Long-term symptom severity in people with irritable bowel syndrome following dietetic treatment in primary care: A service evaluation

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Abstract

Background: Evidence suggests that dietary interventions can improve symptoms in people with irritable bowel syndrome (IBS), although most data explore the short-term (immediate) impact. Data on long-term (>6 months) impact are limited, especially from primary care settings. The present study aimed to investigate the long-term effect of dietetic-led interventions for IBS delivered in primary care.

Methods: A service evaluation of a dietetic-led IBS clinic was completed, analysing data on symptom severity, stool frequency and consistency, and healthcare input. Data were collected before and immediately after dietary intervention as part of patients’ routine clinical appointments. Long-term data were collected via a postal questionnaire at least 11 months later.

Results: In total, 211 patients responded to the long-term follow-up questionnaire at a median of 13 months (interquartile range 12–16 months) post follow-up appointment. Of these, 84% had been advised to follow a low FODMAP (i.e., fermentable oligosaccharides, disaccharides, monosaccharides and polyols carbohydrates) diet. All symptoms were reported significantly less frequently short term, and all except heartburn and acid regurgitation remained so over the long term. The four most commonly reported bowel symptoms reduced in frequency were abdominal pain (62%), bloating (50%), increased wind (48%) and urgency to open bowels (49%) ($p < 0.001$). The percentage of patients reporting satisfactory relief of gut symptoms was 10% at baseline and 55% at long-term follow-up ($p < 0.001$). Visits to a general practitioner were reduced (from 96% to 34%; $p < 0.001$), as were those to the gastroenterologist (from 37% to 12%; $p = 0.002$), during the year prior to long-term follow-up compared to the year prior to dietary intervention.

Conclusions: Patients with IBS who received dietetic-led interventions in primary care reported long-term symptoms improvements that may result in reduced healthcare usage.

Keywords: diet, dietitian, irritable bowel syndrome, long-term effects, primary care
INTRODUCTION

Irritable bowel syndrome (IBS) is a chronic and debilitating functional gastrointestinal disorder with an estimated global prevalence of 4%–9%. It has a significant impact on healthcare utilisation, with up to 50% of IBS patients seeking medical advice, with the majority of these (90%) visiting their general practitioner (GP). Repetitive appointments with GPs are common in this patient group, with rates of attendance in primary care shown to be between 8.1–9.7 per year in the UK. The impact on secondary care services is also substantial, with 29% of IBS patients being referred to specialists, including gastroenterologists and surgeons. Between 63% and 84% of patients have expensive diagnostic procedures, including abdominal ultrasounds and colonoscopies, despite a low probability of finding any organic pathology. Although IBS is not associated with serious disease or mortality, it has been shown to have a negative effect on health-related quality of life. When the financial implications associated with reduced quality of life are combined with direct healthcare costs, IBS has been estimated to cost between £45.6–£200 million per year in the UK alone.

To alleviate the global burden of IBS, timely diagnosis and effective management of symptoms is essential. Both the UK’s National Institute of Care and Health Excellence and the British Society of Gastroenterology recommend primary care as being the most appropriate setting to achieve this, however, other countries’ guidelines are yet to focus on delivering treatment specifically in primary care. Historically, the lack of effective IBS treatment options has been the main challenge in isolating its management in primary care. However, because a large proportion of people with IBS commonly report that foods induce or exacerbate their symptoms, dietary treatments have now been explored as potential therapeutic options. A systematic review, which was part of the development process of the British Dietetic Association’s practice guidelines for the dietary management of IBS, reported that various dietary interventions, including altering intakes of alcohol, spicy foods and fat, as well as reducing intakes of fermentable oligosaccharides, disaccharides, monosaccharides and polyols carbohydrates (FODMAPs), were effective in improving certain symptoms in people with IBS. Improvements in symptoms of people with IBS when following a low FODMAP diet have frequently been reported. As a result, a low FODMAP diet is now recommended within the IBS management guidelines of several countries. The gluten-free diet has also been explored as a potential dietary treatment and was found to improve symptoms in people with diarrhoea predominant IBS.

