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ORIGINAL ARTICLE

Health care utilization of individuals with Rome IV irritable bowel syndrome in the general population

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Abstract

Background: Irritable bowel syndrome (IBS) is highly prevalent worldwide but mechanisms for healthcare seeking behaviours in this patient group are poorly understood.

Objective: To describe healthcare utilization and identify factors associated with seeking healthcare amongst IBS subjects in the general population.

Methods: An internet survey was completed by 6,300 individuals equally distributed between United States, United Kingdom and Canada. The Rome IV diagnostic questionnaire was used to identify subjects with IBS. Data on demographics, medical history, gastrointestinal (GI) and non-GI symptoms, quality of life and health care consumption was collected.

Results: A total of 5,931 subjects were included; 274 (4.6%) IBS subjects and 5657 (95.3%) non-IBS controls. IBS subjects reported more doctor consultations for both GI and other health problems as well as increased use of medication and rate of abdominal surgery (appendectomy excluded). Having healthcare insurance or access to free public healthcare (adjusted odds ratio (AOR) 4.49, 95% confidence interval (CI) 1.31–15.44), followed by high frequency of bloating (AOR 2.65, 95% CI 1.42–4.93) and increasing age (AOR 1.02, 95% CI 1.01–1.05) were found to be independently associated with being an IBS consulter while doctor-diagnosed IBS subjects were more likely to be female and to report abdominal pain as their most bothersome GI symptom than other consulters with IBS.

Conclusion: IBS subjects have higher healthcare utilization than non-IBS controls, medication use and abdominal surgery included. Furthermore, consulters with and without an IBS diagnosis differ in sex distribution and symptom profiles. Hence, awareness of the possibility of unnecessary medical and surgical treatment in IBS subjects and a sex-related diagnostic bias by doctors is warranted.

KEYWORDS

drug utilization, gastrointestinal symptoms, health care seeking behaviour, health care utilization, irritable bowel syndrome, surgery

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INTRODUCTION

Irritable bowel syndrome (IBS) is one of the most prevalent functional gastrointestinal (GI) disorders,¹ characterized by chronic or recurrent abdominal pain associated with altered bowel habits.² It is also associated with impaired quality of life,³ decreased work productivity⁴ and increased health and socioeconomic costs.^{3,5} Many doctors find the disorder challenging to manage⁶ and likewise many IBS patients are dissatisfied with the management, often leading to frequent healthcare visits.⁷ This partly explains why IBS is one of the most common reasons for gastroenterological consultations in both primary and secondary care.⁸

Understanding the mechanisms for healthcare seeking behaviour is essential in order to identify patients' needs and to optimize management. Factors such as GI symptom severity, psychological distress, psychosocial factors and extra-intestinal symptom burden are considered as important contributors to healthcare seeking in the IBS population. In a US community survey, abdominal pain was the most common reason for consulting a doctor, but as many as 75% of those with IBS symptoms never consulted doctors about their GI problems.⁹ Similar findings have been reported by others, that is GI symptom severity is of importance, but does not entirely explain healthcare seeking behaviour.¹⁰⁻¹² IBS consulters have also been found to suffer from increased psychological distress compared to both non-consulting IBS subjects and non-IBS controls.^{13,14} However, as previous studies have used earlier versions of the IBS criteria, assessed specific IBS subtypes or small or selected samples, their generalizability is limited.^{9,10,15} Furthermore, it can be assumed that healthcare seeking behaviour in general have changed over time and also differs between countries and healthcare systems. Hence, healthcare consumption and mechanisms of healthcare seeking behaviour in the IBS population is still poorly understood and updated knowledge is needed.

To address this issue, we used a large population-based sample from three English-speaking countries¹⁶ in order to identify IBS subjects according to the Rome IV criteria with the aims of (1) describing healthcare utilization in the IBS population compared to non-IBS controls, and to (2) identify factors associated with healthcare seeking amongst IBS subjects.

METHODS

Study design and data collection

Representative nationwide general population samples in the United States (US), Canada and United Kingdom (UK) were identified by a global market survey company, Qualtrics Inc. (Provo, Utah, United States). Quota-based sampling was used to achieve pre-defined and comparable distributions in all three countries in regard to sex (50%:50%), age (40% aged 19–39 years, 40% aged 40–64 years, and 20% aged >65 years) and education level (\leq 30% with >16 years of formal education). The sample size was based on the intention to

Key summary

Summarise the established knowledge on this subject

- Irritable bowel syndrome (IBS) is associated with impaired functioning in both work and personal activities
- IBS is associated with high healthcare use and costs

What are the significant and/or new findings of this study?

