

Irritable bowel syndrome: an international study of symptoms in eight countries

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Objectives This report is a preliminary comparative study of irritable bowel syndrome symptoms in eight countries, USA, Mexico, Canada, England, Italy, Israel, India, and China. We also assessed global symptom patterns and correlations and relationships to several psychosocial variables.

Methods Two hundred and thirty-nine participants completed a bowel symptom scale composed of four symptoms, abdominal pain or discomfort, bloating, diarrhea, and constipation as well as two psychosocial questionnaires, quality of relationship and attribution of symptoms to physical or emotional factors.

Results Pain score in Italy, with the least urban population, was significantly higher than six of the seven other countries whereas it was lowest in India and England. Bloating was highest in Italy and constipation was highest in Mexico, both significantly higher than five other countries. Diarrhea was higher in China than five other countries. All significance values were $P < 0.05$. Globally, diarrhea was less common than constipation, $P < 0.001$ and bloating significantly correlated with constipation as well with pain, $P < 0.05$. Composite analysis of psychosocial variables and symptoms indicated that family conflict correlated directly, $P < 0.05$, whereas family support correlated indirectly, $P < 0.01$, with pain and bloating. Pain, bloating and diarrhea were significantly attributed to physical etiology, $P < 0.01$, whereas only diarrhea was attributed to emotional cause, $P < 0.05$.

Introduction

Irritable bowel syndrome (IBS) exists throughout the world. Early reports documented IBS mainly in Europe and North America; subsequent studies have come from Latin America, Africa, and Asia [1–4]. Most published reports describe prevalence rates which appear to be slightly higher in Europe and North America than in Asia [5]. We recently completed a survey of IBS patients in eight countries spanning the globe. We studied several psychosocial variables and also obtained data regarding IBS symptoms. The psychosocial results have been published elsewhere with two major findings [6]. First, family relationships interacted with total IBS symptoms so that high support and depth of relationship correlated with low IBS score, whereas high conflict

Conclusion This study suggests that there are significant variations in irritable bowel syndrome symptoms in different geographic locations around the world. Various hypotheses that may explain our data such as cultural beliefs, gut contamination, urban and rural location, dietary practice, and psychosocial factors should be further investigated. *Eur J Gastroenterol Hepatol* 20:659–667
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European Journal of Gastroenterology & Hepatology 2008, 20:659–667

Keywords: cross-cultural, international, irritable bowel syndrome, irritable bowel syndrome symptoms, mind–body

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Received 17 March 2007 Accepted 26 August 2007

correlated with high IBS score. Second, we assessed the degree to which patients attributed their symptoms to physical or emotional causes. Attribution to physical cause correlated with high IBS symptom scores whereas attribution to emotional cause correlated with low symptom scores.

In this study, we analyze IBS symptom data among the eight countries in an attempt to determine whether significant geographic differences exist. Little data describing IBS symptoms in different geographic areas exist. A few studies have compared symptoms in different countries using a common measure but these have been mainly limited to populations of northern European descent. In one report, symptoms were evaluated in

eight European countries but the results were cumulative, not comparative [7]. Abdominal pain and bloating were the most common symptoms. Constipation and diarrhea rates were similar to each other. In another study, gastrointestinal symptoms were compared in four countries, USA (Rochester, Minnesota), Germany (Essen), Australia (Sydney), and Sweden (Uppsala) [8]. The purpose was to determine if symptom clusters existed that identified upper and lower functional gastrointestinal syndromes in the four countries. In each country, a cluster of symptoms compatible with the diagnosis of IBS was identified. The prevalence of symptoms was similar for all four countries. Several reports have come from Singapore which has a mixed population of ethnic Chinese, Malays, and Indians [3,9]. Prevalence of IBS was similar in all three populations in both studies. In one study, there was no significant difference in rates of chronic diarrhea or constipation [9] and in the other, difference in symptom patterns was not reported [3].

