JGH Open Open Access An open access journal of gastroenterology and hepatology

JGHF Journal of Gastroenterology and Hepatology Foundation

doi:10.1002/jgh3.13072

REVIEW ARTICLE

Treating disorders of brain–gut interaction with multidisciplinary integrated care. Moving towards a new standard of care

Rebecca Elizabeth Burgell,* Louisa Hoey,† Kate Norton‡ and Jessica Fitzpatrick§

*Gastroenterologist Functional GI Disorders Service, Alfred Health and Monash University, †Clinical Psychologist, Functional GI Disorders service, Alfred Health, ‡Clinical Nurse Specialist, Functional GI Disorders service, Alfred Health Melbourne and §Dietitian, Functional GI Disorders service, Alfred Health and Monash University, Melbourne, Australia

Key words
disorder of brain–gut interaction, integrated care, neurogastroenterology, psychogastroenterology.

Accepted for publication 13 April 2024.

Correspondence
Rebecca Elizabeth Burgell, Gastroenterologist, Head of the Functional GI Disorders Service, Alfred Health and Monash University. Melbourne, Australia. Email: rebecca.burgell@monash.edu

Declaration of conflict of interest: All authors work in a public health multi-discipline service treating patients suffering from Disorders of Brain Gut Interaction however there are no financial conflict of interests to declare.

Abstract

Disorders of brain–gut interaction (DGBI) are highly prevalent in our community with a negative burden on the quality of life and function. Symptoms are frequently food-induced, and psychological disorders are commonly co-morbid and contribute greatly to symptom severity and healthcare utilization, which can complicate management. Pathophysiological contributors to the development and maintenance of DGBI are best appreciated within the biopsychosocial model of illness. Established treatments include medical therapies targeting gastrointestinal physiology, luminal microbiota or visceral sensitivity, dietary treatments including dietary optimization and specific therapeutic diets such as a low-FODMAP diet, and psychological interventions. The traditional "medical model" of care, driven predominantly by doctors, poorly serves sufferers of DBGI, with research indicating that a multidisciplinary, integrated-care approach produces better outcomes. This narrative review explores the current evidence for multidisciplinary care and provides the best practice recommendations for physicians and healthcare systems managing such patients.

Introduction

Disorders of brain–gut interaction (DGBI) are a chronic group of conditions characterized by symptoms of gastrointestinal (GI) dysfunction driven by alteration in gut motility, visceral sensitivity, mucosal or immune function, luminal microbiota, or central nervous system processing, in the absence of structural abnormalities on standard investigations.[1] They are defined by specific clinical features most recently characterized by the 2016 ROME IV criteria.[2] DBGI encompass conditions spanning the length of the GI tract and include swallowing disorders, esophageal and gastric disorders, bowel disorders, biliary disorders, and anorectal disorders. Global survey studies have shown that 20–40% of the population meet criteria for at least one of the DBGI, more commonly seen in women than men (OR 1.8–2.0).[3] Between 10% and 50% of sufferers seek medical assistance.[4] Healthcare utilization is influenced predominantly by pain severity, comorbid anxiety, and impact on the quality of life.[4,5] Irritable bowel syndrome (IBS) is the best researched DBGI with a worldwide prevalence of 4.1–11.2%[2,3] depending on the diagnostic criteria. Functional dyspepsia (prevalence 7–10% of the population)[6] as well as constipation and disorders of evacuation (11–14% prevalence) are also common.[2,3] Importantly, DBGI frequently overlap, with studies showing that up to 80% of patients meet criteria for more than one condition.[7,8] Patients with overlapping disorders and co-existent psychological disorders can be more challenging to treat.[7,9]

The pathophysiology of DBGI is not completely understood. However, repeated studies have shown the importance of neuroimmune function and its interaction with luminal microbiota and subsequent impacts on visceral sensitivity and motility.[10] This complex interplay is modulated by psychological state, personality type, and previous life events. Psychological contributors may be a predisposing, triggering, or perpetuating element, or considered co-morbid pathology with shared risk factors.[11]

In the absence of an identified single causative pathology, which remains unlikely to be elucidated, varied treatments have been established that target the multiple causative elements. To date, three main pillars of care exist: medical, dietary, and psychological therapies.

Depending on symptom severity, psychological comorbidity, and impact on the quality of life, multiple therapies may be required to alleviate symptoms. However, it is important to tailor this to the individual because, if they are overwhelmed by options, this may reduce the overall benefit.[12] Determining which treatment paradigm is appropriate for which patient is one of the

most critical components of care and must be undertaken with the patient at the center of discussions.

Although such treatments are highly effective, they encompass multiple different therapeutic disciplines and are thus difficult to be delivered by one clinician in isolation. In addition, many approaches require multiple sequential appointments (i.e., psychological therapy or hypnotherapy), which are not always feasible within the fiscal constraints of public medicine. Furthermore, modern complexity of care makes the need for subspecialization increasingly necessary. Patients also do not present with discrete isolated concerns. Many have disordered eating behaviors (23–48%),[13] and up to 80% meet diagnostic criteria for anxiety or depression.[14] In short, one cannot "do it all".

Role of the medical clinician

The majority of patients with DBGI are managed effectively in primary care. Approximately 20% of primary-care patients met criteria for DBGI.[15] Recent studies have shown that medical therapies such as amitriptyline can be very effective when delivered in that setting.[16] However, barriers to effective care include patients not receiving a clear diagnosis, persistent distressing symptoms, or fear of missing serious pathology.[17] As a result, DBGI still make up approximately 50% of a gastroenterologist's workload.[18,19] Referral to secondary care is recommended if there is diagnostic doubt or if there are severe or refractory symptoms.[20] It is the responsibility of the medical physician, be that in primary or secondary care, to clinically assess patients, undertake simple investigations, screen for high-risk features that may warrant more comprehensive investigation, and ultimately confirm and confidently convey the diagnosis. Communicating the diagnosis clearly and directly is a critical intervention in its own right.[21]

Medically prescribed treatments include medications targeted at altering the physiology such as laxatives or prokinetics, anti-spasmodic or anti-diarrhoeal medications, medications to change the intestinal luminal environment such as probiotics or antibiotics, and medications that modulate visceral sensitivity either peripherally or centrally.

