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The Patient Health Questionnaire 12 Somatic Symptom scale as a predictor of symptom severity and consulting behaviour in patients with irritable bowel syndrome and symptomatic diverticular disease

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SUMMARY

Background
Anxiety, depression and nongastrointestinal symptoms are often prominent in irritable bowel syndrome (IBS), but their relative value in patient management has not been quantitatively assessed. We modified the Patient Health Questionnaire 15 (PHQ-15) by excluding three gastrointestinal items to create the PHQ-12 Somatic Symptom (PHQ-12 SS) scale.

Aims
To compare the value of the PHQ-12 SS scale with the Hospital Anxiety and Depression (HAD) scale in predicting symptoms and patient behaviour in IBS and diverticular disease.

Methods
We compared 151 healthy volunteers (HV), 319 IBS patients and 296 patients with diverticular disease (DD), 113 asymptomatic [ASYMPDD] and 173 symptomatic DD (SYMPDD).

Results
Patient Health Questionnaire 12 SS scores for IBS and SYMPDD were significantly higher than HV. Receiver–operator curves showed a PHQ-12 SS >6, gave a sensitivity for IBS of 66.4% with a specificity of 94.7% and a positive likelihood ratio (PLR) = 13.2, significantly better than that associated with an HAD anxiety score >7, PLR = 3.0 and depression score >7 PLR = 6.5. PHQ-12 SS correlated strongly with IBS severity scale and GP visits in both IBS and DD.

Conclusion
The PHQ-12 SS scale is a useful clinical tool which correlates with patient behaviour in both IBS and symptomatic DD.

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INTRODUCTION

When assessing patients with abdominal pain and disturbed bowel habit associated with normal physical findings, it is recommended to assess psychological variables.[1] Many will turn out to have important psychological abnormalities and addressing these has been shown to improve management and outcomes.[2] Previous studies have tended to emphasize that irritable bowel syndrome (IBS) patients are significantly more anxious and depressed than healthy controls[3–6] and have a higher incidence of previous psychiatric disease.[7, 8] Although this is true, anxiety is a major driver for any consultation[9, 10] and hence it is perhaps not surprising that anxiety is not a useful aid in differential diagnosis as it fails to distinguish clearly IBS patients from patients with other gastrointestinal (GI) diseases such as colon cancer, coeliac disease, peptic ulcer,[11] inflammatory bowel disease[12] or indeed most general medical conditions.[13, 14]

There is increasing recognition of the importance of somatization in determining health care utilization in IBS.[15] Somatization with multiple somatic complaints is also important in understanding the mechanisms of disease as IBS patients can be usefully subdivided into those with low somatization, in whom there is a predominantly GI cause for their symptoms and those with high somatization, in which a central cause, associated with visceral hypersensitivity (VH), predominates.[4, 16] Patients also feel that these symptoms are important as recently reported in a survey of 755 IBS patients, which showed that non-GI pains were one of the factors along with pain, illness belief and defecatory difficulties which contribute to patient-assessed severity.[17]

Although somatization meeting the criteria laid down in the Diagnostic and Statistical Manual for psychiatric disease (DSM-IV) is uncommon, being found in only 1–2% of primary care patients, a lesser condition of multiple unexplained somatic symptoms, the Physical Symptom Disorder as detected by the Patient Health Questionnaire 15 (PHQ-15)[18] has an incidence of 10–15% in patients consulting in primary care.[19] The PHQ-15 is an instrument which records the bothersomeness of 15 symptoms including somatic symptoms such as back ache, limb pain and chest pain, cardiovascular system symptoms such as palpitations and breathlessness as well as three GI symptoms namely abdominal pain, nausea and disordered bowel function, together with sexual dysfunction, lethargy and headaches (Table 1).[20] Clinical experience with this instrument in primary care, internal medicine and gynaecology clinics shows that it correlates well with symptom severity across a range of conditions.[20] Our own experience using this instrument in our clinic over the last 4 years suggested that IBS patients score highly, even when it is modified by excluding the three GI specific questions, a scale we call the PHQ-12. We believe that this is useful because it detects a sensitization to painful and other somatic non-GI stimuli which is an important feature of many IBS patients.[21, 22]

The aim of this study therefore was to assess the value of the PHQ-12 score not only in separating out IBS from other patients but also in predicting both gastrointestinal symptom severity and patient consulting behaviour.