- Updated knowledge regarding the extent of healthcare utilization and associated demographics in a general IBS population defined by the Rome IV criteria
- Bloating, increasing age and having healthcare insurance or access to free public healthcare are independently associated with healthcare utilization in the IBS population
- It is more common for female IBS consulters with abdominal pain as a prominent symptom to receive a formal IBS diagnosis

capture 100–200 cases per country of the main functional GI disorders calculated by an estimated prevalence of 5%–10% per diagnosis.

Eligible participants were invited to complete an online survey on general health, with no mention of the GI context. Participants received points from Qualtrics Inc. that could be exchanged for shopping credits, but no monetary compensation or gift was issued. A personal invitation was needed to access the survey and the registered participants could only complete the survey once. Automated skip patterns and several quality assurance mechanisms were used to minimize poor data quality. Participants were required to complete each applicable question in order to move forward in the questionnaire. Participants who failed to respond consistently on at least two of three pairs of identical questions on GI symptoms presented twice in different parts of the survey were classified as inconsistent responders, and their data were not included in the data analysis.

Further details of the survey methodology can be found elsewhere.¹⁶

Questionnaires

The survey consisted of

- The validated Rome IV diagnostic questionnaire¹⁷ used to identify IBS subjects and GI symptom burden.
- Demographic questions: age, sex, ethnicity, relationship status and home district.
- The Physical Health Questionnaire (PHQ)-12¹⁸ used to determine presence, severity and number of extra-intestinal symptoms.
- The Short Form (SF)-8 questionnaire¹⁹ used to assess health-related quality of life.

- Medical history, healthcare utilization and other healthcare related questions enquiring for:
 - Doctor-diagnosed GI diseases, including celiac disease, inflammatory bowel disease, peptic ulcer, diverticulitis, GI cancer and functional GI disorders including IBS.
 - Doctor visits, including type of specialist seen, related to potential GI problems.
 - Doctor visits related to any health problem.
 - History of abdominal surgeries, including cholecystectomy, hysterectomy, appendectomy, bowel resection and other pelvic or abdominal surgeries.
 - Regular (\geq once/week) use of medications for constipation, diarrhoea, nausea, heartburn or to reduce stomach acid, pain (prescribed or over the counter but without any specification of the type of pain treated), gas or bloating, anxiety or depression.
 - Healthcare insurance status.

Definitions

IBS subjects and non-IBS controls

IBS subjects: Participants fulfilling Rome IV criteria for IBS² without self-reported history of doctor-diagnosed organic GI diseases or history of bowel resection. The excluded organic diseases were decided a priori and included inflammatory bowel disease, celiac disease, GI cancer, peptic ulcer and diverticulitis.

Non-IBS controls: all remaining subjects, including those meeting Rome IV criteria for other functional GI disorders than IBS, and those with organic GI disease even if fulfilling Rome IV criteria for IBS.

IBS consulters and IBS non-consulters

IBS consulters: IBS subjects reporting having consulted a doctor for a GI problem.

IBS non-consulters: IBS subjects without history of doctor consultation for a GI problem.

Diagnosed and undiagnosed IBS consulters

Diagnosed IBS consulters: IBS consulters reporting having been diagnosed with IBS by a doctor.

Undiagnosed IBS consulters: IBS consulters, without information about being diagnosed with IBS by a doctor.

See Figure 1 for overview of the study cohort and subgroups.

Statistical analyses

IBM SPSS Statistics version 22.0 (SPSS Inc. Chicago) was used for statistical analysis. Due to the survey methodology, there were no

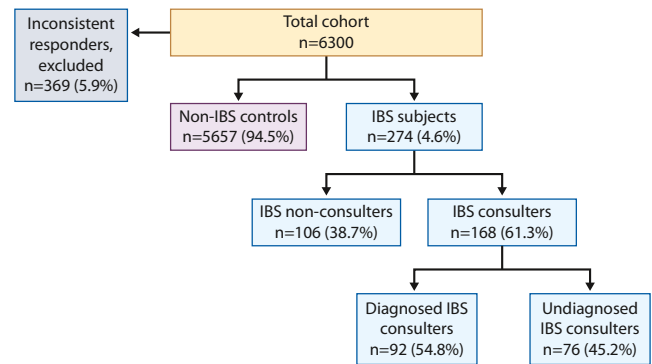


FIGURE 1 Schematic overview of the study cohort and the IBS subgroups used for comparisons. A total of 4.6% of the cohort fulfilled Rome IV criteria for IBS (IBS subjects) and a majority of them reported having consulted a doctor for a gastrointestinal problem (IBS consulter). Of the IBS consulters, 55% had also been diagnosed with IBS by a doctor (Diagnosed IBS consulters)

missing data. Statistical significance was set at a p -value <0.05 , all confidence intervals (CI) were 95%.

