Journal Pre-proof

Worldwide Prevalence and Burden of Functional Gastrointestinal Disorders, Results of Rome Foundation Global Study

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PII: S0016-5085(20)30487-X
DOI: https://doi.org/10.1053/j.gastro.2020.04.014
Reference: YGAST 63361

To appear in: *Gastroenterology*
Accepted Date: 1 April 2020

Please cite this article as: Sperber AD, Bangdiwala SI, Drossman DA, Ghoshal UC, imren M, Tack J, Whitehead WE, Dumitrascu DL, Fang X, Fukudo S, Kellow J, Okeke E, Quigley EM, Schmulson M, Whorwell P, Archampong T, Adibi P, Andresen V, Benninga MA, Bonaz B, Bor S, Fernandez LB, Choi SC, Corazziari ES, Francisconi C, Hani A, Lazebnik L, Lee YY, Mulak A, Rahman MM, Santos J, Setshedi M, Syam AF, Vanner S, Wong RK, Lopez-Colombo A, Costa V, Dickman R, Kanazawa M, Keshteli AH, Khatun R, Maleki I, Poitras P, Pratap N, Stefanyuk O, Thomson S, Zeevenhooven J, Palsson OS, Worldwide Prevalence and Burden of Functional Gastrointestinal Disorders, Results of Rome Foundation Global Study, *Gastroenterology* (2020), doi: https://doi.org/10.1053/j.gastro.2020.04.014.

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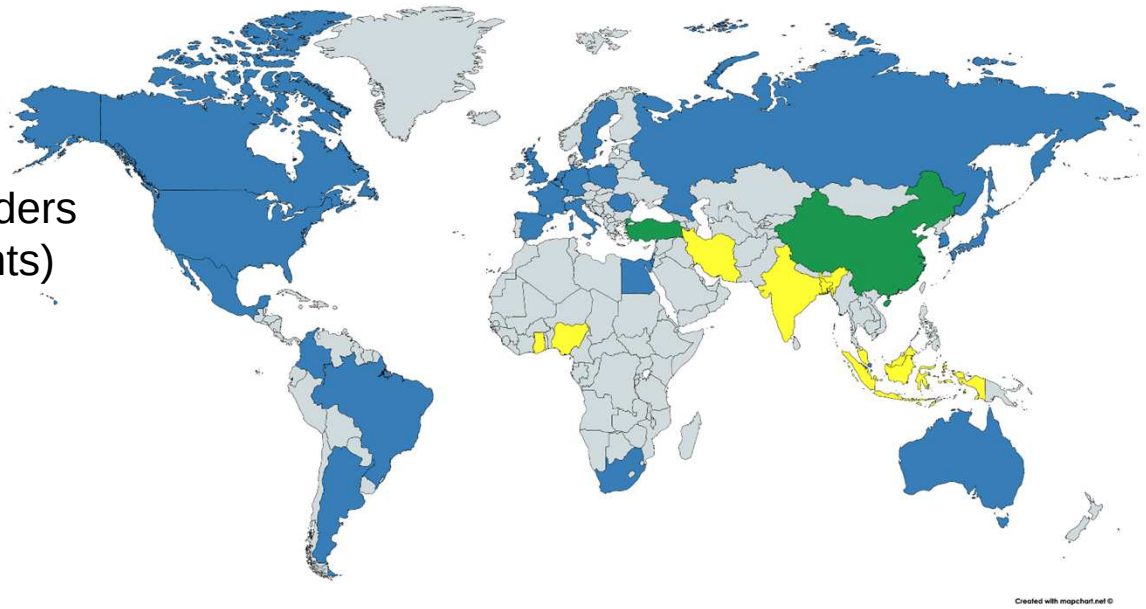
A global epidemiological study of functional GI disorders

- 73,076 adults surveyed (33 countries, 6 continents)
- Data collection: By Internet (24 countries, blue), by household interview (7 countries, yellow), or both methods (China and Turkey, green).



Prevalence of meeting criteria for at least one of 22 functional GI disorders (%):

	All Participants	Females	Males
Internet surveys	42.7	49.0	36.6
Household surveys	21.6	24.1	19.0

Gastroenterology

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No conflicts of interest exist

Short title: Global epidemiology study of FGIDs

Abbreviations: GI-gastrointestinal; FGID-functional gastrointestinal disorder; IBS-irritable bowel syndrome; CI-confidence interval; QOL-quality of life; FD-functional dyspepsia; FC-functional constipation, OR-Odds ratio

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Conflict of interest

None of the authors has a conflict of interest related to this paper.

Acknowledgments

The authors thank Mr. Jerry Schoendorf for his contribution to the graphic design of Fig. 1.

Funding

The study was funded, in part, by research grants from Ironwood, Shire, Allergan, and Takeda. The study in Malaysia was funded by the Fundamental Research Grant Scheme (FRGS) of the Ministry of Education of Malaysia (Reference: 203.PPSP.6171192). The study in Israel was funded by Takeda-Israel. The study in Romania was funded by the Romanian Society of Neurogastroenterology.

None of the funders was involved in the planning, design, implementation, statistical analyses or any other aspect of the study including preparation of the paper or knowledge of its contents.

Abstract

Background & Aims: Although functional gastrointestinal disorders (FGIDs), now called disorders of gut–brain interaction, have major economic effects on healthcare systems and adversely affect quality of life, little is known about their global prevalence and distribution. We investigated the prevalence of and factors associated with 22 FGIDs, in 33 countries on 6 continents.

Methods: Data were collected via the internet in 24 countries, personal interviews in 7 countries, and both in 2 countries, using the Rome IV diagnostic questionnaire, Rome III irritable bowel syndrome questions, and 80 items to identify variables associated with FGIDs. Data collection methods differed for internet and household groups, so data analyses were conducted and reported separately.

Results: Among the 73,076 adult respondents (49.5% women), diagnostic criteria were met for at least 1 FGID by 40.7% persons who completed the internet surveys (95% CI, 40.2–41.1) and 20.9% of persons who completed the household surveys. FGIDs were more prevalent among women than men, based on responses to the internet survey (odds ratio, 1.7; 95% CI, 1.6–1.7) and household survey (odds ratio, 1.4; 95% CI, 1.3–1.5). FGIDs were associated with lower quality of life and more frequent doctor visits. Proportions of subjects with irritable bowel syndrome were lower when the Rome IV criteria were used, compared with the Rome III criteria, in the internet survey (4.1% vs 10.1%) and household survey (1.5% vs 3.5%).

Conclusions: In a large-scale multi-national study, we found that more than 40% of persons worldwide have FGIDs, which affect quality of life and healthcare use. Although the absolute prevalence was higher among internet respondents, similar trends and relative distributions were found in people who completed internet vs personal interviews.

Keywords: DGBI, IBS, epidemiology

Introduction

The functional gastrointestinal disorders (FGIDs), or disorders of gut-brain interaction (DGBIs), are gastrointestinal (GI) disorders related to any combination of motility disturbance, visceral hypersensitivity, altered mucosal and immune function, altered gut microbiota, and altered central nervous system (CNS) processing.[1] They result in significant global healthcare costs[2-4] and impaired health-related quality of life (QOL).[5] However, population-based cross-sectional surveys have not satisfactorily delineated their actual prevalence. Published studies have involved highly variable diagnostic criteria, study populations, questionnaires, and data collection methods.[6-8] For irritable bowel syndrome (IBS) and functional dyspepsia (FD), the two most researched disorders, reported prevalence estimates are very broad (1.1-45.0% for IBS,[9] and 1.8-57.0% for FD).[10, 11] Thus, given the large methodological heterogeneity, it is inappropriate to pool individual prevalence rates, and we are left with an unanswered question as to whether the differences in prevalence rates seen among individual countries in prior surveys reflect genuine differences between populations or are due to methodological differences between studies.

The ideal global epidemiological study would use uniform methodology to assess nationally representative populations of sufficient size throughout the world, but this is not feasible. The present study, conducted in 33 countries at the same time, did use standardized methodology (although circumstances mandated two different data collection methods), with identical diagnostic questions to approximate to that ideal, assessed the global prevalence and burden of FGIDs, including sub-analyses by country, sex, and age groups. The results are summarized for all FGIDs, but the main focus is on five prevalent disorders because they are the most researched of the FGIDs and the most salient for clinicians: IBS, FD, functional constipation (FC), functional diarrhea, and functional bloating/distention.

The overall aims of this global study were to conduct an extensive multinational epidemiological study of all the FGIDs that are assessible by self-report, to obtain reliable and precise regional and local estimates of FGID prevalence, and to collect data on numerous potentially associated factors that might explain differences in FGIDs among populations and generate hypotheses to advance understanding of their pathophysiology.

Secondary aims included the development of a database that could serve as a source of data mining and be integrated with other similar databases in the future, and to establish a network of FGID experts with a track record of research collaboration on a global scale.

The present paper focuses on classic epidemiological findings: prevalence rates by country and geographical region, by age and sex, and preliminary indicators of burden of disease. As a descriptive study, there are no *a priori* hypotheses, so no hypothesis testing was conducted.

Methods

The study was conducted in 33 countries (Fig. 1): Argentina, Australia, Bangladesh, Belgium, Brazil, Canada, China, Colombia, Egypt, France, Germany, Ghana, Holland, India, Indonesia, Iran, Israel, Italy, Japan, Malaysia, Mexico, Nigeria, Poland, Romania, Russia, Singapore, South Africa, South Korea, Spain, Sweden, Turkey, the UK, and the US. This country selection, based on the availability of interested country PIs, provided a good global coverage, except for Africa (represented only by Egypt, South Africa, Ghana, and Nigeria) and the Middle East, especially Arab countries (Egypt only). As seen in Fig. 1, data were collected by Internet survey only in 24 countries, by personal interview only in seven countries and by both methods in two countries (see below).

A minimum of 2,000 individuals were surveyed in each country, in both the Internet and household surveys. In India and China, the minimum number of individuals in the surveys was increased to allow for the size of the national populations. In Japan the sample size was raised to 2,500 because the sex ratio among the first 2,000 participants was higher among

men in some age groups. We recruited an additional 500 participants, primarily women, to achieve a more balanced sex ratio. Thus, the final study population was larger than originally anticipated at 70,000 (33 countries with 2,000 individuals each, plus double surveys in China and Turkey). The pre-defined demographic parameters for all countries were 50% females and 50% males, and 40% for 18-39 years, 40% for 40-64 years, and 20% for 65+ years.

In countries where most adults use the Internet, a secured online survey (accessible only to pre-selected invited participants) was conducted using population samples provided by a professional company (Qualtrics, LLC., Provo, Utah, USA) who awarded participant points redeemable for gifts. These surveys were anonymous, nationwide, and had built-in quality-assurance measures to exclude poor-quality responders, including two attention-check questions, a completion-speed check, and repeat questions to detect inconsistent responders. The software ensured that there were no missing answers to compulsory questions, and had automated skip patterns, resulting in complete and accurate symptom pattern information.

In countries in which an Internet survey was unfeasible, usually because of poor Internet coverage, personal interviews were conducted in probability samples of individuals (one per household) in selected villages and cities, without national representation. The household survey countries were Bangladesh, Ghana, India, Indonesia, Iran, Malaysia, and Nigeria. In the case of Iran, the Internet infrastructure was sufficient for an Internet survey, but Qualtrics, Inc. did not have access to a pool of potential subjects in that country as it did in the other countries where the survey was conducted by Internet. Residents of the participating villages were invited to meetings where the study was explained. They were encouraged by civic and religious community leaders to participate and were offered a one-time free medical consultation in return. In China and Turkey, we collected data with the household methodology and the Internet survey, resulting in a household survey dataset from a total of nine different countries. Unlike the other household surveys, the household study in Turkey

was conducted nationwide after the Internet study had been completed, so we achieved a similar geographical, sex and age distribution as the Internet survey, with interview responses captured directly into electronic devices, eliminating the problems with incomplete or missing responses found in other household surveys.

FGID case definitions: The survey included the complete Adult Rome IV Diagnostic Questionnaire[12] and a self-report checklist of organic diseases and surgeries that can cause gastrointestinal symptoms, to identify FGID cases. Twenty-two FGID diagnoses were assigned according to Rome IV criteria, based on responses to the Rome IV Diagnostic Questionnaire. Individuals who otherwise met Rome IV FGID criteria were excluded from FGID case definition if they self-reported a medical history that could represent organic or structural reasons for the symptoms. For example, subjects reporting celiac disease, GI cancer or inflammatory bowel disease (Crohn's disease or ulcerative colitis) were excluded from all Rome IV FGID diagnoses. Subjects with a history of peptic ulcer disease were excluded from esophageal, gastroduodenal and biliary diagnoses. Finally, subjects who reported diverticulitis or bowel resection were excluded from bowel and anorectal disorders. Since no independent medical evaluation was done, this exclusion method may have eliminated individuals who did not have a functional GI disorder.

For household countries, where a proportion of cases had missing responses to diagnostic questions on the 22 FGIDs, these cases were excluded from prevalence analysis for all the FGIDs (N=4,087) leaving a final total of 18,949. This was necessary because several Rome FGID diagnoses overlap and the determination of whether a person warrants a particular diagnosis may depend on whether criteria for one or more other FGIDs are met.

The survey also included an 80-item supplemental questionnaire on sociodemographic characteristics, medical and health history, co-morbid symptoms and conditions, GI infections, healthcare utilization, medications, childhood and current living conditions,

psychosocial variables, diet, QOL, and culture and religion (Supplemental Table 1). It incorporated validated questionnaires such as the Patient Health Questionnaire-15 (PHQ-15),[13] IBS symptom severity scale (IBS-SSS),[14], and the Personal Health Questionnaire-4 (PHQ-4)[15] on anxiety and depression.

