenterology and Hepatology. 2008; 6(8):899–906. DOI: 10.1016/j.cgh.2008.03.004 [PubMed: 18524691]

Lacy BE, Chey WD, Lembo AJ. New and emerging treatment options for irritable bowel syndrome. Gastroenterology Hepatology (N Y). 2015; 11(4 Suppl 2):1–19.

Ljotsson B, Falk L, Vesterlund AW, Hedman E, Lindfors P, Ruck C, … Andersson G. Internet-delivered exposure and mindfulness based therapy for irritable bowel syndrome--A randomized controlled trial. Behaviour Research and Therapy. 2010; 48(6):531–539. DOI: 10.1016/j.brat.2010.03.003 [PubMed: 20362976]

Ljotsson B, Hedman E, Andersson E, Hesser H, Lindfors P, Hursti T, … Andersson G. Internet-delivered exposure-based treatment vs. stress management for irritable bowel syndrome: A

randomized trial. American Journal of Gastroenterology. 2011; 106(8):1481–1491. DOI: 10.1038/ajg.2011.139 [PubMed: 21537360]

Longstreth GF, Thompson WG, Chey WD, Houghton LA, Mearin F, Spiller RC. Functional bowel disorders. Gastroenterology. 2006; 130(5):1480–1491. DOI: 10.1053/j.gastro.2005.11.061 [PubMed: 16678561]

Longstreth GF, Wilson A, Knight K, Wong J, Chiou CF, Barghout V, … Ofman JJ. Irritable bowel syndrome, health care use, and costs: A U.S. managed care perspective. American Journal of Gastroenterology. 2003; 98(3):600–607. [PubMed: 12650794]

Moher D, Liberati A, Tetzlaff J, Altman DG, Group Prisma. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. Annals of Internal Medicine. 2009; 151(4): 264–269. W264. [PubMed: 19622511]

Moss-Morris R, McAlpine L, Didsbury LP, Spence MJ. A randomized controlled trial of a cognitive behavioural therapy-based self-management intervention for irritable bowel syndrome in primary care. Psychological Medicine. 2010; 40(1):85–94. DOI: 10.1017/S0033291709990195 [PubMed: 19531276]

Oerlemans S, van Cranenburgh O, Herremans PJ, Spreeuwenberg P, van Dulmen S. Intervening on cognitions and behavior in irritable bowel syndrome: A feasibility trial using PDAs. Journal of Psychosomatic Research. 2011; 70(3):267–277. DOI: 10.1016/j.jpsychores.2010.09.018 [PubMed: 21334498]

Pedersen N. EHealth: self-management in inflammatory bowel disease and in irritable bowel syndrome using novel constant-care web applications. EHealth by constant-care in IBD and IBS. Danish Medical Journal. 2015; 62(12):B5168. [PubMed: 26621403]

Rajilic-Stojanovic M, Biagi E, Heilig HG, Kajander K, Kekkonen RA, Tims S, de Vos WM. Global and deep molecular analysis of microbiota signatures in fecal samples from patients with irritable bowel syndrome. Gastroenterology. 2011; 141(5):1792–1801. DOI: 10.1053/j.gastro.2011.07.043 [PubMed: 21820992]

Rajindrajith S, Devanarayana NM. Subtypes and Symptomatology of Irritable Bowel Syndrome in Children and Adolescents: A School-based Survey Using Rome III Criteria. Journal of Neurogastroenterology and Motility. 2012; 18(3):298–304. DOI: 10.5056/jnm.2012.18.3.298 [PubMed: 22837878]

Rasquin A, Di Lorenzo C, Forbes D, Guiraldes E, Hyams JS, Staiano A, Walker LS. Childhood functional gastrointestinal disorders: Child/adolescent. Gastroenterology. 2006; 130(5):1527–1537. DOI: 10.1053/j.gastro.2005.08.063 [PubMed: 16678566]