Demographics, symptom burden and overall healthcare utilization was compared between IBS subjects and non-IBS controls, IBS consulters and IBS non-consulters as well as between diagnosed and undiagnosed IBS consulters. Chi-square test was used to compare categorical variables, and results presented as absolute numbers and percent. To meet test criteria and ensure relevant group comparisons, dichotomized groups were created as follows; population size where the subjects live defined by either more or less than 50,000 inhabitants, relationship status as “In a relationship” or “Not in a relationship”, frequency of bloating as <3 times/month or ≥ 3 times/month, frequency of abdominal pain as <3 times/week or ≥ 3 times/week, frequency of doctor visits as ≤ 1 visit/year or >1 visit/year, and having healthcare insurance or access to free public health care as “yes” or “no”. Continuous variables were analysed with Students T -tests and presented as mean values along with standard deviations.

Logistic regression analysis was performed to identify factors independently associated with being an IBS consulter versus IBS non-consulter. Variables included in the regression analysis were either decided prior to data analysis based on empirical assumptions or statistical significance in the univariate analysis. Among them, health insurance status was included as it differs in the three countries and is expected to impact consulting behavior, and the mental component score of SF-8 as this is the only variable that can be used to assess the potential impact of psychiatric distress on consulting behavior. Multicollinearity can cause unstable coefficient estimates which leads to inaccurate odds ratios of predictor variables. In the current analysis, all predictor variables were found to have low (<3) variance inflation factor, indicating that multicollinearity was not of concern.

Results from the logistic regression analysis are presented as adjusted odds ratios (AOR) with 95% CI.

Ethics

The Institutional Review Board at the University of North Carolina, United States reviewed the study, and decided that ethical approval was not needed as the survey was anonymous.

RESULTS

General characteristics of the cohort

A total of 6,300 subjects were recruited for participation, 2,100 from each country. Of these, 369 (5.9%) were identified as inconsistent responders leaving 5,931 subjects, equally distributed across US, Canada and UK, for analysis. The mean age of the entire cohort was 47.4 (17.1) years; 2,918 (49.2%) were females and 4,244 (71.5%) of white race. See Figure 1 and Table 1.

Characteristics of the IBS cohort

General characteristics

A total of 274 (4.6%) subjects in the sample were classified as IBS subjects after excluding 67 individuals that reported organic GI disease or history of bowel resection. The remaining 5,657 (95.3%) subjects were classified as non-IBS controls. Of the IBS subjects, 168 (61.3%) were identified as IBS consulters and of those 92 (54.8%) were classified as diagnosed IBS consulters. The proportion of diagnosed IBS consulters was larger in the UK compared to the other countries, but the proportion of IBS subjects and IBS consulters was similar across all three countries. See Figure 1 and Table 1 for an overview of the study cohort.

Demographics

IBS subjects were younger and predominantly female compared to the non-IBS controls. IBS consulters were older than IBS non-consulters, but diagnosed and undiagnosed IBS consulters were of similar age. IBS consulters and IBS non-consulters had similar sex distribution, whereas diagnosed IBS consulters had greater female predominance compared to undiagnosed IBS consulters. Being an undiagnosed IBS consulter was most common in the USA and least common in the UK. Ethnicity and IBS subtype was similar across all comparisons. See Table 1 for details.

Gastrointestinal and non-gastrointestinal symptom burden

IBS subjects more frequently rated abdominal pain as their most bothersome GI symptom and had significantly more frequent GI

symptoms than non-IBS controls. IBS subjects also had an excess of non-GI symptoms, as seen in both the sum scores and the absolute number of somatic symptoms on the PHQ-12 questionnaire (Table 2).

IBS consulters reported frequent bloating more commonly than IBS non-consulters, but presence or frequency of abdominal pain was not found to be related to consultation status, nor was non-GI symptom burden. Finally, diagnosed IBS consulters more commonly rated abdominal pain as their most bothersome symptom, whereas frequency of abdominal pain or bloating and number of non-GI symptoms did not differ from undiagnosed consulters. See Figures 2 and 3 for details on GI symptom burden and Table 2 for non-GI symptom burden.

Health-related quality of life

The general health-related quality of life on the SF-8 was impaired in IBS subjects compared to non-IBS controls. IBS consulters had lower physical quality of life scores than IBS non-consulters, while the mental quality of life scores did not differ between those groups. Diagnosed IBS consulters reported better mental quality of life than undiagnosed consulters, but similar overall and physical quality of life. Table 2 summarizes all measures of health-related quality of life.