The Rome III IBS diagnostic questions[16] were included in all nine household survey countries and in 14 of the 26 Internet countries (Belgium, Brazil, Canada, China, Egypt, France, Germany, Holland, Israel, Japan, Mexico, Russia, Singapore, and Turkey) to compare IBS prevalence between Rome III and Rome IV criteria. The reason we did this for IBS and not for all FGIDs was that its criteria underwent the most substantial change between Rome III and IV and the length of the study questionnaires reached a limit that could not be expanded. Including all the Rome III questions for the other FGIDs would have increased the study questionnaire by about 50%.

We used two proxy variables to assess the burden of FGIDs: (1) healthcare utilization; i.e., history of (a) physician consultation about bowel problems and (b) frequency of doctor visits per year for any health problems, and (2) quality of life scores on the PROMIS Global-10 questionnaire (range 4-20).[17] As part of the Patient-Reported Outcomes Measurement Information System (PROMIS), this questionnaire is a publicly available global health assessment tool that measures symptoms, functioning, and healthcare-related quality of life (HRQoL) for a wide variety of chronic diseases and conditions.

The study questionnaire underwent translatability assessment by a professional company (TransPerfect, Inc. USA),[18,] and was then translated by the same company into 21 languages with linguistic validation (cognitive debriefing). Each country PI monitored this process to ensure that the translated questionnaires were linguistically valid and culturally adapted for their country. Where appropriate, the translations were "localized," e.g., the original English

questionnaire was translated into Spanish for Mexico and then localized for Colombia, Argentina, and Spain.

Statistical considerations

In a descriptive study, when estimating prevalence rates, sample size considerations are guided by the desired precision in the 95% confidence intervals. When estimating unknown prevalence rates, the most conservative approach (i.e., the one that provides the largest variance and thus the widest confidence intervals), assumes a prevalence of 0.50. In this study, we chose the minimum sample size of 2,000 participants per country to obtain high precision of within-country estimates of prevalence rates. Thus, 95% confidence intervals (CI) for prevalence rates as high as 0.50 would range within ± 0.022; and less common diagnoses (smaller prevalence rates) would have higher precision (narrower CIs).

We calculated country-specific prevalence rates for all major FGID diagnoses by sex and age groups. Prevalence rates were pooled across countries using Yang's meta-prevalence method,[19] which combines separate population survey prevalence estimates into an overall meta-prevalence estimate. Because of substantial differences in data collection methodology between the Internet and household methods, global pooling was done within survey type only.

Ethical review was completed for all countries. The study was approved or exempted from ethics board oversight (the latter for Internet survey countries, where subjects were anonymous to the investigators). All survey participants completed a written consent form, either electronically (Internet surveys) or on paper (household surveys).

Results

The survey was completed by 73,076 respondents; 36,148 women (49.47%) and 36,928 men (50.53%). The numbers of women by survey group were 26,576 respondents (49.1%) in the Internet countries and 18,949 (50.5%) in the household countries. We successfully

achieved equal sex distribution and pre-planned age ranges in most countries with both surveying methods.

We do not have full data on response rates. In the Internet surveys, panels of registered country-specific survey-takers were contacted through email until all quota categories were filled. There is no way to know how many saw those e-mails or how many were reached, so response rates are not available.

We have full response rates for Bangladesh, Malaysia, both surveyed regions in India, and Iran but the number of subjects approached in the other household sites was not tracked comprehensively. In Bangladesh the response rate was 99.5%, in Malaysia 92.8%, in northern India 99.2%, in southern India 99.0% and in Iran 97.8%.

The sample demographics, by survey method, appear in Supplemental Table 2. All Internet survey countries met the minimum sample size (≥2,000) and equal sex (50%:50%) parameters. In six Internet countries, the age group distribution was not fully met due to the inability to enroll sufficient numbers in the 65+ age group. In these countries, there is limited Internet access or lower usage. In Egypt, females were under-represented, possibly due to lower Internet use or culture. Based on the US Census Bureau classification for rural communities (less than 2,500 residents),[20] 9.7% of the participants lived in rural communities in Internet countries and 43.3% in household countries.

The household surveys achieved the minimum target sample size of at least 2,000 completed interviews, but the quality of the data was lower than in the Internet survey, particularly in Ghana (1,190 records valid for analysis), Indonesia (1,231), and Nigeria (1,442). The total number of respondents who would have met the criteria for FGID diagnoses but were classified as non-FGID due to reporting organic diseases or a GI surgery was 4,094 (7.56%) in Internet surveys and 748 (3.95%) in household surveys.

The prevalence results are presented below in accordance with GI tract anatomical regions, corresponding to the order of the questions in the Rome IV Diagnostic Questionnaire. The results for all the FGIDs appear in Table 1. These results will be discussed in a more comprehensive and overlapping context in the Discussion section below.

The prevalence rates of five selected major FGIDs compared across all the countries surveyed are shown in Table 2 and Fig. 3, to provide a more detailed view of the variance of these disorders globally.

Esophageal disorders

The most prevalent esophageal disorder in Internet and household surveys was functional dysphagia, with pooled prevalence rates of 3.2% (3.0, 3.3) and 1.2% (1.0, 1.3), respectively. The rates for functional heartburn, reflux hypersensitivity, and esophageal chest pain were substantially lower. All esophageal disorders were more prevalent among women in both survey methods. However, there was a divergence in results in terms of age, with decreasing rates in the older age groups in the Internet countries but increasing rates with age in the household countries.

Gastroduodenal disorders

FD was the most prevalent gastroduodenal disorder, with a pooled prevalence rate of 7.2% (7.1, 7.4) for Internet and 4.8% (4.5, 5.1) for household surveys. In the Internet surveys, the subtype distribution was 66.6% postprandial distress syndrome (PDS), 15.3% epigastric pain syndrome (EPS), and 18.1% overlapping PDS/EPS. In the household countries, the subtype distribution was 59.5% PDS, 28.1% EPS and 12.4% overlapping PDS/EPS. FD rates varied widely between countries, from 2.2% in Japan to 12.3% in Egypt in the Internet surveys and from 0.7 (0.5, 1.0) in India to 19.4 (17.7, 21.2) in Bangladesh in the household surveys.

Women had higher mean FD rates in the Internet surveys than men, with an odds ratio of 1.56 (1.46, 1.67) for overall FD, 1.60 for PDS (1.49, 1.72), and 1.42 (1.27, 1.59) for EPS. FD

and its two subtypes were most common among young adults and decreased steadily in prevalence across the adult lifespan.

Functional bowel disorders

The most prevalent bowel disorder in both survey types was FC, with pooled rates of 11.7% (11.4, 12.0) and 6.6% (6.3, 6.9) for Internet and household surveys, respectively. Other prevalent disorders were functional diarrhea at 4.7% (4.5, 4.9) and 1.2% (1.0, 1.3), IBS at 4.1% (3.9, 4.2) and 1.5% (1.3, 1.7), and functional abdominal bloating/distention at 3.5% (3.3, 3.6) and 1.2% (1.0, 1.3), respectively.

The prevalence rates of IBS among Internet survey countries ranged from a low of 1.3% (0.8, 1.8) in Singapore to 7.6% (6.4, 8.7) in Egypt (Table 2 and Fig. 3). However, most of the countries (19 of 26) had IBS rates between 3% to 5%. The outliers besides Singapore and Egypt were Japan (2.2%) China (2.3%), Russia (5.9%), South Africa (5.9%), and the USA (5.3%). Twenty four of the 26 countries had prevalence rates between 2% to 6%, with Singapore and Egypt as outliers. In the household countries, IBS prevalence ranged from 0.2% (0.1, 0.3) in India to 4.6% (3.7, 5.5) in Bangladesh, and the variance was greater than in the Internet countries (Table 2 and Fig. 3). The pooled prevalence rates for IBS were substantially higher among women in both survey methods, with a female-to-male odds ratio of 1.8 (1.7, 2.0) for the Internet and 1.98 (1.5, 2.5) for the household countries. IBS prevalence decreased with age in the Internet surveys, from 5.3% (5.0, 5.6) to 3.7% (3.5, 4.0) to 1.7% (1.4, 1.9) while it increased with age in the household group from 1.4% (1.1, 1.7) to 1.5% (1.2, 1.7) to 1.9% (1.4, 2.4).

As a group, the functional bowel disorders were the most prevalent of all GI regions, with 35.6% (35.2, 36.0) of the 54,127 Internet participants and 16.8% (16.2, 17.3) of the 18,949 household participants having at least one of those six disorders.

Centrally mediated abdominal pain syndrome and biliary pain

There were almost no cases of either of these diagnostic entities. The rate for centrally mediated abdominal pain syndrome was 0.02% (N=9) for the Internet survey and 0.05% (N=9) for the household survey. The corresponding rates for biliary pain were 0.08% (N=44) and 0.03% (N=5), respectively.

Anorectal disorders

In the Internet surveys, 8.1% (7.9, 8.3) of subjects met criteria for at least one anorectal disorder, compared to 2.7% (2.5, 2.9) in the household surveys. In both cases, the most prevalent disorder was proctalgia fugax at 5.9% (5.7, 6.1) in the Internet surveys and 1.7% (1.5, 1.9) in the household surveys.

Comparison of IBS prevalence by Rome IV and Rome III diagnostic criteria (Table 3)

In the 14 Internet countries where Rome III questions were included, the overall IBS prevalence was 3.8% (3.6, 4.0) by Rome IV criteria and 10.1% (9.8, 10.5) by Rome III criteria. Rome IV IBS rates were substantially lower than Rome III in all countries, ranging from 24% to 57% of Rome III IBS prevalence rates. In the nine household countries, the pooled IBS prevalence rates were 1.5% (1.3, 1.7) using Rome IV and 3.5% (3.3, 3.8) using Rome III, with Rome IV prevalence rates ranging from 18% to 75% of Rome III IBS prevalence rates. In this group of countries, the prevalence increased for both criteria with increasing age.

In contrast to the household surveys, by both criteria, IBS rates were lower on average in older individuals in the Internet surveys. Women had substantially higher IBS rates than men in all age groups by both criteria: Rome III OR=1.72 (1.59, 1.86) and Rome IV OR = 1.70 (1.51, 1.92).

The overall Rome IV IBS subtype distribution was 28.7% IBS-D, 32.4% IBS-C, 32.4% IBS-M, and 6.5% IBS-U in the 26 Internet countries, and 28.8% IBS-D, 37.9% IBS-C, 17.2% IBS-M, and 16.1% IBS-U in the 9 household countries.

Rome IV IBS individuals had higher mean IBS-SSS severity scores, 250 (244, 256) vs. Rome III IBS 191 (187, 194), in the Internet countries. In the household countries, Rome IV IBS individuals had an IBS-SSS severity score of 174 (158, 190) vs. Rome III IBS 134 (124, 144.

Burden of FGIDs (Table 4)

Individuals with FGIDs were more likely than others to be high-frequency medical consulters (one or more doctor visit per month for any health problem), with OR=1.75 (1.7, 1.8) for Internet and OR=1.1 (1.00, 1.2) for household surveys. Also, individuals who met Rome IV criteria for any FGID were more likely to have visited doctors at any time in the past because of bowel problems than those with no FGID: 47.1% vs. 26.5% in the Internet, and 26.4% vs. 11.9% in the household survey. The same applied for each of the five selected major FGIDs.

Health-related QOL was lower on the PROMIS Global-10 questionnaire for individuals with any FGID compared to subjects with no FGID for global mental and global physical scores, in both Internet and household surveys. Most participants reported QOL scores in the middle of the possible range of scores, with little variability.

Discussion

This is the first global study of the epidemiology and impact of the FGIDs (DGBIs). By assessing large population samples from 33 globally distributed countries using the same survey instruments and statistical analyses, we can provide a meaningful picture of FGIDs around the world. The study methodology was rigorous, especially for the 26 countries surveyed via the Internet, where we not only achieved predetermined parameters for sample

size, sex, and age distribution, but also a national distribution that reflected closely the actual geographical population distributions.

Several findings are noteworthy from the results presented above: (a) the overall rate for meeting at least one FGID diagnosis was generally consistent between countries within each sampling method, with a pooled mean of 42.7 (42.2, 43.1) in Internet and 21.6 (21.0, 22.1) in household countries. The rate of having any FGID was exceptionally low in the household surveys in Turkey and India, at less than 10%, (b) the prevalence of having any FGID was higher among women than men, with an OR of 1.7 (1.6, 1.7) in Internet and 1.4 (1.3, 1.5) in household countries. When surveyed via the Internet, 49% of the entire adult female population across the six continents surveyed met the diagnostic criteria for one or more of the FGIDs, supporting previous findings that FGIDs are more prevalent in women than in men. The corresponding figure for the household surveys was 24%. Our data show that the female predominance of FGIDs is present for FGIDs in all regions of the GI tract, from the esophagus to the rectum, and with both Internet and household survey methodologies, (c) IBS prevalence rates by Rome IV were lower than in most studies using previous versions of the Rome criteria[9] and generally half or less of Rome III prevalence rates in the same countries. This is in line with a recently published study in the US, Canada and the UK, that used a similar study methodology,[21] (d) Rome IV IBS rates were similar among most of the Internet countries, with 19 of the 26 having prevalence rates between 3-5%. Singapore and Egypt were clear outliers at 1.3% and 7.6%, respectively. In the household countries, the prevalence was more variable, ranging from 0.2% in India to 4.6% in Bangladesh. As has been reported previously, we found women to have higher rates of IBS than men. We also found the sexes to have a different IBS subtype pattern: among women the rate of IBS-C is higher than IBS-D, while among men this is reversed, (e) in the Internet countries FGID prevalence decreased with age, but there was an opposite trend seen in the household countries, (f) FGID

prevalence rates for the household countries were consistently lower than the Internet countries. This also holds true for Turkey, even though their household survey methodology was much more similar to Internet surveys than in other household survey countries. Notably, the pattern of relative prevalence among the various disorders was consistent among the various FGIDs among all countries, and (g) a few disorders, such as functional dysphagia, rumination, and proctalgia fugax, have prevalence rates that are higher than might be expected in light of clinical experience. It is possible that as we deepen our analyses of the entire database, some patterns may evolve that we are unaware of at the present.