IBS has been described as a biopsychosocial illness [10] though the relationship between biological, psychological, and cultural variables and specific IBS symptoms has not been studied. Biological variables that might influence symptoms in different locations include diet, colonic ecosystem, rates of gastrointestinal infection, and genetics. Important psychosocial variables include coping patterns, life stress, quality of relationship, family history, and belief systems regarding illness causality. The context of illness, that is 'normal ways of being ill', varies cross-culturally and has been eloquently described by Kleinman in the *Illness Narratives* [11]. Recently, the concept of 'cultural competence' has emphasized the need to understand the cultural background and illness beliefs of patients to treat them appropriately [12].

We administered a questionnaire symptom scale to IBS patients seen at tertiary centers in seven countries that encompass the globe, USA, Canada, Mexico, Italy, Israel, India, and China, and an eighth country, England, where patients belonged to an IBS support organization. Symptoms assessed include the major Rome II criteria, abdominal pain or discomfort, diarrhea, and constipation as well as bloating, which has been reported to be the most common complaint of IBS patients [13]. In addition to individual symptom analysis, we studied relationship of symptoms to each other and to two psychosocial variables in the entire subject pool.

Methods

Patients

Approximately 30 IBS patients, documented at each center as meeting Rome II criteria [14], completed a series of questionnaires in eight countries, after informed consent. A total of 239 patients were surveyed in the following locations: USA (New York City), Canada

(Montreal), Mexico (Mexico City), England (London), Italy (Bari), Israel (Beer-Sheva), India (Calcutta), and China (Beijing).

Most patients filled out the questionnaires at their initial visit, on a consecutive basis, though there was some mix of new and old patients in Israel and Canada. The main exception was England where patients were recruited by mail. The British patients were found to meet Rome II criteria for the diagnosis of IBS by primary care physicians or specialists and belonged to a self-help organization. Rejection rate was zero in China, Mexico and India, 9% in Italy, Israel, Canada, and the United States. In England, 70% of patients returned the questionnaires. Participants were urban based except for Italy where nine were rural, 13 suburban, and only eight were urban. Most patients were described as middle class in the context of the local economy.

Questionnaires were translated by the investigators into the local language and reviewed for accuracy by bilingual colleagues, as necessary. In Israel, a published method was used for translation of questionnaires [15]. In the other countries, translations were validated by back translation by the investigators with revision as necessary. All investigators felt that the four symptoms and the Likert grading system of the bowel symptom scale (BSS) were clearly understood and differentiated by the research individuals.

Questionnaires

Basic data questionnaire

Questions included age, sex, years of marriage, illness, and education. The most striking sex differential was in India where the percentage of females was 7% whereas the mean percentage females in the other seven countries was 76%. The Italian population was significantly different from the other participants in years of education and years of illness. Italians had 10.3 years of education whereas the mean for the other seven countries was 14.1 years. Sixteen of the 30 Italian participants had between 5 and 8 years of education. Italians had onset of IBS 4.9 years before the survey whereas the other participants had mean length of illness of 13.3 years. No significant difference was found in age or years of marriage. Mean age of all participants was 40.6 years (Table 1).

Bowel symptom scale

The BSS was first reported in a controlled trial of Chinese herbal treatment for IBS [16]. It consists of a visual analog scale for four symptoms: pain/discomfort, diarrhea, constipation, and bloating. The BSS was found to have a high correlation for test-retest reliability, $r = 0.7$ for total score ($P < 0.01$, two-tailed) and 0.8 for bloating, 0.6 for pain, 0.8 for diarrhea, and 0.7 for constipation. In

Table 1 Demographic data

Country	<i>n</i>	Mean age	Female/male	Mean years of education	Referral sources	Habitation
USA	29	36	16/13	17	Tertiary	Urban
Canada	30	43	25/5	15	Tertiary	Urban
Mexico	30	34	30/0	13	Tertiary	Urban
England	31	54	31/0	14	Patient organization	All locales
Italy	30	37	20/10	10*	Tertiary	Rural and Suburban – 22 Urban-8
Israel	30	44	21/7	15	Tertiary	Urban
India	27	37	2/25*	13	Tertiary	Urban
China	32	41	18/14	12	Tertiary	Urban

* $P < 0.05$.

addition, there was a high correlation between patient and physician perception of symptom severity with a Cronbach coefficient α of 0.87 and 0.86. Score for each symptom ranged from 0 to 100.

