

Original Article

Common gastrointestinal symptoms and their impact on psychological state and quality of life in patients with inflammatory bowel disease: a cross-sectional multicenter study in China

Shuo Wang^{1,†}, Cheng Tan^{1,†}, Chuan Liu¹, Zhongchun Liu², Changqing Jiang³, Jie Shi⁴, Kaichun Wu^{5,*} and Weiguo Dong^{1,*}

¹Department of Gastroenterology, Renmin Hospital of Wuhan University, Wuhan, Hubei, P. R. China

²Department of Psychiatry, Renmin Hospital of Wuhan University, Wuhan, Hubei, P. R. China

³Department of Clinical Psychology, Beijing Anding Hospital, Capital Medical University, Beijing, P. R. China

⁴Department of Medical Psychology, Chinese People's Liberation Army Rocket Army Characteristic Medical Center, Beijing, P. R. China

⁵Department of Gastroenterology, Xijing Hospital, Air Force Medical University, Xi'an, Shaanxi, P. R. China

*Corresponding authors. Weiguo Dong, Department of Gastroenterology, Renmin Hospital of Wuhan University, No. 99 Zhangzhidong Road, Wuchang District, Wuhan, Hubei 430060, P. R. China. Tel: +86-27-88041911; Email: dongweiguo@whu.edu.cn; Kaichun Wu, Department of Gastroenterology, Xijing Hospital, Air Force Medical University, No. 127 Changle West Road, Xincheng District, Xi'an, Shaanxi 710032, P. R. China. Tel: +86-29-84771600; Email: kaicwu@fmmu.edu.cn

[†]These authors contributed equally to this paper.

Abstract

Objective: To explore the impact of common gastrointestinal (GI) symptoms on psychological symptoms, sleep quality, and quality of life in patients with inflammatory bowel disease (IBD).

Methods: A unified questionnaire was developed to collect clinical data on the mental psychology and quality of life of IBD patients from 42 hospitals in 22 provinces in P. R. China from September 2021 to May 2022. The general clinical characteristics, psychological symptoms, sleep quality, and quality of life of IBD patients with different numbers of GI symptoms were analyzed by descriptive statistical analysis.

Results: A total of 2,478 IBD patients were finally analysed in this study, including 365 without GI symptoms (14.7%), 752 with single symptoms (30.4%), 841 with double symptoms (33.9%), and 520 with three symptoms (21.0%). Compared with patients without GI symptoms, patients with only simple abdominalgia or diarrhea or hematochezia showed significantly higher levels of anxiety and depression and worse quality of life (all $P < 0.05$). Compared with asymptomatic patients, patients with double symptoms (e.g. abdominalgia plus hematochezia, diarrhea plus hematochezia, abdominalgia plus diarrhea) and patients with three symptoms (abdominalgia, diarrhea, and hematochezia) showed significantly higher levels of anxiety and depression and worse sleep quality and quality of life (all $P < 0.05$).

Conclusion: Compared with IBD patients without gastrointestinal symptoms, patients with gastrointestinal symptoms were more likely to experience anxiety, depression, sleep disturbances, and poorer quality of life.

Keywords: inflammatory bowel disease; gastrointestinal symptom; psychological symptoms; sleep quality; quality of life; survey

Introduction

Inflammatory bowel disease (IBD) is a chronic inflammatory disorder of the digestive system, including ulcerative colitis (UC) and Crohn's disease (CD), the exact causes of which remain unclear [1, 2]. In recent years, the global incidence of IBD, characterized by persistent and recurrent symptoms that are difficult to treat, has been steadily increasing [3]. IBD patients are often plagued by symptoms such as abdominalgia and diarrhea, leading to the development of negative emotions such as anxiety and depression, severely affecting their sleep quality and physical and mental health [4, 5].