Although studies have shown that patients with IBS would be happy to pay a median of between £1 and 50 for a medication that is 100% efficacious while accepting an up to 2–5% risk of death for permanent symptoms control,[22,23] the reality is that no such medication exists. Randomized control trials (RCTs) and meta-analyses have shown that, although medical therapies are efficacious (number needed to treat (NNT) of 5 for antispasmodics, 4 for neuromodulators, 11 antibiotics, 7 for probiotics, 7 for soluble fiber supplementation, etc.),[24,25] patient satisfaction remains low, with up to 73% of sufferers reporting being "unsatisfied" with their care when surveyed.[26] Only 12% of patients using fiber, 13% using laxatives, and 18% using loperamide reported being "very satisfied" with the response. Satisfaction levels are somewhat higher for those using prescription medications: 25% of patients taking Linaclotide or Lubiprostone, 26% of those taking Alosetron, and 21% following Rifaximin.[27] Patients have long advocated for "natural" treatments for their symptoms, with both effective dietary therapy and mental health treatments identified as within the top 10 key research priorities in the field by the recent James Lind Priority setting partnership.[28,29]

Most would, of course, argue that the benefit of a gastroenterologist is greater than the sum of their prescription medication efficacy. Importantly, this has been examined in an Australian study and found to be wanting.[30] After 12 months of intensive gastroenterology-led care, depressingly, more than 50% of patients reported their symptoms to be the same. Just over a third reported symptom improvement or resolution. Nine percent felt they had worsened. Interestingly, one-third of patients were also offered dietary therapy and seen by a dietitian. Access to a dietitian was associated with symptoms improvement.

The role of the doctor is now shifting from solely prescribing pharmaceutical treatments to facilitating an effective treatment plan across multiple modalities. Medical practitioners are important to make a strong confident diagnosis, reduce unnecessary investigations, set expectations and shared goals, and recommend appropriate experienced allied health clinicians to further the patient's care.

Role of dietitian

DBGI and food triggers are inextricably linked. Ninety percent of patients report that food and eating exacerbate symptoms, with the majority restricting food types as a means of symptom control.[31] Furthermore one in three patients with DBGI is at risk of malnutrition.[32] In contrast to medical practitioners, in whom audits have shown to receive as little as 15 h of nutritional training during their 6-year medical studies,[33] dietitians are experts in dietary assessment, dietary optimization, and delivery of therapeutic dietary intervention.

While most of the literature exploring the role of dietetics in the management of DBGI involves the implementation of therapeutic diets, in many cases more simple interventions may be sufficient. Patients with DBGI often have poor diet adequacy, with only 5% meeting the recommended targets for fiber intake and 76%, 91%, and 98% exceeding the recommended fat, sodium, and sugar intake, respectively.[34] The overall habitual diet quality and diversity scores are low.[34] Dietitians play a key role in assessing and correcting this deficit. More serious malnutrition is also common, which may be secondary to self-induced dietary restriction (in an attempt to control symptoms) or part of a more insidious co-morbid eating disorder. In this instance, dietitians play a key role in motivational behavioral change, counseling, education, and monitoring.

Finally, dietitians are best placed to implement prescribed therapeutic diets. Such diets are highly efficacious, with adequate relief reported by 50–75% of individuals. However, they are complex and can be challenging to implement.[35] The best evidence supports the use of a low-FODMAP diet, a three-stage diet (restriction, re-introduction, and personalization) that restricts fermentable and osmotically active carbohydrates. Long-term over-restriction can lead to alteration of the luminal microbiome and place patients at risk of micronutrient deficiency.[36] Given this, it is best implemented by a dietitian who can ensure nutritional adequacy by minimizing unnecessary dietary restriction. This is supported by studies which found that 80% of patients report adequate relief of symptoms after the dietitian's introduction of a low-FODMAP diet *versus* 39% of those educated with a

comprehensive diet booklet alone.[37] Therapeutic dietary education can be conducted both individually or in the right patient, in a group, or online setting.[38,39]

In clinical practice, the role of the dietitian is commonly to withdraw harmful non-evidence-based, self-imposed dietary restrictions. Often, these are based on firmly, but incorrectly based beliefs. Dietetic care alone may not address all pathogenic mechanisms. Studies have shown high rates of disordered eating behaviors, with 6% of neurogastroenterology patients meeting full criteria for avoidant restrictive food intake disorder and 17% having evidence of avoidant or restrictive behaviors.[40] Food-related anxiety is also an increasingly recognized concern.[11] Concurrent psychological intervention is often warranted.

Role of mental health clinicians

Psychologists and other mental health clinicians contribute to the care of patients with DGBI through their expertise in assessing and treating psychosocial factors that can exacerbate central sensitzation in the gut. Central sensitization is characterized by an amplified response to noxious stimuli and plays a crucial role in perpetuating DGBIs. The patient's environment and past experiences impact their presentation but also treatment options. For example, a patient with insecure housing or unsafe relationships is unlikely to be able to engage with any other effective care until these barriers are addressed. Mental health professions are uniquely skilled to help develop patient-centered treatment goal-setting.

Through evidence-based interventions such as cognitive behavioral therapy (CBT), the psychologist can help patients to modulate their pain experience, challenge their illness perceptions, manage stress, and cope with anxiety and fear associated with symptoms, all of which can in turn modulate central sensitization. Network meta-analysis indicate that self-administered or minimal-contact CBT, face-to-face CBT, and gut-directed hypnotherapy have the best evidence of efficacy,[41] improving outcomes in up to three-quarters of sufferers.[42] Treatments can be effectively delivered individually or in a group setting.[43]

More formal involvement of a psychiatrist in the multidisciplinary team may also be warranted. Neuromodulator usage is becoming increasingly complicated with the advent of augmentation therapy (the concept of using additive psychoactive medications to target specific outcomes)[44] and is often beyond the comfort level of gastroenterologists.[45] An experienced psychiatrist or psychologist also plays a key role in supporting the mental health of the multidisciplinary team overall, setting reasonable boundaries, providing supervision, addressing risk of vicarious trauma, and managing burnout.

