

## GASTROENTEROLOGY

**Impact of the coronavirus disease 2019 pandemic on irritable bowel syndrome**

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**Abstract**

**Background and Aim:** Gastrointestinal manifestations of the coronavirus disease 2019 (COVID-19) pandemic may mimic irritable bowel syndrome (IBS), and social distancing measures may affect IBS patients negatively. We aimed to study the impact of COVID-19 on respondents with self-reported IBS.

**Methods:** We conducted an anonymized survey from May to June 2020 in 33 countries. Knowledge, attitudes, and practices on personal hygiene and social distancing as well as psychological impact of COVID-19 were assessed. Statistical analysis was performed to determine differences in well-being and compliance to social distancing measures between respondents with and without self-reported IBS. Factors associated with improvement or worsening of IBS symptoms were evaluated.

**Results:** Out of 2704 respondents, 2024 (74.9%) did not have IBS, 305 (11.3%) had self-reported IBS, and 374 (13.8%) did not know what IBS was. Self-reported IBS respondents reported significantly worse emotional, social, and psychological well-being compared with non-IBS respondents and were less compliant to social distancing measures (28.2% vs 35.3%,  $P = 0.029$ ); 61.6% reported no change, 26.6% reported improvement, and 11.8% reported worsening IBS symptoms. Higher proportion of respondents with no change in IBS symptoms were willing to practice social distancing indefinitely versus those who deteriorated (74.9% vs 51.4%,  $P = 0.016$ ). In multivariate analysis, willingness to continue social distancing for another 2–3 weeks (vs longer period) was significantly associated with higher odds of worsening IBS.

**Conclusion:** Our study showed that self-reported IBS respondents had worse well-being and compliance to social distancing measures than non-IBS respondents. Future research will focus on occupational stress and dietary changes during COVID-19 that may influence IBS.

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<sup>2</sup>Junxiong Pang and Kewin Tien Ho Siah should be considered co-senior authors.

## Introduction

Irritable bowel syndrome (IBS) is a common functional gastrointestinal disorder. In a recent global Internet survey, it was reported that the prevalence of IBS worldwide was between 3% and 5%.<sup>1</sup> Normally, patients may report recurrent abdominal pain that is associated with a change in consistency or frequency of stools, although without gross abnormalities.<sup>2</sup> Although the pathophysiology of IBS is still inadequately understood, it is likely to represent a group of heterogeneous diseases with different pathophysiology such as visceral hypersensitivities, increased mucosal permeability, immune activation, gut dysbiosis, gut dysmotility, and abnormal gut–brain interaction.<sup>3</sup> Findings from several studies present strong evidence that IBS is a stress-sensitive disorder. Multiple studies have shown that the major effects of psychosocial stress on gut physiology include increase in visceral hypersensitivity and mucosal permeability, alterations in gut motility and secretions, and negative effects on gut microbiota.<sup>4–6</sup>

Given the impact of stress on IBS, the sudden arrival of coronavirus disease 2019 (COVID-19) pandemic presented the worst-case scenario for patients with IBS. There is limited knowledge about this evolving disease. Until now, there is no vaccine or effective drug that can battle the disease.<sup>7</sup>

The impact of COVID-19 to human life is not just the psychological stress from the fear of contracting the disease itself but also from the measures taken to control the spread of the disease. The Chinese government placed a local lockdown on Wuhan at the start of the COVID-19 outbreak.<sup>8</sup> Since then, many countries have followed suit and instituted some form of lockdown and public health intervention to reduce the community spread of COVID-19. These measures that range from mandatory quarantine, voluntary self-isolation, compulsory wearing of face masks to social distancing, and traffic restriction have taken a toll on many people. Stress, fear, frustration, boredom, anxiety, and low mood may be the unintended consequences of these measures.<sup>9</sup>

Many people suffer from the loss of social connections and financial income directly or indirectly due to the COVID-19 pandemic. Changes to diet, lifestyle, and daily activities during lockdown also have deleterious effects on the control of chronic diseases like diabetes mellitus and hypertension.<sup>10</sup> There has also been a wider reduction in access to healthcare that could potentially lead to delayed diagnoses and result in simple treatable conditions evolving into more complicated diseases.<sup>11,12</sup>

Hence, in this study, we aim to investigate the impact of COVID-19 pandemic on severity of symptoms in patients with self-reported IBS and on development of new IBS cases. We also aim to evaluate the differences in knowledge, attitude, and

practices between self-reported IBS and non-IBS respondents as well as the risk factors leading to worsening in severity of IBS so as to understand and gather a more comprehensive management of IBS.

## Methods

**Study design and recruitment.** We performed a quantitative cross-sectional survey to assess the knowledge, attitudes, and practices (KAP) on personal hygiene and social distancing among individuals with self-reported IBS during this COVID-19 pandemic.