As a disease control with disturbed bowel habit and pain, we also included a group of older patients with diverticulosis, some of whom were asymptomatic

Table 1 | Patient Health Questionnaire (PHQ)-15 questionnaire

1. Stomach pain	9. Feeling your heart pound or race
2. Constipation, loose bowels, or diarrhoea	10. Shortness of breath
3. Nausea, gas, or indigestion	11. Pain or problems during sexual intercourse
4. Back pain	12. Pain in your arms, legs, or joints (knees, hips, etc)
5. Headaches	13. Feeling tired or having low energy
6. Chest pain	14. Menstrual cramps or other
7. Dizziness	15. Trouble sleeping problems with your periods (women only)
8. Fainting spells	

The PHQ-15 questionnaire asks about the bothersomeness of each symptom, scored 0 = not bothered at all, 1 = bothered a little, and 2 = bothered a lot.

The PHQ-12 excludes the first three gastrointestinal questions.

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diverticular disease (ASYMPDD) who provided age-matched controls for those who were symptomatic diverticular disease (SYMPDD).

SUBJECTS AND METHODS

This study took place at Nottingham University Hospital NHS Trust, Nottingham and the Wythenshawe Hospital, South Manchester between July 2006 and September 2008. The IBS group of patients, who all met the Rome II IBS criteria[23] were part of a larger IBS genetics and biomarker study approved by the Nottingham Research Ethics Committee that also approved the diverticular patient survey.

IBS patients

We recruited 148 IBS patients with diarrhoea (D-IBS), 132 IBS patients with constipation (C-IBS) and 39 patients with a history compatible with postinfective IBS (PI-IBS) from our out-patient clinics, but excluded those with mixed bowel habits.[24] They had all completed full negative evaluation for other diseases in the Gastroenterology Out-Patient Clinic and were then invited to take part in the study. As recruitment of IBS patients continued, we also recruited a total of 151 age- and gender-matched healthy volunteers (HV).

Diverticulosis patients

We also recruited 296 patients with diverticulosis as a disease control. These patients were identified from our database which includes patients being seen in Nottingham University Hospital NHS Trust with a diagnosis of diverticulosis made either by radiological or endoscopic means, as well as from the membership of the National Diverticulitis support group. Of these, 113 were asymptomatic without any abdominal pain or discomfort (ASYMPDD) and 173 had abdominal pain or discomfort (SYMPDD).

Questionnaires

All IBS patients completed the IBS Severity Score (IBSSS) questionnaire, a simple 5-point scale which uses visual analogue scales to express severity of pain, bloating, as well as dissatisfaction with bowel habit and how much IBS symptoms interference with life.[25] We also used the Hospital Anxiety and Depression (HAD) Scale[26] together with a modified Talley Bowel Symptom Questionnaire[27] allowing the diagnosis of IBS according to the Rome II criteria,[28] which was the current gold standard at the time of starting the study. In addition, they filled out the PHQ-15 (Table 1) which asks about the bothersomeness of a range of symptoms.[20] As the PHQ-15 contains three questions directly related to gastrointestinal symptoms (constipation or loose bowels, abdominal pain and nausea or indigestion), which would automatically give a high score, we calculated a PHQ-12 Somatic Symptom (PHQ-12 SS) score in which these three items were excluded. All diverticulosis patients also completed the bowel symptom questionnaire as well as the HAD and the full PHQ-15. HV also completed the same questionnaires except the IBSSS. The modified Talley Bowel Symptom Questionnaire was used to exclude any who met IBS criteria.

Data analysis and statistics

All data were entered from the original paper questionnaires into Excel spread sheets and verified by two individuals to check for transcribing errors. Data were then imported into SPSS Version 15 for analysis.