Our findings on the cumulative presence of FGIDs (meeting diagnostic criteria for at least one FGID) are congruent with a previous study of the U.S. population with the original Rome criteria (when there were 20 FGIDs) published in 1993,[22] which found 69% of U.S. adults to have any FGID. The high prevalence in both cases is simply the result of evaluating simultaneously the presence of many disorders in the same population samples, yielding a comprehensive picture of the vast scope of FGIDs as a societal health problem.

Among the Internet–surveyed countries, the prevalence rates for many of the FGIDs, and IBS in particular, were quite similar and the variance was low. This illustrates that IBS and the other FGIDs are truly world-wide disorders. It also shows that the Rome IV diagnostic questionnaire can identify these disorders across geographical regions and in numerous translations. Yet, as has been reported previoiusly,[8, 10, 23] there is variance among the countries in the prevalence of these disorders. There are several potential explanations for this variability, including cultural differences, social reporting sensitivity, ethnic diversity, genetics, and dietary habits. We are confident that the differences found in this study are not due to differences in study methodology, which was uniform within Internet and household surveys. Thus, in light of the rigorous and uniform research methodology we applied, we believe that the observed prevalence rates do reflect accurately differences among countries

and are variable enough to warrant further investigation into reasons for differences between countries and regions,[24, 25] and their association with potential predictive factors covered in our supplemental questionnaire. Such analyses can provide insights into more subtle aspects of the FGIDs and generate hypotheses for future research but are beyond the scope of the present paper.

One of the more notable findings of our study is that IBS was less than half as prevalent using Rome IV compared to Rome III. This comparison was included in the study to assess whether worldwide regional prevalence differed according to the criteria used.[26] The current Rome IV criteria are more stringent, requiring at least *weekly* abdominal pain (*discomfort was not included*), whereas Rome III required abdominal pain *or discomfort* at least *2-3 times monthl*y.[27, 28] We believe that this change in criteria resulted, as previously reported,[29-32] in a shift in prevalence from IBS-C to FC and from IBS with diarrhea (IBS-D) to functional diarrhea, since the increased pain frequency threshold required for IBS was not reached or the subjects suffered from discomfort rather than pain. This is consistent with the approach of viewing individual patients with constipation on a pain frequency spectrum[33] where differences in pain occurrence determine shifts from IBS to FC or functional diarrhea.

The Rome IV IBS criteria, being more restrictive than Rome III, lead to more similar diagnostic groups for clinical research and drug trials. Consequently, the Rome IV criteria are identifying more severe cases of IBS, as also reflected in the IBS-SSS scores, rather than the totality of the condition as seen by clinicians. However, clinicians may not use such stringent criteria in practice, as treatment is likely to be the same even for “sub-threshold” patients with slightly less frequent abdominal pain. Clinicians tend to rely more on symptom presentation and clusters. Thus, the relative prevalence “shift” away from IBS may have more implications for recruitment into research studies, especially clinical trials, where the Rome IV criteria define a more severe or specific population than those seen in clinical

practice. Since FC and functional diarrhea and their corresponding IBS subtypes often respond to the same therapies,[34] the shift in diagnosis may have less impact on treatment.

Unspecified functional bowel disorder was the most prevalent bowel diagnosis in our study. As it is the default diagnosis for people who have significant bowel symptoms but fail to qualify for another bowel disorder, the diagnostic criteria for functional bowel disorders, especially IBS, may be too restrictive. In contrast, the least prevalent subtype of IBS (Table 1) was IBS-U, so the addition of the Bristol Stool Form Scale as a discriminator for IBS subtypes may have facilitated the classification of the three specific subtypes (IBS-C, IBS-D and IBS-M), reducing the number of non-specific cases. Diagnostic criteria for cannabinoid hyperemesis syndrome, central abdominal pain syndrome, and functional biliary pain, where hardly any cases were identified, may also be restrictive. These disorders may be particularly difficult to identify in studies based on questionnaires. Previous studies have shown somewhat higher prevalence rates, especially for chronic abdominal pain syndrome, the more studied of these relatively rare disorders.[22, 35]

Although the prevalence rates for many of the individual FGIDs were low, a large proportion of individuals met diagnostic criteria for at least one FGID. Combined with the findings that individuals meeting FGID criteria were twice as likely to consult doctors for bowel problems and had significantly lower general QOL than othera, the collective burden of these disorders is substantial. The results of our study confirm that FGIDs are more prevalent among women than men. This is consistent with previous reports over the years.[36] Also consistent with previous reports, we found in the Internet surveys that FGIDs decreased with age.[9] However, in the household surveys, prevalence rates tended to rise with increasing age, as discussed further below.

A key strength of this study that has implications for future research was the effectiveness of Internet surveys. Not only is this now becoming the default option in most countries since

telephone and mail surveys are not feasible ways to reach the general population, but it provided reliable, quality-controlled data with a nationally representative distribution. This could not be accomplished with household surveys.

The most important limitations of our study relate to the lack of national representation and missing data in the household surveys (excepting Turkey). Furthermore, the necessity of relying on two different survey methodologies precluded calculation of pooled global prevalence rates for all 33 countries together.

The anonymous Internet survey methodology constitutes a very different survey experience for subjects than the face-to-face household survey methodology, and cultural sensitivities around reporting of FGID symptoms may have led to the large differences in prevalence rates observed between the two survey methods. Our assessment is that the Internet surveys provided more reliable estimates of prevalence rates because a) we achieved national representation, b) we achieved more complete, accurate and reliable data collection since no question that required an answer could be skipped, and questions that should have been skipped, based on responses to key trigger questions, were always skipped and could not be answered. In addition, quality control measures including maximum speed of questionnaire completion, repeat questions for response consistency assessment, and attention-check questions were included. Finally, data were automatically and accurately entered into the study database, eliminating manual entry errors. Another strength of the study was the uniform translation methodology with linguistic validation and cultural adaptation, which also generated a repository of translated study questionnaires for future global research in FGIDs.

The pattern of relative prevalence among the various FGIDs was consistent in spite of the substantial differences in the absolute prevalence rates between the Internet and household surveys. While the reasons for the lower mean FGID prevalence in the household surveys

compared to the Internet surveys are unclear, there are several possible explanations. It could be a consequence of reluctance to report sensitive or intimate digestive tract symptoms in face-to-face interviews. This could be more salient in younger respondents, consistent with the unique finding in household countries that rates increased with age. Moreover, since we included only one subject per household and FGIDs often cluster in families, this method might have under-estimated the prevalence. Another factor contributing to the prevalence difference was that a much higher percentage of household than Internet survey participants (48.7 vs. 9.7%) lived in rural communities: We found that FGIDs were reported somewhat more frequently in urban than rural areas with an OR=1.14 (1.08, 1.21) for Internet countries and OR=1.17 (1.09, 1.26) for household surveys, although the magnitude of difference was inconsistent across all FGIDs. Because the prevalence rates were particularly low in India and Turkey (household), we rechecked the data entry process and the diagnostic scoring syntax, but no mistakes were found to explain this. The two geographically and linguistically separate sites surveyed in India had similarly low prevalence rates. To date, we have no definitive explanation for these unusually low rates, especially in light of the very different results from Bangladesh, a country with much in common with India.

Another limitation of the study is the lack of response rates for the Internet surveys and limited response rate information for the household surveys. However, in those countries for which we have precise data, Bangladesh, Malaysia, both regions in India, and Iran, the response rates were all over 90%. Since similar participation encouragement methods were used in all household countries, we feel confident that the response rates were high in the others as well, although we don't have the exact figures.

An additional limitation of our study is that since it was a non-clinical questionnaire study of the general population, participants were not evaluated with procedures such as endoscopy or manometry, so some of the participants could have had an "organic" cause of their

digestive symptoms. However, we believe that our inclusion of a checklist of organic diagnoses that might account for GI symptoms, and our exclusion of such cases from FGID prevalence counts (7.6% in Internet countries and 4.0% in household countries), compensated at least partially for this. A further limitation was that we attained less than satisfactory coverage of Africa and the Middle East. Our attempts to rectify this proved futile due to difficulties in recruiting interested investigators in the relevant countries.

The data collected with the supplemental questionnaire used in this study may yield findings on a range of variables with possible associations with FGIDs. Future analyses using those data will enable us to look at the relevance of differences in factors such as diet, hygiene, economic status, level of education, previous GI infections, and psychological co-morbidity, in regard to FGID prevalence. These are likely to generate observations and hypotheses for further work that eventually may produce new insights into the pathophysiological mechanisms of FGIDs.

In conclusion, this paper represents the first report documenting the global prevalence of FGIDs assessed with a uniform diagnostic questionnaire and research methodology. The results may influence substantially future planning of health care resources and clinical trials. Funding for research in the FGIDs is universally low, and they are viewed as a non-priority. The data highlight a strong need and rationale for this to change. They should be of interest to multiple medical disciplines in addition to gastroenterologists, including general practitioners, family physicians, internists, nurses, dieticians, epidemiologists, public health experts, as well as other allied health care providers. We expect that the results presented here, and those to be reported from our future analyses, will serve as essential reference data for years to come.

Titles for figures

Fig. 1. Global map showing study countries, colored-coded by data collection method: Internet, household interviews, or both. The Internet survey was conducted in 26 countries and the household survey in 9 countries, two (Turkey and China) used both methods, totaling 33 countries in all.

Fig. 2. Global maps showing study countries (Internet above, household below), color-coded for prevalence of having any FGID.

Fig. 3. Distribution of country-specific (circles) and pooled (boxes) prevalence rates for five selected major FGIDs in the countries surveyed by Internet (N=26) and household interviews (N=9) with Rome IV criteria.

References

1. Drossman DA. Functional gastrointestinal disorder and the Rome IV process. In: Drossman DA, Chang L, Chey WD, Kellow J, Tack J, Whitehead WE, eds. Functional Gastrointestinal Disorders. Disorders of Brain-gut Interaction. Volume 1. 4th ed. Raleigh, N.C.: Rome Foundation, 2016:1-32.
2. Sandler RS, Everhart JE, Donowitz M, et al. The burden of selected digestive diseases in the United States. Gastroenterology 2002;122:1500-1511.
3. Canavan C, West J, Card T. Review article: the economic impact of the irritable bowel syndrome. Alimentary Pharmacology and Therapeutics 2018;40:1023-1034.
4. Tack J, Stanghellini V, Mearin F, et al. Economic burden of moderate to severe irritable bowel syndrome with constipation in six European countries. BMC Gastroenterol 2019;19:69.
5. Wong RK, Drossman DA. Quality of life measures in irritable bowel syndrome. Expert Rev Gastroenterol Hepatol 2010;4:277-84.
6. Higgins JP, Thompson SG. Controlling the risk of spurious findings from meta-regression. Stat Med 2004;23:1663-1682.
7. Quigley EM, Abdel-Hamid H, Barbara G, et al. A global perspective on irritable bowel syndrome: a consensus statement of the World Gastroenterology Organisation Summit Task Force on irritable bowel syndrome. J Clin Gastroenterol 2012;46:356-366.
8. Sperber AD, Dumitrascu D, Fukudo S, et al. The global prevalence of IBS in adults remains elusive due to the heterogeneity of studies: a Rome Foundation working team literature review. Gut 2016;66:1065-1072.
9. Lovell RM, Ford AC. Global prevalence of and risk factors for irritable bowel syndrome: a meta-analysis. Clin Gastroenterol Hepatol 2012;10:712-721.

10. Ford AC, Marwaha A, Sood R, et al. Global prevalence of, and risk factors for, uninvestigated dyspepsia: a meta-analysis. Gut 2015;64:1049-1057.
11. El-Serag HB, Talley NJ. Systemic review: the prevalence and clinical course of functional dyspepsia. Aliment Pharmacol Ther 2004;19:643-654.
12. Palsson OS, Whitehead WE, van Tilburg MAL, et al. Development and validation of the Rome IV diagnostic questionnaire for adults. Gastroenterology 2016;150:1481-1491.
13. Kroenke K, Spitzer RL, Williams JB. The PHQ-15: validity of a new measure for evaluating the severity of somatic symptoms. Psychosomatic Medicine 2002;64:258-266.
14. Francis CY, Morris J, Whorwell PJ. The irritable bowel severity scoring system: a simple method of monitoring irritable bowel syndrome and its progress. Aliment Pharmacol Ther 1997;11:395-402.
15. Kroenke K, Spitzer RL, Williams JB, et al. An ultra-brief screening scale for anxiety and depression: the PHQ-4. Psychosomatics 2009;50:613-21.
16. Longstreth GF, Thompson WG, Chey WD, et al. Functional bowel disorders. In: Drossman SA, Corazziari E, Delvaux M, Spiller RC, Talley NJ, Thompson WG, Whitehead WE, eds. Rome III. The Functional Gastrointestinal Disorders. McLean, Virginia: Degnon Associates, Inc., 2006:487-555.
17. PROMIS Global-10. https://www.codetechnology.com/promis-global-10/.
18. Crane AL, Popielnicki A, Sperber AD, et al. Translatibility evaluation of the Rome IV diagnostic questionnaire for adults. Value in Health 2016;19:A389.
19. Yang B. Meta Prevalence Estimates. Generating combined prevalence estimates from separate population surveys: NSW Department of Health, Center for Epidemiology and Research, 2007.
20. Defining Rural at the U.S. Census Bureau: American Community Survey and Geography Brief. https://www2.census.gov/geo/pdfs/reference/ua/Defining_Rural.pdf.

