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REVIEW

The epidemiology of irritable bowel syndrome

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Abstract: Irritable bowel syndrome (IBS) is a functional condition of the bowel that is diagnosed using clinical criteria. This paper discusses the nature of the diagnostic process for IBS and how this impacts epidemiological measurements. Depending on the diagnostic criteria employed, IBS affects around 11% of the population globally. Around 30% of people who experience the symptoms of IBS will consult physicians for their IBS symptoms. These people do not have significantly different abdominal symptoms to those who do not consult, but they do have greater levels of anxiety and lower quality of life. Internationally, there is a female predominance in the prevalence of IBS. There is 25% less IBS diagnosed in those over 50 years and there is no association with socioeconomic status. IBS aggregates within families and the genetic and sociological factors potentially underlying this are reviewed. Patients diagnosed with IBS are highly likely to have other functional disease and have more surgery than the general population. There is no evidence that IBS is associated with an increased mortality risk. The epidemiological evidence surrounding these aspects of the natural history is discussed.

Keywords: irritable bowel syndrome, epidemiology, prevalence, mortality, natural history

Introduction

The epidemiology of any condition is an expansive topic, covering many subjects that individually could warrant devoted review articles. Irritable bowel syndrome (IBS) is no different. The intention of this review is to provide a brief overview of the fundamental issues of epidemiological interest relating to IBS. We discuss the diagnostic process and variation in how IBS is defined, how many of the population have IBS based upon these definitions, which members of the population are most likely to be affected, and discuss key aspects of the natural history, including symptom fluctuation and the association with other functional conditions.

In compiling this review, potentially relevant articles were identified through a literature search using MEDLINE and Embase of English language papers published since the first formal definition of IBS in 1978 until August 1, 2013. Medical subject headings (MeSH) used were 'irritable bowel syndrome' or 'IBS' or 'irritable colon' or 'functional bowel disease' combined with 'epidemiology' or 'incidence' or 'prevalence' or 'natural history' or 'mortality'. The references of these papers were reviewed for additional important papers not initially captured.

What is IBS?

IBS is a chronic functional disorder of the gastrointestinal system. Patients experience abdominal pain and altered bowel habit, with either predominantly diarrhea (IBS-D),

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constipation (IBS-C), or both (IBS-M). There is no definitive investigation as no biomarker has been found, so IBS is diagnosed clinically. The earliest reports describing IBS are from the turn of the 19th and 20th century.[1] At this time, diagnosis was only made by exclusion of malignant, inflammatory, or infectious disease after full investigation and "extensive unsuccessful surgeries."[2] IBS remained "frequently misdiagnosed and poorly understood"[3] into the 1970s, with the problem of unsuccessful, or unnecessary, surgery continuing.[3]

In an attempt to standardize and define IBS and reduce unnecessary surgery, Manning created the first set of formal criteria that allowed IBS to be positively diagnosed without the need for extensive investigations to exclude other diagnoses. These criteria were developed through expert consensus to create the Rome criteria, now in their third iteration.[4] The Rome criteria also recommend that IBS should be a positive diagnosis but are more restrictive than the Manning criteria. When assessing the epidemiology of IBS, the diagnostic criteria employed are important to consider as they reflect how cases are ascertained and the differences between studies and over time. Most studies use either the Manning, Rome II, or Rome III criteria, and the variation between these can be seen in Table 1. It is argued that the Rome criteria are only useful for clinical trials and not for clinical practice. The criteria have been compiled by secondary and tertiary care specialists who undoubtedly see a different population of patients than are seen in primary care where the criteria are recommended to be implemented. Clinicians frequently use other clinical findings (such as bloating and psychological stress) to assist in diagnosing IBS and do not adhere to the criteria.[5,6] Some even suggest that attempts to sub-type functional gastrointestinal disease are arbitrary and IBS should remain a diagnosis of exclusion.[6–8] International best practice guidelines disagree with this stance and promote positive diagnosis using the Rome criteria.[9]