All parameters were assessed for abnormality of distribution. Age, IBS severity score, PHQ-12 SS and HAD were normally distributed, whereas bowel symptoms were not. Normally distributed data are expressed as mean ± standard error of the mean and differences between groups were assessed by an initial overall analysis of variance (ANOVA) followed by postdoc comparisons using the Tukey's test. Correlation was performed using the Pearson correlation coefficient. Nonparametric data are presented in the text as median (range). The Kruskal–Wallis nonparametric analysis of variance was used to assess overall group differences and *post hoc* comparisons were evaluated using Dunn's multiple comparison test.

Approximately 3% of data were missing owing to undecipherable or missing responses, but the numbers on which each assessment is made is indicated in the text. Multivariate analysis was also undertaken to assess the relative importance of the factors shown in univariate analysis to be significantly associated with outcomes of interest, namely IBSSS, doctor visits and PHQ-12. Backward logistic regression was used including initially PHQ-12 SS, age, anxiety and depression to predict IBSSS in IBS groups only. PHQ-12 SS, age, anxiety and depression were also used to predict doctor visits and bloating both in the entire group and within each patient group. Initially we used binary logistic regression to predict dichotomous outcomes (IBSSS above 296, abnormal values of anxiety, depression, presence of bloating, doctor visits >2/year) and then used linear regression to derive predictive equations to help understand the relative importance of each variable for the various outcomes of interest (IBSSS, doctor visits, PHQ-12, bloating).

Standard receiver–operator curves were constructed to determine the optimum cut-off of the PHQ-12 SS for distinguishing IBS from HV and to compare the efficacy of the different scores in discriminating IBS from HV. We also calculated the positive (PLRs) and negative likelihood ratios (NLRs), which respectively indicate by how much the probability of having IBS is increased by having an elevated score or how much it decreases if the score is normal. These measures have the advantage over positive and negative predictive values of being independent of the proportion of IBS in the initial sample. It is generally considered that to be useful, a diagnostic test should have a PLR in excess of 2, with a value >10 being considered excellent; thus, the tissue transglutaminase test has a PLR of 11. Similarly, to be useful, the NLR should be <0.2, again the tissue transglutaminase test has an NLR of 0.09. As will be seen by these criteria, the PHQ-12 SS performs well.

Inclusion and exclusion criteria

All subjects in the IBS study underwent a screening medical examination including a general physical examination and screening blood tests including full blood count, serum calcium and endomysial antibodies to exclude underlying diseases. In the course of the 3-year study, two supposed IBS patients were shown to have coeliac disease and excluded, but no other conditions were identified. Exclusion criteria were serious concomitant disease, bleeding or clotting disorders, previous gastrointestinal surgery (other than appendectomy or cholecystectomy), history of alcohol or drug dependence and pregnancy. HV were excluded if they had IBS symptoms or had gastroenteritis within the previous 6 months. As this was part of a larger genetic study, only Caucasians were included to avoid heterogeneity attributable to racial differences. Subjects in the diverticulosis group were not subjected to systematic screening for this study, but had already been investigated for their original presenting complaint. Any subject with a diagnosis of bowel cancer or other serious gastrointestinal disease was excluded.

RESULTS

Demographics and bowel symptoms

In accordance with our planned age- and gender-matching, there are no differences in age and gender between our HV and the IBS groups except that C-IBS were slightly more likely to be women (93%) compared with PI-IBS (70%) and D-IBS (67.2%), chi-squared $P < 0.001$ (Table 2). SYMPDD patients were likewise female-predominant (78%), whereas in the ASYMPDD patient group, gender distribution was more even with only 56% being women (chi-squared $P < 0.0001$). The diverticular patients, as expected, were significantly older than the IBS and HV groups.