21. Palsson OS, Whitehead W, Tornblom H, et al. Prevalence of Rome IV Functional Bowel Disorders Among Adults in the United States, Canada, and the United Kingdom. Gastroenterology 2020.
22. Drossman DA, Li Z, Andruzzi E, et al. U.S. householder survey of functional GI disorders: prevalence, sociodemography and health impact. Digestive Disease and Sciences 1993;38:1569-1580.
23. Hungin AP, Whorwell PJ, Tack J, et al. The prevalence, patterns and impact of irritable bowel syndrome: an international survey of 40,000 subjects. Alimentary Pharmacology and Therapeutics 2003;17:643-650.
24. Enck P, Aziz Q, Barbara G, et al. Irritable bowel syndrome. Nat Rev Dis Primers 2016;2:16014.
25. Fukudo S, Hahm KB, Zhu Q, et al. Survey of clinical practice for irritable bowel syndrome in East asian countries. Digestion 2015;91:99-109.
26. Aziz I, Tornblom H, Palsson OS, et al. How the Change in IBS Criteria From Rome III to Rome IV Impacts on Clinical Characteristics and Key Pathophysiological Factors. Am J Gastroenterol 2018;113:1017-1025.
27. Longstreth GF, Thompson WG, Chey WD, et al. Functional bowel disorders. Gastroenterology 2006;130:1480-1491.
28. Lacy BE, Mearin F, Chang L, et al. Bowel Disorders. Gastroenterology 2016;150:1393-1407.e5.
29. Lopez-Colombo A, Morgan D, Bravo-Gonzalez D, et al. The epidemiology of functional gastrointestinal disorders in Mexico: a population-based study. Gastroenterology research and practice 2012;2012:606174.

30. Schmulson M, Lopez-Colombo A, Mendoza-Gomez A, et al. The Rome III Adult Questionnaire in Spanish-Mexico has a low sensitivity for identifying IBS and higher sensitivity for uninvestigated dyspepsia. Gastroenterology 2012;143(Suppl. 1):S-829.
31. Sperber AD, Shvartzman P, Friger M, et al. A comparative reappraisal of the Rome II and Rome III diagnostic criteria: are we getting closer to the 'true' prevalence of irritable bowel syndrome? European Journal of Gastroenterology and Hepatology 2007;19:441-447.
32. Black CJ, Yiannakou Y, Houghton LA, et al. Epidemiological, Clinical, and Psychological Characteristics of Individuals with Self-reported Irritable Bowel Syndrome Based on the Rome IV vs Rome III Criteria. Clin Gastroenterol Hepatol 2019.
33. Simren M, Palsson OS, Whitehead WE. Update on Rome IV Criteria for Colorectal Disorders: Implications for Clinical Practice. Curr Gastroenterol Rep 2017;19:15.
34. Simren M, Tack J. New treatments and therapeutic targets for IBS and other functional bowel disorders. Nat Rev Gastroenterol Hepatol 2018;15:589-605.
35. Thompson WG, Irvine EJ, Pare P, et al. Functional gastrointestinal disorders in Canada: first population-based survey using Rome II criteria with suggestions for improving the questionnaire. Digestive Diseases and Sciences 2002;47:225-235.
36. Kim YS, Kim NY. Sex-Gender Differences in Irritable Bowel Syndrome. J Neurogastroenterol Motil 2018;24:544-558.

Table 1. Pooled prevalence rates (% and 95% CI) for 22 Rome IV functional gastrointestinal diagnoses, in a combined population-based Internet survey sample of 54,127 individuals in 26 countries and in a combined household survey sample of 18,949 individuals in 9 countries.

FGID		Sex		Age group (years)		
	Overall N=54127	**Female N=26578**	**Male N=27549**	**18-39 N=23003**	**40-64 N=22281**	**65+ N=8843**
INTERNET						
Any FGID	**42.7 (42.2, 43.1)**	**49.0 (48.4, 49.6)**	**36.6 (36.0, 37.1)**	**47.4 (46.8, 48.1)**	**41.4 (40.7, 42.0)**	**33.4 (32.5, 34.4)**
A. Esophageal Disorders						
Functional chest pain	1.4 (1.3, 1.5)	1.5 (1.3, 1.6)	1.3 (1.1, 1.4)	1.4 (1.3, 1.6)	1.5 (1.3, 1.6)	1.0 (0.8, 1.3)
Functional heartburn	1.1 (1.0, 1.2)	1.3 (1.1, 1.4)	1.0 (0.9, 1.1)	1.3 (1.1, 1.4)	1.2 (1.0, 1.3)	0.7 (0.5, 0.8)
Reflux hypersensitivity	0.8 (0.8, 0.9)	0.9 (0.8, 1.0)	0.8 (0.7, 0.9)	0.9 (0.7, 1.0)	1.0 (0.8, 1.1)	0.5 (0.4, 0.6)
Globus	0.8 (0.7, 0.8)	0.9 (0.7, 1.0)	0.7 (0.6, 0.8)	0.8 (0.6, 0.9)	0.9 (0.7, 1.0)	0.5 (0.4, 0.7)
Functional dysphagia	3.2 (3.0, 3.3)	3.5 (3.3, 3.7)	2.9 (2.7, 3.1)	3.3 (3.1, 3.5)	3.2 (3.0, 3.4)	2.7 (2.4, 3.0)
Any esophageal disorder	6.0 (5.8, 6.2)	6.6 (6.3, 6.9)	5.4 (5.1, 5.6)	6.2 (5.9, 6.5)	6.3 (6.0, 6.6)	4.6 (4.2, 5.0)
B. Gastroduodenal Disorders						
Functional dyspepsia **Post-prandial distress syndrome (PDS)** **Epigastric pain syndrome (EPS)**	7.2 (7.0, 7.4) 6.1 (5.9, 6.3) 2.4 (2.3, 2.5)	8.7 (8.4, 9.1) 7.5 (7.2, 7.8) 2.8 (2.6, 3.0)	5.8 (5.5, 6.0) 4.8 (4.6, 5.1) 2.0 (1.8, 2.2)	9.2 (8.8, 9.5) 7.8 (7.5, 8.2) 2.9 (2.7, 3.1)	6.6 (6.2, 6.9) 5.5 (5.2, 5.8) 2.4 (2.2, 2.6)	3.8 (3.4, 4.2) 3.3 (2.9, 3.6) 1.2 (0.9, 1.4)
Belching disorder	1.0 (0.9, 1.1)	1.1 (1.0, 1.2)	0.9 (0.7, 1.0)	1.1 (1.0, 1.2)	1.0 (0.8, 1.1)	0.7 (0.5, 0.8)
Rumination syndrome	2.8 (2.7, 2.9)	3.1 (2.9, 3.3)	2.5 (2.3, 2.7)	2.7 (2.5, 2.9)	3.0 (2.8, 3.2)	2.4 (2.1, 2.7)
Chronic nausea vomiting syndrome	0.9 (0.8, 1.0)	1.2 (1.0, 1.3)	0.7 (0.6, 0.8)	1.3 (1.2, 1.5)	0.7 (0.6, 0.8)	0.4 (0.3, 0.5)
Cyclic vomiting syndrome	1.2 (1.1, 1.2)	1.2 (1.1, 1.3)	1.1 (1.0, 1.2)	1.6 (1.4, 1.8)	0.9 (0.8, 1.0)	0.6 (0.5, 0.8)
Cannabinoid hyperemesis syndrome	0.05 (0.03, 0.07)	0.02 (0.01, 0.04)	0.08 (0.05, 0.11)	0.11 (.07, 15)	0.010(.00, 0.02)	0.01 (0.00, 0.03)
Any gastroduodenal disorder	10.6 (10.4, 10.9)	12.4 (12.0, 12.8)	8.9 (8.6, 9.2)	13.0 (12.5, 13.4)	9.8 (9.4,10.2)	6.6 (6.1, 7.2)
C. Bowel Disorders						

Rome-IV IBS **IBS-C** **IBS-D** **IBS-U** **IBS-M**	4.1 (3.9, 4.2) 1.3 (1.2, 1.4) 1.2 (1.1, 1.3) 0.3 (0.2, 0.3) 1.3 (1.2, 1.4)	5.2 (5.0, 5.5) 1.8 (1.7, 2.0) 1.3 (1.2, 1.5) 0.3 (0.2, 0.4) 1.8 (1.6, 1.9)	2.9 (2.7, 3.1) 0.8 (0.7, 0.9) 1.0 (0.9, 1.1) 0.2 (0.2, 0.3) 0.9 (0.8, 1.0)	5.3 (5.0, 5.6) 1.8 (1.6, 2.0) 1.1 (0.9, 1.2) 0.3 (0.2, 0.4) 1.6 (1.5, 1.8)	3.7 (3.5, 4.0) 1.1 (1.0, 1.2) 0.5 (0.3, 0.6) 0.3 (0.2, 0.3) 1.3 (1.2, 1.5)	1.7 (1.4, 1.9) 0.6 (0.4, 0.8) 0.5 (0.3, 0.6) 0.1 (0.0, 0.2) 0.5 (0.3, 0.6)
Functional Constipation	11.7 (11.4, 12.0)	15.2 (14.8, 15.7)	8.3 (8.0, 8.6)	13.2 (12.8, 13.7)	11.0 (10.6, 11.4)	9.4 (8.8, 10.0)
Opioid-induced constipation	1.6 (1.5, 1.7)	1.8 (1.6, 1.9)	1.4 (1.2, 1.5)	1.5 (1.3, 1.7)	1.6 (1.5, 1.8)	1.5 (1.3, 1.8)
Functional diarrhea	4.7 (4.5, 4.9)	4.1 (3.8, 4.3)	5.3 (5.1, 5.6)	4.6 (4.3, 4.9)	5.1 (4.8, 5.3)	4.1 (3.7, 4.5)
Functional bloating/distention	3.5 (3.3, 3.6)	4.6 (4.3, 4.8)	2.4 (2.2, 2.5)	3.4 (3.2, 3.7)	3.9 (3.6, 4.1)	2.4 (2.1, 2.7)
Unspecified functional bowel disorder	11.0 (10.8, 11.3)	11.8 (11.4, 12.2)	10.9 (9.9, 10.7)	12.6 (12.2, 13.1)	10.3 (9.9, 10.7)	8.6 (8.0, 9.2)
Any bowel disorder	35.6 (35.2, 36.0)	41.6 (41.0, 42.2)	29.9 (29.3,30.4)	39.8 (39.2, 40.4)	34.6 (34.0, 35.2)	27.2 (26.3, 28.1)
D. CNS Disorders of GI Pain						
Centrally mediated abdominal pain syndrome	0.02 (0.01, 03)	0.03 (0.01, 0.06)	0.00*	0.03 (0.01, 0.05)	0.01(0.00, 0.02)	0.01 (0.00, 0.03)
E. Biliary Disorders						
Functional biliary pain	0.08 (0.06, 0.11)	0.14 (0.09, 0.18)	0.03 (0.01, 0.04)	0.13 (0.08, 0.18)	0.05 (0.02, 0.08)	0.02 (0.00, 0.05)
F. Anorectal Disorders						
Fecal incontinence	1.6 (1.5, 1.7)	1.5 (1.4, 1.7)	1.6 (1.5, 1.8)	1.1 (1.0, 1.3)	1.7 (1.6, 1.9)	2.3 (2.0, 2.7)
Levator ani syndrome	1.1 (1.1, 1.2)	1.4 (1.2, 1.5)	0.9 (0.8, 1.0)	1.3 (1.2, 1.5)	1.2 (1.1, 1.4)	0.6 (0.4, 0.7)
Proctalgia fugax	5.9 (5.7, 6.1)	6.8 (6.5, 7.1)	5.1 (4.8, 5.4)	6.4 (6.1, 6.7)	6.1 (5.8, 6.4)	4.3 (3.8, 4.7)
Any anorectal disorder	8.1 (7.9, 8.3)	9.2 (8.9, 9.6)	7.0 (6.7, 7.3)	8.3 (8.0, 8.7)	8.4 (8.0, 8.8)	6.8 (6.2, 7.3)
HOUSEHOLD						
Any FGID	**21.6 (21.0, 22.1)**	**24.1 (23.3, 24.9)**	**19.0 (18.2, 19.7)**	**17.9 (17.1, 18.7)**	**21.3 (20.5, 22.2)**	**31.5 (30.0, 33.1)**
A. Esophageal Disorders						
Functional chest pain	1.0 (0.9, 1.2)	1.2 (1.0, 1.4)	0.8 (0.7, 1.0)	0.7 (0.5, 0.9)	1.2 (1.0, 1.5)	1.2 (0.8, 1.6)
Functional heartburn	0.4 (0.3, 0.4)	0.5 (0.3, 0.6)	0.2 (0.1, 0.3)	0.2 (0.1, 0.3)	0.4 (0.3, 0.6)	0.6 (0.3, 0.8)