The validity of these diagnostic criteria has been studied; however, this has not been done using conventional measurement of sensitivity and specificity in general population samples because there is no gold standard to allow independent confirmation of diagnosis, such as a biomarker. Instead estimations of specificity have been made among those with organic gastrointestinal disease, and sensitivity amongst cases who have already presented and been diagnosed (potentially an atypical minority). All of these criteria have modest specificity to diagnose IBS in those with organic gastrointestinal disease of about 0.7.[10] This reflects the fact that the symptoms experienced in IBS are common to other gastrointestinal conditions. Specificity is increased to 0.9 if patients with red flag symptoms such as anemia, weight loss, and rectal bleeding (present in just 3% of patients)[11] are more extensively investigated and IBS is diagnosed by exclusion.[10] Sensitivity across the criteria ranges from 0.4 to 0.9 depending on the experience of the clinician,[10] possibly reflecting variation in confidence to use criteria for positive diagnosis.

How much IBS is there?

As outlined above, there is no gold standard case definition of IBS. Diagnostic criteria have not been standardized over time and they have a large margin of error in their application.[5,8,15] The definition of cases in epidemiological studies is therefore difficult and there may be limited opportunities for ascertainment of cases. There is no specific or standardized therapy, with many of the preparations available over the counter and some patients not requiring any medication,[15,16] so prescription data have limited use. Few patients will be admitted to hospital with IBS or diagnosed during an admission,[17] and IBS is not considered a cause of death so these data are also not useful to define cases. The methods chosen to define and ascertain cases will clearly affect the number of cases found.

Table 1 Comparison of the Manning and Rome diagnostic criteria frequently used in epidemiological studies for case ascertainment

Manning (1978)[12]	Rome I (1989)[13]	Rome II (1999)[14]	Rome III (2006)[4]
2 or more of the following symptoms: Abdominal distension Pain relief with defecation Frequent stools with pain Looser stools with pain Passage of mucus Sensation of incomplete evacuation	At least 3 months of continuous or recurrent abdominal pain: Relieved with defecation or Associated with change in stool consistency With at least 2 of the following on at least 25% of days: Altered stool frequency Altered stool form Altered stool passage Passage of mucus Bloating or abdominal distension	At least 12 weeks in past 12 months of continuous or recurrent abdominal pain or discomfort With at least 2 of the following: Relief with defecation Altered stool frequency Altered stool form Onset of symptoms more than 12 months before diagnosis	At least 3 days per month in past 12 weeks of continuous or recurrent abdominal pain or discomfort With at least 2 of the following: Relief with defecation Altered stool frequency Altered stool form Onset of symptoms more than 6 months before diagnosis

Incidence

Symptoms associated with IBS are commonly experienced within the population, it has an insidious onset, and frequently does not result in medical care.[16,18] Consequently, there is discrepancy between incidence of the first occurrence of symptoms, which occur within the community, and the first diagnosis of IBS, which will occur after visiting a physician.[16] Consequently, few studies calculate the incidence of IBS.

One study in the USA using first occurrence of IBS symptoms within the community estimated the incidence of new IBS by conducting two population cohort surveys 1 year apart. Of patients with no IBS symptoms and no diagnosis of IBS in the baseline survey, 9% had developed symptoms over the year, an incidence rate of 67 per 1,000 person-years.[19] Studies that opt for defining cases as first diagnosis by a physician produce more conservative estimates of around two per 1,000 person years.[20–22]

Global prevalence

Prevalence estimates for IBS vary greatly internationally, both within and between countries, as shown in Figure 1 and Table 2.

Most studies addressing prevalence of IBS are community surveys, with the majority from Europe, Southeast Asia, and North America. Often, postal questionnaires or telephone interviews invite individuals to self-report symptoms, and these responses are then assessed by investigators according to one set of diagnostic criteria. This method reflects the underlying burden of symptoms consistent with a diagnosis of IBS. Other studies ask participants if they have ever received a diagnosis of IBS, capturing those who have sought medical advice for their symptoms. The prevalence of IBS within the community is between 10% and 25%.[20,43,44,57,58,62–65] Meta-analysis shows a pooled estimate of international IBS prevalence of 11.2% (95% confidence interval [CI] 9.8–12.8),[38] with variation by geographic region; the lowest occurring in South Asia (7.0%) and the highest in South America (21.0%).[38]