Healthcare utilization

Compared to non-IBS controls, IBS subjects more commonly reported having consulted a doctor for a GI problem, and also reported visiting doctors more frequently for any reason. Consultations about GI problems were most commonly with general practitioners/family doctors or gastroenterologists. The overall rate of abdominal surgery and medication utilization was greater among IBS subjects compared to non-IBS controls; all types of abdominal surgery that was surveyed except for appendectomy were more prevalent in IBS subjects, as was the use of analgesics, GI-relevant medications and psychotropics (Table 3).

IBS consulters and IBS non-consulters reported similar frequency of doctor visits for any health reason. They also reported similar rates of cholecystectomy, appendectomy and unspecified pelvic or abdominal surgery, as well as utilization of anxiolytics, antidepressants and over the counter analgesics. However, the overall rate of abdominal surgery was increased among IBS consulters, which was mainly due to the significantly higher rate of hysterectomy compared to IBS non-consulters. Furthermore, IBS consulters more commonly reported regular use of medications for constipation, diarrhoea, acid suppression and gas/bloating, and increased use of prescribed analgesics and antidepressants, compared to IBS non-consulters. Diagnosed and undiagnosed IBS consulters reported similar frequency of overall doctor visits and abdominal surgeries, as well as of all types of medications used regularly. See Table 3 for details on health care consumption.

TABLE 1 Demographic overview of the study cohort

	IBS subjects	Non-IBS controls	P-value	IBS consulters	IBS non-consulters	P-value	Diagnosed IBS consulters	Undiagnosed IBS consulters	P-value
Total	274 (4.6)	5657 (94.5)		168 (61.3)	106 (38.7)		92 (54.8)	76 (45.2)	
Mean age (SD)	43.5 (14.2)	47.6 (17.2)	p < 0.001	45.7 (14.3)	40.1 (13.2)	p < 0.001	45.5 (14.5)	46 (14)	0.79
Female n (%)	177 (64.6)	2741 (48.5)	p < 0.001	104 (61.9)	73 (68.9)	0.24	64 (69.5)	40 (52.6)	0.02
Country, n (%)			0.95			0.82			0.01
USA	92 (4.7)	1857 (95.3)		55 (59.8)	37 (40.2)		23 (25)	32 (35.8)	
Canada	90 (4.5)	1898 (95.5)		57 (63.3)	33 (36.7)		30 (33.3)	27 (30)	
U.K	92 (4.6)	1902 (95.4)		56 (60.8)	36 (39.1)		39 (42.4)	17 (18.5)	
Relationship status, n (%)			0.19			0.99			0.10
Not in a relationship	111 (40.5)	2518 (44.5)		68 (40.5)	43 (40.6)		32 (34.8)	36 (47.4)	
Married or cohabiting	163 (59.5)	2139 (55.5)		100 (59.5)	63 (59.4)		60 (65.2)	40 (52.6)	
Home district, n (%)			0.51			0.70			0.50
Urban (>50.000 inhabitants)	141 (51.1)	3026 (53.5)		88 (52.4)	53 (50)		46 (50)	34 (44.7)	
(<50.000 inhabitants)	133 (48.5)	2631 (46.5)		80 (47.6)	53 (50)		46 (50)	42 (55.3)	
Ethnicity, n (%)			0.07			0.46			0.27
White/caucasian	197 (71.9)	4074 (72)		121 (72)	76 (71.7)		69 (75)	52 (68.4)	
Non white/caucasian	42 (15.3)	1063 (18.7)		23 (13.7)	19 (17.9)		9 (9.8)	14 (18.4)	
Not disclosed	35 (12.8)	520 (9.2)		24 (14.3)	11 (10.4)		14 (15.2)	10 (13.2)	
IBS subtype, n (%)						0.11			0.34
IBS-C	78 (28.5)	N/A		46 (27.4)	32 (30.2)		24 (26.1)	22 (28.9)	
IBS-D	96 (35)	N/A		61 (36.3)	35 (33)		33 (35.9)	28 (36.8)	
IBS-M	85 (31)	N/A		56 (33.3)	29 (27.4)		34 (37)	22 (28.9)	
IBS-U	15 (5.5)	N/A		5 (3)	10 (9.4)		1 (1)	4 (5.3)	
At least partial health care benefits n (%)									
USA	77 (83.7)	1643 (88.5)	0.17	51 (92.7)	26 (70.3)	0.004	21 (91.3)	30 (93.8)	0.73
Canada	89 (98.9)	1842 (97)	0.31	56 (98.2)	33 (100)	0.44	29 (96.7)	27 (100)	0.34
UK	92 (100)	1862 (97.9)	0.16	56 (100)	36 (100)	N/A	39 (100)	17 (100)	N/A

Note: Significant differences in bold.