Existing research has confirmed that IBD patients experiencing gastrointestinal symptoms tend to have a worse prognosis [6]. This might be attributed to multiple mechanisms, where psychological status, sleep quality, and quality of life likely play pivotal roles. Numerous studies consistently indicate a clear correlation between adverse psychological states, particularly anxiety and depression, and unfavorable outcomes in individuals with IBD [7, 8]. Previous studies have found that this impact may be related to the gut-brain axis and have extensively investigated its bidirectionality [9–11]. Consequently, timely intervention holds paramount significance in enhancing the mental well-

Received: 7 October 2023. Revised: 23 December 2023. Accepted: 18 January 2024

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being, sleep quality, and overall health of IBD patients [12, 13]. This study conducted outpatient questionnaire surveys at 42 medical institutions in China, with the primary aim of investigating the impact of common gastrointestinal symptoms (abdominalgia, diarrhea, and hematochezia) on the psychological status, sleep quality, and quality of life of IBD patients. Employing a diverse array of assessment scales, this research meticulously evaluated these patients' psychological state, sleep quality, and life satisfaction, thereby striving to delve into the ramifications of prevalent digestive symptoms on their psychological well-being, overall sleep quality, and life satisfaction. For clinical practitioners, particularly outpatient physicians, these data serve as valuable reference material. Based on the outcomes of the data, relevant symptom inquiries should be conducted with patients. Vigilance regarding these prevalent gastrointestinal symptoms can potentially enhance patients' emotional well-being and overall quality of life.

Materials and methods

Study design and patient population

This is a national, multicenter, cross-sectional survey conducted by the Psychology Club of the Inflammatory Bowel Disease Group of the Gastroenterology Society of the Chinese Medical Association and the Chinese Association for Mental Hygiene. The survey took place from September 2021 to May 2022 and involved 66 gastroenterologists and 2,782 IBD patients from 42 hospitals in 22 provinces (including autonomous regions and municipalities) in P. R. China. Uniformly trained investigators used standardized speech techniques during explanation sessions. A total of 304 surveys were deemed invalid due to patients not meeting the criteria. All patients were informed of the purpose, methodology, voluntary participation, and harmlessness of the findings, and informed consent was obtained. The survey was conducted using an online survey platform system for IBD patients. Finally, 2,478 patients were included in the study.

The study was approved by the Institutional Review Board of Renmin Hospital of Wuhan University (approval number WDRY2022-K150), and informed consent was obtained from all patients. The inclusion criteria for the study were as follows: (1) patients with a confirmed diagnosis of IBD based on endoscopy, radiology, and histopathology; (2) age ≥ 18 years old; (3) patients capable of understanding and willing to participate in the investigation (e.g. willing to follow the doctor's management, undergo psychological evaluation, and comply with medication management); and (4) availability of complete clinical data. The exclusion criteria were as follows: (1) pregnant or lactating women; (2) individuals with limited reading and writing skills or communication difficulties; (3) patients with a history of severe mental illness or unable to answer the questionnaire due to mental illness; and (4) patients with other diseases significantly affecting their quality of life and/or mental state (such as other intestinal diseases, malignant tumors, etc).

Study assessments and data collection

Variable definition

Data on general clinical characteristics of patients with IBD were aggregated, which included key information like age, time of initial consultation, disease activity, disease duration, and primary clinical symptoms (e.g. diarrhea, abdominalgia, hematochezia, etc). In addition, we recorded details of the therapeutic agents used, such as 5-aminosalicylic acid, glucocorticoids, immunosuppressants, and biological agents. Surgical history was also documented. The disease course was defined as the period

between the onset of symptoms and the time of investigation for this study. To evaluate the disease activity of UC patients, the modified Mayo score was employed, considering scores of ≤ 2 as indicating remission and scores > 2 as indicating active disease [14]. For CD patients, the CDAI score was used to assess disease activity, with scores of < 150 considered as remission and scores ≥ 150 as indicating active disease, following the guidelines outlined in the *consensus opinion on the diagnosis and treatment of IBD* [15].

Outcome measurement

Inflammatory Bowel Disease Questionnaire (IBD-Q) has been widely used to evaluate the quality of life of IBD patients, including 4 dimensions of bowel symptoms, systemic symptoms, emotional ability, and social ability, with a total of 32 items. Each item was divided into 7 grades representing 1–7 points, and the total score ranged from 32 to 224. The higher the total score, the better the quality of life of the patient, with scores < 169 being indicative of poor quality of life [16].