Considerable heterogeneity exists between studies.[38] Some of this is explained through the differences in study methodology and sampling, as described above, and the use of different diagnostic criteria to define IBS, rather than a biological marker, may also account for some of the variation. The Manning criteria account for the highest reported prevalence,[13,47] whilst the Rome iterations are associated with lower estimates of prevalence that are similar across the iterations.[13] Meta-analysis has shown that prevalence does not vary significantly according to the calendar year in which studies are conducted.[38]

It is plausible that the underlying prevalence of symptoms in communities internationally is the same, around 11%, and the variations reflect differences in access to health care[66,67] and acceptability of a diagnosis, both to the physician making the diagnosis and to the patient in receiving and believing it.[5,68] Significant stigma is associated with receiving a diagnosis of a functional disorder as well as seeking health care for IBS

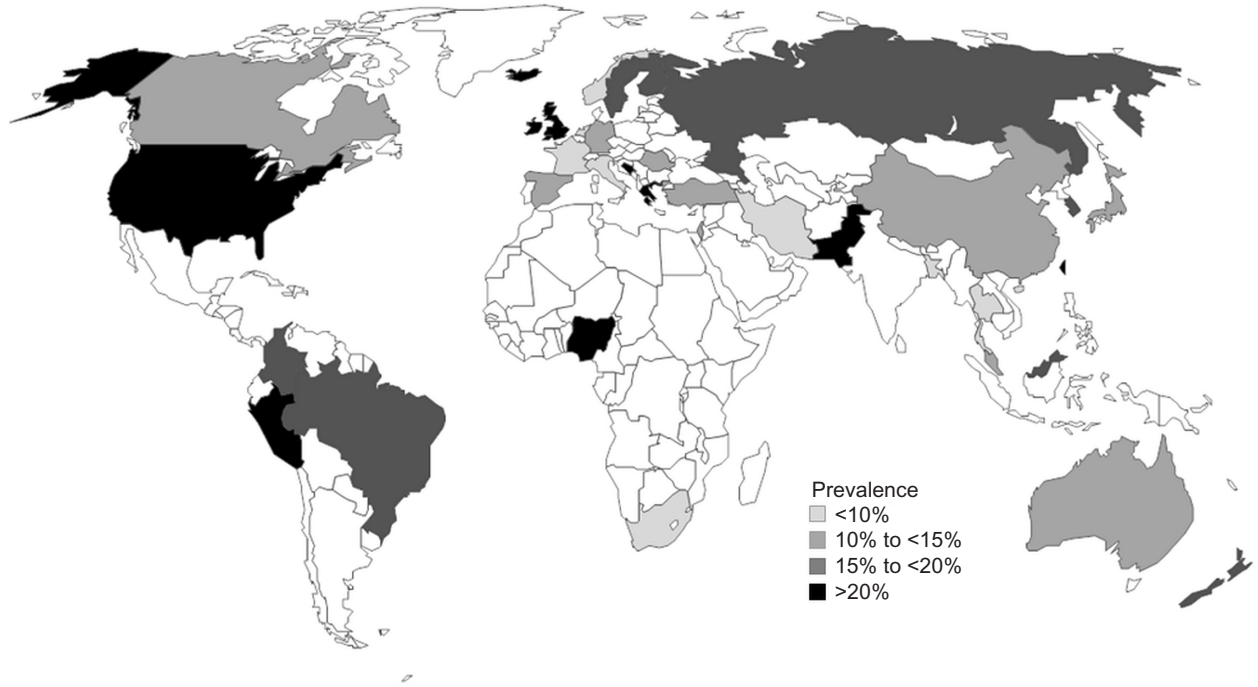

Figure 1 Worldwide prevalence of irritable bowel syndrome, as reported by country.