The quality of relationship inventory

The quality of relationship inventory (QRI) is a validated self-report measure of three different aspects of relationships, support, depth, and conflict [17]. Support and depth are positive attributes whereas conflict is negative. The QRI consists of 25 questions, seven regarding support, 12 regarding conflict, and six regarding depth. Participants select their closest relationship and answer on a 4-point Likert scale, from 1 = not at all to 4 = very much. The subscales had good internal reliability, Cronbach coefficient $\alpha = 0.87$, 0.91, and 0.86, respectively.

The mind–body irritable bowel syndrome questionnaire [6]

This is a 20-question scale that measures patient attribution of their IBS symptoms to physical or emotional factors, created for this study. Ten questions addressed physical causation and 10 questions addressed emotional causation, randomly listed (Table 5). For each question, scores ranged from 1 = agree very much to 4 = disagree very much. The subscales had adequate internal reliability, Cronbach coefficient for mind subscale $\alpha = 0.76$ and for body subscale $\alpha = 0.78$.

Statistical methods

Two unique questions were investigated. First, are there geographic differences in how IBS is experienced? To determine the ways in which individuals from various countries may differentially experience IBS symptoms, results were assessed in two ways. Analyses were conducted to determine whether individual countries differed significantly from each other in reports of the various IBS symptom scales. Then, subscales of the BSS were correlated with each other, and these correlations were examined by country. This analysis revealed how the pattern of symptomatology differed by country.

To determine whether there are geographic differences in the way IBS is experienced, univariate analyses of

Table 2 Mean and standard deviation for all subscales of the bowel symptom scale

Subscale	Total (<i>N</i>)	Mean	SD
Bloating	236	49.52	28.21
Pain/discomfort	236	48.51	26.39
Constipation	229	40.39	33.33
Diarrhea*	235	27.06*	30.59

* $P < 0.001$ vs. all three other subscales.

covariance were conducted on each of the four subscales of the BSS to determine if the mean subscale score differed by country, after covarying out the potential impacts of age, sex, and years of education. When the overall analysis of covariance was significant, the Bonferroni correction was used to allow for multiple comparisons to be conducted while protecting the overall error rate [18–20]. All results expressed as significantly different were at the $P < 0.05$ level unless specified otherwise. We have only highlighted the results when a location's score was significantly different from at least two other countries, and in most cases, from more than two.

Second, what is the overall relationship between IBS symptomatology and psychosocial measures across all eight countries? To assess this relationship, the BSS was correlated with the QRI and the mind–body questionnaire. Results of these analyses are presented at the aggregate level.

Results

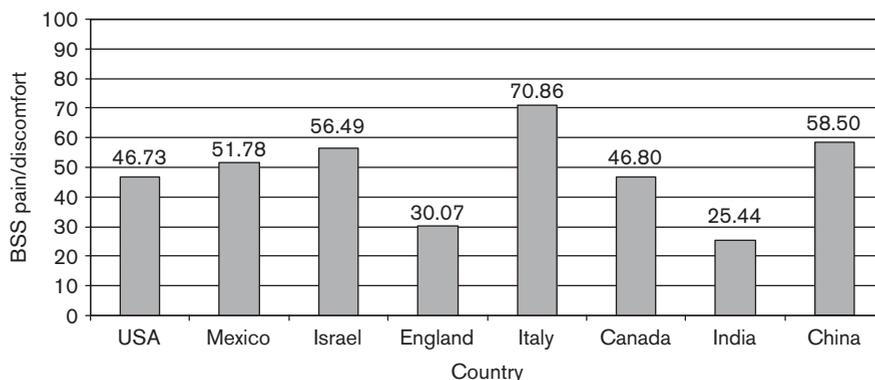
Global symptom scores

Across all eight countries, symptom scores on the bloating scale were the highest ($M = 49.52$) followed by scores on the pain/discomfort subscale ($M = 48.51$), constipation ($M = 40.39$), and diarrhea (27.06) (Table 2). Thus, on average, individuals treated for IBS suffer most from bloating, pain, and discomfort, and significantly less from diarrhea [$t(227) = 4.1$, $P < 0.001$].