Physical therapist/physiotherapist/nurse therapist

In patients with constipation, evacuatory disorders, disorders of continence, and IBS, pelvic floor physiotherapy or nurse-led biofeedback may be an effective therapy.[46–48] It remains to be determined which clinician is best placed to deliver such therapy, and at present this is mostly determined by local practices and expertise as there is no uniform protocol or treatment approach. This has hampered data collection, and meta-analyses have been inconclusive, which has hampered acceptance of the therapy.[49] The role of physiotherapy in other disorders of the brain–gut axis, particularly upper GI symptoms, is even less clear, although a recent trial in a small number of patients showed promise in treating bloating with biofeedback.[50]

A nurse therapist can also be a key support for sufferers outside clinic time, reinforcing education and minimizing illness and symptom-related anxiety as well as titrating fiber and medication administration. Nurse-led education programs have been shown to be effective with improvement in GI symptoms as well as improved health behaviors and healthcare utilization.[51]

Integrated care and disorders of brain–gut interaction

Ultimately, patients do not exist as silos of medical, psychological, or nutritional disorders. Each biopsychosocial contributor has a bidirectional impact on the others. While in some patients one intervention may be sufficient to provide adequate relief, in many (particularly those presenting to secondary or tertiary care) multiple elements must be tackled.

Integrated care addresses this need by providing timely and cohesive access to multiple therapists taking a holistic approach to the individual. Integrated care is defined by the World Health Organization as "a concept bringing together inputs, delivery, management, and organization of services related to diagnosis, treatment, care, rehabilitation and health promotion".[52] In general, integrated care requires the co-location of multiple different services required to address individual needs. As a concept, however, there is no single model of care that defines integrated care, and a number of different approaches have been explored in the literature in patients with DBGI (Table 1).

Initial studies in this area have explored combined psychological interventions with standard medical care. A well-conducted randomized controlled study[53] showed that a combined gastroenterology and psychology multicomponent behavioral therapy is superior to gastroenterology care alone. Although a small study ($n = 24$), all were well phenotyped and met the ROME criteria for IBS. After completion of the program, and at 3 and 6 months, improvements in GI symptoms were seen as well as improvements in overall well-being, control of health, and quality of life. This did not appear to be mediated by change in physiological measures (visceral sensitivity), as there were no changes in sensory thresholds on rectal barostat testing before *versus* after intervention and at 3 and 6 months.

Interestingly, a subsequent larger Australian study ($n = 105$)[54] comparing three treatments (standard gastroenterologist care, standard care plus cognitive behavior therapy, standard care plus relaxation therapy) found no differences in outcomes. However, in this study the gastroenterologist was blinded to the patient allocation, and thus its design would not represent true integrated care.

In contrast, a joint gastroenterology and psychiatry consultation with a focus on the interaction between psychosocial contributors and somatic presentations was shown to be helpful.[55] Although involving a less defined patient cohort, a study of 124 patients with refractory GI symptoms and suspected psychosocial contributors found improvement in psychological metrics (Hospital anxiety and depression scale, Short-form 36, and State

Table 1 Overview of studies of integrated multidisciplinary care in patients with disorders of brain–gut interaction

Authors, Year	Study type	Intervention	Number of participants	Follow-up duration	Outcomes
Multidisciplinary education programs					
Saito et al.[51]	Observational cohort	Nurse-led 3-h multidisciplinary education program	Patients with symptoms consistent with functional bowel diagnosis	6 months	Improved gastrointestinal symptoms. Improved health behaviors. No improvement in pain scores. Satisfaction Healthcare utilization Quality of life
Combined standard medical care and psychological intervention					
Heymann-Monnikes et al.[53]	Randomized controlled study (RCT)	1. Standard gastroenterologist care *vs* 2. Standard care plus 10 sessions of multicomponent behavioral therapy delivered by a clinical psychologist	24 tertiary referral patients with IBS diagnosed by ROME criteria 1992	12 weeks (2 weeks post completion of program) 3 months post program completion 6 smonth post program completion.	Improvement in IBS symptom score. Improved overall well-being, control of health and quality of life. No change in visceral sensitivity as measured by Barostat
Boyce et al.[54]	RCT	1. Standard gastroenterologist care *vs* 2. Standard care plus cognitive behavior therapy *vs* 3. Standard care plus relaxation.	105 patients meeting ROME I criteria for IBS (refractory patients excluded)	End of treatment 52 weeks post completion of treatment	Overall reduction in symptoms anxiety, and depression, locus of control scales, bowel frequency, and SF36 but no difference between groups noted.
Kruimel et al.[55]	Observational cohort	Joint gastroenterology and psychiatry consultations	124 patients with refractory, unexplained gastroenterology symptoms	6 months 12 months	Improvement in: 1. Psychological metrics HADS – A, HADS – D, SF36, STAI -T, STAI – S, RAND – 36. 2. Gastrointestinal symptoms; Gastrointestinal rating scale; Cognitive scale; for functional bowel disorders Improvement in psychological metrics but not gastrointestinal symptoms.
Berens et al.[56]	RCT	1. Wait list control *vs* 2. Integrated care program with enhanced medical care, interactive psychoeducation and gut-directed hypnotherapy.	Refractory IBS diagnosed as somatoform autonomic dysfunction ($n = 30$).	End of treatment (post 12 sessions)	Numerally greater reduction in IBS symptoms but not statistically significant.
Combined medical, psychological, and nutritional programs					
McDonald et al.[57]	RCT	1. Wait list control *vs* 2. 4-week group-orientated treatment combining dietary and mind body therapies followed by 8 weeks of telephone coaching.	66 patients; IBS diagnosis of at least 1 year without major psychiatric comorbidity.	4, 8 and 12 weeks	Significant improvement in IBS symptoms at 4 weeks, which was maintained at the 12-week timepoint. Improvement in depression severity scores. No change in quality of life

(*Continues*)

Table 1 (Continued)