Table 2 Prevalence of irritable bowel syndrome reported internationally, the highest and lowest estimated rates for each country

Country	Lowest estimated prevalence	95% CI	Highest estimated prevalence	95% CI
France	1.1[23]	NR	4.7[24]	4.36–5.04
Thailand	–	–	5.7[25]	NR
Netherlands	–	–	5.8[26]	4.0–9.0
Hong Kong	3.7[27]	2.0–5.2	6.6[28]	NR
Italy	–	–	7.2[29]	6.0–9.0
Iran	–	–	7.1[30]	6.0–13.0
South Africa	–	–	8.1[31]	NR
Norway	–	–	8.4[32]	7.9–9.4
Bangladesh	–	–	8.5[33]	7.0–10.0
Turkey	6.3[34]	NR	10.2[35]	6.0–16.0
Singapore	2.3[36]	0.8–3.9	11.0[37]	9.7–12.3
Israel	2.9[38]	NR	11.4[38]	NR
People's Republic of China	0.8[38]	NR	11.5[39]	NR
Germany	–	–	12.5[40]	10.7–14.5
Australia	4.4[41]	3.6–5.1	13.0[42]	11.0–16.0
Pakistan	–	–	13.3[43]	4.0–62.0
Canada	–	–	13.5[44]	10.2–14.0
Japan	6.1[45]	5.0–7.0	14.0[46]	NR
Spain	3.3[47]	2.1–4.9	14.1[47]	10.0–18
Romania	–	–	14.4[38]	11.9–19.0
Sweden	12.5[20]	9.0–18.0	15.0[48]	NR
South Korea	6.6[49]	2.0–11.0	15.5[50]	12.0–19.0
Malaysia	–	–	15.6[51]	13.0–18.0
Finland	5.1[52]	4.4–5.8	16.4[52]	15.0–17.2
Brazil	–	–	17.0[53]	12.0–23.0
New Zealand	3.3[54]	2.1–4.5	18.8[54]	16.3–21.3
Russia	–	–	19.0[38]	17.0–22.0
Columbia	–	–	19.9[38]	16.7–23.3
USA	3.0[55]	NR	20.4[13]	16.7–24.2
Taiwan	17.5[56]	NR	22.1[56]	NR
UK	6.1[57]	NR	21.6[58]	NR
Greece	–	–	21.4[59]	NR
Peru	15.0[38]	NR	24.0[38]	21.0–28.0
Croatia	–	–	28.2[38]	24.0–32.0
Iceland	17.2[60]	14.4–19.9	30.9[60]	28.0–33.0
Nigeria	–	–	31.6[61]	27.0–36.0

Abbreviations: CI, confidence interval; NR, not reported.

symptoms specifically.[69,70] It is therefore likely that areas where greater stigma is perceived will report lower prevalence, as will populations where symptoms are more often identified as variations of normal. Those communities in which there is higher perceived stress or lower perceived quality of life, greater potential gain from receiving a diagnosis, or fewer barriers to accessing health care will report higher prevalence.[71–74]

Prevalence in primary care

Many patients do not seek medical attention for symptoms indicative of IBS.[18] Estimates of the proportion who do attend primary care for their symptoms are between 10%[63] and 70%.[75] In the UK, estimates of the proportion who consult vary from 30%[58] to 50%.[57,62,63] Reported consultation rates of people with symptoms also vary in studies from Germany, between 10%[63] and 50%.[40] Asking individuals to recall if they have consulted a primary care physician about their symptoms shows that the proportion of patients who report they have attended primary care varies considerably by country across Europe. The highest proportion is in Italy, with 50% consulting; 30% consult in the Netherlands, 20% in Belgium, and 10% in Switzerland, France, and Spain.[63] These differences may again reflect differences in diagnostic criteria employed, perceived acceptability of symptoms, and ease of access to primary care, which varies across different health care systems. These studies are also limited by relying on individuals' recall of their behavior. Studies from the USA report more consistently that 30% of people with symptoms will consult[16,65] and, of these patients, 80% have IBS-D.[16]

There are no significant differences in gastrointestinal symptoms between those who consult and those who do not, but those who consult do report higher pain scores, greater levels of anxiety, and greater reduction in quality of life.[76,77]

Who gets IBS?