Bowel symptom scale pain/discomfort

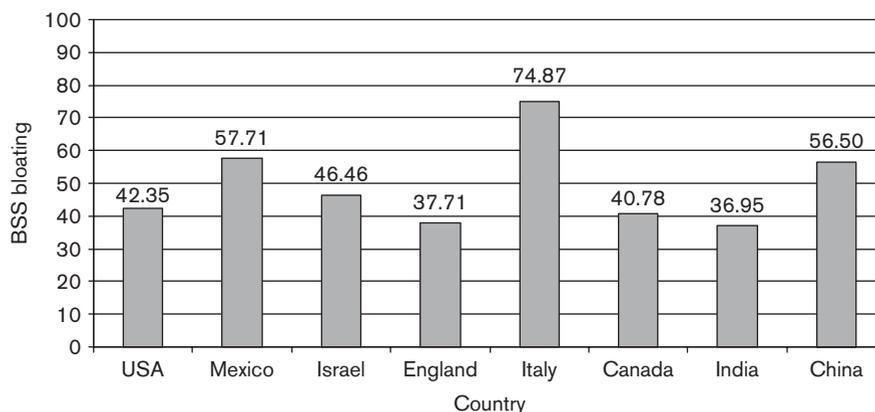
The countries significantly differed on the pain/discomfort subscale of the BSS [$F(7,228) = 11.77$, $P < 0.01$] (Fig. 1). Analysis of adjusted means showed that Italy reported the highest pain/discomfort score, whereas India

Fig. 1



Adjusted means bowel symptom scale (BSS) pain/discomfort scores by country.

Fig. 2



Adjusted means bowel symptom scale (BSS) bloating scores by country.

reported the lowest. Post-hoc comparisons using the Bonferroni correction revealed that Italy's scores were significantly higher than all other countries except for China. England and India reported significantly less pain than all other countries, and they did not differ from each other.

Bowel symptom scale bloating

A significant difference was found across countries on bloating scores of the BSS [$F(7,223) = 6.27, P < 0.01$] (Fig. 2). Italy reported the highest bloating scores across all countries, significantly higher than all countries except for Mexico and China. The lowest mean bloating score came from India but it was not significantly lower than any country other than Italy, after adjusting for age, sex, and years of education. No significant differences between any other countries on the BSS bloating subscale were found.

Bowel symptom scale constipation

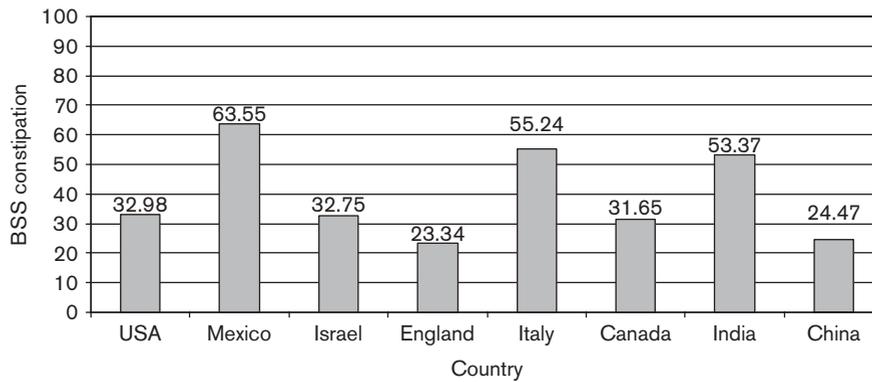
The countries also differed significantly on BSS constipation scores [$F(7,216) = 6.28, P < 0.01$]. Figure 3 illustrates mean constipation scores of the BSS for each country.

Mexico reported the highest constipation scores, significantly higher than all countries except for Italy and India. Italy's adjusted mean scores were significantly higher than England and China. China and England had the lowest and differed significantly from Italy and Mexico. China was also lower than India, but China and England did not differ from each other. There were no significant differences among the United States, Israel, England, Canada, and China.