Reflux hypersensitivity	0.6 (0.5, 0.7)	0.8 (0.6, 1.0)	0.4 (0.3, 0.5)	0.4 (0.2, 0.5)	0.7 (0.5, 0.8)	0.9 (0.6, 1.3)
Globus	0.2 (0.2, 0.3)	0.3 (0.2, 0.4)	0.2 (0.1, 0.3)	0.2 (0.1, 0.3)	0.3 (0.2, 0.4)	0.3 (0.1, 0.4)
Functional dysphagia	1.2 (1.0, 1.3)	1.5 (1.2, 1.7)	0.9 (0.7, 1.1)	0.6 (0.5, 0.8)	1.0 (0.8, 1.2)	2.9 (2.4, 3.5)
Any esophageal disorder	2.9 (2.7, 3.2)	3.6 (3.2, 3.9)	2.3 (2.0, 2.6)	1.9 (1.6, 2.2)	3.1 (2.8, 3.5)	4.9 (4.2, 5.7)
B. Gastroduodenal Disorders						
Functional dyspepsia **Post-prandial distress syndrome (PDS)** **Epigastric pain syndrome (EPS)**	4.8 (4.5, 5.1) 3.5 (3.2, 3.7) 1.9 (1.7, 2.1)	5.5 (5.0, 5.9) 3.8 (3.4, 4.2) 2.4 (2.1, 2.7)	4.1 (3.7, 4.5) 3.1 (2.7, 3.4) 1.4 (1.2, 1.7)	3.2 (2.8, 3.5) 2.2 (1.9, 2.5) 1.3 (1.1, 1.6)	4.7 (4.2, 5.1) 3.2 (2.8, 3.6) 2.1 (1.8, 2.5)	9.2 (8.3,10.2) 7.4 (6.5, 8.3) 3.0 (2.4, 3.6)
Belching disorder	0.7 (0.5, 0.8)	0.8 (0.6, 1.0)	0.5 (0.4, 0.7)	0.5 (0.4, 0.7)	0.6 (0.4, 0.8)	1.1 (0.8, 1.5)
Rumination syndrome	1.1 (0.9, 1.2)	1.4 (1.2, 1.7)	0.8 (0.6, 0.9)	0.9 (0.7, 1.1)	1.1 (0.8, 1.3)	1.6 (1.2, 2.1)
Chronic nausea vomiting syndrome	0.5 (0.4, 0.6)	0.6 (0.4, 0.7)	0.4 (0.2, 0.5)	0.4 (0.2, 0.5)	0.4 (0.3, 0.6)	0.8 (0.5, 1.1)
Cyclic vomiting syndrome	0.3 (0.3, 0.4)	0.5 (0.3, 0.6)	0.2 (0.1, 0.3)	0.3 (0.2, 0.4)	0.4 (0.2, 0.5)	0.5 (0.2, 0.7)
Cannabinoid hyperemesis syndrome	0.01 (0.00, 0.02)	0.00*	0.01 (0.00, 0.03)	0.01 (0.00, 0.04)	0.00*	0.00*
Any gastroduodenal disorder	6.3 6.0, 6.6)	7.3 (6.8, 7.8)	5.2 (4.8, 5.7)	4.5 (4.0, 4.9)	6.1 (5.6, 6.7)	11.3 (10.3,12.4)
C. Bowel Disorders						
Rome-IV IBS **IBS-C** **IBS-D** **IBS-U** **IBS-M**	1.5 (1.3, 1.7) 0.6 (0.5, 0.7) 0.4 (0.3, 0.5) 0.2 (0.2, 0.3) 0.3 (0.2, 0.3)	2.0 (1.7, 2.3) 0.8 (0.6, 1.0) 0.5 (0.4, 0.6) 0.3 (0.2, 0.4) 0.4 (0.2, 0.5)	1.0 (0.8, 1.2) 0.3 (0.2, 0.4) 0.4 (0.2, 0.5) 0.2 (0.1, 0.3) 0.2 (0.1, 0.2)	1.4 (1.1, 1.7) 0.4 (0.3, 0.5) 0.5 (0.3, 0.6) 0.3 (0.2, 0.4) 0.2 (0.1, 0.3)	1.5 (1.2, 1.7) 0.6 (0.4, 0.7) 0.4 (0.3, 0.6) 0.2 (0.1, 0.3) 0.2 (0.1, 0.3)	1.9 (1.4, 2.4) 1.0 (0.6, 1.3) 0.3 (0.1, 0.4) 0.2 (0.0, 0.3) 0.5 (0.2, 0.7)
Functional Constipation	6.6 (6.3, 6.9)	7.4 (6.9, 7.9)	5.8 (5.4, 6.3)	5.2 (4.7, 5.6)	6.3 (5.8, 6.8)	11.1 10.0,12.1)
Opioid-induced constipation	0.9 (0.7, 1.0)	1.0 (0.8, 1.2)	0.8 (0.6, 0.9)	0.5 (0.4, 0.7)	0.8 (0.6, 1.0)	1.9 (1.4, 2.4)
Functional diarrhea	1.2 (1.0, 1.3)	1.1 (0.9, 1.3)	1.3 (1.0, 1.5)	0.9 (0.7, 1.1)	1.2 (1.0, 1.5)	1.7 (1.3, 2.2)
Functional bloating/distention	1.2 (1.0, 1.3)	1.3 (1.1, 1.5)	1.1 (0.9, 1.3)	1.1 (0.8, 1.3)	1.4 (1.1, 1.6)	1.0 (0.7, 1.4)
Unspecified functional bowel disorder	5.6 (5.3, 5.9)	6.2 (5.8, 6.7)	5.0 (4.6, 5.4)	5.2 (4.8, 5.7)	5.4 (4.9, 5.9)	7.2 (6.3, 8.2)
Any bowel disorder	16.8 (16.2, 17.3)	18.7 (17.9, 19.4)	14.8 (14.1, 15.5)	14.1 (13.3, 14.8)	16.4 (15.6, 17.2)	24.5 (23.0, 25.9)

D. CNS Disorders of GI Pain						
Centrally mediated abdominal pain syndrome	0.05 (0.02, 0.08)	0.05 (0.01, 0.10)	0.04 (0.00, 0.08)	0.06 (0.01, 0.12)	0.03 (0.00, 0.06)	0.06 (0.00, 0.15)
E. Biliary Disorders						
Functional biliary pain	0.03 (0.00, 0.05)	0.04 (0.00, 0.08)	0.01 (0.00, 0.03)	0.00*	0.00*	0.16 (0.02, 0.30)
F. Anorectal Disorders						
Fecal incontinence	0.4 (0.4, 0.5)	0.5 (0.4, 0.7)	0.4 (0.2, 0.5)	0.2 (0.1, 0.3)	0.4 (0.3, 0.5)	1.2 (0.8, 1.6)
Levator ani syndrome	0.7 (0.6, 0.8)	0.9 (0.7, 1.1)	0.5 (0.3, 0.6)	0.4 (0.3, 0.6)	0.7 (0.5, 0.9)	1.3 (0.9, 1.7)
Proctalgia fugax	1.7 (1.5, 1.9)	2.0 (1.7, 2.2)	1.4 (1.2, 1.7)	1.4 (1.1, 1.6)	1.9 (1.6, 2.2)	1.8 (1.4, 2.3)
Any anorectal disorder	2.7 (2.5, 2.9)	3.3 (2.9, 3.6)	2.1 (1.8, 2.4)	1.9 (1.6, 2.2)	3.0 (2.6, 3.3)	4.0 (3.3, 4.7)

*= no cases

Table 2. Prevalence rates (% and 95% CI) for five selected major functional gastrointestinal diagnoses (Rome IV), for any FGID (26 countries) and Rome III IBS (14 countries) in the Internet survey and for all 9 countries in the Household survey.

	N	Any FGID	Functional Dyspepsia	IBS (Rome IV)	IBS (Rome III) (N=14)	Functional Constipation	Functional Diarrhea	Functional bloating/distention
INTERNET								
Argentina	2057	47.1 (44.9, 49.2)	6.9 (5.8, 8.0)	3.5 (2.7, 4.3)	N/A	12.2 (10.7, 13.6)	6.3 (5.2, 7.3)	5.2 (4.2, 6.1)
Australia	2036	39.6 (37.5. 41.7)	7.2 (6.0, 8.3)	3.5 (2.7, 4.3)	N/A	7.7 (6.6, 8.9)	5.1 (4.1, 6.0)	4.2 (3.3, 5.0)
Belgium	2021	38.3 (36.2, 40.5)	5.0 (4.0, 5.9)	3.3 (2.5, 4.0)	7.5 (6.4, 8.7)	11.0 (9.7, 12.4)	4.0 (3.2, 4.9)	2.4 (1.7, 3.0)
Brazil	2004	45.9 (43.7, 48.0)	10.6 (9.2, 11.9)	4.7 (3.8, 5.6)	8.3 (7.1, 9.5)	11.9 (10.5, 13.3)	4.8 (3.9, 5.7)	2.7 (2.0, 3.5)
Canada	2029	43.0 (40.9, 45.2)	7.8 (6.7, 9.0)	4.2 (3.3, 5.1)	10.12 (8.8, 11.4)	9.3 (8.0, 10.5)	7.6 (6.4, 8.7)	3.3 (2.5, 4.1)
China	2914	37.3 (35.5, 39.1)	5.9 (5.0, 6.7)	2.3 (1.8, 2.9)	7.4 (6.5, 8.4)	10.6 (9.5, 11.7)	5.6 (4.8, 6.5)	0.7 (0.4, 1.0)
Colombia	2007	44.7 (42.6, 46.9)	7.2 (6.0, 8.3)	4.3 (3.4, 5.2)	N/A	12.8 (11.3, 14.2)	4.1 (3.2, 5.0)	4.5 (3.6, 5.4)
Egypt	2020	50.0 (47.8, 52.2)	12.3 (10.8, 13.7)	7.6 (6.4, 8.7)	14.0 (12.4, 15.59)	14.1 (12.6, 15.6)	2.2 (1.6, 2.9)	3.2 (2.4, 3.9)
France	2019	48.8 (46.6, 51.0)	8.5 (7.3, 9.7)	4.2 (3.3, 5.0)	9.8 (8.5, 11.1)	14.5 (12.6, 16.1)	6.1 (5.1, 7.2)	6.0 (5.0, 7.0)
Germany	2020	38.7 (36.6, 40.8)	6.9 (5.8, 8.0)	3.7 (2.8, 4.5)	11.1 (9.8, 12.5)	9.8 (7.9, 10.5)	5.4 (4.4, 6.4)	2.8 (2.1, 3.5)
Holland	2008	32.4 (30.3, 34.4)	4.1 (3.2, 5.0)	3.8 (2.9, 4.6)	9.7 (8.4, 11.0)	9.2 (7.9, 10.5)	3.2 (2.5, 4.0)	1.5 (1.0, 2.0)
Israel	2012	40.1 (37.9, 42.2)	3.6 (2.8, 4.4)	3.2 (2.5, 4.0)	12.8 (11.4, 14.3)	13.1 (11.6, 14.6)	2.4 (1.8, 3.1)	2.1 (1.5, 2.7)
Italy	2063	49.4 (47.3, 51.6)	9.1 (7.8,10.3)	5.0 (4.1, 5.9)	N/A	14.4 (12.7, 15.8)	3.2 (2.5, 4.0)	8.2 (7.1, 9.4)
Japan	2504	40.3 (38.3, 42.2)	2.4 (1.8, 3.0)	2.2 (1.6, 2.7)	9.3 (8.2, 10.4)	16.6 (15.1, 18.0)	5.2 (4.3, 6.0)	1.2 (0.8, 1.6)
South Korea	2022	41.0 (38.9, 43.1)	4.9 (4.0, 5.9)	4.7 (3.8, 5.6)	N/A	12.5 (11.0, 13.9)	5.8 (4.8, 6.8)	2.1 (1.5, 2.8)
Mexico	2001	43.2 (41.0, 45.4)	6.6 (5.5, 7.7)	4.0 (3.2, 4.9)	12.6 (11.1, 14.0)	11.5 10.1, 12.9)	4.4 (3.5, 5.3)	3.4 (2.6, 4.2)
Poland	2057	47.6 (45.4, 49.8)	8.3 (7.1, 9.5)	4.4 (3.5, 5.3)	N/A	14.2 (12.7, 15.8)	4.5 (3.6, 5.4)	5.3 (4.3, 6.3)
Romania	2049	41.5 (39.4, 43.7)	7.4 (6.3, 8.6)	3.5 (2.7, 4.3)	N/A	11.7 (10.3, 13.1)	2.6 (1.9, 3.3)	6.7 (5.6, 7.8)
Russia	2000	46.7 (44.5, 48.9)	10.3 (9.0, 11.6)	5.9 (4.8, 6.9)	16.5 (14.9, 18.1)	11.6 (10.1, 13.0)	7.1 (6.0, 8.2)	2.6 (1.9, 3.2)