As required by the IBS classification used, there were significant differences in bowel frequency and the

Table 2 | Demographics and bowel habit in the healthy volunteers and patients with irritable bowel syndrome or diverticulosis

	P†	HV	PI-IBS	D-IBS	C-IBS	ASYMPDD	SYMPDD
n		151	39	148	132	113	173
Gender F/M	0.000	115/36	27/12	96/52	123/9**	64/49***	135/38
Age	0.000	37.9 ± 1.1	42.1 ± 2.4	47.4 ± 1.0***	42.5 ± 1.1*	73.7 ± 0.9***[a]	69.8 ± 0.8***[a]
BM/day	0.000	1.0 (0–5)	3.0 (0–7)***	4.0 (0–12)***	1.0 (0–5)***[b]	1 (1–5)**[c]	2 (1–5)***
Days/wk loose BM	0.000	0 (0–5)	3 (0–7)***	5 (0–7)***	0.0 (0–7)***[b]	3(1–7)***[d]	5 (1–7)***
Days/wk hard BM	0.000	0 (0–7)	2 (0–7)***	1 (0–7)*	3 (0–7)***[b]	5 (1–7)***	3 (1–7)***
Days/wk pain	0.000	0	4 (0–7)***	3 (0–7)**	4 (0–7)***	0[e]	2 (0–7)***[f]

HV, healthy volunteers; PI-IBS, postinfectious IBS; IBS-D, IBS with diarrhoea; IBS-C, IBS with constipation; SYMPDD, symptomatic diverticular disease; ASYMPDD, asymptomatic diverticulosis; age, age in years mean ± S.E.M.; BM/day, bowel movements per day, median (range); days/week loose BM, days per week with loose bowel movements, median (range); days/wk hard BM, days per week hard bowel movements, median (range).

Difference from HV: * $P < 0.05$; ** $P < 0.01$, *** $P < 0.001$, [a]$P < 0.0001$ vs. IBS; [b]$P < 0.0001$ vs. D-IBS; [c]$P < 0.0001$ vs. SYMPDD; [d]$P < 0.05$ vs. SYMPDD; [e]$P < 0.0001$ vs. SYMPDD; [f]$P < 0.001$ vs. D-IBS and C-IBS.

† ANOVA of Kruskal–Wallis test except age, which is being normally distributed, was analysed using ANOVA.

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proportion of days with loose and hard stool in the IBS subgroups. The diverticular patients had significantly more days with both loose and hard stool than the HV, including those patients not troubled by abdominal pain. SYMDD had fewer days of pain than both CIBS and DIBS, both with $P < 0.001$. By definition, ASYMDD did not report recurrent abdominal pain.

Somatization scores

The most striking difference was the clear separation of the three groups of IBS patients by the PHQ-12 SS scores (Figure 1, Table 3 and Figure S1) from both HV and from the ASYMPDD group.

A receiver-operating curve comparing all IBS patients with HV (Figure 2) gave an ROC score of 0.88. A cut-off of >6 was chosen to give the best combination of sensitivity 66.4% and specificity 94.7%. This gave an excellent PLR of 13.2 with an NLR of 0.3.

Using the cut-off of >6 (Table 4), 67% of all IBS patients considered as a single group had abnormally elevated values compared with only 54.8% of the SYMPDD patients. As the supplementary figure shows, most of the ASYMPDD had values within the normal range.

Performance of anxiety and depression scores

Although anxiety and depression did differ between the IBS groups and HV, there was a greater overlap than for PHQ-12 SS (Tables 3 and 4). The ROC area under the curve for anxiety was less than that for the PHQ-12 SS at 0.8 and, using the standard cut-off of >7, sensitivity was 72.4% and specificity 74.8% for all IBS vs. HV. The PLH was less good than for the PHQ-12 SS at 2.9 and an NLR of 0.4. The ROC area for depression was similar at 0.8, but using the standard cut-off of >7 gave a sensitivity of only 36% with specificity of 93.4% (PLR 5.5 and NLR 0.7). Thus, the PHQ-12 SS score was approximately three times as likely to be abnormally high in IBS as depression and 1.3 times as likely to be elevated compared with anxiety.