With dietary interventions now recognised as an integral part of the management of IBS, dietitians should play an essential role in the effective delivery of this therapeutic option. Prior to recommending a dietary treatment, a dietitian must first complete an assessment with patients to confirm the diagnosis of IBS and determine the most appropriate intervention. Other conditions, including undiagnosed coeliac disease, non-coeliac gluten sensitivity and gastrointestinal food allergy, can all present with symptom profiles similar to those for IBS, and are often misdiagnosed. However, each of these conditions require different diets and variable levels of dietary stringency, emphasising the need for specialist dietetic intervention. Coeliac disease must first be excluded via appropriate tests, and exploring a patient’s atopic history may provide an indicator for a potential food allergy. Non-coeliac gluten sensitivity involves intestinal and extra-intestinal symptoms that are triggered by gluten ingestion in the absence of coeliac disease and wheat allergy and may also include ‘foggy mind’, tiredness, headaches, fibromyalgia-like joint or muscle pain, and leg or arm numbness.

The majority of available evidence demonstrates the benefits of diet, including the low FODMAP diet, on IBS symptoms immediately following implementation, and up to 9 months afterwards. However, little has been reported on the benefits of diet beyond 11 months of implementation. Studies examining the longer-term effects of the low FODMAP diet on IBS symptoms have primarily delivered the dietary advice in secondary care. Providing dietetic input for IBS patients within primary care offers an opportunity to reduce the burden of the condition on healthcare resources, including reducing unnecessary secondary care referrals and associated costs. The present study aimed to assess the impact of dietetic-led interventions for IBS patients delivered in primary care, a year after treatment completion.

METHODS

Study design

This is an observational service evaluation of a specialist dietetic-led gastroenterology clinic at Somerset NHS Foundation Trust that was set up to provide dietary advice for patients with IBS in primary care in January 2013. Patients referred into the clinic were initially diagnosed with IBS by their GP, which, as per the local diagnosis pathway, included an assessment of alarming symptoms and exclusion of coeliac disease via a negative tissue transglutaminase blood test. It was assumed that GPs would have considered alternative diagnoses as part of their assessment. Prior to referral patients were encouraged to implement first-line dietary advice discussed in the British Dietetic Association’s practice guidelines for the management of IBS, and support for this was delivered either by the GP or by the general community dietetic clinics. Only those with intractable symptoms were referred on to the specialist clinic. Those who attended the dietetic-led gastroenterology clinic were assessed and counselled by a specialist gastroenterology dietitian. The patient attended at least two dietetic appointments, comprising an initial appointment for assessment and education on recommended
dietary intervention, as well as a follow-up appointment at least 4 weeks later when they had implemented the advised dietary changes. Some patients attended subsequent appointments if further dietetic intervention was recommended at their first follow-up. At the final follow-up appointment, patients were educated on how to complete relevant food challenges, and advice was provided on food reintroductions and long-term self-management.

All patients seen in the clinic between May 2013 and April 2017 were included. Data were collected at three time points: (1) prior to their initial appointment (baseline); (2) prior to their final follow-up appointment (short-term follow-up) (both of which were part of the routine clinical care); and (3) approximately 11 months later (long-term follow-up) via a postal questionnaire.

Ethical approval via the UK Health Research Authority was not required because it was deemed an evaluation of the dietetic service. Local approval was given by the Somerset NHS Foundation Trust Research Department to carry out the data collection.

**Dietary advice**

Patients were seen in the dietetic-led gastroenterology clinic by one of three specialist gastroenterology dietitians. As per routine clinical practice, a medical, social and diet history was completed along with an assessment of gut and non-gut related symptoms, followed by a discussion regarding previous treatments and dietary habits. Following careful consideration of these parameters, and in consultation with the patient, at the initial appointment, one of the following dietary interventions was recommended: a low FODMAP diet, a gluten-free diet, or another single or multiple food exclusion diet. Education was provided on the specific diet and patients received practical advice on how to implement the dietary intervention along with appropriate written booklets to provide additional support.

The patients were asked to implement dietary changes for a period of 4–8 weeks, and were then reviewed in clinic as soon as possible after this time. If the initial dietetic intervention resulted in minimal symptom improvements, an alternative dietary change may have been recommended if appropriate for a further 4–8 weeks. At the final follow-up appointment with the dietitian, education was provided on how to complete relevant food challenges, and advice was also provided on food reintroductions and long-term self-management.