The secured survey was conducted via mySurvey from May to June 2020, an online survey platform hosted by the National University of Singapore (Verint Systems Inc., New York, NY, USA). The initial questionnaire was developed in English language. Translation to other languages was performed by Google Translate with review by native speakers of the language (including Chinese, Indonesian Bahasa, Malay, Bengali, and Korean). It was subsequently translated back to English for review by the local questionnaire development team to resolve any discrepancies in language.

The study was conducted during a period where many of the participating countries still had enhanced personal hygiene and social distancing measures in place. Recruitment was performed through social media platforms such as Facebook advertisements, Instagram, and WhatsApp. The countries involved were Singapore, Bangladesh, China, Hong Kong, Indonesia, Japan, Malaysia, Philippines, South Korea, and Taiwan to recruit participants from different parts of Asia who were currently residing in 33 different countries. Participants were from the general population, including those who were currently and previously diagnosed with COVID-19.

**Questionnaire.** The questionnaire was grouped into four main sections: (i) demographics, which surveyed socio-demographic information and included gender, age, housing, occupation, and household income; (ii) KAP on personal hygiene; (iii) KAP on social distancing; and (iv) the biopsychosocial impact on participants. Questions on 5-point Likert scale (never, seldom, 50% of the time, most of the time, and always) were designed to assess how often participants were compliant to good personal hygiene and social distancing practices. Knowledge about correct personal hygiene, use of personal protective equipment, modes of transmission of COVID-19, and correct social distancing practices were asked.

To assess the psychological impact of COVID-19, a validated questionnaire, Mental Health Continuum—Short Form, was used.<sup>13</sup> The Mental Health Continuum—Short Form has been developed to help assess positive mental health and incorporate emotional, psychological, and social components. The MCH-SF scale measures these three components and can also be used to classify participants as flourishing and not flourishing. Typically, those who are classified as flourishing reflect high levels of psychological, social, and emotional well-being.

To assess the impact of COVID-19 on IBS participants, we select respondents who reported themselves having IBS. Respondents who had never heard of or not sure about IBS diagnosis were excluded. Respondents with self-reported IBS were further divided into three groups (improve, no change, and worsen) based on the question, “If Yes, how is the control of your IBS during COVID-19 pandemic?”

To assess the rates of new development of IBS, respondents who previously did not have diagnosed IBS were selected and were asked if they had symptoms suggestive of IBS (fulfill Rome IV IBS criteria) and further questions evaluating the severity of these symptoms during the COVID-19 pandemic. Respondents were deemed to have newly developed IBS if they answered “Yes” to “Did you experience any newly developed abdominal pain at least 1 day per week in the last 3 months associated with

- pain that occurs together with bowel movement > 30% of the time with less frequent or harder stool.
- pain that occurs together with bowel movement > 30% of the time with more frequent or softer stool.
- pain not related to bowel movement, but less frequent and harder stool.
- pain not related to bowel movement but more frequent and softer stool.”

**Ethics.** As our study was completely anonymous, it posed no more than minimal risks to respondents and waiver of informed consent would not adversely affect the rights or welfare of study subjects. As such, it qualified for exemption from Singapore’s National Health Group Domain Specific Review Board ethics review (2020/00470). It was made clear to participants that by completing the questionnaire, they were giving implied consent for collected information to be used for the purpose of research.

**Statistical analysis.** Statistical analysis was performed using SPSS version 26 (IBM SPSS Statistics, Armonk, NY, USA). Respondents with improvement and worsening in severity of IBS were compared with those with no change, respectively, using chi-squared tests for questions with categorical outcomes and univariate analysis for questions with continuous outcomes. Bonferroni correction was applied. Factors, which were significant in univariable logistic regression, were included in multivariable logistic regression to determine if these factors were associated with improvement or worsening of IBS. The statistical significance level was set at  $P < 0.05$ .

## Results

**Study population demographics.** Out of 2704 respondents, 2024 (74.9%) did not have IBS, 305 (11.3%) had self-reported IBS, and 374 (13.8%) did not know what IBS was (Table 1 and Fig. 1). There were 234 (11.6%) respondents with self-reported IBS and 60 (19.7%) respondents without IBS who also had comorbidities (including diabetes mellitus, hypertension, hyperlipidemia, lung disease, heart disease, being immunocompromised, chronic kidney disease, chronic liver disease, gastrointestinal disease, and/or cancers) ( $P < 0.01$ ). There were no differences between respondents with and without self-reported IBS in terms of age, gender, economic region, education level, employment, work from home status, or country of origin (Tables 1 and S1). However, respondents with self-reported IBS reported significantly worse emotional, social, and psychological well-being compared with non-IBS respondents ( $P < 0.01$ ). They were also less compliant to social distancing measures compared with non-IBS respondents (28.2% vs 35.3%,  $P = 0.029$ ). Among the respondents who were IBS free, 55 (2.7%) developed IBS-C like symptoms and 41 (2.0%) developed IBS-D-like symptoms during COVID-19.