The Generalized Anxiety Disorder 7 (GAD-7) is a valuable tool for healthcare providers to identify and monitor anxiety symptoms in patients [17]. It helps make informed decisions about appropriate interventions and treatment options for individuals with generalized anxiety disorder. A score of 0–4 indicates the absence of anxiety, while a score of 5–9 suggests the possibility of mild anxiety. Scores ranging from 10 to 13 are indicative of potential moderate anxiety, whereas scores between 14 and 18 may suggest the presence of moderate to severe anxiety. A score exceeding 19 is considered indicative of severe anxiety.

The severity of depression symptoms among patients was evaluated using the Patient Health Questionnaire-9 (PHQ-9), a widely recognized self-assessment tool. The questionnaire consists of 9 items, each reflecting a specific symptom of depression, and respondents rate the frequency of these symptoms over the past two weeks. The total score on PHQ-9 ranges from 0 to 27. A score of 0–4 indicates minimal or no depressive symptoms, 5–9 indicates mild depression, 10–14 indicates moderate depression, 15–19 indicates moderate to severe depression, and 20–27 indicates severe depression [18].

Patients' sleep quality in the month before the survey was assessed using the Pittsburgh Sleep Quality Index (PSQI), a well-validated self-assessment method. The scale comprises 7 dimensions, and the total score ranges from 0 to 21. Scores greater than 5 suggest significant sleep disturbance. A score of 0–5 indicates good sleep quality, 6–10 indicates medium sleep quality, 11–15 indicates poor sleep quality and 16–21 indicates inferior sleep quality [19].

Statistical analysis

Data entry, statistical analysis, and visualization were performed using Excel 2021, SPSS 26.0, and GraphPad Prism software. Mean \pm standard deviation (SD) was used for normally distributed or approximately normally distributed data, and group comparisons were performed using the t-test. If the data distribution did not meet the criteria for normality, the median (interquartile range) was utilized, and group comparisons were conducted using the non-parametric Mann-Whitney U test. Multiple-group comparisons were carried out using the chi-square test. The significance level for this study was set at $\alpha=0.05$, and a P-value less than 0.05 was considered to indicate a statistically significant difference.

Results

Clinical characteristics of IBD patients with different numbers of symptoms

Our study included a total of 2,478 patients with IBD, out of which 1,107 cases were CD patients (44.7%) and 1,371 cases were UC patients (55.3%). Among all IBD patients, 61.2% experienced symptoms of diarrhea, while 57.3% were troubled by abdominalgia, and 42.7% exhibited symptoms of hematochezia. There were 365 asymptomatic patients (14.7%), 752 patients with single symptoms (30.4%), 841 patients with double symptoms (33.9%), and 520 patients presenting all 3 symptoms simultaneously (21.0%). (Figure 1 and Table 1)

In terms of disease activity, patients with a higher number of gastrointestinal symptoms exhibited a higher proportion of active disease. This difference in proportions between groups was found to be statistically significant (21.1% vs 51.7% vs 71.5% vs 89.4%, $P < 0.001$). In each activity subgroup, the situation is generally consistent, except in the subgroup of mild activity, where the proportion of patients with dual symptoms is slightly higher than those with triple symptoms (29.1% vs 27.1%). As the number of gastrointestinal symptoms increases, the proportion of patients with a disease duration of less than 2 years becomes progressively higher. This intergroup difference in proportions is statistically significant (21.9% vs 36.6% vs 41.7% vs 45.2%, $P < 0.001$). Nearly 4.7% of the asymptomatic patients had used steroids,

compared with a significantly higher 34.6% of those with all 3 symptoms. Among patients who had used biologics, the proportion with single and dual symptoms was higher, with infliximab having the highest usage frequency. Additionally, the percentage of patients who had undergone gastrointestinal surgery was higher than that among those with all 3 symptoms (13.4% vs 3.3%, $P < 0.001$). There was no statistically significant difference between immunosuppressant-treated and immunosuppressant-free patients. (Table 1)

Psychological symptoms, sleep quality, and quality of life in IBD patients with different numbers of symptoms

Psychological symptoms, sleep quality, and quality of life in IBD patients with single digestive symptom