Singapore	2047	33.7 (31.6, 35.7)	5.9 (4.9, 6.9)	1.3 (0.8, 1.8)	4.3 (3.4, 5.1)	9.5 (8.2, 10.7)	4.3 (3.4, 5.1)	3.6 (2.8, 4.4)
South Africa	2021	48.1 (46.0, 50.3)	11.0 (9.7, 12.4)	5.9 (4.9, 7.0)	N/A	11.1 (9.7, 12.5)	5.1 (4.2, 6.1)	4.2 (3.3, 5.1)
Spain	2072	47.7 (45.6, 49.9)	7.4 (6.3, 8.5)	4.2 (3.4, 5.1)	N/A	12.8 (11.4, 14.3)	4.8 (3.9, 5.7)	3.4 (2.6, 4.2)
Sweden	2084	41.1 (39.0, 43.2)	8.2 (7.0, 9.4)	4.0 (3.1, 4.8)	N/A	10.3 (9.0, 11.6)	5.9 (4.8, 6.9)	3.1 (2.4, 3.9)
Turkey	2010	46.2 (44.0, 48.4)	5.3 (4.3, 6.3)	3.9 (3.1, 4.8)	9.8 (8.5, 11.1)	14.1 (12.6, 15.6)	2.5 (1.8, 3.2)	3.0 (2.2, 3.7)
USA	2023	41.3 (39.2, 43.5)	10.1 (8.8, 11.4)	5.3 (4.4, 6.3)	N/A	8.7 (7.5, 10.0)	5.0 (4.1, 6.0)	2.0 (1.4, 2.6)
UK	2027	38.1 (36.0, 40.2)	6.6 (5.5, 7.6)	4.0 (3.1, 4.8)	N/A	8.6 (7.4, 9.8)	4.5 (3.6, 5.4)	3.8 (3.0, 4.7)
Pooled overall prevalence	**54127**	**42.7 (42.2, 43.1)**	**7.2 (7.0, 7.4)**	**4.1 (3.9, 4.2)**	**10.1 (9.8, 10.5)**	**10.1 (11.4, 12.0)**	**4.7 (4.5, 4.9)**	**3.5 (3.3, 3.6)**
HOUSEHOLD								
Bangladesh	2018	40.4 (38.2, 42.5)	19.4 (17.7,21.2)	4.6 (3.7, 5.5)	10.7 (9.3, 12.0)	11.8 (10.4, 13.2)	2.1 (1.5, 2.8)	2.2 (1.6, 2.9)
China	2710	23.1 (21.5, 24.7)	4.3 (3.6, 5.1)	1.4 (1.0, 1.8)	3.8 (3.1, 4.5)	6.2 (5.3, 7.1)	2.6 (2.0, 3.2)	1.3 (0.8, 1.7)
Ghana	1190	45.5 (42.6, 48.3)	7.2 (5.8, 8.7)	0.3 (0.0, 0.7)	0.4 (0.1, 0.8)	26.1 (23.6, 28.6)	0.7 (0.2, 1.1)	0.0
India	4592	8.1 (7.3, 8.8)	0.7 (0.5, 1.0)	0.2 (0.1, 0.3)	0.4 (0.2, 0.6)	1.8 (1.4, 2.2)	0.2 (0.1, 0.4)	0.2 (0.1, 0.3)
Indonesia	1231	18.9 (16.7, 21.1)	4.4 (3.2, 5.5)	3.5 (2.5, 4.5)	6.2 (4.8, 7.5)	3.5 (2.5, 4.5)	1.1 (0.5, 1.6)	1.1 (0.5, 1.6)
Iran	1840	29.6 (27.5, 31.7)	2.9 (2.1, 3.6)	2.1 (1.4, 2.7)	4.6 (3.6, 5.5)	11.0 (9.5,12.4)	1.3 (0.7, 1.8)	5.1 (4.1, 6.1)
Malaysia	1976	20.0 (18.3, 21.8)	3.3 (2.5, 4.1)	0.7 (0.3, 1.1)	3.9 (3.1, 4.8)	5.4 (4.4, 6.4)	1.7 (1.1, 2.3)	0.9 (0.5, 1.3)
Nigeria	1442	27.5 (25.2, 29.8)	6.0 (4.8, 7.3)	2.7 (1.9, 3.5)	5.1 (3.8, 6.4))	4.3 (3.3, 5.3)	0.9 (0.4, 1.4)	0.3 (0.0, 0.7)
Turkey	1950	8.5 (7.2, 9.7)	1.1 (0.6, 1.5)	0.4 (0.1, 0.7)	0.9 (0.5, 1.3)	1.9 (1.3, 2.6)	0.4 (0.1, 0.6)	0.5 (0.2, 0.8)
Pooled overall prevalence	**18949**	**21.6 (21.0, 22.1)**	**4.8 (4.5, 5.1)**	**1.5 (1.3, 1.7)**	**3.5 (3.3, 3.8)**	**6.6 (6.3, 6.9)**	**1.2 (1.0, 1.3)**	**1.2 (1.0, 1.3)**

Table 3. A comparison of pooled prevalence rates (% and 95% CI) for Rome III and Rome IV diagnostic criteria for IBS in 14 Internet countries (N=29,606) and 9 household countries (N=18,949).

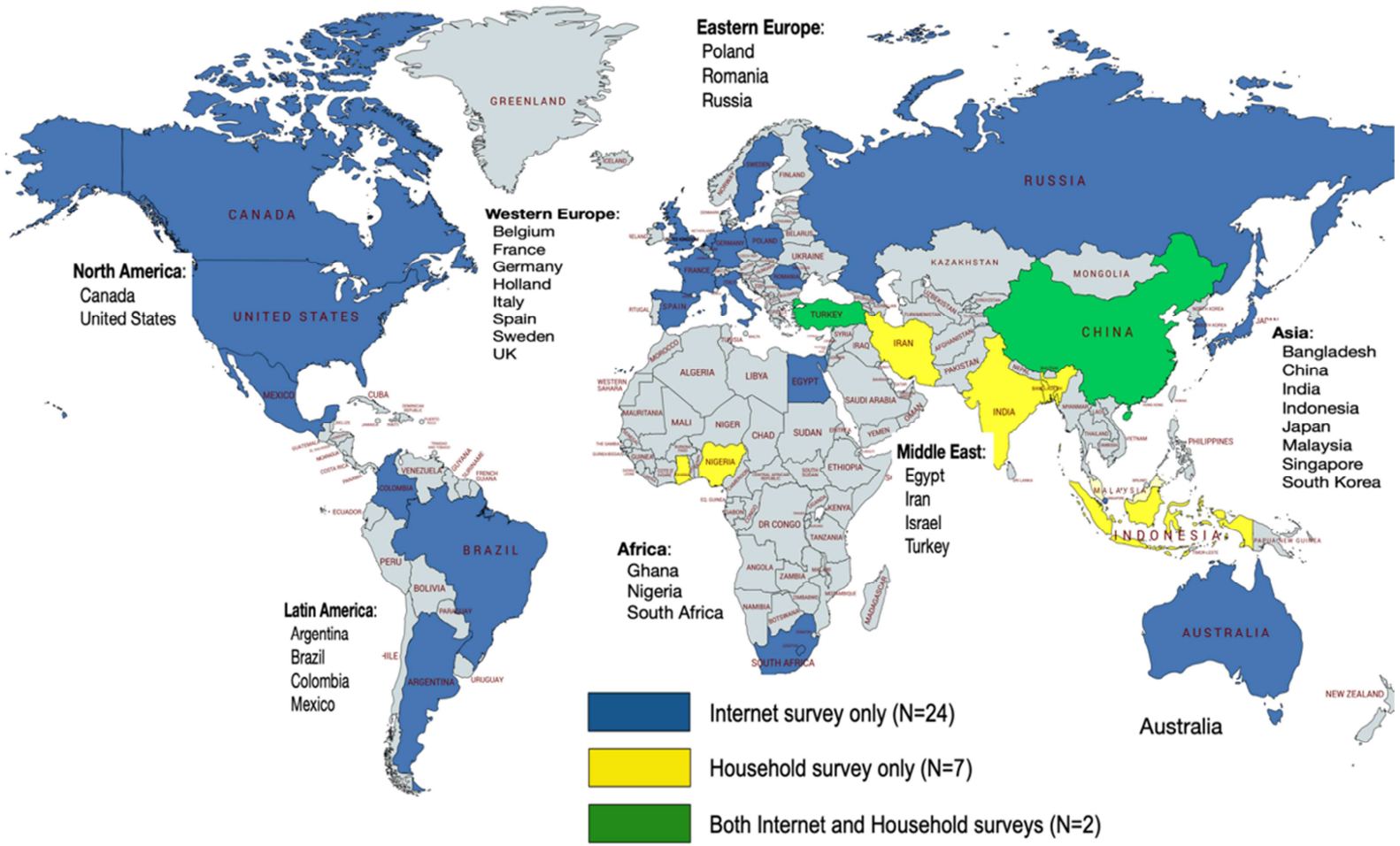
FGID	Overall	Sex		Age group (years)		
		Females	Males	18-39	40-64	65+
INTERNET						
Rome IV IBS	3.8 (3.6, 4.0)	4.8 (4.4, 5.1)	2.9 (2.6, 3.1)	4.9 (4.5, 5.3)	3.3 (3.0, 3.6)	1.9 (1.6, 2.3)
Rome III IBS	10.1 (9.8, 10.5)	12.6 (12.1, 13.2)	7.80 (7.3, 8.2)	11.5 (11.0, 12.1)	9.7 (9.1, 10.2)	7.5 (6.78, 8.2)
HOUSEHOLD						
Rome IV IBS	1.5 (1.3, 1.7)	2.0 (1.7, 2.3)	1.0 (0.8, 1.2)	1.4 (1.1, 1.7)	1.5 (1.2, 1.7)	1.9 (1.4, 2.4)
Rome III IBS	3.5 (3.3, 3.81)	4.1 (3.7, 4.5)	3.0 (2.6, 3.3)	2.9 (2.5, 3.2)	3.4 (3.0, 3.8)	5.5 (4.7, 6.3)

Table 4. Comparison of PROMIS-10 quality of life scores (physical and mental) for patients with and without at least one FGID, and rates of doctor visits for bowel and any other health problems in the 26 Internet survey countries and in the 9 Household survey countries.

		PROMIS-10 Physical (mean, 95% CI)		**PROMIS-10 Mental (mean, 95% CI)**		**Has visited a doctor for bowel problem (%, 95% CI)**		**One or more doctor visits/month for any health problem (%, 95% CI)**	
	N	**Any FGID**	**No FGID**	**Any FGID**	**No FGID**	**Any FGID**	**No FGID**	**Any FGID**	**No FGID**
INTERNET									
Pooled Estimates	**54127**	**13.5 (13.4, 13.5)**	**15.2 (15.2, 15.2)**	**12.6 (12.5, 12.6)**	**14.3 (14.2, 14.3)**	**15.5 (15.0, 16.0)**	**9.7 (9.4, 10.0)**	**46.7 (46.0, 47.3)**	**26.1 (25.7, 26.6)**
Argentina	2057	13.9 (13.7, 14.0)	15.3 (15.1, 15.4)	13.5 (13.3, 13.7)	14.8 (14.7, 15.0)	12.0 9.9, 14.0)	12.0 (10.1,14.0)	51.0 (47.9,54.2)	34.9 (32.1,37.7)
Australia	2036	13.6 (13.4, 13.8)	15.3 (15.2, 15.5)	12.4 (12.1, 12.6)	14.4 (14.2, 14.6)	24.6 (21.6, 27.5)	14.5 (12.5, 16.4)	39.0 (35.6, 42.3)	18.9 (16.8, 21.1)
Belgium	2021	13.4 (13.2, 13.6)	15. (14.9, 15.2)	12.8 (12.6, 13.1)	14.3 (14.1, 14.4)	16.6 (14.0, 19.3)	9.6 (7.9, 11.2)	49.3 (45.8, 52.8)	31.7 (29.1, 34.3)
Brazil	2004	13.0 (12.8, 13.2)	14.9 (14.8, 15.1)	12.6 (12.3, 12.8)	14.6 (14.4, 14.7)	13.4 (11.2, 15.6)	9.3 (7.6, 11.0)	45.3 42.0, 48.5)	26.8 (24.2, 29.5)
Canada	2029	13.4 (13.2, 13.6)	15.3 (15.2, 15.5)	12.4 (12.1, 12.6)	14.5 (14.3, 14.7)	14.8 (12.4, 17.1)	6.3 (4.9, 7.7)	39.6 (36.4, 42.9)	16.6 (14.5, 18.8)
China	2914	13.9 (13.8,14.0)	15.5 (15.4, 15.6)	12.3 (12.2, 12.5)	13.7 (13.6, 13.9)	12.5 (10.5, 14.5)	6.4 (5.3, 7.5)	59.9 (57.0, 62.8)	36.6 (34.4,38.8)
Colombia	2007	14.2 (14.0, 14.3)	15.8 (15.7, 15.9)	13.9 (13.7, 14.1)	15.4 (15.3, 15.6)	16.0 (13.6, 18.4)	13.3 (11.3, 15.3)	60. 1(56.9, 63.3)	34.4 (31.6, 37.2)
Egypt	2020	13.3 (13.1, 13.4)	15.2 (15.1, 15.4)	12.4 (12.3,12.6)	14.2 (14.0, 14.4)	10.5 8.6,1 2.4)	8.4 (6.7, 10.1)	47.4 (44.3, 50.5)	24.4 (21.7, 27.0)
France	2019	13.4 (13.3, 13.6)	15.0 (14.8, 15.1)	12.7 (12.6, 12.9)	14.3 (14.1, 14.5)	13.9 (11.7, 16.1)	8.9 (7.2, 10.6)	45.3 (42.2, 48.4)	27.6 (24.8, 30.3)
Germany	2020	13.1 (12.9, 13.3)	15.1 (15.0, 15.3)	12.6 (12.4, 12.8)	14.5 (14.3,14.7)	20.5 (17.6 ,23.3)	10.2 (8.5,11.9)	38.5 (35.1, 41.9)	22.6 (20.3, 25.0)