### **Impact of coronavirus disease 2019 pandemic on irritable bowel syndrome respondents.**

Out of the 305 respondents with self-reported IBS, the majority reported no change of their symptoms (61.6%), while 79 (26.6%) reported improvement in IBS symptoms and 35 (11.8%) reported worsened IBS symptoms. There were eight missing responses. There were no differences in demographics, knowledge, attitude, and practice of personal hygiene and social distancing and well-being between respondents with improvement and no change in severity of IBS (Tables 2 and S2). Comparing those with no change and those who deteriorated in severity of IBS, a higher proportion of respondents with self-reported IBS who had no change in severity indicated that they were more worried about contracting COVID-19 compared with those who deteriorated in severity (49.2% vs 31.4%,  $P = 0.034$ ) (Table 3). A greater proportion of respondents with self-reported IBS with no change in severity of IBS were also more willing to practice social distancing indefinitely compared with those who deteriorated (74.9% vs 51.4%,  $P = 0.016$ ). There was a higher proportion of respondents with no change in the severity of IBS who had better hygiene practices such as always washing their hands before and after handling food and covering their mouths when they sneezed or coughed compared with those with worsening in the severity of IBS (63.4% vs 40.0%,  $P = 0.018$  and 61.7% vs 31.4%,  $P < 0.01$ , respectively). There were a higher proportion of respondents who were flourishing among those with no change in severity of IBS compared with those with worsened symptoms. Respondents with no change in severity of IBS also reported better emotional well-being compared with those with worsening in severity of IBS ( $9.5 \pm 3.5$  vs  $7.7 \pm 3.6$ ,  $P = 0.014$ ; Fig. 2).

**Factors associated with worsening of irritable bowel syndrome during coronavirus disease 2019 pandemic.** Next, we determined the factors associated with worsening in severity of IBS compared with those with no change

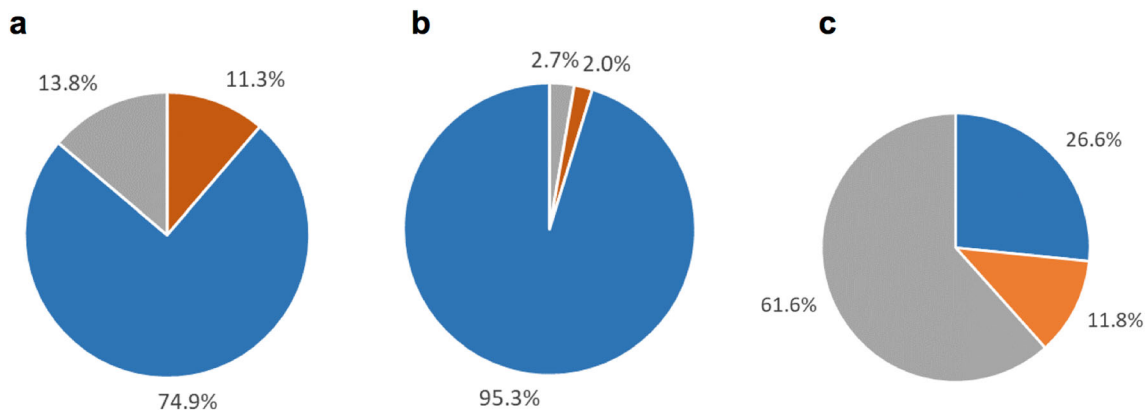
**Table 1** Comparison of demographic variables between respondents with and without IBS