Bowel symptom scale diarrhea

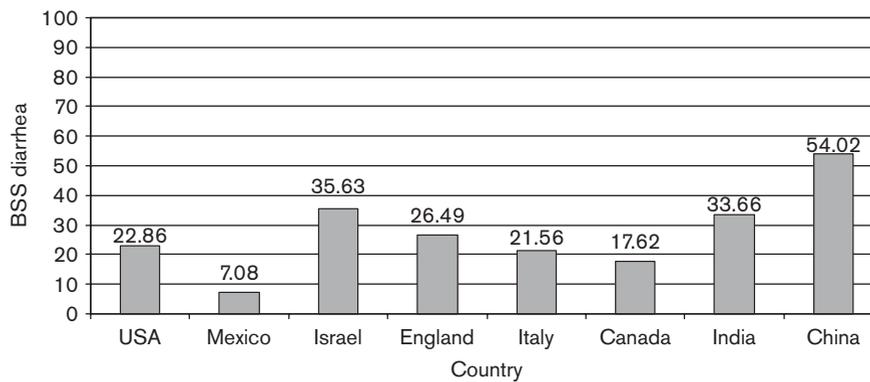
The diarrhea subscale of the BSS also differed significantly by country [$F(7,222) = 6.90, P < 0.01$], (Fig. 4).

Fig. 3



Adjusted means constipation bowel symptom scale (BSS) scores by country.

Fig. 4



Adjusted means diarrhea bowel symptom scale (BSS) scores by country.

China reported the highest scores on the diarrhea subscale, and this score was significantly higher than all countries except for India and Israel, which were not different from each other. Mexico reported the lowest scores, significantly lower than Israel and China. The United States, Israel, England, India, Italy, and Canada did not differ from each other on the BSS diarrhea subscale.

Correlations between symptom scales

Correlation between bloating and pain subscales

For every country other than China, the correlation between the pain and bloating subscales on the BSS measure was significantly positive and quite high, indicating that individuals who report higher pain scores also tend to report higher bloating scores. China, in contrast, exhibited a significantly negative correlation indicating that higher pain scores were associated with lower bloating scores (Table 3).

Correlation between bloating and constipation subscales

Across all countries, bloating and constipation were strongly positively correlated, and this correlation reached significance for all countries except Italy and China. With a larger sample size, it is likely that the positive correlations for Italy and China would attain significance. No consistent pattern was noted in any of the other symptom correlations, except for the predictably negative correlation between constipation and diarrhea (Table 3).

Composite scores for psychosocial measures

Although there were few significant differences between countries in the correlation between symptoms and the two psychosocial scales, composite data showed mild significant symptom differences. When subscales on the BSS were correlated with the Quality of Relationships Inventory, higher reports of relationship support and depth were associated with lower reports of pain and

Table 3 Correlations among subscales across eight countries

Correlation	USA	Mexico	Israel	England	Italy	Canada	India	China
Pain-bloating	0.43*	0.71*	0.48*	0.60*	0.60*	0.73*	0.52*	-0.45*
Pain-constipation	0.14	0.33	0.25	0.33	0.37*	0.11	0.19	-0.31
Pain-diarrhea	0.13	0.41*	0.40*	0.1	0.08	0.34	-0.46*	0.28
Bloating-constipation	0.64*	0.59*	0.42*	0.45*	0.34	0.41*	0.39*	0.38
Bloating-diarrhea	0.11	0.3	0.03	-0.09	-0.04	0.08	-0.26	-0.33
Constipation-diarrhea	-0.17	0.21	-0.18	-0.38*	-0.72*	-0.49*	-0.06	-0.68*

* $P < 0.05$.**Table 4 Correlation between BSS and quality of relationship inventory, and BSS and the mind-body questionnaire**

	N	Pearson correlation
Quality of relationship inventory		
Support-Pain	235	-0.217**
Support-Bloating	235	-0.174**
Conflict-Pain	235	0.152*
Conflict-Bloating	235	0.156*
Conflict-Constipation	228	0.174**
Depth-Pain	234	-0.225**
Depth-Bloating	234	-0.180**
Mind-body questionnaire		
Body, diarrhea	235	0.223**
Body, pain	236	0.217*
Body, bloating	236	0.225**
Mind, diarrhea	235	0.142*

BSS, bowel symptom scale.