Abbreviation: IBS, irritable bowel syndrome.

Factors associated with consulting behaviour in IBS subjects

In a logistic regression analysis aimed at identifying factors independently associated with consulting for IBS, the following variables were included in the model: age, gender, country, healthcare insurance status, ethnicity, relationship status, most bothersome GI symptom, frequency of abdominal bloating, frequency of abdominal pain, IBS subtype, PHQ-12 score and SF-8 mental component score. We found

that the strongest independent predictor for being an IBS consulter was having healthcare insurance or access to free public healthcare, followed by high frequency of bloating and increasing age (Table 4).

Discussion

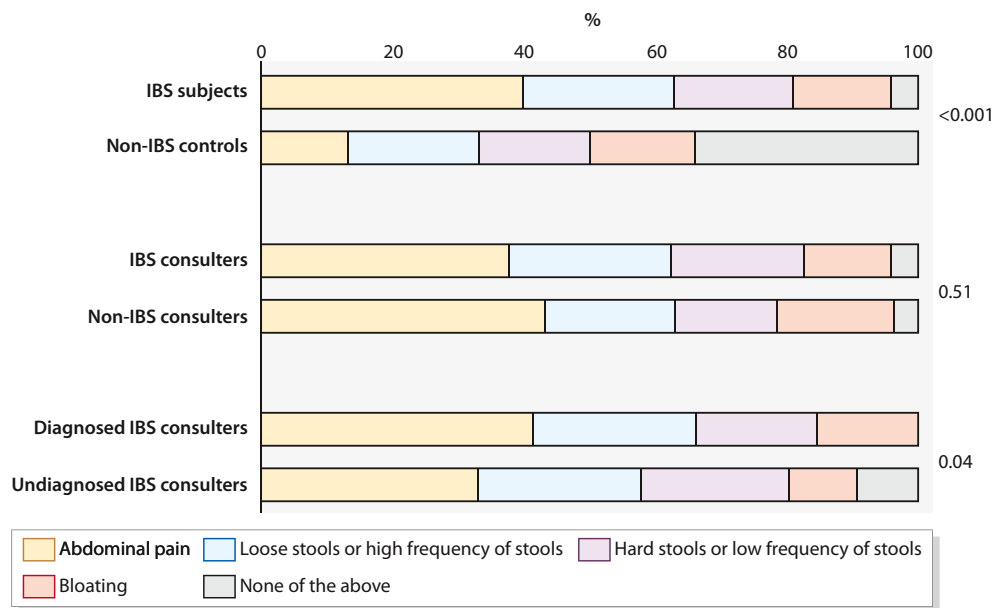
In this study we have characterized healthcare utilization and identified factors of importance for seeking healthcare among subjects

TABLE 2 Extra-intestinal symptom burden and health related quality of life of the study cohort

	IBS subjects	Non-IBS controls	P-value	IBS consulters	IBS non-consulters	P-value	Diagnosed IBS consulters	Undiagnosed IBS consulters	P-value
Total n (%)	274 (4.6)	5657 (94.5)		168 (51.3)	106 (38.7)		92 (54.8)	76 (45.2)	
PHQ-12 mean (SD)									
Score	9.7 (4.4)	4.5 (3.6)	<0.001	9.7 (4.4)	9.6 (4.3)	0.78	9.3 (4.3)	10.3 (4.5)	0.17
No of somatic symptoms, T-test.	3 (2.3)	0.9 (1.4)	<0.001	3 (2.3)	2.9 (2.3)	0.82	2.8 (2.3)	3.2 (2.4)	0.32
SF-8 mean (SD)									
PCS	39 (11)	50 (9)	<0.001	38 (11)	41 (11)	0.02	38 (11)	38 (11)	0.65
MCS	39 (12)	50 (11)	<0.001	39 (11)	37 (13)	0.16	41 (11)	38 (10)	0.04
Total SF-score	234 (85)	393 (49)	<0.001	320 (56)	326 (60)	0.44	326 (60)	314 (52)	0.14

Note: Significant differences in bold.

Abbreviations: IBS, irritable bowel syndrome; MCS, Mental component score; PCS, Physical component score; PHQ-12, Patient Health Questionnaire-12 (Extra-intestinal symptoms); SF-8, Short Form-8 (Health Related Quality of Life).

**FIGURE 2** Bar charts displaying the most bothersome gastrointestinal symptom in all groups

with IBS in a general population cohort. IBS was associated with increased healthcare utilization, and the majority of IBS subjects had consulted a physician for GI-related problems. However, healthcare utilization in IBS consulters and IBS non-consulters were similar for health problems in general. Having healthcare insurance or free public healthcare, more frequent bloating and increasing age were independently associated with healthcare seeking among IBS subjects.