As Table 4 shows that 54.8% SYMPDD had abnormal PHQ-12 SS compared with just 26.6% in ASYMPDD, chi-squared 27.0 vs. SYMPDD, $P < 0.001$.

Similarly, abnormal anxiety/depression was seen in 71.7%/39.3% of the SYMPDD patients significantly

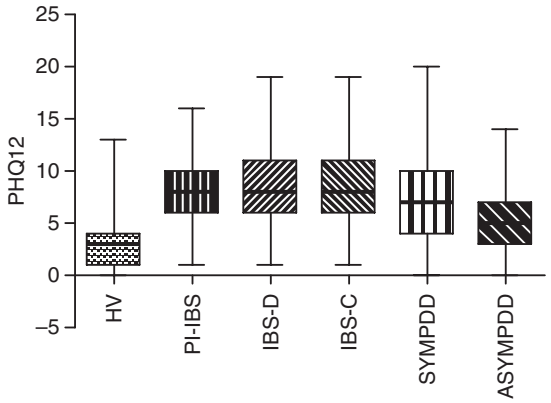

Figure 1 | Somatization (PHQ-12) scores in IBS and diverticular disease (DD) compared with healthy volunteers. Box and whiskers plot showing median and interquartile ranges together with extreme values. HV, healthy volunteer; PI-IBS, postinfective IBS; IBS-D, IBS with diarrhoea; IBS-C, IBS with constipation; SYMPDD, symptomatic diverticular disease; ASYMPDD, asymptomatic diverticulosis. All groups were significantly different from HV, $P < 0.001$, ASYMPDD were significantly less than SYMPDD and all IBS groups, $P < 0.001$.

Table 3 | Somatization (PHQ-12), anxiety and depression scores in healthy volunteers and patients with irritable bowel syndrome or diverticulosis

	ANOVA *P*	HV	PI-IBS	D-IBS	C-IBS	ASYMPDD	SYMPDD
n		151	39	148	132	113	173
PHQ-12	0.000	3.2 ± 0.2	8.2 ± 0.3*	8.0 ± 0.3*	8.4 ± 0.3*	5.0 ± 0.3*[a]	7.4 ± 0.3*[b]
Anxiety	0.000	4.8 ± 0.2	8.3 ± 0.6*	8.6 ± 0.3*	9.7 ± 0.4*	5.6 ± 0.3[c]	8.9 ± 0.3*[b]
Depression	0.000	2.1 ± 0.2	5.1 ± 0.6*	5.7 ± 0.3*	5.6 ± 0.3*	4.4 ± 0.3*[d]	5.8 ± 0.3*[b]

PHQ-12, Patient Health Questionnaire 12; HV, healthy volunteers; PI-IBS, postinfectious IBS; IBS-D, IBS with diarrhoea; IBS-C, IBS with constipation; SYMPDD, symptomatic diverticular disease; ASYMPDD, asymptomatic diverticulosis.

Difference from HV: * $P < 0.001$; [a]$P < 0.001$ vs. all IBS and symptomatic DD; [b]$P < 0.001$ vs. ASYMPDD; [c]$P < 0.002$ vs. PI-IBS and $P < 0.001$ vs. IBS-C, IBS-D and SYMPDD; [d]$P < 0.05$ vs. IBS-D and $P < 0.01$ vs. SYMPDD.