Ringstrom G, Storsrud S, Simren M. A comparison of a short nurse-based and a long multidisciplinary version of structured patient education in irritable bowel syndrome. European Journal of Gastroenterology & Hepatology. 2012; 24(8):950–957. DOI: 10.1097/MEG.0b013e328354f41f [PubMed: 22617366]

Robinson A, Lee V, Kennedy A, Middleton L, Rogers A, Thompson DG, Reeves D. A randomised controlled trial of self-help interventions in patients with a primary care diagnosis of irritable bowel syndrome. Gut. 2006; 55(5):643–648. DOI: 10.1136/gut.2004.062901 [PubMed: 16099784]

Saad RJ, Rao SS, Koch KL, Kuo B, Parkman HP, McCallum RW, … Chey WD. Do stool form and frequency correlate with whole-gut and colonic transit? Results from a multicenter study in constipated individuals and healthy controls. American Journal of Gastroenterology. 2010; 105(2): 403–411. DOI: 10.1038/ajg.2009.612 [PubMed: 19888202]

Sanders KA, Blanchard EB, Sykes MA. Preliminary study of a self-administered treatment for irritable bowel syndrome: comparison to a wait list control group. Applied Psychophysiology and Biofeedback. 2007; 32(2):111–119. DOI: 10.1007/s10484-007-9037-7 [PubMed: 17564825]

Schurman JV, Karazsia BT, Friesen CA. Examination of competing diagnostic models of functional gastrointestinal disorders related to pain in children. Neurogastroenterology and Motility. 2017; doi: 10.1111/nmo.13126

Shahabi L, Naliboff BD, Shapiro D. Self-regulation evaluation of therapeutic yoga and walking for patients with irritable bowel syndrome: A pilot study. Psychology, Health & Medicine. 2016; 21(2):176–188. DOI: 10.1080/13548506.2015.1051557

Simren M, Barbara G, Flint HJ, Spiegel BM, Spiller RC, Vanner S. … Rome Foundation, Committee. Intestinal microbiota in functional bowel disorders: A Rome foundation report. Gut. 2013; 62(1): 159–176. DOI: 10.1136/gutjnl-2012-302167 [PubMed: 22730468]

Tang YR, Yang WW, Liang ML, Xu XY, Wang MF, Lin L. Age-related symptom and life quality changes in women with irritable bowel syndrome. World Journal of Gastroenterology. 2012; 18(48):7175–7183. DOI: 10.3748/wjg.v18.i48.7175 [PubMed: 23326122]

Tang YR, Yang WW, Wang YL, Lin L. Sex differences in the symptoms and psychological factors that influence quality of life in patients with irritable bowel syndrome. European Journal of Gastroenterology & Hepatology. 2012; 24(6):702–707. DOI: 10.1097/MEG.0b013e328351b2c2 [PubMed: 22382707]

Trinkley KE, Nahata MC. Medication management of irritable bowel syndrome. Digestion. 2014; 89(4):253–267. DOI: 10.1159/000362405 [PubMed: 24992947]

van Tilburg MA, Chitkara DK, Palsson OS, Turner M, Blois-Martin N, Ulshen M, Whitehead WE. Audio-recorded guided imagery treatment reduces functional abdominal pain in children: a pilot study. Pediatrics. 2009; 124(5):e890–897. DOI: 10.1542/peds.2009-0028 [PubMed: 19822590]

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(4):1140–1156. [PubMed: 11910364]

Zia JK, Barney P, Cain KC, Jarrett ME, Heitkemper MM. A comprehensive self-management irritable bowel syndrome program produces sustainable changes in behavior after 1 year. Clinical Gastroenterology and Hepatology. 2016; 14(2):212–219. e211–e212. DOI: 10.1016/j.cgh.2015.09.027 [PubMed: 26453951]