The following data were collected from the clinical notes for baseline and short-term follow-up and from the questionnaire for the long-term follow-up:

**Gastrointestinal symptoms and stool output**

At each of the three time points, patients were asked to assess severity of individual gastrointestinal symptoms, based on frequency and the extent to which they affected their social activities, using the Gastrointestinal Symptom Rating Scale (GSRS). Symptoms assessed included abdominal pain/discomfort, abdominal bloating/distension, increased wind, belching/burping, gurgling noises from stomach, urgency to open bowels, incomplete evacuation of stools, nausea, heartburn, acid regurgitation and tiredness. Patients were also asked about their stool frequency and consistency according to the Bristol Stool Form Scale (BSFS), which is a seven-point scale of stool types ranging from type 1 (separate hard lumps) to type 7 (entirely liquid with no solid pieces). Satisfaction with gut symptom relief was assessed by asking the question ‘Do you currently have satisfactory relief of your gut symptoms?’

**Healthcare utilisation and resources**

At baseline and long-term follow-up, patients were asked to recall, in the previous 12 months, how many times they had visited their GP or gastroenterologist for their IBS symptoms and whether they had any investigations for gut symptoms. Patients were also asked to confirm whether or not they were currently taking any prescribed medication for their gut symptoms.

**Statistical analysis**

Statistical analysis was performed using SPSS, version 25 (IBM Corp.).

Demographics, dietary intervention and baseline symptoms were analysed descriptively. Symptom responses were assessed by changes in the proportion of patients reporting the presence of moderate or severe symptoms on the GSRS. Stool frequency was reclassified into four categories depending on the number of times stools were passed: once every 4 or more days; between once every 3 days and up to 3 times a day; 4 or more times a day; and variable. Stool frequency was also dichotomised as normal (between once every 3 days and up to 3 times a day) or abnormal (any of the other three categories). Similarly, stool consistency was grouped into four categories: BSFS 1–2 (hard); 3–4 (normal); 5–7 (loose); and mixed. Additionally stool consistency was dichotomised as normal (BSFS 3–4) or abnormal (BSFS 1, 2, 5, 6, 7 and mixed).

A Wilcoxon ranked test was applied to determine whether there were any significant differences over time for individuals symptom severity, number of GP and gastroenterologist visits, and number of gastrointestinal investigations. McNemar’s test was applied to determine whether there were any significant associations across the time frames for satisfactory relief of symptoms, presence of normal stool consistency and stool frequency, and current use of prescribed medication.

$p < 0.01$ was considered to be statistically significant. A $p$ value lower than the usual 0.05 was applied to counteract the
increased risk of a type 1 error associated with the multiple comparisons completed.

RESULTS

In total, 742 patients were seen in the primary care dietetic-led gastroenterology for their initial appointment between May 2013 and April 2017. Of these, 547 attended at least one follow-up appointment and 499/547 (91%) patients were sent postal questionnaires at least 11 months after their final follow-up appointment as part of the service evaluation. The remaining 48/547 (9%) patients were not sent postal questionnaire at 11 months as a result of not completing recommended dietary intervention (n = 6), providing incomplete paperwork at initial and follow-up appointments (n = 35) or receiving on-going dietetic review (n = 7). Of the 499 patients sent postal questionnaires, 227 patients (45%) returned completed questionnaires. Of these, 16 patients were referred for other reasons than IBS; therefore, 211 (44%) patients were analysed at long-term follow-up. The mean (SD) age was 53.6 (15) years and 182 (86%) were female. The median duration from baseline to short-term follow-up appointment was 9 weeks (interquartile range 9–13 weeks) and the median duration from short-term to long-term follow-up was 13 months (interquartile range 12–16 months). Five patients (2%) were sent postal questionnaires before the planned 11 months because of an administrative error. In 38 patients (18%) there was more than a 6 month delay in sending out questionnaires after their final appointment as a result of other work priorities at the time.