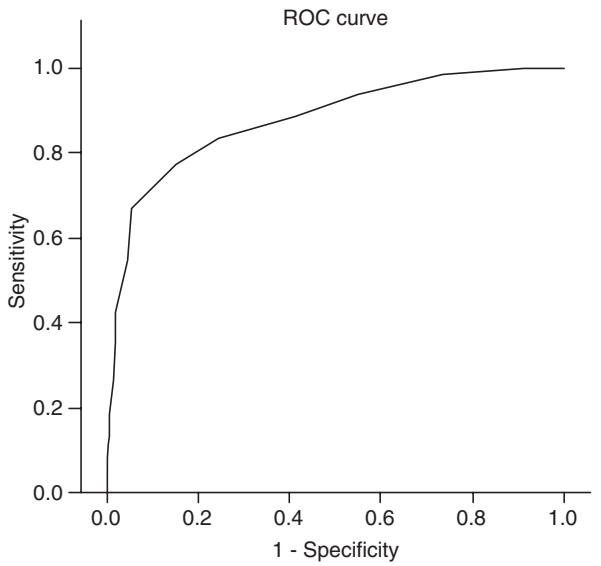

Figure 2 | Receiver-operating curve for distinguishing IBS from healthy volunteers showing sensitivity vs. 1-specificity for varying cut-off values. The area under the curve was 0.88. Using a cut-off score of >6 gave a sensitivity of 66.4% and specificity of 94.7%.

greater than the 38.9%/23.0% of the ASYMPDD group, chi-squared 27.3/8.2, $P < 0.001/0.01$ respectively.

Predicting IBS symptom severity score

Restricting analysis just to IBS patients showed that PHQ-12 SS correlated more strongly with IBS symptom severity scale (IBSSS) than anxiety or depression ($r = 0.41$ vs. 0.29 and 0.34, all $P < 0.00$, $n = 309$). Binary logistic regression showed that PHQ-12 SS, lower age and depression were all independent predictors of IBSSS > 296, $P < 0.000$, 0.001 and 0.01 respectively. Predictably, anxiety correlated with depression and was not an independent predictor of IBSSS. Multiple regression showed that each one point rise in PHQ-12 SS or depression score increased IBSSS by 8.3 and 7.1 points respectively, whereas each additional decade of age reduced the score by 13 points. Put another way, each 1 standard deviation (s.d.) rise in depression increased IBSSS 0.28 s.d., whereas each 1 s.d. rise in PHQ-12 SS increased IBSSS 0.31 s.d. again showing that PHQ-12 is a more important predictor of IBSSS than depression.

Predicting visits to doctors: role of age, PHQ-12 SS anxiety and depression

IBS patients reported visiting their doctor for their abdominal symptoms an average of 2.2(0.2) times in the previous year, which is significantly more than that of the ASYMPDD patients 0.3(0.1) and SYMPDD patients 1.4(0.2), $P < 0.0001$ and 0.002 respectively.

Considering the IBS patients separately, GP visits correlated negatively with age ($r = -0.19$) $P = 0.001$ and positively with PHQ-12 SS ($r = 0.17$), $P = 0.002$ anxiety ($r = 0.12$), $P = 0.03$ and depression ($r = 0.18$) $P = 0.001$, $n = 310$. Gender did not significantly influence the number of visits. Binary logistic regression using age, PHQ-12 SS, anxiety and depression to predict two or more doctor visits per year showed that neither gender nor anxiety nor depression was an independent predictor, but that age and PHQ-12 SS were. Multiple linear regression showed that visits increased 0.23/year for each unit rise in PHQ-12 SS and fell 0.28 visits/year for each advancing decade of life.

The pattern in DD was slightly different with only PHQ-12 SS showing an independent effect on doctor visits on binary logistic regression. Multiple regression showed that visits increased 0.17/year for each unit rise in PHQ-12 SS.

Within the diverticulosis patients, there were 19 patients with more severe symptoms. This group reported prolonged periods of pain lasting >24 h with fever for which they had sought medical attention and

Table 4 | Percentage of subjects with abnormal values for somatization, anxiety or depression

	Chi-squared *P*	HV	PI-IBS	IBS-D	IBS-C	ASYMPDD	SYMPDD
PHQ-12	0.000	5.3	71.8*	65.5*	67.4*	26.6	54.8[a]
Anxiety	0.000	25.2	69.2*	70.3*	75.8*	38.9	71.7[a]
Depression	0.000	6.6	30.8*	40.5*	32.6*	23.0	39.3[b]

PHQ-12, Patient Health Questionnaire 12; HV, healthy volunteers; PI-IBS, postinfectious IBS; IBS-D, IBS with diarrhoea; IBS-C, IBS with constipation; SYMPDD, symptomatic diverticular disease; ASYMPDD, asymptomatic diverticulosis.