Sex

In most populations, women report more IBS symptoms than men, irrespective of the diagnostic criteria employed.[68] Rates in women are approximately 1.5- to 3-fold higher than those seen in men.[12,78,79] Internationally, the overall prevalence of IBS in women is 67% higher than in men (odds ratio 1.67 [95% CI 1.53–1.82]). This relative difference reflects an absolute difference in prevalence of just over 5% between the sexes, with a prevalence in women of 14.0% (95% CI 11.0–16.0) compared with 8.9% in men (95% CI 7.3–10.5).[80] In South Asia, South America, and Africa, rates of IBS in men are much closer to those of women, and in some cases higher. Consequently, if prevalence is stratified according to geographic region, no significant sex difference can be seen in these areas.[80] It is possible that this reflects the sex differences in access to health care and symptom normalization in these regions.[81,82] Equal proportions of men and women with symptoms seek primary care advice.[83,84]

It is likely that the differences in reported sex-specific prevalence occur for reasons similar to those discussed for overall prevalence. It is also probable that the rates reflect differences in illness behavior that motivates consulting and referral patterns rather than the underlying condition. It could

be argued that the high rate of IBS symptoms in people within the community who do not access health care is a measure of unmet need.[68] However, it could also be considered that symptoms affecting such a high proportion of the population are a variation of normal function.

Age

IBS occurs in all age groups, including children[85] and the elderly, with no difference seen in the frequency of subtypes by age.[86] However, 50% of patients with IBS report having first had symptoms before the age of 35 years,[87] and prevalence is 25% lower in those aged over 50 years than in those who are younger.[38] This would suggest that symptoms remit over time, and is contrary to the belief that IBS is a chronic lifelong condition, because, if this were the case, then prevalence should remain constant or increase with age. Patients aged over 50 years also report milder pain, but their overall quality of life is worse.[86] Those aged over 65 years are also likely to have had their symptoms for longer than 1 year before they consult, whilst those under 65 years report significantly shorter duration of symptoms.[42]

Socioeconomic status

One study suggested that IBS was associated with lower socioeconomic status,[65] a finding supported by the theory that lower income is associated with poorer health care outcomes, lower overall quality of life, and increased life stressors.[88] However, others suggest that the opposite is true and that being in a higher socioeconomic group during childhood is associated with higher prevalence of IBS.[89,90] Similarly, areas in which there is a lower proportion of people employed in manual labor have higher rates of IBS. It is suggested that this is due to the higher level of stress perceived by people working in professional and managerial roles.[91] This supports the argument that IBS is a disease of industrialization and urbanization, and that the higher rates now being reported in Asia, South America, and Africa are due to increased affluence in these regions.[92] This may be because those with higher income have greater access to health care and tendency to seek help and hence receive a diagnosis.[93] It could also reflect differing dietary choices[94] or greater internalization of stress in higher earning groups.[95]

Family studies

The relative risk of IBS is twice as high in individuals with a biological relative with IBS.[96] In twin studies, having a mother or father with IBS is an independent risk factor for an individual having IBS and a stronger predictor than having a twin with IBS.[97] Concordance in monozygotic twins (the proportion of twin pairs who both have IBS) is less than 20%,[97,98] and the association seen in familial clustering is significantly reduced when somatization is adjusted for.[99] These findings suggest heredity may be more closely linked to learned behavior than to genetic factors.[100]

What is the natural history?

Misdiagnosis

At the time of diagnosis of IBS, rates of organic lesions found on colonoscopy in patients with no red flag symptoms are no higher than seen in healthy controls, ranging from around 10%[101,102] to around 40%.[103,104] Even most patients with alarm symptoms have no organic pathology.[105]

In contrast to the endoscopy findings at diagnosis, in the period following diagnosis the rate of inflammatory bowel disease (IBD) is 9[106] to 16[21] times higher than the general population. The average time between diagnosis of IBS and IBD is 2–3 years,[106,21] suggesting that, in some, IBS symptoms are possibly early signs of IBD before lesions are visible. Colorectal cancer incidence is around 1%[21] in the first year following diagnosis of IBS, higher than in the general population. After 1 year, the rate returns to the population level.