Authors, Year	Study type	Intervention	Number of participants	Follow-up duration	Outcomes
Basnayake et al.[58] Basnayake et al.[59]	RCT	Standard gastroenterologist care *vs* Standard gastroenterologist care plus access to dietitian, psychologist/ psychiatrist, or physical therapy as required	Standard gastroenterology care group $n = 46$ Multidisciplinary care group $n = 98$	9 months post inception into the study or at discharge 12 months post completion of the study	84% (integrated care) vs. 57% (gastroenterologist care) had a global symptom improvement. 83% *vs* 63% respectively, had adequate relief of symptoms. Greater improvement in Gastrointestinal symptom severity index and IBS-symptom severity score and quality of life in the integrated care group This benefit was maintained 12 months post conclusion of the study.
Bray et al.[60]	Cohort study	1. Matched historical controls vs. 2. Novel multidisciplinary integrated treatment approach	Historical controls $n = 104$ Multidisciplinary integrated care $n = 52$ (NB 28 dropped out)	12 weeks or at completion of the multidiscipline program	Greater improvement in gastrointestinal symptoms in the multidisciplinary group Improvement in HADS score in the multi disciplinary group but no information available for the controls.

and trait anxiety inventory) and GI symptoms at 6 months after the combined consultations. After 12 months, there was ongoing improvement in psychiatric health but, interestingly, no change in GI symptoms.

Outcomes of a broader integrated care approach have also been examined. A German group randomized 30 patients to either waitlist control or an integrated care program including enhanced medical care, interactive psychoeducation, gut-directed hypnotherapy, and open-group setting.[56] Patients completed an average of nine therapeutic sessions. The integrated care group had a numerically greater reduction in IBS severity scale, but it was not statistically significant, perhaps due to the small number of participants.

Similarly, a 4-week group-integrated care program, combining nutritional therapy (low-FODMAP diet) and mind body intervention (utilizing gut-directed hypnotherapy) followed by an 8-week telephone coaching intervention, found a significant reduction in IBS symptom severity score (IBS-SSS) compared with a waitlist control group at 4 weeks. This was sustained at 8 and 12 weeks' follow-up.[57] Importantly, however, there was a high dropout rate (33%) in the integrated therapy arm, mostly due to patients finding the dietary intervention too difficult. Despite this, the study was analyzed as per-protocol rather than intention-to-treat, which may have confounded the results.

Two Australian groups have conducted larger controlled studies of integrated care. Most critically, the comparator group was standard gastroenterologist care and not just waitlist control. They first examined 65 patients randomized to standard care and 98 patients to multidisciplinary integrated care.[58] A gastroenterologist was responsible for patient assessment and diagnosis in both study arms. In the multidisciplinary intervention, patients also had access to dietitians, a pelvic floor physiotherapist, a gut-directed hypnotherapist, and a psychiatrist. The primary outcome measures were a 5-point Likert scale for global change in symptoms and the proportion of patients who described adequate relief of symptoms in the preceding 7 days. Outcomes were assessed at clinic discharge or 9 months after commencing the intervention. The standard care group had a median clinic visit of two, whereas the multidisciplinary group attended a median of five sessions. Thirty-eight percent of the multidisciplinary group saw the gastroenterologist exclusively and did not require allied health intervention. Eighty-three percent of patients in the multidisciplinary group and 63% of the standard group described adequate relief of symptoms post intervention. A global symptom improvement of 84% *versus* 57%, respectively, was reported. Secondary endpoint measures (IBS-SSS, Gastrointestinal symptom severity index and Nepean Dyspepsia Index, HADS scores) were numerically better in the multidisciplinary group than in the standard group. Cost per successful outcome was also lower in the multidisciplinary group. This benefit was sustained at 12 months after completion of treatment.[59]

In the second study, 104 historical controls were compared to 52 patients enrolled into a 12-week gastroenterologist-led integrated care program.[60] The number of allied health interventions varied, with an average of 24 consultations over the program. While there was a high dropout rate (35%) within the integrated care group, in those that completed the program there was

significantly better outcomes (−9.7 point reduction the Structured Assessment of Gastrointestinal Symptoms score [SAGIS] *vs* −1.7 in the control group). There was also a statistically and clinically important reduction in mental health indices (HADS score) before and after the program. Unfortunately, similar data were not available for the historical controls.

Alternative models of care

There are also studies that explore non-medical models of care in the treatment of patients with DBGI. While medical professionals cannot be eliminated entirely, as they remain important to confirm the diagnosis and exclude alternative pathologies, patients with established DGBI can be safely managed in nursing and allied health-led programs often at significantly reduced cost.[61]

Nurse-led care. A Canadian group explored a nurse-led, shared care model in comparison with usual care with a gastroenterologist.[62] In the nurse-led program, the patient underwent a nurse assessment before being enrolled in group education session with a nurse educator, a behavioral change physician, a dietitian, and a pharmacist, before finally undergoing a medical review after the program. Four-hundred and forty-one patients completed the program and were compared with 359 patients managed by a gastroenterologist alone. The nurse-led approach resulted in a reduction in time to care (from 137 to 12 weeks), less emergency room visits, less endoscopy utilization, and, most importantly, an improvement in symptoms.

Similarly, an Australian study[63] triaged patients referred to a tertiary referral DBGI service to either nurse-led care (low risk patients) or medical care (presence of red flags, atypical symptoms, or high-risk mental health concerns) using a standardized questionnaire and simple investigations. This approach reduced the number of patients requiring medical review by just under a third, resulted in a marked reduction in waiting time (345 days reduced to 120 days), and more than doubled the number of new patients who could be seen within the service. This was associated with an impressive reduction in cost per new patients (from $887 to $484), extremely high patient satisfaction, and, most critically, a significant improvement in global symptoms.