**Table 1**

Self-Management of IBS – Internet-Based Interventions

| Authors/Year/Country | Study design | Subjects | Self-Management Intervention/Control | Study Duration | Outcome Measures | Major Results | Comments |
|---|---|---|---|---|---|---|---|
| Dorn, et al., 2015<br>USA | Pilot Study; | N=40<br>Age:18–80 yr<br>Female: 35<br>Male: 5<br>Rome III criteria | Web-based IBS self-management program<br>No control group. | 12 weeks intervention; IBS visit last 12 months | FBSDI; PAM; IBS-QOL; Satisfactory Relief Scale (adequate relief); Perceived IBS knowledge | Self-rated IBS knowledge increased from baseline, p<. 0001; increase in mean IBS-QOL scores, p=.02; ~75% of participants reported some relief in symptoms at week 12. | Small sample size; no randomization no control group; self-report bias; sampling bias. |
| Everitt, et al., 2013<br>United Kingdom | Factorial RCT | N=123<br>Age:16–60 yr<br>Female: 105<br>Male: 30<br>IBS Rome III criteria | SM website program: SM with nurse telephone session and email support; SM with minimal support; or no access to website. | 6 weeks of intervention; 12 week follow-up | IBS SSS; IBS QOL; SGA of Relief; HADS; Patient Enablement Questionnaire | Website groups compared to No website group: higher IBS-SSS at 6 weeks, p= . 037; improved Enablement scores at 12 weeks, p= .000; improved SGA scores at 12 weeks, p= .035. | Low recruitment rate; low power related to small sample size. |
| Hunt, et al., 2009<br>USA | RCT | N = 54<br>Age: 19–59 yr<br>Female: 44<br>Male: 10<br>IBS diagnosis; no other GI disorder | 5 online modules with education and practice components.<br>Control group - Usual care and waitlist. | 5 weeks of intervention with pre and post-treatment assessments; 6 week and 3-month follow-ups. | GSRS-IBS; ASI, GI and non-GI; IBS-QOL; CPSQ, GI and non-GI; Visceral Anxiety Sensitivity. | Treatment group compared to wait list control: GSRS, p<.01; IBS–QOL, p<. 05; ASI–GI, p<. 01; ASI–Non GI, p <.01; CPSQ–GI, p<.001; CPSQ–Non GI, p<.01; visceral hypersensitivity, p<.05; GI specific catastrophizing, p<.05. | No medical confirmation of IBS diagnosis; significant attrition; poorly validated measures of visceral hypersensitivity and IBS-specific catastrophizing. |
| Ljotsson, et al., 2011<br>Sweden | RCT | N = 195<br>$M_{age}$ = 38.9 yr<br>Female: 79% | Internet-delivered exposure-based CBT (ICBT) group; stress Management (ISM) group.<br>No control group. | 10 weeks of intervention; 6 months follow up. | GSRS-IBS; VSI; HADS<br>Cognitive Scale for Functional Bowel Disorders; Perceived Stress Scale. | At 6 months, ICBT participants (65%; CI: 56–75%) and ISM participants | No control; CBT treatment did not include cognitive interventions or behavioral |

| Authors/Year/Country | Study design | Subjects | Self-Management Intervention/Control | Study Duration | Outcome Measures | Major Results | Comments |
|---|---|---|---|---|---|---|---|
| | | IBS Rome III criteria | | | | (44%; CI: 34–54%) experienced adequate relief of IBS related pain and/or discomfort, p=0.004. | strategies; selection bias. |
| Ljotsson, et al., 2010 Sweden | RCT | N= 85 $M_{age}$ = 34.6 yr Female: 72 Male: 13 IBS Rome III criteria | Internet-delivered CBT with 5 steps of treatment and online discussion forum. Control group - waitlist. | 10 weeks of intervention; 3 month online follow up. | GI Symptom Diary; GSRS-IBS; IBS-QOL; VSI; MADRS-S; Sheehan Disability Scales; Treatment Credibility Scale; symptom reduction score. | Treatment: large effect size on bloating (p<.001) and moderate effects on flatulence and total pain (p<.01 – .001). In the follow-up, improved IBS-QOL (p=0.04). | No medical confirmation of IBS diagnosis; sampling bias; inconsistent data collection methods. |
| Pedersen, 2015 Denmark | Non-randomized control trial | N = 123 Age: ≤ 35 yr Gender distribution not reported IBS Rome III criteria | Web-based application to monitor severity of symptoms while treated with LFD. Control group – normal Danish/Western diet (ND) or LGG diet. | 6 weeks | IBS-SSS; IBS-QOL | Significant reduction in IBS-SSS in both groups, p<.001; treatment with LFD/ND was associated with overall IBS-SSS response (p<0.01). | Non-blinded design; non-randomized design. |