	Non-IBS ( <i>n</i> = 2024)	IBS ( <i>n</i> = 305)	<i>P</i>
Age	39.7 ± 12.9	40.1 ± 13.0	1.0
Gender			0.6
Male	727 (35.9)	119 (39.0)	
Female	1297 (64.1)	186 (61.0)	
Race			0.2
Bengali	31 (1.5)	2 (0.7)	
Caucasian	24 (1.2)	6 (2.0)	
Chinese	1148 (56.7)	188 (61.6)	
Filipino	45 (2.2)	2 (0.7)	
Indian	154 (7.6)	20 (6.6)	
Japanese	5 (0.2)	0 (0.0)	
Korean	131 (6.5)	28 (9.2)	
Malay	328 (16.2)	39 (12.8)	
Others	158 (7.8)	20 (6.6)	
Economic region			0.3
High	1156 (57.1)	183 (60.0)	
Upper–middle	457 (22.6)	74 (24.3)	
Middle/low	411 (20.3)	48 (15.7)	
What is your highest education level?			0.8
No formal education/primary school	9 (0.4)	0 (0.0)	
Secondary school	164 (8.1)	29 (9.5)	
Pre-university	258 (12.7)	44 (14.4)	
Tertiary—undergraduate/postgraduate degree	1593 (78.7)	232 (76.1)	
Employment			0.4
Full-time	1497 (74.0)	213 (69.8)	
Part-time	125 (6.2)	18 (5.9)	
Not working	402 (19.9)	74 (24.3)	
Housing			1.0
Dormitory	61 (3.0)	13 (4.3)	
Government housing with 2 or 3 rooms	306 (15.1)	37 (12.1)	
Government housing with more than 3 rooms	376 (18.6)	62 (20.3)	
Private apartment or condominium	601 (29.7)	89 (29.2)	
Private landed property	680 (33.6)	104 (34.1)	
Annual household income per capita in USD (total household income/number of people in the household)			1.0
Less than \$1000	259 (12.8)	37 (12.1)	
\$1000–\$2000	274 (13.5)	46 (15.1)	
\$2000–\$4000	375 (18.5)	49 (16.1)	
\$4000–\$6000	211 (10.4)	29 (9.5)	
\$6000–\$8000	138 (6.8)	24 (7.9)	
\$8000–\$10 000	173 (8.5)	23 (7.5)	
More than \$10 000	594 (29.3)	97 (31.8)	
Have you been diagnosed with COVID-19?			1.0
Yes	32 (1.6)	4 (1.3)	
No	1992 (98.4)	301 (98.7)	
Compliance			<b>0.029</b>
Yes	715 (35.3)	86 (28.2)	
No	1309 (64.7)	219 (71.8)	
Not flourishing	1025 (50.6)	207 (67.9)	<b>&lt; 0.01</b>
Flourishing	999 (49.4)	98 (32.1)	
Well-being total scores	45.8 ± 14.6	40.5 ± 14.8	<b>&lt; 0.01</b>
Emotional well-being	10.3 ± 3.5	9.4 ± 3.6	<b>&lt; 0.01</b>
Social well-being	15.0 ± 6.1	12.8 ± 6.1	<b>&lt; 0.01</b>
Psychological well-being	20.4 ± 6.6	18.3 ± 6.7	<b>&lt; 0.01</b>

The bold emphasis was to highlight the factors that were statistically significant, that is, *P* < 0.05.

COVID-19, coronavirus disease 2019; IBS, irritable bowel syndrome.





**Figure 1** (a) Proportion of respondents who answered yes, no, and I do not know what is irritable bowel syndrome (IBS) to the question “Do you have IBS?”. ■, yes; ■, no; ■, don't know. (b) Proportion of respondents without IBS who developed IBS. ■, IBS-C; ■, IBS-D; ■, no. (c) Proportion of respondents with IBS who experienced improvement, no change, or worsening of IBS. ■, improve; ■, worsen; ■, no change. [Color figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

in severity of IBS. In univariate analysis, respondents who have lack of knowledge on the severity of COVID-19 such as indicating fear of fines and punitive measures as the main reason for compliance with social distancing measures (odds ratio [OR] 5.8, 95% confidence interval [CI] [1.6–21.6]) and were only willing to practice social distancing for another 2–3 weeks (OR 7.6, 95% CI [1.7–33.1]) and 1 month (OR 3.8, 95% CI [1.3–11.4]) were associated with higher odds of worsening in severity of IBS (Table 4). Better emotional well-being (OR 0.9, 95% CI [0.8–1.0]) was associated with lower odds of worsening in severity of IBS.

In multivariate analysis, fear of fines and punitive measures as the main reason for compliance to social distancing measures (adjusted OR [AdjOR] 5.9, 95% CI [1.4–25.6]) and willingness to practice social distancing for only another 2–3 weeks (AdjOR 6.0, 95% CI [1.2–28.8]) remained significantly associated with higher odds of worsening in severity of IBS compared with those with no change. Better emotional well-being (AdjOR 0.9, 95% CI [0.8–1.0]) remained significantly associated with lower odds of worsening in severity of IBS.

## Discussion

This study presents key information regarding the impact of COVID-19 and the consequences of control measures on patients with self-reported IBS. Respondents with self-reported IBS had overall poorer emotional, social, and psychological well-being compared with non-IBS respondents. Our survey showed that respondents with self-reported IBS were less compliant to social distancing measures compared with non-IBS respondents. In addition, we found that those with worsening IBS symptoms during this period were also less willing to practice personal hygiene and wanted social distancing to end as soon as possible. Poorer emotional well-being was associated with worsening in severity of IBS. Among the respondents who were non-IBS, 4.7% developed IBS-like symptoms during the first 3 months of COVID-19 pandemic.