Dietitian-led care. A similar model utilizing an expanded scope of practice dietitian to manage patients with DBGI also appeared effective.[64] After the gastroenterologist triage (based on the primary care referral), patients who were deemed low risk were referred to a dietitian clinic. The dietitian assessed the patient and ordered simple blood tests and fecal calprotectin. If abnormal results or high-risk features were found on consultation, the patient was redirected back to the medical service. Otherwise, the dietitian offered lifestyle and dietary advice. Overall wait times were significant decreased, there was high patient satisfaction, and only 11% of patients required referral back to the medical team. Up to 24 months post discharge from the service, re-referral rates remained low and were on par with that seen under a traditional medical model of care.[65]

Online programs. To improve access to cost-effective care, there is increasing interest in the role that virtual, telehealth, and online programs in the care of patients with DBGI.[66] While these fall outside the remit for integrated care, they can be effectively used as an adjunct to care in resource-scarce jurisdictions. A number have studies have found that internet-delivered CBT and mindfulness can be effective in reducing symptoms[67,68] with benefits remaining in the intermediate term[69–71] However, when directly compared to online program in conjunction with clinician-led care, outcomes were better with the integrated approach.[72] The use of smart phone applications to facilitate a low-FODMAP diet has also been shown to be effective, albeit at a lower rate than dietitian care.[37] Similarly, smart phone application-based hypnotherapy programs have been shown to improve abdominal pain and stool symptoms,[73,74] although these outcomes have not been compared directly with face-to-face care. Choosing which patients are suitable for what mode of care is the key. In general, online or virtual, behavioral, and mental health programs are not suitable for patients with severe mood disorders, altered consciousness (i.e., psychosis), untreated post-traumatic stress, or cognitive impairment.[66]

Recommendations for best practice care

There has been increasing interest in the role that formal multidisciplinary models of care play in managing DBGI,[75,76] with the latest British Society of Gastroenterology going so far as to recommend that severe or refractory IBS should be managed within an integrated multidisciplinary service.[20] Nevertheless, the recent clinical practice guidelines from America,[77] India,[78] Canada,[79] and Japan[80] are short of calling for formal integrated management approaches. All, however, acknowledge the role that multidisciplinary practitioners play in the care of patients with IBS.

The longitudinal nature of primary care makes general practitioners best placed to manage care. Creating informal multidisciplinary teams within local areas may well be sufficient to manage most individuals. Nevertheless, a proportion of sufferers, often with overlapping disorders or significant psychological/psychiatric co-morbidity, represent a more challenging and complex patient group to manage. It is this group of refractory patients with severe symptoms, usually requiring tertiary care, who are best managed in a dedicated multidisciplinary integrated care team.

Assessment and screening for co-morbid conditions should be carried out by the clinician with first contact with the patient. While this can occur as part of a comprehensive history-taking, this process can be undertaken using pre-consultation questionnaires that assess for psychological distress, dietary adequacy, and malnutrition. Although disordered eating behaviors are common in patients with DBGI, there is a risk of overdiagnosis if eating disorder screening questionnaires are used because of the overlap between symptoms of DBGI and disordered eating behaviors. Such questionnaires can still be helpful to draw the clinician's attention to potential problematic habits; however, they have not been validated in this patient group.

Given the three pillars of care (medical, nutritional, and psychological) in the treatment of DBGI, the minimum members of the integrated care team should include (i) a medical physician with interest in DBGI, (ii) a dietitian, and (iii) a mental health/behavioral therapist/hypnotherapist. It is also advantageous to have access to a pelvic floor physiotherapist and psychiatrist.

Furthermore, while there is limited data exploring nurse-led care, the potential for providing cost-efficient and effective care is huge.[63,76]

Ultimately, the exact composition of the team is less important than the ability to work together and to provide carefully considered patient-centered care. Medical and allied health clinicians should have good knowledge of the biopsychosocial model so that each patient is examined via an interdisciplinary lens. The use of combined appointments and/or group programs can mitigate against a silo approach, as it encourages clinicians from various disciplines to collaborate with one another while the patient remains central to all. Where, because of resource limitations, a formal, integrated multidiscipliary service is not possible, clinicians working in this space should develop informal networks with trusted experienced therapists locally.

Ultimately, the most critical component of integrated care is effective interdisciplinary communication. While this can be informal in nature, it is best done via multidisciplinary meetings, collaborative assessments, and collaborative correspondence back to referrer and/or patient. This capability can be enhanced by video telecommunication support if clinicians and/or patient are not co-located.

Conclusions

There has been a frame shift in management approaches in the field of DBGI. Given the variety of effective treatments now available, no one clinician can do it all. Similarly, the complex interaction of biopsychosocial contributors to symptom generation means clinicians can no longer work in individual craft group silos. There is increasing evidence that integrated models of care improve not only access to care but also mental health and gastrointestinal symptoms in patients suffering from DBGI in comparison to classical medical models of care. Patients with refractory or severe symptoms or co-morbid mental health contributors are likely to particularly benefit from this approach. Recent studies have strengthened the argument for creating centers of excellence for DBGI, where such patients can be referred to access atimely comprehensive and patient-centered wholistic care.

Acknowledgment

Open access publishing facilitated by Monash University, as part of the Wiley - Monash University agreement via the Council of Australian University Librarians.