% IBS patients with abnormal PHQ-12, anxiety and depression were significantly greater than HV while %SYMPDD were significantly greater than ASYMPDD for all three variables.

* $P < 0.001$ vs. HV; [a]$P < 0.001$ vs. ASYMPDD; [b]$P < 0.01$ vs. ASYMPDD.

received antibiotic treatment. These 19 were predominantly women (16/19) and significantly younger than the other DD patients being aged 61.6 ± 2.8 years, $P < 0.001$. These patients reported visiting their doctor more at 2.2(0.3) visits/year than the remaining SYMPDD excluding these 19, who visited 0.8(0.2) times or ASYMPDD patients 0.3(0.1) visits, $P < 0.01$ and 0.0001 respectively. They had significantly higher PHQ-12 SS scores at 10.3 ± 1.1 compared with the remaining SYMPDD patients as a whole 7.1 ± 0.3, $P < 0.01$ and the ASYMPDD at 5.0 ± 0.3, $P < 0.001$.

Predicting PHQ-12 SS

Within the entire study group, PHQ-12 SS correlated with both anxiety $r = 0.54$ and depression $r = 0.55$, $P < 0.001$, $n = 583$. Multiple logistic regression in all subjects also showed that depression and anxiety and female gender were all significant independent predictors of having a PHQ-12 SS score greater than the cut-off of >6, P for all variables <0.0001. Linear regression showed that for each unit rise in anxiety score, PHQ-12 SS rose 0.29, and 0.39 for each unit rise in depression score. Women scored on average 6.8 ± 0.2 points, significantly greater than those of men who scored 5.1 ± 0.2 points, $P < 0.001$. PHQ-12 SS score fell slightly with increasing age, but this was not significant, $P = 0.52$.

Predicting bloating and abnormal bowel function

A proportion of 86% of IBS patients reported being troubled by abdominal distension or bloating significantly more than ASYMPDD (24%) and SYMPDD (68%), both $P < 0.001$. PHQ-12 SS scores correlated more strongly than anxiety or depression with days with bloating ($r = 0.48$ vs. $r = 0.43$ and 0.33, all $P < 0.000$, $n = 582$). Multiple logistic regression showed that advancing age and male gender were independently protective, Odds ratio for being troubled by bloating 0.99 ($P < 0.03$) and 0.62 ($P < 0.000$), whereas anxiety and PHQ-12 SS showed a modest adverse effect, odd's ratio 1.1 and 1.2, both $P < 0.000$. Advancing years also reduced the incidence of loose stools with every decade of age reducing the number of days with loose stool on average 0.4 days/week, $P < 0.001$. Male gender, in contrast, significantly increased the frequency by 1.1 days/week, $P < 0.001$.

Predicting symptoms in DD

Binary logistic regression showed both gender, anxiety and PHQ-12 SS were significant ($P < 0.001$) independent predictors of having symptoms. Each 1 unit rise in Anxiety or PHQ-12 SS score increasing the risk of having symptoms 19% and 11% respectively, whereas women were at 2.3-fold increased risk compared with men.

DISCUSSION

This is the first study to evaluate a large group of patients with gastrointestinal symptoms using the modified PHQ-15. After excluding the three items which cover gastrointestinal symptoms, we found that the modified scale, which we have called the PHQ-12 SS, clearly distinguishes IBS patients from HV. Although the sensitivity of PHQ-12 SS for identifying IBS in general, using a cut-off of >6, was only 66%, the specificity was 95%, which would be very helpful in a clinical setting such as out-patients in which IBS is very common. As, in our study, IBS accounted for about two-third of the group, we would expect similar performance in a clinical setting and a normal PHQ-12 SS score would be against a diagnosis of IBS and prompt further tests.