Note. RCT = randomized clinical trial; IBS = irritable bowel syndrome; FBSDI = functional bowel disorder severity index; PAM = patient activation measure; IBS-QOL = irritable bowel syndrome quality of life; IBS-SSS = Irritable Bowel Symptom Severity Scale; SGA of Relief = subjects global assessment of relief; HADS = Hospital Anxiety and Depression Scale; ISM = Internet stress management; GSRS-IBS = Gastrointestinal Symptoms Rating Scale; ASI = Anxiety Sensitivity Index; CPSQ = Consequences of Physical Sensations Questionnaire; VSI = visceral sensitivity index; MADRS-S = Montgomery Asberg Depression Rating Scale-Self Report; LFD = low FODMAP diet; LGG = probiotic strain Lactobacillus Rhamnosus GG.

**Table 2**

Self-Management of IBS – Self-Training Booklet Interventions

| Authors/Year/Country | Study Design | Subjects | Self-Management Intervention | Study Duration | Outcome Measures | Major Results | Comments |
|---|---|---|---|---|---|---|---|
| Ghiyasvandian et al., 2016<br>Iran | RCT | N = 119<br>Age: 18–65 yr<br>Female: 74<br>Male: 45<br>IBS Rome III criteria; no previous training of IBS self-management. | Self-Care Program: training booklet, CD for teaching relaxation techniques, individual training sessions (20–30min), 2 follow-up calls, and group training with counseling.<br>Control: Usual care and 1 follow-up call | 2 months | IBS-QOL; IBS-SSS | Improved IBS-QOL and reduced severity of symptoms, p<.0001 after intervention.<br>Negative correlation between quality of life and severity of symptoms, p=.01, r=-.62. | Self-reporting bias; non-blinded design. |
| Moss-Morris et al., 2010<br>United Kingdom | RCT | N = 64<br>Age: 18–72 yr<br>Female: 46<br>Male: 18<br>IBS diagnosis with Rome I modified and/or Rome II criteria | Self-management cognitive behavioral program including a 1-hour face-to-face therapy session and 2 one-hour telephone sessions.<br>Control: Usual care and IBS fact sheet provided | 7 weeks intervention; 3 and 6 month follow-ups. | IBS-SSS; WSAS; SGA of Relief. | Self-management group: decreased IBS-SSS, p<0.002; 23 (76.7%) of subjects in the self-management group experienced symptom relief. At 8 months 83% subjects in treatment group showed a significant change on the IBS-SSS compared to 49% in the control group. | No control therapy; no fidelity checks during therapy sessions. |
| Robinson et al., 2006<br>United Kingdom | Three arm, RCT | N = 420<br>$M_{age}$ = 40 yr<br>Female: 370<br>Male: 50<br>IBS diagnosis with Rome II criteria. | Arm 1: Comprehensive self-help book with focus group meetings to discuss how coping skills.<br>Arm 2: Self-help book and one self-help group meeting<br>Control: Usual care. | 12 month follow-up | VAS; IBS-QOL; GHQ-28; SF-36. Global Impression Scale; number of physician consults and hospital visits. | Self-help guidebook group: declined in clinic visits, p<0.001; improved in the IBS symptoms, p=<0.001. There was no significant difference of pain, bloating, constipation or quality of life. | Sampling bias; exclusion of hospital admission data. |
| Sanders et al., 2007<br>USA | RCT | N = 28<br>$M_{age}$ = 56.9 yr<br>Female: 22<br>Male: 6<br>IBS diagnosis with Rome II criteria. | 5 modules of an IBS self-help book and worksheets.<br>Control: Usual care and waitlist. | 10 weeks intervention; 3 month follow-up. | WRAT; CPSR; BSI; IBS-QOL; SCID-I. Albany GI History; GI Symptom Diary; Self-help book questionnaires | Treatment group: improved CPSR scores, p=0.01; had a 25% improvement in GI symptoms.<br>Control group: 32% participants in control group had worsening of symptoms. | Small sample size; short length of symptom monitoring; no measure of healthcare utilization. |