Symptom patterns

Symptoms experienced by patients with IBS fluctuate over time. Over short periods of time, as some patients experience resolution of symptoms, others develop new ones, meaning the prevalence of symptomatic IBS remains stable over 1–2 years follow-up.[20,83,107] In the first 3 months following diagnosis, patients experience four distinct episodes of symptoms per month on average. The longest of these episodes lasts around 5 days, and most patients experience symptoms on more than half of the days.[55] However, 1 year after initial diagnosis 30%–45% of patients will have prolonged periods that are symptom free, potentially in remission.[20,108] After 10 years, 50%–70% of patients report persistent symptoms.[20,109]

In patients who do report IBS symptom resolution, 45% will subsequently experience other functional gastrointestinal symptoms.[20,110] Up to two-thirds of IBS patients experience functional dyspepsia, the prevalence of which in patients with IBS is up to seven times higher than in controls.[111–113]

If all gastrointestinal symptoms resolve, then many develop symptoms of other functional diseases.[20,114] Those with lower quality of life and higher levels of anxiety are more likely to suffer with other functional comorbid conditions.[111,115] Together with family studies proposing

consultation behavior is learnt and highly associated with somatization,[97,99,116] this suggests that IBS is one expression of an underlying tendency toward functional disease.

Co-existing functional conditions

Fibromyalgia, chronic fatigue syndrome, chronic back pain, chronic pelvic pain, chronic headache, and temporomandibular joint dysfunction exist in approximately half of all patients with IBS, and occur almost twice as often as in the general population.[78,111,118] These conditions, defined by their symptoms, have considerable overlap and their etiologies are poorly understood.[119,120] Some people feel these conditions should be considered together under the single umbrella term of 'functional somatic syndromes'.[121] Whilst these conditions do share some predisposing risk factors, the triggers for developing each condition vary.[120] Multivariate analysis supports the idea that somatic comorbidities seen in IBS are distinct disorders and not manifestations of one somatization disorder.[118] Even so, patients who have IBS and other somatic comorbidities report more severe symptoms than those patients with IBS alone.[111,115,122] In addition, over one-half of all patients with IBS report depression or anxiety,[86,115,120,123] and these patients experience more severe somatic symptoms.[124]

Surgery

Symptoms of IBS have considerable overlap with organic gastrointestinal and pelvic pathologies. Consequently, patients with IBS are at risk of undergoing unnecessary surgical procedures due to misdiagnosis.[93,125] The likelihood of having cholecystectomy is between two[126] and three[127] times as high in IBS as in the general public, and patients with IBS are almost twice as likely to have appendectomies[63,127] or hysterectomies.[127]

Mortality

IBS is a functional disease that significantly reduces patients' quality of life, is associated with depression and suicidal ideation, and patients have an increased frequency of invasive procedures and surgery.[118,127] Despite this, community-based studies have shown that IBS is not associated with any increased mortality.[128,129] A large study in the USA of over 4,000 patients, followed for a total of 30,000 patient-years, and with 1,101 deaths, observed no increased mortality compared with the general population (hazard rate 1.06 [95% CI 0.86–1.32]).[128] A recent much smaller study from the People's Republic of China followed 263 patients over 5 years and found the same. They did notice that the incidence of colorectal cancer was increased, especially in elderly patients with IBS-C, where it was 7.5 times that of the general population. This possibly reflects misdiagnosis or ascertainment bias.[129]

Summary

IBS is a significant health care burden, irrespective of setting or geography, affecting around 11% of the population globally.

Accurate case definition remains difficult in IBS due to the high frequency of symptoms within the community, variations in diagnostic criteria and the stringency with which they are implemented, lack of specific histopathological changes, and lack of a definitive point of onset. This makes epidemiological studies challenging, with rates dependent on the methods chosen to define and measure IBS, so the literature should be considered within this context.

Evidence of lower prevalence of IBS in older age groups suggests that symptoms resolve over time, but this is contradicted by natural history studies, which imply chronicity of symptoms. A significant amount of evidence also suggests that patients with IBS are more likely to also have other functional conditions. Evidence suggests that 'symptom shifting' occurs in a proportion of patients, where resolution of functional bowel symptoms sees development of functional symptoms in another system.

Older studies suggest a high secondary care burden of IBS, with it accounting for up to 50% of gastrointestinal outpatient clinic time. However, these are highly biased estimates, often reliant on questioning physicians about their perceived workload. More recent studies would suggest IBS accounts for closer to 20% of gastroenterology outpatient work, possibly in part reflecting changes in primary care referral guidelines. Even so, this remains a significant proportion and highlights the importance of continuing to improve diagnosis and management of these individuals, to optimize their health care utilization and fully assess the impact and benefit of different management approaches.

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