As shown in Table 1, the majority of patients (84%) were advised to follow the low FODMAP diet, either in isolation or combined with an additional dietary intervention. This is similar to the proportion of the original cohort (n = 547) who were advised to follow the low FODMAP diet (81%).

Gastrointestinal symptoms

At baseline, the most common gastrointestinal symptoms were abdominal pain and bloating, increased wind, and urgency to open bowels (Figure 1). Over 60% of patients rated the severity of these symptoms as moderate or severe, with those included in the long-term follow-up analysis (n = 211) presenting with baseline symptom profiles similar to those of the whole cohort (n = 547). Tiredness was the most common symptom, reported by 71% and 69% of patients in the whole cohort and long-term follow-up group, respectively. There was a significant reduction (p < 0.001 for all symptoms) in the proportion of patients reporting presence of moderate or severe symptoms between baseline and short-term follow-up (Figure 1) for both the whole cohort and the long-term follow-up group. The significant difference from baseline was maintained at long-term follow-up for all symptoms apart from heartburn (13% vs. 10% p = 0.059) and acid regurgitation (13% vs. 12% p = 0.354). The four mostly commonly reported gastrointestinal symptoms reduced in frequency by approximately half (abdominal pain by 62%; bloating by 50%; increased wind by 48%; and urgency to open bowels by 49%).

A sub-analysis was completed to determine whether symptom improvements from baseline to long-term follow-up were affected by the type of dietary intervention (Figure 2). Diets were reclassified into two types: those that include the low FODMAP diet (n = 177) and those that used other dietary interventions (n = 34), with an improvement in a symptom being defined as a positive change of at least one on the GSRS. With both dietary approaches, all symptoms improved but the size of the improvement was not significantly different between the two approaches (Mann–Whitney U-tests, p > 0.3 for all symptoms) (Figure 2).

At baseline 10% of patients (n = 22) reported having satisfactory relief of gut symptoms. At short-term follow-up, this increased to 66% (n = 139, p < 0.001) and was maintained at 55% (n = 116; p < 0.001) at long-term follow-up.

Stool output

At baseline, only 23% of patients reported a normal stool consistency (BSFS 3 or 4) (Table 2). The most common stool types were mixed and loose stools (BSFS 5–7) and the least common was constipation (type 1–2). At short-term

| Dietary intervention                                  | For whole group, n = 547 | For long-term follow-up group, n = 211 |
|-------------------------------------------------------|--------------------------|----------------------------------------|
| Low FODMAP                                            | 361 (66)                 | 155 (74)                               |
| Low FODMAP with additional dietary exclusions         | 84 (15)                  | 22 (10)                                |
| Gluten-free                                          | 22 (4)                   | 8 (4)                                  |
| Other single dietary exclusion                        | 39 (7)                   | 14 (7)                                 |
| Other multiple dietary exclusions                     | 31 (6)                   | 9 (4)                                  |
| Other                                                 | 10 (2)                   | 3 (1)                                  |

FODMAP, fermentable oligosaccharides, disaccharides, monosaccharides and polyols carbohydrates.
follow-up, the proportion of patients reporting normal stool consistency significantly increased to 49% ($p < 0.001$). At long-term follow-up, this reduced to 45% but remained significant compared to baseline ($p < 0.001$).

At baseline, 74% of patients reported a normal stool frequency (between once every 3 days and 3 times a day) (Table 2). This significantly increased to 89% ($p < 0.001$) at short-term follow-up and 82% ($p = 0.005$) at long-term follow-up.

**Healthcare utilisation and resources**

Table 2 shows the proportion of 140 patients who answered the question regarding number of GP visits in the previous 12 months at baseline and 138 at long-term follow-up. Data indicate a dramatic decrease in any patient visits to their GP (96% vs. 34% $p < 0.001$). Only 128 patients provided information on the number of times they had seen a gastroenterologist in the previous 12 months at baseline and 125 at long-term follow-up (Table 2). Similar to GP visits, the proportion visiting a gastroenterologist at least once reduced from 37% to 12% ($p = 0.002$).