Compared with asymptomatic patients, those experiencing abdominalgia, hematochezia, or diarrhea show significantly elevated anxiety levels ($P = 0.004$, $P = 0.008$, and $P = 0.002$, respectively). While those with solely abdominalgia or diarrhea also exhibit notable signs of depression ($P < 0.001$ and $P = 0.006$, respectively). However, the presence of any single symptom does not significantly affect the sleep quality of IBD patients ($P = 0.330$, $P = 0.109$, and $P = 0.141$, respectively). Concerning quality of life, individuals with any singular symptom demonstrate marked

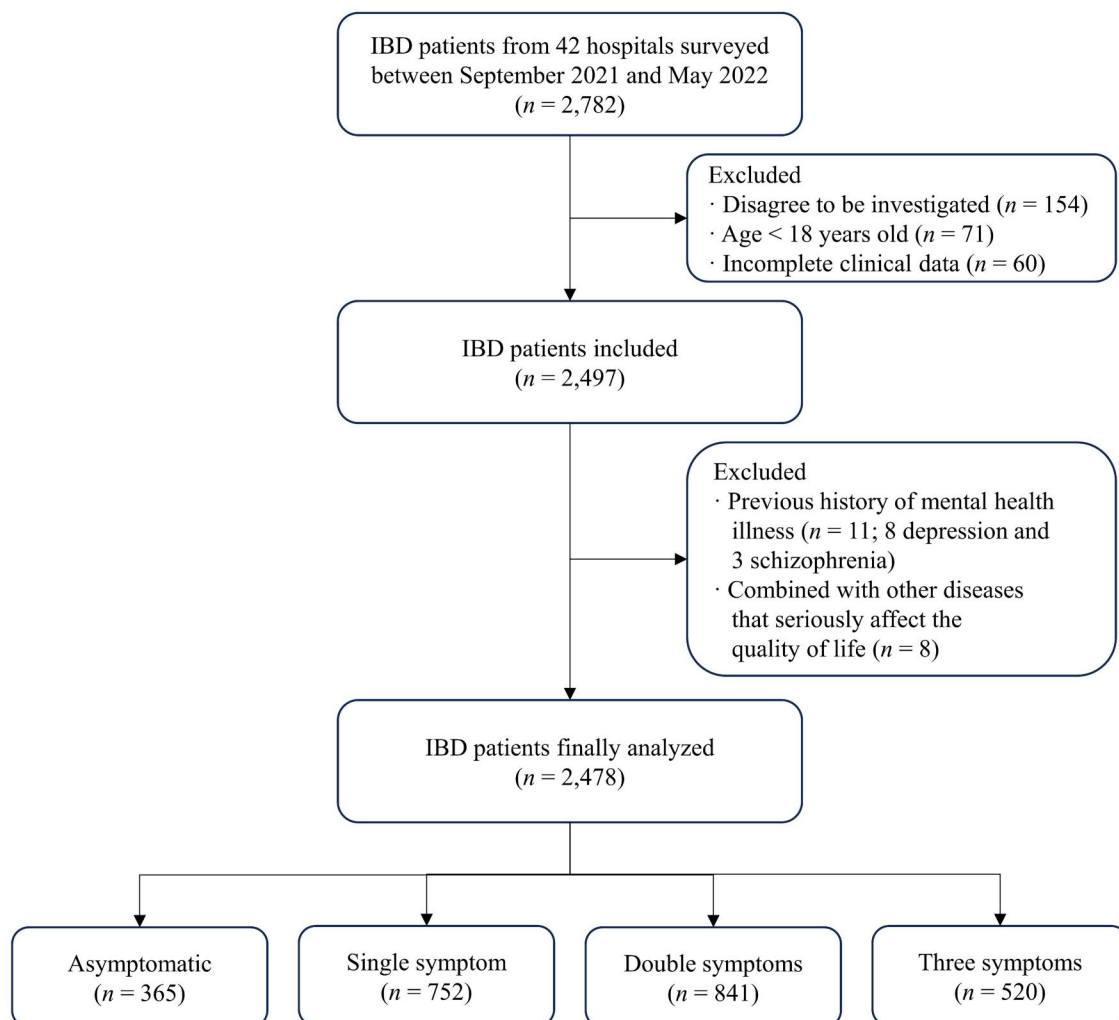


Figure 1. Screening process. IBD = inflammatory bowel disease.