We did not observe differences in baseline characteristics between respondents with and without self-reported IBS. Our observations are supported by results from other Asian epidemiological

studies. For example, the Asian consensus on IBS showed moderate evidence that there is no gender difference in IBS prevalence in Asian countries.<sup>14</sup> Another review by Gwee *et al.* showed that while several studies in Western countries reported higher female prevalence in IBS, this was not observed in Asian countries, further supporting our observations.<sup>15</sup>

Overall, respondents with self-reported IBS were less flourishing compared with those without IBS. Supporting evidence for our observations was provided by studies that showed subjective well-being to be negatively correlated with IBS symptoms, independent of the presence of anxiety and depression symptoms—this highlights the possibility that well-being may play a protective role in IBS.<sup>16</sup> Gilmour<sup>17</sup> showed that in a Canadian study, subjects with chronic pain were significantly less flourishing compared with those without chronic pain (69% vs 79%). Besides this, other studies also indicated that those who are flourishing have fewer physical problems and missed days at work compared with those who are not flourishing.<sup>18,19</sup> Further support for our observations is provided by a recent meta-analysis, which showed that positive emotional well-being is beneficial for prognosis of physical illness.<sup>20</sup> We observed the same trend within the group with self-reported IBS where more flourishing respondents were reported to be among those with better control of IBS, relative to those with worsening in severity of IBS. Surprisingly, our survey showed that instead of deteriorating IBS symptoms, there were more respondents with self-reported IBS who were status quo or became better during the COVID-19 pandemic—we called it the COVID-19 IBS paradox.

### **The coronavirus disease 2019 irritable bowel syndrome paradox.**

Irritable bowel syndrome is a heterogeneous disease, and the comorbidity of IBS and psychological distress is common. In a prospective study performed in Japan, Fujii and Nomura<sup>21</sup> showed that increase in stressor score was associated with the development of IBS. Most of the respondents were working adults who have been made to work from home probably for the first time in their lives due to social distancing and traffic restriction measures. To date, there are limited studies that

**Table 2** Comparison of demographic variables between respondents who reported improvement and no change in severity of IBS

Question	Improve ( <i>n</i> = 79)	No change ( <i>n</i> = 183)	<i>P</i>
Age	42.2 ± 13.8	38.8 ± 12.2	0.1
Gender			1.0
Male	33 (41.8)	71 (38.8)	
Female	46 (58.2)	112 (61.2)	
Economic region			0.9
High	42 (53.2)	110 (60.1)	
Upper–middle	20 (25.3)	44 (24.0)	
Middle/low	17 (21.5)	29 (15.8)	
What is your highest education level?			0.3
Secondary school	5 (6.3)	18 (9.8)	
Pre-university	16 (20.3)	22 (12.0)	
Tertiary—undergraduate/postgraduate degree	58 (73.4)	143 (78.1)	
Employment			0.3
Full-time	49 (62.0)	132 (72.1)	
Part-time	7 (8.9)	7 (3.8)	
Not working	23 (29.1)	44 (24.0)	
Work from home			0.7
Yes	23 (39.0)	45 (32.1)	
No	36 (61.0)	95 (67.9)	
Compliance			1.0
Yes	21 (26.6)	54 (29.5)	
No	58 (73.4)	129 (70.5)	
Which of the following would you consider as main reason for compliance with social distancing measures?			0.1
Fear of obtaining COVID-19	49 (62.0)	90 (49.2)	
Fear of family members obtaining COVID-19	30 (38.0)	86 (47.0)	
Fear of fines/punitive measures	0 (0)	7 (3.8)	
Would you willingly participate in the contact tracing app?			1.0
Yes	61 (77.2)	143 (78.1)	
No	18 (22.8)	40 (21.9)	
For how long are you willing to practice social distancing behavior to keep yourself and others safe?			0.5
As long as it takes	55 (69.6)	137 (74.9)	
For another 2–3 weeks	1 (1.3)	4 (2.2)	
For another 1 month	4 (5.1)	12 (6.6)	
For another 3 months	6 (7.6)	14 (7.7)	
For another 6 months	13 (16.5)	13 (7.1)	
I want social distancing to stop now	0 (0)	3 (1.6)	
Flourishing			1.0
Yes	26 (32.9)	64 (35.0)	
No	53 (67.1)	119 (65.0)	
Well-being total scores	41.8 ± 14.8	40.5 ± 15.0	1.0
Emotional well-being	9.5 ± 3.7	9.5 ± 3.5	1.0
Social well-being	13.1 ± 6.2	12.7 ± 6.3	1.0
Psychological well-being	19.2 ± 6.3	18.3 ± 6.9	0.7