Whether investigations for gut symptoms occurred was reported by 130 patients at baseline and long-term follow-up. Endoscopic investigation was the most common type, followed by ultrasound (Table 2). At baseline, 49% of patients reported having at least one investigation in the previous 12 months and 18% reported multiple investigations. At long-term follow-up, this reduced to 17% and 5%, respectively ($p < 0.001$).

The results for medication usage showed a similar pattern; 57% reported using prescribed medication for their gut symptoms at baseline, and this reduced to 49% at long-term follow-up; however, this was not significant based on our defined criteria ($p = 0.034$) (Table 2).
| Outcome                                      | Whole group at baseline, \( n = 547 \) | Whole group at short-term follow-up | Long-term follow-up group at baseline, \( n = 211 \) | Long-term follow-up group at short-term follow-up | Long-term follow-up group at long-term follow-up |
|----------------------------------------------|----------------------------------------|------------------------------------|----------------------------------------|-----------------------------------------------|-----------------------------------------------|
| Stool type, \( n \) (%)                     |                                        |                                    |                                        |                                               |                                               |
| BSFS 1–2 (hard)                              | 46 (9)                                 | 54 (10)                            | 19 (9)                                 | 26 (12)                                       | 23 (11)                                       |
| BSFS 3–4 (normal)                            | 122 (22)                               | 254 (47)                           | 48 (23)                                | 103 (49)                                      | 96 (46)                                       |
| BSFS 5–7 (loose)                             | 187 (34)                               | 62 (11)                            | 70 (33)                                | 26 (12)                                       | 43 (20)                                       |
| Mixed stool                                  | 191 (35)                               | 133 (24)                           | 74 (35)                                | 56 (27)                                       | 45 (21)                                       |
| Missing data                                 | 1 (0)                                  | 44 (8)                             | 0 (0)                                  | 0 (0)                                         | 4 (2)                                         |
| Stool frequency, \( n \) (%)                |                                        |                                    |                                        |                                               |                                               |
| Once every 4 or more days                   | 27 (5)                                 | 14 (3)                             | 7 (3)                                  | 3 (1)                                         | 11 (5)                                        |
| Between once every 3 days and 3 times a day  | 353 (65)                               | 420 (77)                           | 156 (70)                               | 188 (89)                                      | 172 (82)                                      |
| (normal)                                     |                                        |                                    |                                        |                                               |                                               |
| Four times or more a day                    | 122 (22)                               | 39 (7)                             | 43 (21)                                | 14 (7)                                        | 23 (11)                                       |
| Variable                                     | 45 (8)                                 | 28 (5)                             | 5 (2)                                  | 5 (2)                                         | 3 (1)                                         |
| Missing data                                 | 0 (0)                                  | 46 (8)                             | 0 (0)                                  | 1 (1)                                         | 2 (1)                                         |
| Number of visits to GP in previous year, \( n \) (%) |                                        |                                    |                                        |                                               |                                               |
| None                                         | 14 (4)                                 | 6 (4)                              | 91 (65)                                |                                               |                                               |
| 1–3                                          | 218 (58)                               | 92 (66)                            | 35 (25)                                |                                               |                                               |
| 4–6                                          | 96 (25)                                | 29 (21)                            | 11 (8)                                 |                                               |                                               |
| 7–9                                          | 20 (5)                                 | 4 (3)                              | 0 (0)                                  |                                               |                                               |
| 10 or more                                   | 27 (7)                                 | 9 (6)                              | 1(1)                                   |                                               |                                               |
| Missing data                                 | 2 (1)                                  | 0 (0)                              | 2 (1)                                  |                                               |                                               |
| Number of visits to Gastroenterologist in previous year, \( n \) (%) |                                        |                                    |                                        |                                               |                                               |
| None                                         | 214 (57)                               | 81 (63)                            | 109 (85)                               |                                               |                                               |
| 1                                            | 84 (22)                                | 30 (23)                            | 7 (6)                                  |                                               |                                               |
| 2                                            | 27 (7)                                 | 9 (7)                              | 6 (5)                                  |                                               |                                               |
| 3                                            | 16 (4)                                 | 6 (5)                              | 3 (2)                                  |                                               |                                               |
| 4                                            | 8 (2)                                  | 2 (2)                              | 0 (0)                                  |                                               |                                               |
| Missing data                                 | 28 (8)                                 | 0 (0)                              | 3 (2)                                  |                                               |                                               |
LONG-TERM SYMPTOM SEVERITY IN PEOPLE WITH IRRITABLE BOWEL SYNDROME FOLLOWING DIETETIC TREATMENT IN PRIMARY CARE: A SERVICE EVALUATION