Holland	2008	13.4 (13.2, 13.6)	15.8 (15.6,15.9)	12.7 (12.5, 13.0)	14.8 (14.6,14.9)	10.5 (8.1,12.8)	4.1 (3.0, 5.1)	44.9 (41.1, 48.8)	19.8 (17.7, 21.9)
Israel	2012	14.2 (14.0, 14.4)	15.8 (15.6, 15.9)	14.0 (13.8, 14.3)	15.8 (15.6, 16.0)	18.7 (16.0, 21.4)	10.6 (8.9, 12.4)	44.2 (40.7, 47.6)	20.6 (18.3, 22.8)
Italy	2063	13.8 (13.6, 14.0)	15.3 (15.1, 15.4)	12.4 (12.2, 12.6)	13.9 (13.8, 14.1)	21.4 (18.9, 23.9)	18.5 (16.1, 20.9)	53.8 (50.8, 56.9)	32.5 (29.7, 35.3)
Japan	2504	13.7 (13.5, 13.8)	15.0 (14.9, 15.1)	10.6 (10.4, 10.8)	12.3 (12.1, 12.5)	23.0 (20.4, 25.6)	17.8 (15.8, 19.7)	45.2 (42.2, 48.3)	31.1 (28.8, 33.5)
South Korea	2022	12.0 (11.9, 12.2)	13.5 (13.4, 13.7)	10.7 (10.5, 10.9)	12.3 (12.1, 12.5)	20.1 (17.4, 22.9)	15.2 (13.1, 17.2)	51.0 (47.6, 54.4)	29.5 (26.9, 32.1)
Mexico	2001	13.5 (13.4, 13.7)	15.3 (15.2, 15.5)	13.5 (13.4, 13.7)	15.2 (15.0, 15.3)	22.2 (19.4, 25.0)	18.6 (16.4, 20.9)	73.5 (70.5, 76.4)	46.6 (43.7, 49.5)
Poland	2057	13.3 (13.2, 13.5)	14.7 (14.6, 14.9)	13.0 (12.9, 13.2)	14.2 (14.0, 14.4)	15.7 (13.4, 18.0)	9.8 (8.1, 11.6)	40.4 (37.4, 43.5)	22.1 (19.6, 24.6)
Romania	2049	13.4 (13.2, 13.5)	15.0 (14.9, 15.1)	13.3(13.2, 13.5)	14.8(14.6, 14.9)	15.6 (13.2, 18.1)	10.6 (8.9, 12.3)	38.1 (34.8, 41.3)	23.7 (21.3, 26.1)
Russia	2000	12.8 (12.6, 12.9)	14.3 (14.1, 14.4)	11.2 (11.0, 11.4)	12.9 (12.7, 13.0)	10.0 (8.0, 11.9)	5.3 (3.9, 6.6)	41.8 (38.6, 44.9)	21.9 (19.4, 24.3)
Singapore	2047	14.3 (14.1, 14.4)	15.5 (15.4, 15.6)	12.5 (12.3, 12.7)	14.0 (13.8, 14.1)	8.3 (6.2, 10.3)	3.5 2.5, 4.4)	39.0 (35.4, 42.7)	23.6 (21.4 ,25.9)
South Africa	2021	13.7 (13.6, 13.9)	15.7 (15.6, 15.8)	12.7 (12.5, 12.9)	14.6 (14.4, 14.7)	6.7 (5.1, 8.3)	4.4 (3.1, 5.6)	41.4 (38.3, 44.5)	21.4 (18.9, 23.9)
Spain	2072	13.8 (13.6, 14.0)	15.5 (15.4, 15.6)	13.2 (13.0, 13.4)	14.7 (14.5, 14.9)	16.7 (14.4, 19.0)	7.9 (6.3, 9.6)	60.4 (57.3, 63.4)	35.9 (33.1, 38.8)
Sweden	2084	13.4 (13.2, 13.6)	15.0 (14.9, 15.2)	12.3 (12.1, 12.6)	14.6 (14.4, 14.8)	5.6 (4.1, 7.1)	2.9 (1.9, 3.8)	36.3 (33.1, 39.5)	18.7 (16.6, 20.9)
Turkey	2010	13.1 (12.9, 13.2)	14.5 (14.4, 14.7)	12.2 (12.0, 12.4)	13.7 (13.5, 13.8)	19.1 (16.5, 21.6)	13.0 (11.0, 15.0)	40.2 (37.0, 43.4)	21.2 (18.7, 23.6)
USA	2023	13.6 (13.4, 13.8)	15.8 (15.7, 16.0)	13.1 (12.9, 13.4)	15.3 (15.1, 15.5)	20.0 (17.3, 22.7)	8.4 (6.8, 10.0)	36.5 (33.2, 39.8)	15.1 (13.0, 17.1)

UK	2027	13.1 (12.9, 13.3)	15.5 (15.4, 15.7)	12.0 (11.7, 12.2)	14.4 (14.2, 14.6)	14.4 (11.9, 16.9)	4.9 (3.7, 6.1)	42.1 (38.6, 45.6)	18.6 (16.5, 20.8)
HOUSEHOLD									
Pooled Estimates	**18949**	**14.1 (14.0, 14.2)**	**15.7 (15.7, 15.7)**	**13.1 (13.0, 13.2)**	**14.1 (14.1, 14.2)**	**14.0 (13.0, 15.1)**	**13.7 (13.2, 14.2)**	**26.8 (25.5, 28.1)**	**11.6 (11.1, 12.1)**
Bangladesh	2018	13.0 (12.8, 13.2)	15.2 (15.1, 15.3)	11.0 (10.8, 11.1)	12.0 (11.9, 12.1)	2.5 (1.4, 3.5)	1.0 (0.4, 1.6)	20.4 17.6, 23.1)	5.6 (4.3, 6.9)
China	2710	14.8 (14.6, 15.0)	16.7 (16.6 ,16.8)	13.1 (12.9, 13.3)	14.4 (14.3, 14.5)	16.0 (13.1, 18.9)	6.5 (5.5, 7.6)	37.3 (33.5, 41.1)	15.9 (14.3, 17.4)
Ghana	1190	16.4 (16.3, 16.6)	17. 4 (17.3, 17.5)	17.3 (17.2, 17.5)	17.7 (17.5, 17.9)	13.5 (10.6, 16.4)	24.5 (21.2, 27.8)	3.2 (1.7, 4.7)	9.5 (7.2, 11.8)
India	4592	13.3 (13.1, 13.6)	15.2 (15.1, 15.3)	11.8 (11.5, 12.1)	13.2 (13.1, 13.2)	34.9 (30.0, 39.7)	18.3 (17.1, 19.5)	20.1 (15.9, 24.2)	6.2 (5.5, 7.0)
Indonesia	1231	15.4 (15.1, 15.8)	16.7 (16.5, 16.8)	13.6 (13.3, 13.9)	14.3 (14.1, 14.4)	23.6 (18.1, 29.1)	9.2 (7.4, 11.0)	18.0 (13.1, 23.0)	6.2 (4.7, 7.7)
Iran	1840	13.2 (13.0, 13.4)	14.8 (14.6, 14.9)	12.1 (11.9, 12.3)	13.1 (12.9, 13.3)	9.4 (6.9, 11.8)	7.3 (5.9, 8.8)	54.3 (50.1, 58.5)	46.5 (43.8, 49.2)
Malaysia	1976	14.8 (14.6, 15.1)	16.4 (16.2, 16.5)	14.0 (13.7, 14.2)	15.2 (15.1, 15.3)	14.1 (10.7, 17.6)	15.3 (13.5, 17.0)	28.4 (24.0, 32.9)	7.8 (6.4, 9.1)
Nigeria	1442	13.8 (13.5, 14.1)	15.7 (15.5, 15.9)	13.1 (12.9, 13.4)	14.6 (14.4, 14.8)	13.6 (10.2, 17.0)	8.0 (6.4, 9.7)	25.0 (20.6, 29.4)	9.7 (7.9, 11.5)
Turkey	1950	13.9 (13.5, 14.3)	16.1 (16.0, 16.2)	13.2 (12.7, 13.7)	15.9 (15.8, 16.0)	21.8 (15.5, 28.2)	24.9 (22.9, 26.9)	30.9 (23.8, 38.0)	6.4 (5.3, 7.5)



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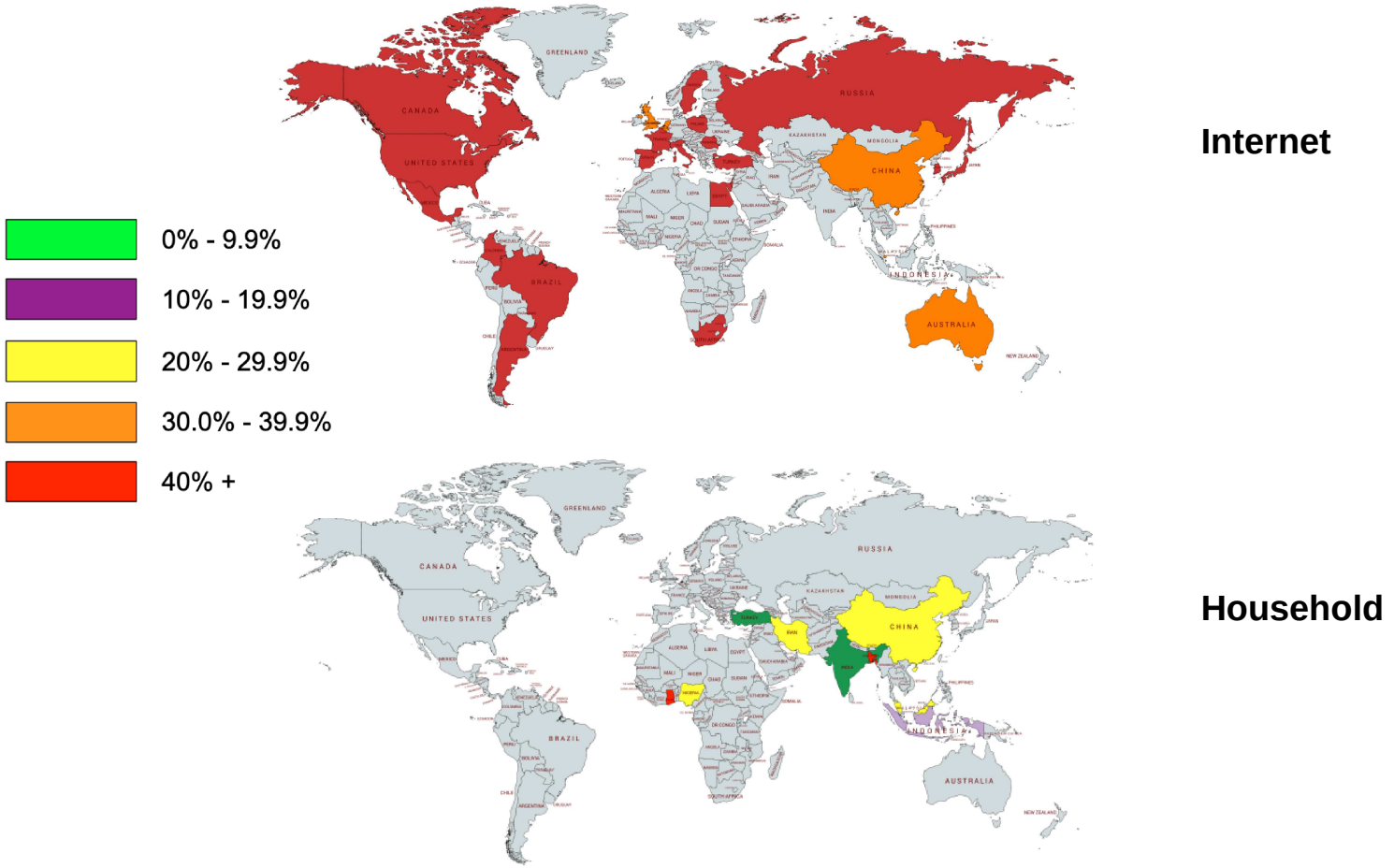