Note. RCT = randomized clinical trial; IBS = irritable bowel syndrome; IBS-QOL = irritable bowel syndrome quality of life; IBS-SSS = Irritable Bowel Symptom Severity Scale; WSAS = Work and Social Adjustment Scale; SGA of relief = subject's global assessment of relief; VAS = Visual Analog Scale; VSI = visceral sensitivity index; GHQ-28 = General Health Questionnaire; SF-36 = short form health

survey; WRAT = Wide Range Achievement Test–Reading Section; CPSR = composite primary symptom reduction score; BSI = Brief Symptom Inventory; GSRS-IBS = Gastrointestinal Symptoms Rating Scale; SCID-I = structured clinical interview for DSM-IV Axis I.

**Table 3**

Self-Management of IBS – Individual and Group Interventions

| Authors/Year/Country | Study design | Subjects | Self-Management Intervention/Control | Study Duration | Outcome Measures | Major Results | Comments |
|---|---|---|---|---|---|---|---|
| Jarrett et al., 2009 USA | Three-arm RCT | N=176 Female: 152 Male: 24 Age: >18 yr Rome II criteria | Intervention: 9 individual 1-hour sessions with psych NPs (13 weeks) Treatment groups: Telephone and In-person; or In-person Control: Usual Care | 9 weeks intervention follow-up at 3, 6, and 12 months post-randomization. | IBS-SSS; IBS-QOL; BSI; CSFBD; WPAI | Improvements in CSM group's GI symptom score and QOL from baseline to 3, 6 and 12 months ($p<0.001$) compared to UC. No statistical difference between CSM-IP and CSM-T/IP. | Participants often distracted with CSM via telephone; CSM T/IP participants were not solely by phone, but required 3 in person visits. |
| Jarrett et al., 2016 USA | Two-armed RCT | N=85 Female: 75 Male: 10 Age: 18–70 yr Rome Criteria III | Intervention: 8 individual sessions, lasting 60 minutes with a research nurse (in-person, telephone, or both). Control: Usual Care (IBS Workbook included with all groups.) | 12 weeks duration. Baseline, 3 and 6 months after randomization. | Daily diary; IBS-QOL; CSFBD; Biomarkers: heart rate variability, salivary cortisol, IL-10, & lactulose/mannitol ratio. | CSM was more effective than usual care at 6 months consistently in the domains of abdominal pain/ discomfort ($p=0.002$), IBS symptom score ($p=<.001$); Quality of Life ($p=0.051$). | Small sample size. Difficult to determine which components of the intervention are helpful in decreasing IBS related symptoms. |
| Labus et al., 2013 USA | RCT | N=69 Female: 50 Male: 19 $M_{age}$ = 46.8 yr Rome II criteria. | Intervention: Psycho-educational course lead by a gastroenterologist with a therapist. 5 consecutive weekly, 2 hour sessions in a group setting (5–8 participants/group). Homework and reading assignments were also assigned. Control: Usual care | Timepoints include baseline, end of 5-week intervention course and then at 3 months. | Global GI symptom severity; IBS-QOL; HADS; VSI; CSQ | Intervention group: reduced symptom severity ($p=0.0003$); also reduced symptom severity at 3 months ($p=0.001$); increased total IBS-QOL ($p=0.002$), as well as at the end of the intervention ($p=0.002$); reduced depression ($p=0.006$), but not anxiety ($p=0.13$). | Small sample size. Randomization may create unbalanced baseline groups (anxiety and symptom severity). Though not significant. |
| Ringstrom et al., 2012 Sweden | RCT | N=80 Female: 70 Male: 10 Age: 18–70 yr Rome II Criteria. | Short, nurse-based educational session. Three, 2 hour sessions held weekly via a GI nurse. Long interdisciplinary educational session. Six, 2 hour sessions held weekly. | Assessed at baseline, 3-, 6-, 12-months after baseline | Satisfactory relief; IBS-SSS; Perceived Knowledge; VAS; IBS-QOL; VSI; HAD; Individual Goal. | Nurse led short sessions are comparable to long interdisciplinary sessions, there was no statistical difference. | No blinding of participants, who had preference for treatment groups. Unbalanced baseline anxiety between intervention groups. |