COVID-19, coronavirus disease 2019; IBS, irritable bowel syndrome.

examined the relationship between occupational factors and IBS. Several studies had linked gastrointestinal alternations with occupational stress or burnout.<sup>22–24</sup> This so-called The Great Work-from-Home Experiment of 2020 can provide insights on the experiences of working from home for those with IBS. According to a study conducted in Singapore, Singaporeans reported some improvements in sleep and exercise, and falling ill less during the lockdown that began in April compared with January when

COVID-19 was not prevalent locally.<sup>25</sup> Another local study also reported that 85% of workers were keen to work from home at least half of the time after quarantine compared with 8% who do not want to work from home.<sup>26</sup> This is in line with previous research showing that flexible work often involves longer hours but provides other benefits such as reduced burnout, greater job satisfaction, and improved well-being.<sup>27,28</sup> In addition to having more control over when to work or take breaks, advantages of working from home

**Table 3** Comparison of demographic variables between respondents who reported no change and worsening in severity of IBS

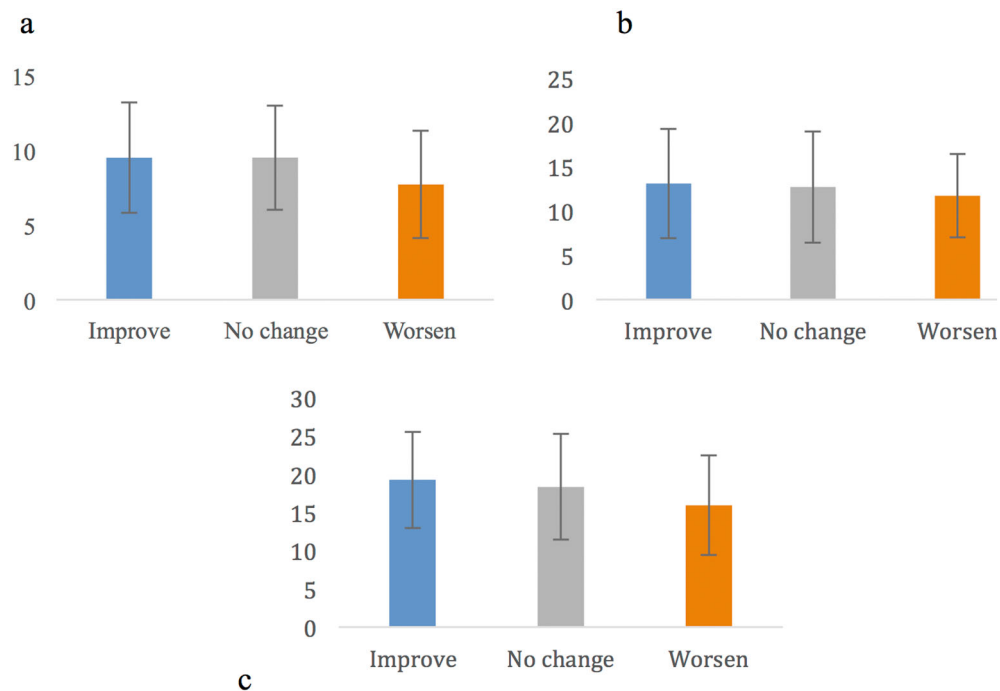
Question	No change ( <i>n</i> = 183)	Worsen ( <i>n</i> = 35)	<i>P</i>
Age	38.8 ± 12.2	40.1 ± 14.3	1.0
Gender			1.0
Male	71 (38.8)	14 (40.0)	
Female	112 (61.2)	21 (60.0)	
Economic region			0.1
High	110 (60.1)	28 (80.0)	
Upper–middle	44 (24.0)	6 (17.1)	
Middle/low	29 (15.8)	1 (2.9)	
What is your highest education level?			1.0
Secondary school	18 (9.8)	4 (11.4)	
Pre-university	22 (12.0)	5 (14.3)	
Tertiary—undergraduate/postgraduate degree	143 (78.1)	26 (74.3)	
Employment			0.2
Full-time	132 (72.1)	26 (74.3)	
Part-time	7 (3.8)	4 (11.4)	
Not working	44 (24.0)	5 (14.3)	
Work from home			1.0
Yes	45 (32.1)	8 (26.7)	
No	95 (67.9)	22 (73.3)	
Compliance			1.0
Yes	54 (29.5)	10 (28.6)	
No	129 (70.5)	25 (71.4)	
Which of the following would you consider as main reason for compliance with social distancing measures?			<b>0.034</b>
Fear of obtaining COVID-19	90 (49.2)	11 (31.4)	
Fear of family members obtaining COVID-19	86 (47.0)	19 (54.3)	
Fear of fines/punitive measures	7 (3.8)	5 (14.3)	
Would you willingly participate in the contact tracing app?			1.0
Yes	143 (78.1)	27 (77.1)	
No	40 (21.9)	8 (22.9)	
For how long are you willing to practice social distancing behavior to keep yourself and others safe?			<b>0.016</b>
As long as it takes	137 (74.9)	18 (51.4)	
For another 2–3 weeks	4 (2.2)	4 (11.4)	
For another 1 month	12 (6.6)	6 (17.1)	
For another 3 months	14 (7.7)	5 (14.3)	
For another 6 months	13 (7.1)	1 (2.9)	
I want social distancing to stop now	3 (1.6)	1 (2.9)	
Flourishing			< <b>0.01</b>
Yes	64 (35.0)	3 (8.6)	
No	119 (65.0)	32 (91.4)	
Well-being total scores	40.5 ± 15.0	35.4 ± 13.3	0.1
Emotional well-being	9.5 ± 3.5	7.7 ± 3.6	<b>0.014</b>
Social well-being	12.7 ± 6.3	11.7 ± 4.7	0.8
Psychological well-being	18.3 ± 6.9	15.9 ± 6.5	0.1