Our report of 61% of IBS subjects having had a doctor appointment due to a GI problem is within the range previously reported based on other IBS definitions.⁹⁻¹¹ Two of our findings regarding IBS consulters contradict common clinical perception; we found that IBS consulters were older compared to IBS non-consulters and that no relative female predominance was present amongst IBS consulters.

Interestingly, the relative female predominance reappeared in the subset of consulters who had received a clinical IBS diagnosis compared to the undiagnosed IBS consulters. This has not been reported before and might indicate a sex-dependent discrepancy in physicians' diagnosis of IBS. Furthermore, diagnosed IBS consulters more commonly reported abdominal pain as the most bothersome symptom, while neither presence nor frequency of abdominal pain were found to be associated to consulting behaviour amongst IBS subjects. These findings suggest that doctors are more likely to diagnose IBS if abdominal pain is prominent in the symptom presentation. By considering these discrepancies regarding the risk for IBS consulters of male sex and those where bloating is most bothersome to not receive an IBS diagnosis, doctors might improve their diagnostic accuracy and adapt treatment for IBS patients more effectively.

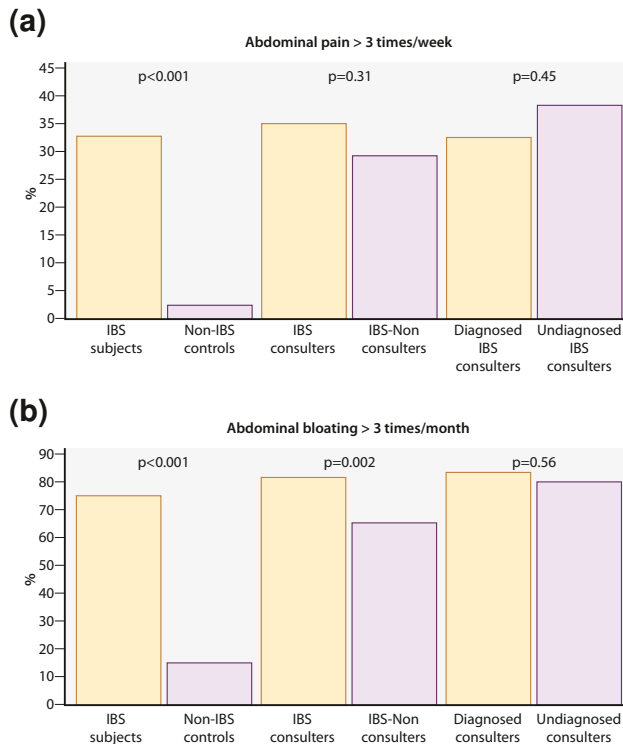


FIGURE 3 (a) Bar chart showing abdominal pain more than 3 times/week. (b) Percent of IBS subjects with abdominal bloating more than 3 times/month

IBS subjects in our sample had poorer quality of life compared to non-IBS controls, which has been repeatedly shown.^{3,20,21} Interestingly, we found that IBS consulters scored lower on the physical, but not mental, quality of life components compared with the IBS non-consulters. This is in conflict with results from previous studies suggesting psychological distress to be an important factor for healthcare consumption.^{11,13,14,22} However, a major limitation with the cross-sectional design of our study is that it does not allow for causation analysis and cannot assess the potential bias introduced by the impact of consultations or treatments. Receiving a diagnosis, structured information, diet advice and treatment with medications, might have changed symptoms in the IBS-consulters group²³ in a way that our study cannot correct for, for example reduced the impact of abdominal pain or other GI symptoms asked for by the survey.

Our study clearly shows that fulfilling diagnostic criteria for IBS is associated with increased utilization of medications. This is expected for medications aiming at relieving IBS symptoms based on treatment recommendations, such as constipation and diarrhoea.⁶ The increased use of antidepressants and anxiolytics are also expected, both as treatment of IBS,²⁴ and for comorbid depression and anxiety,²⁵ while the increased use of antiemetics and acid-suppressive medications may partly be explained by the significant overlap with other functional GI disorders in this population.¹⁶ Added to this, self-medication is not uncommon in IBS and dyspepsia.²⁶ The increased use of medication for bloating in the IBS

consulters group probably reflects how common and bothersome this symptom is. As high frequency of bloating is also associated with being an IBS consulters, we believe that bloating needs to be actively addressed in subjects with IBS,²⁷ even though it is not a part of the Rome IV diagnostic criteria for the disorder.²⁸ Moreover, the excess use of analgesics in IBS subjects is worrying, particularly as it was more pronounced in the IBS consulters group. This finding can partly be explained by pain related to comorbid diagnoses associated with IBS,²⁹ such as fibromyalgia and endometriosis.³⁰ Another possible explanation is that the increased use of analgesics could be a result of doctors' frustration in treating abdominal pain in IBS,³¹ or unsatisfactory knowledge of other, more effective treatments. This indicates a need for educational efforts regarding effective pharmacologic and non-pharmacologic treatment options for IBS-related pain.^{6,32}