References

1 Drossman DA. Functional gastrointestinal disorders: history, pathophysiology, clinical features and Rome IV. *Gastroenterology*. 2016; **150**: 1262–1279.e2.
2 Mearin F, Lacy BE, Chang L, Chey WD, Lembo AJ, Simern M, Spiller R. Bowel disorders. *Gastroenterology*. 2016; **150**: 1393–407.
3 Sperber AD, Bangdiwala SI, Drossman DA *et al*. Worldwide prevalence and burden of functional gastrointestinal disorders, results of Rome Foundation Global Study. *Gastroenterology*. 2021; **160**: 99–114 e3.
4 Canavan C, West J, Card T. Review article: the economic impact of the irritable bowel syndrome. *Aliment. Pharmacol. Ther.* 2014; **40**: 1023–34.
5 Snijkers JTW, Winkens B, Weerts ZZRM *et al*. Satisfaction with life in IBS is associated with psychological burden rather than gastrointestinal symptom severity. *Am. J. Gastroenterol.* 2023; **119**: 512–20.
6 Stanghellini V, Chan FKL, Hasler WL *et al*. Gastroduodenal disorders. *Gastroenterology*. 2016; **150**: 1380–92.
7 Fairlie T, Shah A, Talley NJ *et al*. Overlap of disorders of gut-brain interaction: a systematic review and meta-analysis. *Lancet Gastroenterol. Hepatol.* 2023; **8**: 646–59.
8 Gwee KA, Lee YY, Suzuki H *et al*. Asia-Pacific guidelines for managing functional dyspepsia overlapping with other gastrointestinal symptoms. *J. Gastroenterol. Hepatol.* 2023; **38**: 197–209.
9 Sperber AD, Freud T, Aziz I *et al*. Greater overlap of Rome IV disorders of gut-brain interactions leads to increased disease severity and poorer quality of life. *Clin. Gastroenterol. Hepatol.* 2022; **20**: e945–56.
10 Vanuytsel T, Bercik P, Boeckxstaens G. Understanding neuroimmune interactions in disorders of gut-brain interaction: from functional to immune-mediated disorders. *Gut*. 2023; **72**: 787–98.
11 Staudacher HM, Black CJ, Teasdale SB, Mikocka-Walus A, Keefer L. Irritable bowel syndrome and mental health comorbidity—approach to multidisciplinary management. *Nat. Rev. Gastroenterol. Hepatol.* 2023; **20**: 582–96.
12 Peters SL, Yao CK, Philpott H, Yelland GW, Muir JG, Gibson PR. Randomised clinical trial: the efficacy of gut-directed hypnotherapy is similar to that of the low FODMAP diet for the treatment of irritable bowel syndrome. *Aliment. Pharmacol. Ther.* 2016; **44**: 447–59.
13 Evans KM, Averill MM, Harris CL. Disordered eating and eating competence in members of online irritable bowel syndrome support groups. *Neurogastroenterol. Motil.* 2023; **35**: e14584.
14 Trindade IA, Hreinsson JP, Melchior C *et al*. Global prevalence of psychological distress and comorbidity with disorders of gut-brain interactions. *Am. J. Gastroenterol.* 2024; **119**: 165–75.
15 Chuah KH, Beh KH, Mahamad Rappek NA, Mahadeva S. The epidemiology and quality of life of functional gastrointestinal disorders according to Rome III vs Rome IV criteria: a cross-sectional study in primary care. *J. Dig. Dis.* 2021; **22**: 159–66.
16 Ford AC, Wright-Hughes A, Alderson SL *et al*. Amitriptyline at low-dose and titrated for irritable bowel syndrome as second-line treatment in primary care (ATLANTIS): a randomised, double-blind, placebo-controlled, phase 3 trial. *Lancet*. 2023; **402**: 1773–85.
17 Linedale EC, Shahzad MA, Kellie AR, Mikocka-Walus A, Gibson PR, Andrews JM. Referrals to a tertiary hospital: a window into clinical management issues in functional gastrointestinal disorders. *JGH Open*. 2017; **1**: 84–91.
18 Hulisz D. The burden of illness of irritable bowel syndrome: current challenges and hope for the future. *J. Manag. Care Pharm.* 2004; **10**: 299–309.
19 Shivaji UN, Ford AC. Prevalence of functional gastrointestinal disorders among consecutive new patient referrals to a gastroenterology clinic. *Frontline Gastroenterol.* 2014; **5**: 266–71.
20 Vasant DH, Paine PA, Black CJ *et al*. British Society of Gastroenterology guidelines on the management of irritable bowel syndrome. *Gut*. 2021; **70**: 1214–40.
21 Linedale EC, Chur-Hansen A, Mikocka-Walus A, Gibson PR, Andrews JM. Uncertain diagnostic language affects further studies, endoscopies, and repeat consultations for patients with functional gastrointestinal disorders. *Clin. Gastroenterol. Hepatol.* 2016; **14**: 1735–1741 e1.
22 Goodoory VC, Ng CE, Black CJ, Ford AC. Willingness to pay for medications among patients with Rome IV Irritable Bowel Syndrome. *Neurogastroenterol. Motil.* 2023; **35**: e14483.

23 Goodoory VC, Ng CE, Black CJ, Ford AC. Willingness to accept risk with medication in return for cure of symptoms among patients with Rome IV irritable bowel syndrome. *Aliment. Pharmacol. Ther.* 2022; **55**: 1311–9.

24 Ford AC, Moayyedi P, Chey WD *et al*. American College of Gastroenterology monograph on management of irritable bowel syndrome. *Am. J. Gastroenterol.* 2018; **113**: 1–18.

25 Black CJ, Yuan Y, Selinger CP *et al*. Efficacy of soluble fibre, antispasmodic drugs, and gut-brain neuromodulators in irritable bowel syndrome: a systematic review and network meta-analysis. *Lancet Gastroenterol. Hepatol.* 2020; **5**: 117–31.

26 Quigley BM, Sova CC, Brenner DM *et al*. (Can't Get No) patient satisfaction: the predictive power of demographic, GI, and psychological factors in IBS patients. *J. Clin. Gastroenterol.* 2018; **52**: 614–21.

27 Rangan V, Ballou S, Shin A *et al*. Use of treatments for irritable bowel syndrome and patient satisfaction based on the IBS in America Survey. *Gastroenterology*. 2020; **158**: 786–788 e1.

28 Black CJ, McKenzie YA, Scofield-Marlowe M *et al*. Top 10 research priorities for irritable bowel syndrome: results of a James Lind Alliance priority setting partnership. *Lancet Gastroenterol. Hepatol.* 2023; **8**: 499–501.

29 Sturkenboom R *et al*. Do Patients' and Physicians' Perspectives Differ on Preferences for Irritable Bowel Syndrome Treatment? *J. Patient Exp.* 2022; **9** p. 23743735221147762.

30 Basnayake C, Kamm MA, Salzberg M *et al*. Outcome of hospital outpatient treatment of functional gastrointestinal disorders. *Intern. Med. J.* 2019; **49**: 225–31.

31 McKenzie YA, Bowyer RK, Leach H *et al*. British Dietetic Association systematic review and evidence-based practice guidelines for the dietary management of irritable bowel syndrome in adults (2016 update). *J. Hum. Nutr. Diet.* 2016; **29**: 549–75.

32 Meehan EM, Burgell RE. Prevalence of, and risks for, malnutrition in patients with functional gastrointestinal disorders. In: *Australasian Society of Parenteral and Enteral Nutrition*. 2021 Brisbane.