The bold emphasis was to highlight the factors that were statistically significant, that is, *P* < 0.05. COVID-19, coronavirus disease 2019; IBS, irritable bowel syndrome.

include control in other areas such as noise levels, air temperature, and interactions with colleagues, to minimize work interruptions. For IBS patients, who sometimes feel that their conditions are governing their lives, having more control over their work environment can be particularly important. Similarly, commute-related stress was identified as one of the important factors in flexible work arrangements in a US survey.<sup>29</sup> Longer commutes were reported to increase risk of depression.<sup>30</sup> Commute factors may be even more relevant in the Asian context, where the average

commute time is often longer than that of the US context. Our hypothesis of flexible work/school styles and commute factors affecting IBS severity was supported in a recent study in Japan by Oshima *et al.*,<sup>31</sup> where these were found to be “improvement factors” for patients with functional dyspepsia and IBS.

Another possible explanation for the results may be attributed to social support. Relationships have an impact on IBS experience and treatment.<sup>32,33</sup> Patients with IBS reported having less social support than those with no symptoms.<sup>34,35</sup> In the current study,



**Figure 2** Mean scores with standard deviation of respondents with improvement, no change or worsening in severity of irritable bowel syndrome for (a) emotional, (b) social, and (c) psychological well-being. [Color figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com)]

those with stable and improved IBS symptoms showed a trend towards better social well-being. Interestingly, Zhang and Ma<sup>36</sup> found that during COVID-19, participants reported increased social support from family and friends. Similarly, Cigna COVID-19 Global Impact Study showed that in April, Singaporeans reported feeling less lonely and isolated, experienced less family stress, and increase in quality family time, compared with January.<sup>25</sup> In the current study, respondents whose symptoms worsened indicated that they wanted social distancing measures to end sooner compared with the other two groups. This suggests the lack of social support and engagement. Taken together, more flexible working arrangements, less work-related stress, and increased social well-being can help the control and improvement of IBS.

The strengths of our study include the collaboration with other physicians in different Asian countries, as it is useful to understand COVID-19's impact on a varied pool of participants among the surveyed countries. Another strength is the online administration of the survey, which was convenient and able to garner responses from a large number of respondents from different countries. This also mitigated the risk of transmitting infections that hard copy or face-to-face surveys might have posed.

There are limitations in our study. Firstly, our results may be affected by some biases. There may be misclassification bias leading to underreporting of IBS status as well as social desirability bias where respondents may choose responses that are more socially acceptable. We also relied on self-reported IBS, which may not be very accurate and subjected to recall bias. Newly developed IBS would have been identified more accurately using questionnaires administered at several time points during the COVID-19 pandemic. Secondly, questions regarding changes in