Table 1. Clinical characteristics of IBD patients with different numbers of symptoms

Characteristics	Number of symptoms				P-value
	0 (n = 365)	1 (n = 752)	2 (n = 841)	3 (n = 520)	
IBD, n (%)					<0.001
UC	194 (53.2)	297 (39.5)	450 (53.5)	430 (82.7)	
CD	171 (46.8)	455 (60.5)	391 (46.5)	90 (17.3)	
Age, years old, mean ± SD	38.55 ± 12.78	36.90 ± 11.91	37.39 ± 12.59	39.96 ± 12.90	<0.001
Male, n (%)	238 (65.2)	503 (66.9)	510 (60.6)	296 (56.9)	0.001
Disease activity, n (%)					<0.001
Remission	288 (78.9)	363 (48.3)	240 (28.5)	55 (10.6)	
Active					
Mild	31 (8.5)	171 (22.7)	245 (29.1)	141 (27.1)	
Moderate	41 (11.2)	178 (23.7)	272 (32.3)	243 (46.7)	
Severe	5 (1.4)	40 (5.3)	84 (10.0)	81 (15.6)	
Disease course, n (%)					<0.001
< 2 years	80 (21.9)	275 (36.6)	351 (41.7)	235 (45.2)	
2–5 years	158 (43.3)	243 (32.3)	224 (26.6)	139 (26.7)	
> 5 years	127 (34.8)	234 (31.1)	266 (31.7)	146 (28.1)	
5-aminosalicylic acid, n (%)	208 (57.0)	378 (50.3)	508 (60.4)	436 (83.8)	<0.001
Glucocorticoids, n (%)	17 (4.7)	66 (8.8)	120 (14.3)	180 (34.6)	<0.001
Immunosuppressants, n (%)	41 (11.2)	119 (15.8)	130 (15.5)	70 (13.5)	0.153
Biological agents, n (%)					<0.001
No	206 (56.5)	316 (42.0)	399 (47.4)	285 (54.8)	
Yes					
Infliximab	100 (27.4)	309 (41.1)	300 (35.7)	144 (27.7)	
Vedolizumab	33 (9.0)	68 (9.0)	78 (9.3)	68 (13.1)	
Adalimumab	18 (4.9)	33 (4.4)	38 (4.5)	14 (2.7)	
Ustekinumab	8 (2.2)	26 (3.5)	26 (3.1)	9 (1.7)	
History of surgery, n (%)	49 (13.4)	139 (18.5)	99 (11.8)	17 (3.3)	<0.001

IBD = inflammatory bowel disease, UC = ulcerative colitis, CD = Crohn's disease, SD = standard deviation.

differences compared with asymptomatic patients ($P < 0.001$, $P = 0.004$, and $P = 0.001$, respectively). (Table 2)

Patients with abdominalgia or hematochezia exhibit significant differences in the proportion of anxiety, while those with diarrhea do not show significant variation ($P = 0.009$, $P = 0.011$, and $P = 0.108$, respectively). Only patients with either abdominalgia or diarrhea present statistically significant differences in the proportion of depression compared with asymptomatic patients, while those with only hematochezia do not exhibit such distinctions ($P = 0.004$, $P = 0.059$, and $P = 0.022$, respectively). The proportion of IBD patients experiencing decreased sleep quality does not notably change with any single symptom (all $P > 0.05$). But there is a significant increase in the proportion experiencing decreased quality of life in all the single symptom groups ($P < 0.001$, $P = 0.008$, and $P < 0.001$, respectively). (Table 2 and Figure 2)

Psychological symptoms, sleep quality, and quality of life in IBD patients with double digestive symptoms

Compared with the asymptomatic patient group, patients with any combination of two symptoms exhibited significant differences in anxiety and depression scores (all $P < 0.05$). Regarding sleep quality, patients experiencing both abdominalgia and diarrhea showed no significant differences in sleep scores, whereas the other two groups displayed significant variations ($P = 0.220$, $P = 0.007$, $P = 0.002$). Additionally, in terms of quality of life, patients with two concurrent symptoms demonstrated a decrease in their quality of life scores ($P < 0.001$). (Table 3)

Our findings indicate that among patients experiencing either abdominalgia and hematochezia or hematochezia and diarrhea, there were significant differences in the proportion of anxiety and decreased sleep quality compared with the asymptomatic patient group (30.5% vs 17.5%, $P = 0.001$; 33.0% vs 17.5%, $P < 0.001$; 68.8% vs 55.1%, $P = 0.004$; 63.6% vs 55.1%, $P = 0.031$).