33 Schreiber KR, Cunningham FO. Nutrition education in the medical school curriculum: a review of the course content at the Royal College of Surgeons in Ireland-Bahrain. *Ir. J. Med. Sci.* 2016; **185**: 853–6.

34 Staudacher HM, Ralph FSE, Irving PM, Whelan K, Lomer MCE. Nutrient intake, diet quality, and diet diversity in irritable bowel syndrome and the impact of the low FODMAP diet. *J. Acad. Nutr. Diet.* 2020; **120**: 535–47.

35 Trott N, Aziz I, Rej A, Surendran Sanders D. How patients with IBS use low FODMAP dietary information provided by general practitioners and gastroenterologists: a qualitative study. *Nutrients*. 2019; **11**: 1313.

36 Chey WD, Keefer L, Whelan K, Gibson PR. Behavioral and diet therapies in integrated care for patients with irritable bowel syndrome. *Gastroenterology*. 2021; **160**: 47–62.

37 Dimidi E, McArthur AJ, White R, Whelan K, Lomer MCE. Optimizing educational methods for the low FODMAP diet in disorders of gut-brain interaction: A feasibility randomized controlled trial. *Neurogastroenterol. Motil.* 2023; **35**: e14640.

38 Whigham L, Joyce T, Harper G *et al*. Clinical effectiveness and economic costs of group versus one-to-one education for short-chain fermentable carbohydrate restriction (low FODMAP diet) in the management of irritable bowel syndrome. *J. Hum. Nutr. Diet.* 2015; **28**: 687–96.

39 Colgan A, Digby K, Apekey T *et al*. A dietitian-led low-FODMAP diet webinar: a pre-post study evaluating its impact on symptoms of irritable bowel syndrome. *J. Hum. Nutr. Diet.* 2023; **37**: 396–407.

40 Murray HB, Bailey AP, Keshishian AC *et al*. Prevalence and Characteristics of avoidant/restrictive food intake disorder in adult neurogastroenterology patients. *Clin. Gastroenterol. Hepatol.* 2020; **18**: 1995–2002 e1.

41 Black CJ, Thakur ER, Houghton LA, Quigley EMM, Moayyedi P, Ford AC. Efficacy of psychological therapies for irritable bowel syndrome: systematic review and network meta-analysis. *Gut*. 2020; **69**: 1441–51.

42 Devenney J, Hasan SS, Morris J, Whorwell PJ, Vasant DH. Clinical trial: predictive factors for response to gut-directed hypnotherapy for refractory irritable bowel syndrome, a post hoc analysis. *Aliment. Pharmacol. Ther.* 2024; **59**: 269–77.

43 Lovdahl J *et al*. Randomised clinical trial: individual versus group hypnotherapy for irritable bowel syndrome. *Aliment. Pharmacol. Ther.* 2022; **55**: 1501–11.

44 Drossman DA, Tack J, Ford AC, Szigethy E, Törnblom H, van Oudenhove L. Neuromodulators for functional gastrointestinal disorders (Disorders of Gut-Brain Interaction): a Rome foundation working team report. *Gastroenterology*. 2018; **154**: 1140–1171 e1.

45 Nulsen B, LeBrett W, Drossman DA, Chang L. A survey of gastroenterologists in the United States on the use of central neuromodulators for treating irritable bowel syndrome. *Aliment. Pharmacol. Ther.* 2021; **54**: 281–91.

46 Skardoon GR, Khera AJ, Emmanuel AV, Burgell RE. Review article: dyssynergic defaecation and biofeedback therapy in the pathophysiology and management of functional constipation. *Aliment. Pharmacol. Ther.* 2017; **46**: 410–23.

47 Iqbal F, Askari A, Adaba F *et al*. Factors associated with efficacy of nurse-led bowel training of patients with chronic constipation. *Clin. Gastroenterol. Hepatol.* 2015; **13**: 1785–92.

48 Duelund-Jakobsen J, Haas S, Buntzen S, Lundby L, Bøje G, Laurberg S. Nurse-led clinics can manage faecal incontinence effectively: results from a tertiary referral centre. *Color. Dis.* 2015; **17**: 710–5.

49 Woodward S, Norton C, Chiarelli P. Biofeedback for treatment of chronic idiopathic constipation in adults. *Cochrane Database Syst. Rev.* 2014; **2014**: CD008486.

50 Barba E, Livovsky DM, Accarino A, Azpiroz F. Thoracoabdominal wall motion-guided biofeedback treatment of abdominal distension: a randomized placebo-controlled trial. *Gastroenterology*. 2024 (in press).

51 Saito YA, Prather CM, van Dyke CT, Fett S, Zinsmeister AR, Locke GR III. Effects of multidisciplinary education on outcomes in patients with irritable bowel syndrome. *Clin. Gastroenterol. Hepatol.* 2004; **2**: 576–84.

52 Grone O, Garcia-Barbero M, W.H.O.E.O.f.I.H.C. Services. Integrated care: a position paper of the WHO European Office for Integrated Health Care Services. *Int. J. Integr. Care*. 2001; **1**: e21.

53 Heymann-Monnikes I *et al*. The combination of medical treatment plus multicomponent behavioral therapy is superior to medical treatment alone in the therapy of irritable bowel syndrome. *Am. J. Gastroenterol.* 2000; **95**: 981–94.

54 Boyce PM, Talley NJ, Balaam B, Koloski NA, Truman G. A randomized controlled trial of cognitive behavior therapy, relaxation training, and routine clinical care for the irritable bowel syndrome. *Am. J. Gastroenterol.* 2003; **98**: 2209–18.

55 Kruimel J, Leue C, Winkens B *et al*. Integrated medical-psychiatric outpatient care in functional gastrointestinal disorders improves outcome: a pilot study. *Eur. J. Gastroenterol. Hepatol.* 2015; **27**: 721–7.

56 Berens S, Stroe-Kunold E, Kraus F *et al*. Pilot-RCT of an integrative group therapy for patients with refractory irritable bowel syndrome (ISRCTN02977330). *J. Psychosom. Res.* 2018; **105**: 72–9.