| Outcome                                      | Whole group at baseline, n = 547 | Whole group at short-term follow-up | Long-term follow-up group at baseline, n = 211 | Long-term follow-up group at short-term follow-up | Long-term follow-up group at long-term follow-up |
|----------------------------------------------|----------------------------------|-------------------------------------|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|
| Investigations in previous year for gut symptoms, n (%) | n = 376                          |                                     | n = 130                                       |                                               |                                               |
| None                                         | 178 (47)                         |                                     | 66 (51)                                       |                                               | 108 (83)                                      |
| Colonoscopy                                  | 38 (10)                          |                                     | 13 (10)                                       |                                               | 7 (5)                                         |
| Gastroscopy                                  | 14 (4)                           |                                     | 5 (4)                                         |                                               | 3 (2)                                         |
| Sigmoidoscopy                                | 10 (3)                           |                                     | 4 (3)                                         |                                               | 1 (1)                                         |
| Barium enema/meal                            | 4 (1)                            |                                     | 1 (1)                                         |                                               | 1 (1)                                         |
| Ultrasound                                   | 49 (13)                          |                                     | 16 (12)                                       |                                               | 4 (3)                                         |
| Multiple endoscopies                         | 12 (3)                           |                                     | 5 (4)                                         |                                               | 1 (1)                                         |
| Multiple Others                              | 51 (14)                          |                                     | 19 (14)                                       |                                               | 5 (4)                                         |
| Other                                        | 1 (0)                            |                                     | 1 (1)                                         |                                               | 0 (0)                                         |
| Missing data                                 | 19 (5)                           |                                     | 0 (0)                                         |                                               | 0 (0)                                         |
| Using prescribed medication for gut symptoms, n (%) | n = 547                          |                                     | n = 211                                       |                                               |                                               |
| Yes                                          | 308 (56)                         |                                     | 121 (57)                                      |                                               | 103 (49)                                      |
| No                                           | 227 (42)                         |                                     | 89 (42)                                       |                                               | 106 (50)                                      |
| Missing data                                 | 12 (2)                           |                                     | 1 (1)                                         |                                               | 2 (1)                                         |

BSFS, Bristol Stool Form Scale; GP, general practitioner.
DISCUSSION

This observational service evaluation focuses on the long-term symptom severity of patients with IBS who have received dietetic-led dietary interventions and it includes data from the largest cohort of primary care-based patients to date. The study demonstrated that, after receiving dietetic advice from a specialist dietitian based in primary care, patients with IBS reported improvements in the severity of symptoms, and these improvements were sustained at least 11 months after treatment completion. With over a half of patients reporting long-term satisfactory relief of symptoms, the study supports the use of diet as a potential effective therapeutic option for the long-term management of IBS. A reduction in the utilisation of healthcare services, including those in secondary care, was reported in the year following dietary treatment, thereby suggesting a primary care dietitian may be able to facilitate a reduction in healthcare usage in IBS patients.

Satisfactory control of gut symptoms was reported by 55% of patients, after a median of 13 months following the completion of dietary intervention, and this is consistent with the findings of O’Keeffe et al.\textsuperscript{35} These authors used a similar study design to the current study and found that 57% of patients had satisfactory relief of symptoms at long-term follow-up, which was between 6 and 18 months after the completion of dietetic-led low FODMAP education. An earlier study with a median follow-up period of 16 months reported that 57% and 29% of IBS patients had a partial and full response to the low FODMAP diet, respectively.\textsuperscript{34} These reported levels of satisfaction are less than the more recent findings of Nawawi et al.,\textsuperscript{36} who demonstrated that 76% of patients were satisfied with the improvements in their symptoms at 12 months. Their study analysed data from 30 patients at long-term follow-up compared to the 211 patients in the present study. Nawawi et al.\textsuperscript{36} also had patients complete the long-term follow-up questionnaire in clinic during their final follow-up appointment, whereas the present study used postal questionnaires for long-term data collection. These differences in study design may contribute to variations in the observed results.