* $P < 0.05$, ** $P < 0.01$.**Table 5 Mind-body IBS scale**

I believe that because I am too nervous, my stomach and colon are upset	If my life were more in balance, I would be able to get better
I think I have stomach problems because I don't absorb my food	My stomach bothers me because I have allergies
I think I have stomach problems because I don't absorb my food	Sometimes I think that I am being punished for something I did wrong, and that it why I am sick
I think my intestinal problem is caused by infection	I have stomach trouble because of medicine I took in the past
I think that too much thinking about myself and my problems is making me sick	My health is better when there is peace in my family
I think I was born with a weak body	My health is better when there is peace in my family
I think I am living with intestinal problems because it runs in my family	I think my stomach bothers me because I don't exercise enough
I wish that my family would worry less about me because their worries are making me sicker	My shame about my stomach problems makes me even sicker
I believe I have an intestinal parasite that the doctors can't find	The people who love me actually make me feel worse because they don't understand me and my illness
I believe that my sickness can lead to cancer	The people who love me actually make me feel worse because they don't understand me and my illness

IBS, irritable bowel syndrome.

bloating ($P < 0.01$), but not with constipation and diarrhea. More relationship conflict was significantly associated with higher reports of pain, bloating ($P < 0.05$), and constipation ($P < 0.01$), but not with higher reports of diarrhea (Table 4).

Aggregated across all countries, subscales on the BSS were correlated with the mind-body questionnaire

(Table 5). Results revealed that higher attribution of symptoms to physical causes (i.e. body attributions) was significantly associated with higher reports of IBS symptoms. Although the correlations are modest, they are statistically significant. This relationship existed for three of the four BSS subscales, namely pain ($P < 0.05$), bloating, and diarrhea (0.01) but not for constipation (Table 4). No association between attribution to emotional causes and IBS symptoms was found, except for diarrhea ($P < 0.05$).

Discussion

This survey is the first attempt to compare IBS symptoms in a number of countries spanning the globe. The strength of this study is the finding that a functional gastrointestinal disorder such as IBS, defined by symptoms, may be manifested differently in different geographic locations, suggesting an effect of local variables. The statistically significant results were strengthened by controlling the data for age, sex, and years of education. The weakness of the study is the limited number of participants at each center, partly related to the difficulty in obtaining comparable data in such disparate parts of the globe. The investigators felt that the symptom patterns detected were typical of IBS patients in their particular locale. The significant differences that were detected offer an opportunity to explore various hypotheses that can be applied to larger population studies in the future.

When pain scores were assessed, Italian patients had higher pain scores than five of the other countries. As mentioned, Italians were less urban, less educated and had a shorter IBS history. Several studies have found a higher prevalence of IBS in urban than rural populations [21,22]. In one report, rural Bedouins had lower prevalence of IBS than Bedouins who had moved to an urban environment. Although IBS may be less common in rural areas, there is no published data regarding access to tertiary healthcare and its effect on IBS symptom severity in rural vs. urban locations. Referral patterns and local health systems differ from country to country and may be an important variable in this regard. Although prevalence may be greater in an urban population, severity of symptoms leading to tertiary referral may be greater in a rural population. When the data were controlled for

years of education, Italy still differed from most other countries so education was not a determining variable. The effect of educational level on IBS is controversial. Several studies have found that greater education was associated with higher prevalence of IBS [3,23] though another report found the same association with less education [24].

Italy also had the highest bloating score. The Italian diet is high in starch and beans which may lead to bloating and gas [25]. Lactose intolerance may play a role as it is common in Italy [26]. Our results also showed that Mexican participants had the highest constipation score, significantly higher than all countries but Italy and India. Local dietary factors may contribute to constipation as well. We do not have specific dietary data on our participants. In a report by Zuckerman *et al.* [27], Hispanics were compared with non-Hispanic whites on the Texas–Mexico border and constipation occurred more frequently than diarrhea in Hispanic males and females.

It is worth noting that Italian participants had such high ratings for pain and bloating. In a study of patients with inflammatory bowel disease, patients from southern Europe including Italy were compared with northern Europeans. The southern European group had greater overall concern about their illness [28]. This could translate into amplification of symptoms, explaining, at least in part, the Italian findings in our study.