The rate of abdominal surgical interventions in the IBS population was almost double that of the non-IBS controls. This has been reported previously^{33–35} and theories proposed in the past to explain this excess of surgeries in IBS have included misdiagnosis and post-operative IBS,^{33–35} explanations that a cross-sectional study design is unable to prove. The increase in hysterectomies that we found in the IBS population can be expected and probably reflects the higher female prevalence in IBS, and the similar rates of appendectomies in the IBS subjects and non-IBS controls might reflect a greater awareness amongst physicians and better trust in non-invasive diagnostic tools in this specific surgical area. However, the increased rate of cholecystectomies in the younger IBS population, compared to non-IBS controls, is considered to be relevant as increasing age otherwise is a risk factor for this surgical intervention. Still, our results highlight a need for continued awareness of this issue in order to avoid unnecessary surgical interventions in IBS.

A key strength of our study is that it was conducted with a validated methodology in a large, representative, population-based sample.¹⁶ Moreover, survey participants were not aware of the GI focus of the survey when they consented to participate, minimizing the risk of inclusion bias. Built-in data quality assurance mechanisms further reduced the risk for poor data and eliminated the problem of missing data. All of these factors contribute to the generalizability of our results. Our findings that subjects fulfilling Rome IV criteria for IBS were predominantly female and of younger age,² that they suffered from both excess GI and non-GI symptoms¹⁸ and had a high burden of non-GI symptoms, all support the position that we have indeed identified a relevant IBS population. As such, we believe that our study presents a novel, comprehensive and accurate analysis of healthcare utilization and factors driving health care seeking behaviour in IBS.

Nevertheless, our study has limitations. First, the Rome IV diagnostic questionnaire was not translated to all languages used by citizens of the three countries at the time of this study, limiting us to the English-speaking populations. This means, for example, that some native French-speaking people in Canada were unable to participate. Second, about one third of subjects fulfilling criteria for

TABLE 3 Health care utilization and use of medication

	IBS subjects	Non-IBS controls	P-value	IBS consulters	IBS non-consulters	P-value	Diagnosed IBS consulters	Undiagnosed IBS consulters	P-value
Total n (%)	274 (4.6)	5657 (94.5)		168 (51.3)	106 (38.7)		92 (54.8)	76 (45.2)	
Ever visited any doctor for bowel related problems	168 (61.3)	1203 (21.3)	<0.001	168 (100)	-	N/A	92 (100)	76 (100)	N/A
Frequency of general doctor visits									
≥1 visit per year	213 (77.7)	3194 (56.5)	<0.001	134 (79.8)	79 (74.5)	0.31	77 (83.7)	57 (75)	0.16
Specialist consultations for GI problems, n (%)									
General practitioner/family doctor	153 (55.8)	1081 (19.1)	<0.001	153 (91.1)	-	N/A	85 (92.4)	68 (89.5)	0.51
Gastroenterologist	84 (30.7)	488 (8.6)	<0.001	84 (50)	-	N/A	49 (53.3)	35 (46.1)	0.35
Gynecologist	15 (5.5)	74 (1.3)	<0.001	15 (0.09)	-	N/A	11 (12)	4 (5.3)	0.13
Surgeon	20 (7.3)	157 (2.8)	<0.001	20 (11.9)	-	N/A	10 (10.9)	10 (13.2)	0.65
Abdominal surgery, n (%)									
Cholecystectomy	41 (15)	430 (7.6)	<0.001	29 (17.3)	13 (12.3)	0.26	16 (17.4)	13 (17.1)	0.96
Appendectomy	30 (10.9)	573 (10.1)	0.66	22 (13.1)	8 (7.5)	0.15	12 (14.1)	9 (11.8)	0.66
Hysterectomy	26 (9.5)	346 (6.1)	0.03	21 (12.5)	5 (4.7)	0.03	11 (12)	10 (13.2)	0.81
Other (unspecified) abdominal or pelvic surgery	45 (16.4)	415 (7.3)	<0.001	33 (19.6)	12 (11.3)	0.07	21 (22.8)	12 (15.8)	0.25
At least one of the above	112 (40.9)	1337 (23.6)	<0.001	79 (47)	33 (31.1)	<0.001	49 (53.3)	30 (39.5)	0.08
Regular drug use, n (%)									
Medication for constipation	65 (23.7)	296 (5.2)	<0.001	55 (32.7)	10 (9.4)	<0.001	35 (38)	20 (26.3)	0.11
Medication for diarrhea	56 (20.4)	178 (3.2)	<0.001	49 (29.2)	7 (6.6)	<0.001	30 (32.6)	19 (25)	0.28
Medication for nausea	47 (17.2)	158 (2.8)	<0.001	33 (19.6)	14 (13.2)	0.17	18 (19.6)	15 (19.7)	0.98
Medication for heartburn or stomach acid	135 (49.3)	1020 (18)	<0.001	96 (57.1)	39 (36.8)	<0.001	52 (56.5)	44 (57.9)	0.86
Medication for pain, prescribed	105 (38.3)	809 (14.3)	<0.001	77 (45.8)	28 (26.4)	<0.001	45 (48.9)	32 (42.1)	0.38
Medication for pain, not prescribed	104 (38)	998 (17.6)	<0.001	61 (36.3)	43 (40.6)	0.48	32 (34.8)	29 (38.2)	0.65
Medication for gas/bloating	60 (21.9)	266 (4.7)	<0.001	49 (29.2)	11 (10.4)	<0.001	30 (32.6)	19 (25)	0.28
Medication for anxiety	83 (30.3)	586 (10.4)	<0.001	58 (34.5)	25 (23.6)	0.06	34 (37)	24 (31.6)	0.47
Medication for depression	97 (35.4)	696 (12.3)	<0.001	68 (40.5)	29 (27.4)	0.03	37 (40.2)	31 (40.8)	0.94
GI-related medication (constipation, diarrhea, acid, gas/bloating)	171 (62.4)	1307 (23.1)	<0.001	124 (73.8)	47 (44.3)	<0.001	25 (27.2)	19 (25)	0.75