| Authors/Year/Country | Study design | Subjects | Self-Management Intervention/Control | Study Duration | Outcome Measures | Major Results | Comments |
|---|---|---|---|---|---|---|---|
| Zia et al., 2016 USA | Cohort study of previous RCT | N=81 Female: 70 Male: 11 $M_{age}$ = 45 yr | Intervention: CSM included 9 sessions, lasting 1 hour, in a 13 week period by trained psychiatric nurse therapists. Sessions were either conducted in person or via telephone. Control: Usual Care | 9 sessions over 13 weeks; 1 year follow up | Evaluate if still using CSM techniques at 12 months follow up. | At 12 months, 94% of those who responded were still using at least 6 CSM strategies. The highest adherence was “diet composition” (99%) and lifestyle behaviors (99%). | Prescribed CSM program is not easily accessed by everyone with IBS. Possibly inflated adherence rates due to lack of psychometric evaluation. |

Note. RCT = randomized clinical trial; IBS = irritable bowel syndrome; IBS-SSS = Irritable Bowel Symptom Severity Scale; IBS-QOL = irritable bowel syndrome quality of life; BSI = Brief Symptom Inventory; CSFBD = Cognitive Scale for Functional Bowel Disorders; WPAIQ = Work Productivity and Activity Impairment Questionnaire; CSM = comprehensive self-management; HADS = Hospital Anxiety and Depression Scale; VSI = visceral sensitivity index; CSQ = Catastrophizing Scale Questionnaire; VAS = Visual Analog Scale; FFQ = Food Frequency Questionnaire.