57 McDonald E, Teets R, Ortiz C *et al*. A randomized trial of a group-based integrative medicine approach compared to waitlist control on irritable bowel syndrome symptoms in adults. *Explore (N.Y.)*. 2018; **14**: 406–13.

58 Basnayake C, Kamm MA, Stanley A *et al*. Standard gastroenterologist versus multidisciplinary treatment for functional gastrointestinal disorders (MANTRA): an open-label, single-centre, randomised controlled trial. *Lancet Gastroenterol. Hepatol.* 2020; **5**: 890–9.

59 Basnayake C, Kamm MA, Stanley A *et al*. Long-term outcome of multidisciplinary versus standard gastroenterologist care for functional gastrointestinal disorders: a randomized trial. *Clin. Gastroenterol. Hepatol.* 2022; **20**: 2102–2111 e9.

60 Bray NA, Koloski NA, Jones MP *et al*. Evaluation of a multidisciplinary integrated treatment approach versus standard model of care for functional gastrointestinal disorders (FGIDS): a matched cohort study. *Dig. Dis. Sci.* 2022; **67**: 5593–601.

61 Basnayake C, Kamm MA, Salzberg MR, Wilson-O'Brien A, Stanley A, Thompson AJ. Delivery of care for functional gastrointestinal disorders: a systematic review. *J. Gastroenterol. Hepatol.* 2020; **35**: 204–10.

62 Novak KL, Halasz J, Andrews C *et al.* Nurse-led, shared medical appointments for common gastrointestinal conditions-improving outcomes through collaboration with primary care in the medical home: a prospective observational study. *J. Can. Assoc. Gastroenterol.* 2020; **3**: 59–66.

63 McNamara L WJ, Moore J, Burgell RE. A nursing and allied health-led functinoal gastrointestinal disorders clinic is well received by patients, highly efficient, cost effective and reduces the need for medical intervention in J Gastroenterol Hepatol. 2019.

64 Mutsekwa RN, Canavan R, Whitfield A, Spencer A, Angus RL. Dietitian first gastroenterology clinic: an initiative to reduce wait lists and wait times for gastroenterology outpatients in a tertiary hospital service. *Frontline Gastroenterol.* 2019; **10**: 229–35.

65 Mutsekwa R, Ostrowski S, Canavan R, Ball L, Angus R. Health service usage and re-referral rates: comparison of a dietitian-first clinic with a medical specialist-first model of care in a cohort of gastroenterology patients. *Frontline Gastroenterol.* 2021; **12**: 175–81.

66 Riehl ME. Limited access to integral care: digital therapeutics show promise of scalable solutions to behavioral interventions. *Clin. Transl. Gastroenterol.* 2022; **13**: e00444.

67 Brenner DM, Ladewski AM, Kinsinger SW. Development and current state of digital therapeutics for irritable bowel syndrome. *Clin. Gastroenterol. Hepatol.* 2023; **22**: 222–34.

68 Ljotsson B *et al*. Internet-delivered exposure and mindfulness based therapy for irritable bowel syndrome—a randomized controlled trial. *Behav. Res. Ther.* 2010; **48**: 531–9.

69 Ljotsson B *et al*. Long-term follow-up of internet-delivered exposure and mindfulness based treatment for irritable bowel syndrome. *Behav. Res. Ther.* 2011; **49**: 58–61.

70 Everitt HA, Landau S, O'Reilly G *et al*. Cognitive behavioural therapy for irritable bowel syndrome: 24-month follow-up of participants in the ACTIB randomised trial. *Lancet Gastroenterol. Hepatol.* 2019; **4**: 863–72.

71 Hunt M, Miguez S, Dukas B, Onwude O, White S. Efficacy of Zemedy, a mobile digital therapeutic for the self-management of irritable bowel syndrome: crossover randomized controlled trial. *JMIR Mhealth Uhealth*. 2021; **9**: e26152.

72 Chen J, Zhang Y, Barandouzi ZA *et al*. The effect of self-management online modules plus nurse-led support on pain and quality of life among young adults with irritable bowel syndrome: a randomized controlled trial. *Int. J. Nurs. Stud.* 2022; **132**: 104278.

73 Peters SL, Gibson PR, Halmos EP. Smartphone app-delivered gut-directed hypnotherapy improves symptoms of self-reported irritable bowel syndrome: a retrospective evaluation. *Neurogastroenterol. Motil.* 2023; **35**: e14533.

74 Berry SK, Berry R, Recker D, Botbyl J, Pun L, Chey WD. A randomized parallel-group study of digital gut-directed hypnotherapy vs muscle relaxation for irritable bowel syndrome. *Clin. Gastroenterol. Hepatol.* 2023; **21**: 3152–3159 e2.

75 Corsetti M, Whorwell P. The global impact of IBS: time to think about IBS-specific models of care? *Ther. Adv. Gastroenterol.* 2017; **10**: 727–36.

76 Linedale EC, Mikocka-Walus A, Gibson PR, Andrews JM. The potential of integrated nurse-led models to improve care for people with functional gastrointestinal disorders: a systematic review. *Gastroenterol. Nurs.* 2020; **43**: 53–64.

77 Lacy BE, Pimentel M, Brenner DM *et al*. ACG clinical guideline: management of irritable bowel syndrome. *Am. J. Gastroenterol.* 2021; **116**: 17–44.

78 Ghoshal UC, Sachdeva S, Pratap N *et al*. Indian consensus statements on irritable bowel syndrome in adults: a guideline by the Indian Neurogastroenterology and Motility Association and jointly supported by the Indian Society of Gastroenterology. *Indian J. Gastroenterol.* 2023; **42**: 249–73.

79 Moayyedi P, Andrews CN, MacQueen G *et al*. Canadian Association of Gastroenterology clinical practice guideline for the management of irritable bowel syndrome (IBS). *J. Can. Assoc. Gastroenterol.* 2019; **2**: 6–29.

80 Fukudo S, Okumura T, Inamori M *et al*. Evidence-based clinical practice guidelines for irritable bowel syndrome 2020. *J. Gastroenterol.* 2021; **56**: 193–217.