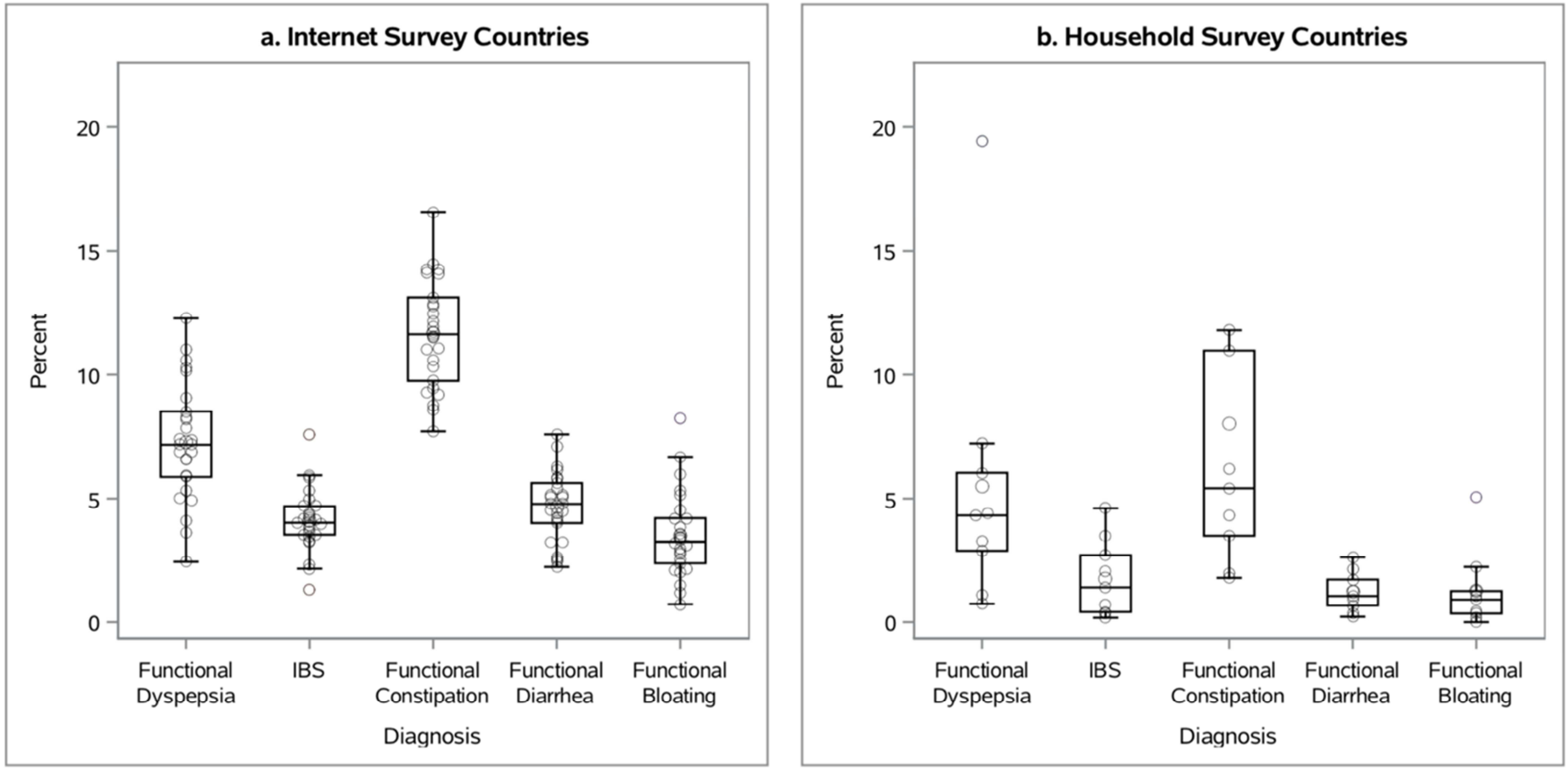

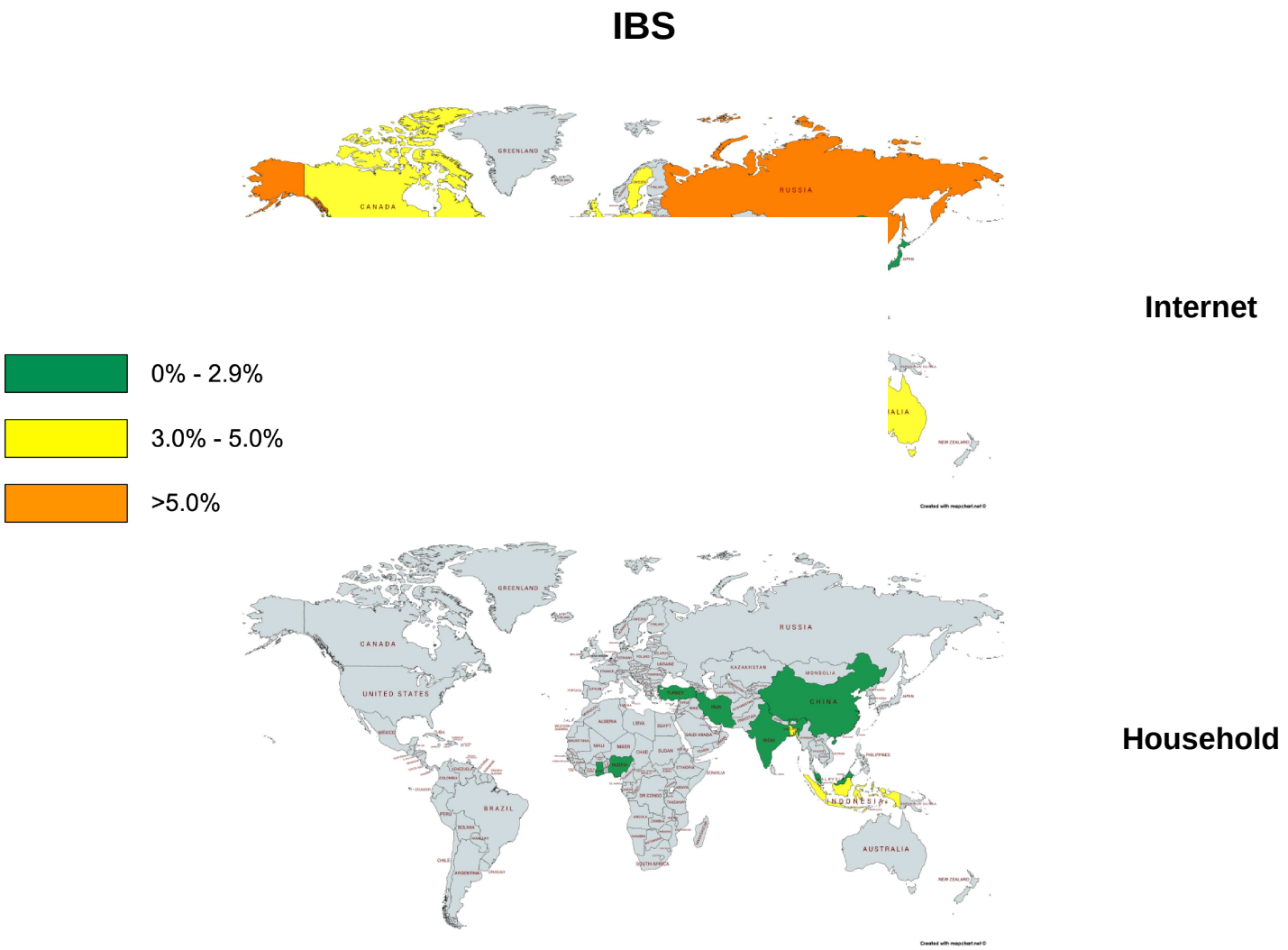

Supplemental Table 1. Item content of the entire global study questionnaire.

Question content	*Number of questions*
Demographic questions:	
Age	1
Sex	1
Years of education	1
Relationship status	1
Size of local community where respondent lives	1
Region (state, province, etc·) of residence	1
Race/Ethnicity (not administered in all survey countries)	1
Religious/spiritual self-identification	1
Personal Health Questionnaire-15 (PHQ-15)	15
Rome IV Diagnostic Questionnaire for Adult FGIDs	89
IBS Severity Scale Score (IBS-SSS)	7
Current living conditions: Whether respondent lives on a farm, has running water and electricity, daily access to telephone and internet, number of people in the household, number of bedrooms and toilets·	4
Childhood living conditions up to age 7: Whether respondent lived on a farm, had running water and electricity, number of people in the household, number of bedrooms and toilets·	4
Childhood country of residence	1
Childhood size of local community	1
Access to medical care if needed	1
Type of medical care that would be sought if needed (Western style medicine and/or traditional or folk healer	1
Frequency of doctor visits	1
Who pays for medical expenses	1
History of medical diagnoses (checklist of 12 GI diagnoses and conditions that may affect FGIDs)	1
History of GI and abdominal surgeries· Checklist of 5 surgery types	1
Medications taken regularly (at least once a week)· Yes/no list of 10 types of medications	1
Bowel infection history: Whether current bothersome symptoms first started immediately after bowel infection	1
Symptoms, conditions and treatment of bowel infection preceding first onset of current bothersome bowel symptoms	2
History of visiting doctor because of a bowel problem (yes/no)	1
Type of doctor seen for bowel problems	1
Concern about own bowel functioning (yes/no)	1
Embarrassment about bowel functioning (yes/no)	1
Impact of stress, pressure or tension on bowel functioning (yes/no)	1
Diet: Days per week of consumption of 10 food types	1
PROMIS Global-10 quality of life questionnaire	10
Personal Health Questionnaire – 4 (PHQ-4): Anxiety and depression screening measure	4
Height and weight	2
Rome III diagnostic questions for IBS (not administered in all countries)	8

Supplemental table 2. Countries, language, and distribution by sex and age for the Internet and Household surveys. The planned sex distribution was 50/50 and the planned age distribution was 40% (18-39), 40% (40-64), and 20% (65+). O=original translation; L=localized translation.

Country	Languages	N	Sex distribution (%)		Age distribution (%)		
			Male (50%)	Female (50%)	18-39 (40%)	40-64 (40%)	65+ (20%)
INTERNET							
Argentina	Spanish (L)	2,058	50.6	49.4	39.5	40.2	20.4
Australia	English (L)	2,037	50.2	49.8	39.8	40.2	20.0
Belgium	French (L), Dutch (L)	2,021	50.1	49.9	40.2	40.0	19.8
Brazil	Portuguese (O)	2,000	50.0	50.0	39.8	40.0	20.2
Canada	English (L), French (L)	2,029	50.1	49.9	39.9	40.0	20.1
China	Chinese (O)	3,013	50.2	49.8	40.1	40.1	19.8
Colombia	Spanish (L)	2,088	49.9	50.1	41.1	43.4	15.4
France	French (O)	2,043	49.9	50.1	40.2	40.8	19.0
Germany	German (O)	2,042	49.8	50.2	40.3	40.2	19.5
Holland	Dutch (O)	2,008	50.0	50.0	39.8	40.1	20.1
Israel	Hebrew (O), Arabic (L), Russian (L), English (L)	2,014	50.0	50.0	40.3	40.4	19.3
Italy	Italian (O)	2,073	50.3	49.7	39.9	40.2	19.9
Japan	Japanese (O)	2,504	48.6	51.4	40.5	39.8	19.7
Mexico	Spanish (O)	2,001	50.4	49.6	40.4	40.4	19.2
Poland	Polish (O)	2,057	49.9	50.1	40.2	40.1	19.7
Romania	Romanian (O)	2,049	50.1	49.9	40.5	54.9	4.6
Russia	Russian (O)	2,000	50.7	49.3	40.0	40.3	19.7
Singapore	English (L), Chinese (L), Bahasa Malay (L)	2,047	50.0	50.0	47.7	48.6	3.7
South Africa	English (L)	2,023	50.3	49.7	53.1	40.6	6.3
South Korea	Korean (O)	2,085	50.4	49.6	38.6	51.0	10.3
Spain	Spanish (L)	2,071	50.2	49.8	39.8	40.3	19.9

Country	Languages	N	Sex distribution (%)		Age distribution (%)		
			Male (50%)	Female (50%)	18-39 (40%)	40-64 (40%)	65+ (20%)
Sweden	Swedish (O)	2,088	50.2	49.8	39.8	40.1	20.1
Turkey	Turkish (O)	2,010	49.8	50.2	50.1	44.7	5.2
UK	English (L)	2.027	50.1	49.9	39.8	40.1	20.1
US	English (O)	2,026	50.1	49.9	39.8	40.0	20.2
HOUSEHOLD							
Bangladesh	Bengali (L)	2018	49.01	50.99	39.69	40.39	19.92
China	Chinese (O)	2710	47.42	52.58	33.32	47.27	19.41
Ghana	English (L)	1190	51.09	48.91	40.92	40.34	18.74
India	Hindi (O), Telugu (O), Bengali (O)	4592	50.20	49.80	42.09	41.70	16.20
Indonesia	Bahasa (L)	1231	48.90	51.10	39.32	40.70	19.98
Iran	Farsi (O)	1840	49.84	50.16	40.16	40.00	19.84
Malaysia	Bahasa-Malay (O)	1976	47.67	52.33	46.51	40.13	13.36
Nigeria	English (L)	1442	51.53	48.47	39.67	41.68	18.65
Turkey	Turkish (O)	1950	50.67	49.33	53.69	43.49	2.82

Title for supplementary figure

Supplementary Fig. 1. Global maps showing study countries (Internet above, household below), color-coded for prevalence of IBS.

What you need to know:

Background and Context: Functional gastrointestinal disorders (FGIDs, or disorders of gut–brain interaction) place an economic burden on healthcare systems and reduce quality of life, but little is known about their worldwide prevalence or distribution.

New Findings: In a large-scale multi-national study, the authors found that more than 40% of persons worldwide have FGIDs. Similar trends and relative distributions were found in people who completed internet vs personal interviews.

Limitations: Study participants completed questionnaires over the internet or by in-person interviews; further studies of the worldwide prevalence of FGIDs, where possible with confirmation, are indicated.

Impact: FGIDs are common in all regions of the world. Proportions of persons with irritable bowel syndrome are lower when the Rome IV criteria are used, compared with the Rome III criteria.

Lay Summary: Functional gastrointestinal disorders, such as irritable bowel syndrome, are common worldwide, have negative effects on quality of life, and are a substantial economic burden; further research and new treatment strategies are needed.