We believe that a high PHQ-12 SS indicates heightened awareness of bodily symptoms. Earlier studies suggested that visceral hypersensitivity (VH) is a significant component in at least 50% of IBS patients who experience a range of stimuli such as rectal distension or colonic contraction as more painful than normal subjects.[29, 30, 31] These studies suggested that VH did not extend to somatic pain; however, more recently, the overlap of IBS with fibromyalgia has been recognized and there have been some major advances in understanding the neurological basis of VH which may reflect defective antinociceptive systems.[32–34] The descending inhibitory pathways, which are normally activated to reduce sensation from the viscera, appear defective in IBS. Some of the most effective treatments in IBS, the tricyclic antidepressants, have been shown to produce changes in brain activation suggesting that they may restore this antinociceptive activity.[35] A similar defect may underlie fibromyalgia.[36] Failure to inhibit noxious signals may be a more generalized defect and clinically, IBS patients are known to consult frequently not only for bowel symptoms but also for non-GI symptoms[37–39] and also to receive more treatments such as antibiotics for non-GI complaints.[40]

Excessive awareness of signals from many parts of the body other than the gut is detected by the PHQ-12 SS scale, which provides a rapid and useful clinical assessment. One of the authors (RS), has been using this for over 4 years in his clinic and this study confirms the clinical impression that this is more useful than anxiety and depression scales, which are elevated in patients with organic as well as functional disease.[41] One reason why

the PHQ-12 SS separates IBS from the other groups more clearly is that it may be a way of detecting generalized hypersensitivity, which is a key feature in at least half of IBS patients and seems to predict the more severe symptoms.[42]

The recognition that multiple somatic complaints are frequently seen in IBS patients is also of considerable importance from a management point of view. This is because these significantly add to the burden of illness as well as lead to inappropriate referral and even unnecessary treatment.[43–45] Thus, patients with IBS are over-represented in gynaecological and urological clinics and it has been shown that they are also subjected to an excess of surgical procedures.[46] These non-GI complaints are also a major cause of concern to patients themselves who often fear that other disease is being overlooked. It has been shown that these symptoms can be just as intrusive as the gastroenterological symptoms.[47] Furthermore, these features have diagnostic utility, as it has been shown that the more noncolonic symptoms of which a patient complains, the more secure the diagnosis of IBS becomes.[48]

Although both IBS and DD patients suffer abdominal pain and disturbed bowel habit, there are important differences, including the structurally abnormal bowel and the effect of advancing age, which increases the prevalence of symptomatic DD, but reduces IBS prevalence. Our previous studies show that using the Rome II criteria, only a minority (15%) of SYMDD patients meet Rome criteria for IBS largely because their pain was not relieved by defecation nor closely linked to stool consistency or frequency. A recent survey in Olmstead County found a somewhat higher prevalence, but even so, only 29% of patients with diverticulosis meet the Rome II criteria for IBS compared with 13% in the population overall.[49] PHQ-12 SS scores in both asymptomatic and symptomatic patients with diverticulosis in the current study were higher than those of the healthy controls, but lower compared with IBS patients despite their greater age and their having a similar disturbance of bowel habit as judged by the number of days per week with hard or loose stools. This discrepancy supports the idea that the symptoms in at least some DD patients are related to the associated peripheral abnormality, namely muscular hypertrophy and altered innervation,[50] which is absent in IBS, where symptoms are mainly driven by central abnormalities of sensory processing and interpretation. The higher PHQ-12 SS score in the small subgroup with a history of fever, pain lasting >24 h and prescription of antibiotics is intriguing. It may represent a group with somatization who seek and get more medical attention, but alternatively, it may indicate that recurrent pain from acute diverticulitis leads to generalized hypersensitivity. Only a prospective study with objective rather than the current subjective criteria for diagnosing diverticulitis could answer this question.

Completing the PHQ-12 SS takes only a few minutes and, we believe, is a valuable addition to the clinical assessment of patients. Not only is the physician gaining useful data but the patient becomes re-assured that his/her medical attendants are familiar with these additional features of their condition, which can be so disabling.

Future studies should assess the value of these scores when combined with alarm symptoms and the Rome criteria in reducing the need for unnecessary investigations in this important group of patients.

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SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article:

Figure S1. Showing individual data points.

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