The Chinese participants were notable for the highest diarrhea score, significantly higher than five other locations. In a recent study, Gwee [29] proposed that the common frequency of gastrointestinal infection in Asia may affect IBS bowel patterns. It is possible that this affected the bowel pattern in China. Postinfectious IBS has been characterized by a predominance of diarrhea rather than constipation [30]. In one of the Singapore studies already quoted, constipation was significantly more common than diarrhea in IBS patients [3]. These results in Singapore may represent the effects of more advanced urbanization and improved sanitation. No published data are available on changing bowel patterns in societies undergoing modernization but the reduced incidence of tropical sprue in south India provides an example of this phenomenon (personal communication, G. Kurian).

Interestingly, India had a low score for abdominal pain. Indian participants were predominantly male, as noted in earlier reports [31]. In our study as well as in a recent survey of the role of sex in Indian IBS patients, it seems that Indian males have more access to specialists than females and are less revealing about their GI symptoms (Chowdhury and Varshey, personal communication). Pain score was low in India even after

controlling for sex so it may reflect other cultural factors.

British participants also had low pain scores. This is probably a result of patients being accessed through mailing to a patient support group, rather than visits to a tertiary center. Talley *et al.* [32] have reported that pain was the main variant driving IBS patients to a specialist so patients in the community would be expected to have lower pain scores. Results from New York, Montreal, London, and Beersheva did not yield significant differences. In those four centers, patients were mainly of northern European origin. This underlines the need to include culturally diverse locations to determine whether different geographic symptom patterns exist.

This study gave us an opportunity to examine the relationships between IBS symptoms in a large sample of patients. Significant correlations were found between bloating and abdominal pain, and between bloating and constipation. The correlation between bloating and constipation is consistent with the recent report by Houghton and colleagues [33]. In their study, patients with IBS and constipation were more likely to have bloating than IBS patients with diarrhea but patients were divided *a priori* by their history, not by quantitative analysis of symptoms. Our data show a direct correlation between severity of constipation and bloating for the entire spectrum of patients. The association between bloating and constipation has been noted previously [29,34,35]. The negative correlation between pain and bloating in Chinese participants may reflect a problem with interpretation of the terms, so that bloating was subsumed under the category of pain.

We also found that diarrhea was significantly less common than constipation with a mean of 27 vs. 40%. This difference has not been noted in reports of IBS symptoms in the western world. In a large survey of IBS symptoms in the United States, diarrhea occurred at a slightly greater percentage than constipation [36]. Our results suggest that this may not be representative of IBS populations in a more broadly based geographic spectrum.

Evaluation of the association between symptoms and psychosocial factors yielded mixed results. Although there were few significant correlations in each study location, possibly related to the small number of participants, composite results showed some low level significance. We have previously described composite results for total symptom score in our participants [6] but this report suggests that the effect may be selective in regard to specific symptoms. Family relationships interacted with pain and bloating, not with constipation or diarrhea. Family support and depth correlated weakly with less pain and bloating whereas family conflict had

the reverse effect. An extensive literature exists describing the impact of relationships on pain and our results are consistent with this concept [37,38]. Spousal support has been reported to correlate with lower pain levels in arthritis patients as well as reduction of pain over a 1-year period [39]. With regard to IBS, Jones *et al.* [40] have reported reduced interpersonal support in IBS patients compared with controls.

The mind–body scale indicated that three of the four symptoms were significantly attributed to physical cause; diarrhea alone was attributed to emotional factors. This could be related, at least in part, to local cultural beliefs. Kleinman [41] has described how Chinese patients suffering from depression presented with somatic complaints, believing they had a physical illness.

IBS is defined by a set of symptoms. This preliminary study suggests that these symptoms may vary considerably depending on a patient's geographic location. We have raised a number of hypotheses that require further study. The differences that we found could be explained by a number of variables. Possible factors include education and rural origin, as in Italy, access to healthcare as in Italy and India, diet as in Italy and Mexico, gastrointestinal infection and altered flora as in China and India. Psychological dynamics and cultural premises affect symptomatology in all populations. Recognition of these variables can expand our understanding of functional gastrointestinal disorders and enhance the effectiveness with which IBS patients are treated.

Acknowledgements

This study was supported by the Tai Foundation. The authors thank Amie Rapaport for statistical advice.

Conflict of interest: none declared.

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