The present study reported after following dietetic advice, all individual gastrointestinal symptoms, apart from heartburn and acid regurgitation, significantly improved in the long term, although there were differences between lower and upper gastrointestinal symptoms. Lower gastrointestinal symptoms were the most commonly reported at baseline, with over 60% of patients reporting moderate or severe abdominal pain, bloating or excess wind, and these symptoms reduced by approximately half in the long term. Although less common, upper gastrointestinal symptoms, including heartburn and acid regurgitation, had a frequency of 13%, suggesting that, although they are seldom included in diagnostic criteria for IBS, they are still symptoms that are reported by IBS patients. Despite a significant improvement in these symptoms at short-term follow-up, changes at the long-term follow did not remain significant for these upper gastrointestinal symptoms. These findings are consistent with existing long-term studies.\textsuperscript{34–36}

Stool consistency significantly improved in the present study at long-term follow-up (abnormal 77% vs. 53%), and this is in keeping with findings of both O’Keeffe et al.\textsuperscript{35} and Maagaard et al.\textsuperscript{34} Stool frequency also improved in the present study and was deemed statistically significant, concurring with O’Keeffe et al.\textsuperscript{35} These findings, along with the significant reduction in urgency to open bowels and incomplete evacuation, suggest that dietary interventions may produce lasting improvements in bowel habits in IBS patients. With a large proportion of patients stating that issues with bowel habits have the most detrimental impact on their daily lives, effective therapeutic options addressing this area may lead to the most significant improvements in the quality of life of IBS patients.

We also showed that reported healthcare usage was significantly reduced in IBS patients in the period after receiving dietary advice. Both GP and gastroenterologist appointments decreased significantly after dietary intervention. This reduction may be explained by the symptom improvements; however, further work is required to compare healthcare utilisation in IBS patients who do and do not receive dietetic advice. Dietetic intervention may have the potential to reduce secondary care input and associated healthcare costs in the case of younger patients (<45 years of age) by providing a therapeutic treatment option to a population who do not generally need secondary care investigations to exclude alarming pathology, prior to their IBS diagnosis. With the average age of the studied cohort being 54 years, it may be argued that the potential cost savings from reduced secondary care on a diagnostic basis is limited. However, in this cohort of patients, effective dietetic-led interventions have the potential to reduce secondary care input by stopping the revolving door effect of poor symptoms management leading to repeated secondary care referrals and investigations. Almost half the cohort (49%) reported having had at least one investigation in the year prior to initial dietetic input; however, clinical experience suggests that, if we had looked at the number of investigations over the last 15 years, this number would have significantly increased, and included repeated investigations. Patients often reported in clinic having suffered with IBS symptoms for many years and, as a result of a lack of effective treatment options, they had repeatedly visited their GP and had repeated referrals to secondary care over many years. Therefore, there is the potential to reduce healthcare usage in all age groups by offering effective dietetic treatments.

Additionally, as a result of the number of patients reporting having visited their GP and gastroenterologist on numerous occasions before seeing the dietitian, the question is raised of whether earlier referral to a dietitian could have resulted in further reductions in healthcare usage. Having the delivery of dietary treatments based in primary care, rather than secondary care, is essential for optimising potential cost savings. If GPs have access
to dietitians offering effective dietary treatment options within a primary care setting, this could reduce the number of referrals to secondary care and referrals for unnecessary expensive investigations.