**Table 4**

Self-Management of IBS – CBT, Exercise and other Interventions

| Authors/Year/Country | Study design | Subjects | Self-Management Intervention/Control | Study Duration | Outcome Measures | Major Results | Limitations |
|---|---|---|---|---|---|---|---|
| Kennedy et al., 2013 United Kingdom | Pragmatic, two arm, RCT | (N=5599; 44 practices) IBS n = 1419 Gender and age data not reported for IBS patients. | Whole system informing self-management engagement (WISE); Control: Routine primary care. | Data collected at baseline, 6 and 12 months. | Short Form Healthcare Climate Questionnaire; EQ-5D; PRISMS tool. | No significant differences between intervention and control groups in primary or secondary outcomes. | Low response rate; Cluster trials may lead to baseline imbalances. |
| Lackner et al., 2008 USA | Three arm RCT. | N= 75 Male: 10 Female: 65 Ages: 18–70 yr Rome II diagnosis of IBS. | Standard CBT (S-CBT): 10 weekly, 1 hour sessions; Minimal Contact CBT (MC-CBT): self-study materials. Wait list control group | 10 weeks in duration | Efficacy assessment; CGI-I; Global Severity Index of Brief Symptom Inventory; IBS-SSS; IBS-QOL. | Both CBT groups: patients reporting adequate relief and symptom improvement ($p<0.05$); improved IBS-QOL and IBS-SSS ($p<0.001$); minimal difference between S-CBT and MC-CBT. | Small sample size; single site feasibility study; homogenous samples. |
| Oerlemans et al., 2011 Netherlands | Feasibility trial; RCT. | N= 76 Female: 71 Male: 5 Ages 18–65 yr. International Classification of Primary Care (ICPC: D93) or Rome III criteria. | CBT intervention using personal digital assistants: situational feedback diaries from a psychologist. Control: Usual Care | 4 weeks intervention 3 month follow up. | CSFBD, IBS-QOL; PCS, Abdominal Pain (5-point Likert scale), Electronic Diary | Intervention group: improved IBS-QOL at 4 weeks ($p<0.05$), but no long term effect; improved catastrophizing thoughts at 4 weeks and at 3 months ($p<0.01$); improved abdominal pain at 4 weeks ($p<0.5$), but no long term effects. | Subjects in varying subgroups of IBS; No measures of efficacy of education and learning materials. |
| Shahabi et al., 2015 USA | Two arm, RCT (no control group) | N= 27 Male: 3 Female: 24 Ages: 18–65 yr Rome III criteria | Yoga: 16 sessions, biweekly, 60 min each. Walking: 16 sessions, moderately paced, outdoors and non-aerobic, led by physical trainers, biweekly, 60 min each. | 8 weeks treatment, 3 month follow up | Overall GI and abdominal pain severity; PANAS-X; VSI; PHQ-15; STAI. | Yoga group: improved in abdominal pain ($p<0.05$), overall GI symptoms ($p<0.05$), visceral sensitivity ($p<0.05$), and severity of somatic symptoms ($p<0.05$); Walking group: improved | Small sample size; no control; Yoga position may be difficult to replicate at home. |

| Authors/Year/Country | Study design | Subjects | Self-Management Intervention/Control | Study Duration | Outcome Measures | Major Results | Limitations |
|---|---|---|---|---|---|---|---|
| | | | | | | in overall GI symptoms ($p<0.05$), negative affect ($p<0.05$), and state anxiety ($p<0.05$). | |
| van Tilburg, et al., 2009 USA | RCT | N= 19<br>Female: 14<br>Male: 5<br>Age: 6–15 yr<br>Physician diagnosis of functional abdominal pain. | Guided imagery treatment: a 25 min instructional DVD with instructions for parents, 3x biweekly sessions, 1 booster session, 3 daily sessions recorded on CDs, a calendar, a portable CD player.<br>Standard medical care – wait list control. | 2 month intervention, monitored for 6 months | API, Functional Disability Inventory; School attendance and health care utilization; Pediatric Quality of Life Inventory; Global Rating of Change in Abdominal Pain; Treatment Compliance; Questionnaire on Pediatric Gastrointestinal Symptoms | Treatment group: improved in abdominal pain ($p=0.02$) and disability ($p=0.02$); improved quality of life ($p=0.49$); reduced number of visits to medical care providers ($p=0.02$). Treatment effects were sustained over 6 months. Wait list control group: reduced in pain ($p=0.01$) and disability ($p=0.01$) when received the treatment. | Small sample size; difficulty with younger children performing weekly recall of pain. |

Note. RCT = randomized clinical trial; IBS = irritable bowel syndrome; CBT = cognitive-behavioral therapy; IBS-SSS = Irritable Bowel Symptom Severity Scale; IBS-QOL = irritable bowel syndrome quality of life; CGI-I = Clinical Global Impressions-Improvement Scale; CSFBD = Cognitive Scale for Functional Bowel Disorders; PCS = Pain Catastrophizing Scale; PANAS-X = positive and negative affect schedule; VSI = visceral sensitivity index; PHQ-15 = Patient Health Questionnaire-15; STAI = Speilberger State Anxiety Inventory; API = abdominal pain index.