Note: Significant differences in bold.

Abbreviations: GI, gastrointestinal; IBS, irritable bowel syndrome.

TABLE 4 Multivariate analysis evaluating independent factors associated with consulting a doctor for IBS

	AOR (95% CI)	P value
Increasing age	1.02 (1.01–1.05)	0.02
Female	0.77 (0.42–1.40)	0.39
White race	1.44 (0.61–3.42)	0.39
Marital status	0.99 (0.57–1.73)	0.97
Country		
United States	1	
Canda	0.83 (0.39–1.79)	0.64
United Kingdom	0.79 (0.38–1.66)	0.53
IBS subtype		
IBS-C	1	
IBS-D	1.24 (0.58–2.66)	0.58
IBS-M	1.55 (0.75–3.22)	0.24
IBS-U	0.47 (0.13–1.72)	0.25
Health insurance status		
Having health care insurance or access to free public health care	4.49 (1.31–15.44)	0.02
Most bothersome symptom		
Abdominal pain	1	
Watery/mushy stools	1.26 (0.59–2.67)	0.55
Hard stools	1.46 (0.65–3.29)	0.37
Abdominal bloating	0.80 (0.36–1.78)	0.59
None of the above	1.59 (0.38–6.62)	0.53
GI symptom frequency		
Abdominal pain >3 times/week	1.17 (0.64–2.14)	0.61
Abdominal bloating >3 times/month	2.65 (1.42–4.93)	<0.01
Non-GI symptom burden		
Non-GI symptom burden	1.04 (0.97–1.12)	0.27
SF-8 mental component score	1.02 (0.99–1.05)	0.08

Note: Significant differences in bold.

Abbreviations: AOR, adjusted odds ratios; CI, confidence interval; GI, gastrointestinal; IBS, irritable bowel syndrome.

IBS reported that they had never seen a doctor for their GI health issues, meaning that their GI symptoms had not been clinically evaluated for possible alternative causes. Additionally, healthcare insurance systems vary from country to country, and Canada and the UK are supposed to have universal healthcare. Hence, health insurance status was included in the logistic regression analysis and its expected impact of insurance status on consulting behavior was confirmed.

In summary, IBS subjects have increased healthcare utilization, are more likely to use medications regularly, and undergo abdominal surgeries more frequently than other people. IBS consulters are more likely to be older and have increased frequency of bloating than other people with IBS, whilst IBS consulters that have also been formally

diagnosed with IBS are predominantly female and more bothered by abdominal pain. Based on these findings, we suggest that greater clinical awareness is warranted regarding potentially unnecessary medical and surgical treatment in IBS subjects, as well as regarding possible sex-dependent bias in IBS diagnosis in clinical practice.

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DATA AVAILABILITY STATEMENT

Data available on request from the authors.

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