diet or eating habits were not included in the survey. Dietary habits and accessibility to food were impacted when IBS patients were confined at home due to social distancing as there has been evidence showing that the periods of confinement could have led to reduced physical activity and overeating. In a survey by Scarmozzino and Visioli<sup>37</sup> in Italy, 46.1% of participants reported an increase in eating during confinement, 19.5% gained weight, and there was an increase in "comfort food" consumption, notably chocolate, ice cream, and desserts (42.5%) and salty snacks (23.5%). Poor diet quality can also impact mental health and well-being while influencing the symptomology of IBS patients.<sup>38</sup> Critically, food availability to IBS patients on a community level is influenced by difficulties in food distribution and transportation.<sup>39</sup> It is known that food sources low in fermentable oligosaccharides, disaccharides, monosaccharides, and polyols can lead to improvement of reported IBS symptoms, and a disrupted supply of low-fermentable oligosaccharide, disaccharide, monosaccharide, and polyol foods might lead to worsening of symptoms.<sup>40</sup> Thirdly, the survey did not ask about disruptions in care of IBS and how follow-up visits or medication availability and compliance have been affected. A survey of 155 countries by the World Health Organization in May 2020 found that health services have been partially or completely disrupted in many countries, with 53% of countries reporting complete or partial disruptions to hypertension management and 49% for treatment of diabetes and its complications.<sup>41</sup> It is plausible that the disruption to follow-up and pharmacological management for IBS were disrupted for patients, which could have affected the compliance rate to medications. Although the prevalence of comorbidities was higher in non-IBS group compared with the IBS group, other medical conditions that we did not capture information on such as anxiety



**Table 4** Univariable and multivariable regression of factors associated with worsening in severity of IBS (with no change in severity of IBS group as reference)

Question	OR (95% CI)	P	AdjOR (95% CI)	P
Do you wash your hands before and after handling food? <sup>†</sup>				
Never (ref)	1.00		—	—
Seldom	0.0 (0.0)	1.0	—	—
50% of the time	0.0 (0.0)	1.0	—	—
Most of the time	0.0 (0.0)	1.0	—	—
Always	0.0 (0.0)	1.0	—	—
Do you cover your mouth when you sneeze or cough? <sup>†</sup>				
Never (ref)	1.00		—	—
Seldom	0.0 (0.0)	1.0	—	—
50% of the time	0.0 (0.0)	1.0	—	—
Most of the time	0.0 (0.0)	1.0	—	—
Always	0.0 (0.0)	1.0	—	—
Which of the following would you consider as main reason for compliance with social distancing measures?				
Fear of obtaining COVID-19 (ref)	1.00		1.00	
Fear of family members obtaining COVID-19	1.8 (0.8–4.0)	0.1	2.0 (0.9–4.7)	0.1
Fear of fines/punitive measures	<b>5.8 (1.6–21.6)</b>	<b>&lt; 0.01</b>	<b>5.9 (1.4–25.6)</b>	<b>0.017</b>
For how long are you willing to practice social distancing behavior to keep yourself and others safe?				
As long as it takes (ref)	1.00		1.00	
For another 2–3 weeks	<b>7.6 (1.7–33.1)</b>	<b>&lt; 0.01</b>	<b>6.0 (1.2–28.8)</b>	<b>0.026</b>
For another 1 month	<b>3.8 (1.3–11.4)</b>	<b>0.017</b>	2.9 (0.9–9.0)	0.1
For another 3 months	2.7 (0.9–8.4)	0.1	3.1 (0.9–10.2)	0.1
For another 6 months	0.6 (0.1–4.7)	0.6	0.6 (0.1–4.7)	0.6
I want social distancing to stop now	2.5 (0.3–25.7)	0.4	1.3 (0.1–22.3)	0.9
Emotional well-being	<b>0.9 (0.8–1.0)</b>	<b>&lt; 0.01</b>	<b>0.9 (0.8–1.0)</b>	<b>0.042</b>

Flourishing was excluded from analysis due to overlap with emotional well-being. The bold emphasis was to highlight the factors that were statistically significant, that is,  $P < 0.05$ .

<sup>†</sup>Excluded from multivariable analysis due to 0 respondents in reference categories for respondents with no change in control IBS.

AdjOR, adjusted odds ratio; CI, confidence interval; COVID-19, coronavirus disease 2019; IBS, irritable bowel syndrome; OR, odds ratio.

or depression may confound our results because this may affect compliance to social distancing measures. Ballou and Keefer observed greater disruption of daily activities including social activity, travel, and eating alone or in groups in IBS patients, particularly in those with anxiety, depression, and/or panic disorder.<sup>42</sup> Conversely, Coroiu *et al.* showed that high anxiety and depression were linked to high compliance to avoidance of in-person socializing during the COVID-19 pandemic.<sup>43</sup> Harper *et al.* also observed a positive correlation between anxiety and compliance to COVID-19 protective measures.<sup>44</sup> Fourthly, we observed that our population has differences in age, gender, employment, and education compared with the general population of the respective countries; hence, results of this convenience sample may not be representative of the general population.

## Conclusion

As the COVID-19 pandemic progresses, IBS patients would likely be asked to continue with social distancing practices. Further research on the occupational stress and dietary changes can yield insights on how patients can adopt various stress and diet management strategies in a new working environment.

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## Supporting information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

**Table S1.** Number of responses from each country surveyed.

**Table S2.** Comparison of demographic variables between subjects who reported improvement and no change in severity of IBS.