Patients included in this service evaluation would have been encouraged to implement first-line dietary approaches, as recommended by the British Dietetic Association, before being referred onto the specialist dietetic clinic. Because these interventions were delivered in the patient’s GP practice or by another part of the community dietetic service, data on changes in symptoms following such advice were not available for this service evaluation. Because studies have shown that traditional first-line dietary approaches for IBS can be effective in reducing IBS symptoms and are less restrictive, future studies should include an analysis of these types of dietary interventions. The most frequently used dietary intervention in this service evaluation was a low FODMAP diet in isolation or combined with another dietary restriction. Only a few other diets were used, including a gluten-free diet and other single dietary restrictions. However, the comparison of low FODMAP with ‘other’ diets showed no significant differences in symptom improvements from baseline to long-term follow-up. Patients on both dietary approaches improved equally well, suggesting that diets such as gluten-free and other dietary exclusions may deliver long-term symptom improvements, and a dietitian has the appropriate skills to make the assessment and recommend the most appropriate dietary intervention. The mechanisms for how the low FODMAP diet leads to symptom improvements include reductions in small intestinal water volume and colonic gas production. However, further studies including randomised control trials (RCTs), are required to assess the mechanisms for the other diets used in clinical practice, along with the long-term implications and safety, before the diets can be included in formal guidelines.

It may be that the improvements seen in patients following alternative diets (not low FODMAP) were a result of the diets being effective treatments for alternative diagnoses, rather than an effective treatment for IBS. IBS is difficult to diagnose because of the vague symptoms; thus, this diagnosis may not always be accurate. Undiagnosed coeliac disease, non-coeliac gluten sensitivity and gastrointestinal food allergy all present with symptom profiles similar to those for IBS. Further research is needed to explore this area; however, this real-life service evaluation supports the view that a ‘one-size fits all’ approach to dietary treatment of patients who present with IBS is not appropriate. Dietitians, especially those with expertise in gastroenterology, can play an essential role in the appropriate assessment and effective delivery of the dietary treatment options for IBS patients.

The main limitation of the present study is that, because it was an observational service evaluation, it is not possible to draw clear conclusions on the cause and effect relationship, between symptoms improvement and healthcare usage, and dietetic-led dietary intervention. Other factors, including stress levels, management strategies to help manage emotions, other dietary changes, and the use of probiotics and prebiotics, were not reported in the present study, and may have all played a role in the changes reported at long-term follow-up. Additionally, with approximately half of the patients using medication for their gut symptoms at baseline and long-term follow-up, we cannot exclude medication as playing a role in improvements seen. Accordingly, further RCTs are needed that explore benefits of dietary treatments on IBS management, which also take into account these other factors. Other limitations to the present study include the increased risk of non-response bias associated with a postal questionnaire design because those patients who decided not to respond to the questionnaire at long-term follow-up may differ from those who did. Questionnaire designs also increase the risk of recall bias, which can lead to a deviation from true results. In the present study, we included patients who were referred for IBS, although we did not apply strict ROME IV criteria for inclusion. This was because, in real-life clinical practice, patients often report a wide range of variable gut symptoms and bowel habits, which can potentially benefit from dietary interventions. Another limitation of the present study is that we did not assess adherence to dietary interventions. Nawawi et al. demonstrated stricter adherence to a diet resulted in greater symptom improvements; assessment of adherence would provide a greater clarification on the size of impact of the dietary interventions.

In conclusion, our service evaluation has demonstrated that IBS patients who received dietary interventions, delivered by specialist gastroenterology dietitians in primary care, reported long-term reductions in gastrointestinal symptom severity and improvements in bowel habits. Healthcare usage following dietetic intervention was also reduced, indicating the potential for cost savings by including dietetic-led dietary interventions in the management pathways for IBS patients. However, further RCTs are needed to explore the cause and effect relationship of dietetic-led interventions on IBS management and healthcare usage.

ETHICS STATEMENT
Ethical approval via the UK Health Research Authority was not required because it was deemed an evaluation of the dietetic service. Local approval was given by Somerset NHS Foundation Trust Research & Development Department to carry out the data collection.

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AUTHOR CONTRIBUTIONS
L.S. and M.W designed the study. L.S., M.W. and C.M. collected the data. L.S. processed the data, performed the
analysis, and designed the tables and figures. L.S. wrote the manuscript in consultation with M.H. Critical feedback and contribution to the final version of the manuscript was given by Y.B., M.H., C.M. and M.W. All authors approved the final version of the paper submitted for publication.

TRANSPARENCY DECLARATION

The lead author affirms that this manuscript is an honest, accurate and transparent account of the study being reported. The lead author affirms that no important aspects of the study have been omitted and that any discrepancies from the study as planned have been explained.

PEER REVIEW

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