However, patients with both diarrhea and abdominalgia did not exhibit significant differences in anxiety proportions or decreased sleep quality compared with the asymptomatic group (both $P > 0.05$). Nevertheless, any combination of the three common gastrointestinal symptoms led to significant differences in the proportion of depression and decreased quality of life among IBD patients (all $P < 0.05$). (Figure 3 and Table 3)

Psychological symptoms, sleep quality, and quality of life in IBD patients with three digestive symptoms

The results indicate that patients with all three gastrointestinal symptoms concurrently experience a noticeable increase in anxiety and depression scores, a significant decrease in sleep quality scores, and a substantial impact on their quality of life with markedly reduced scores. (Figure 3 and Table 4)

Compared with the asymptomatic group, the anxiety score, depression score and quality of life score of patients with single gastrointestinal symptom were significantly different, but there was no significant difference in sleep quality score (GAD-7, PHQ-9, IBD-Q; $P < 0.05$; PSQI: $P = 0.098$). The scores of anxiety, depression, sleep, and quality of life of patients with double or triple gastrointestinal symptoms were significantly different from those of asymptomatic patients (all $P < 0.05$). The results of pairwise comparison between patients with different numbers of gastrointestinal symptoms showed that there were significant differences in the scores of quality of life between the groups (all $P < 0.001$), but there were no significant differences in the scores of anxiety, depression, and sleep quality (all $P > 0.05$). Between the four groups, there were significant differences in anxiety scores, depression scores, and quality of life scores among groups with different numbers of gastrointestinal symptoms. However, there was no statistically significant difference in sleep quality scores (GAD-7, PHQ-9, IBD-Q; $P < 0.05$; PSQI: $P = 0.244$). (Table 5)

Table 2. Psychological symptoms, sleep quality, and quality of life in IBD patients with single digestive symptom.

Score	Asymptomatic (n = 365)	Abdominalgia (n = 322)	P ^a	Hematochezia (n = 120)	P ^a	Diarrhea (n = 310)	P ^a
GAD-7, median (IQR)	5 (2, 8)	6 (2, 11)	0.004	6 (3, 10)	0.008	6 (9, 13)	0.002
Anxiety (GAD-7 ≥ 10), n (%)	64 (17.5)	83 (25.8)	0.009	34 (28.3)	0.011	67 (21.6)	0.108
PHQ-9, median (IQR)	5 (2, 9)	7 (3, 11)	<0.001	5 (2, 10)	0.193	6 (2, 10)	0.006
Depression (PHQ-9 ≥ 10), n (%)	76 (20.8)	95 (29.5)	0.004	35 (29.2)	0.059	88 (28.4)	0.022
PSQI, median (IQR)	6 (4, 8)	6 (4, 9)	0.330	6.5 (5, 9)	0.109	6.5 (4, 9)	0.141
Sleep disturbance (PSQI >5), n (%)	201 (55.1)	194 (60.2)	0.171	78 (65.0)	0.056	183 (59.0)	0.300
IBD-Q, median (IQR)	196 (180, 208.5)	183 (163, 201)	<0.001	190.5 (165.25, 203.0)	0.004	187.5 (162.75, 202)	0.001
Poor quality of life (IBQ-Q < 169), n (%)	60 (16.4)	105 (32.6)	<0.001	33 (27.5)	0.008	93 (30.0)	<0.001

GAD-7 = Generalized Anxiety Disorder 7, PHQ-9 = Patient Health Questionnaire-9, PSQI = Pittsburgh Sleep Quality Index, IBD-Q = Inflammatory Bowel Disease Questionnaire.

^a Compared with asymptomatic group.

Discussion

In this multicenter study, our objective was to investigate the correlation between common gastrointestinal symptoms experienced by patients with IBD and their psychological well-being, sleep quality, and overall quality of life. Over the past few years, there has been a notable rise in the global incidence of IBD, with projections indicating that it could affect as much as 1% of the world's population by the year 2030 [20]. Moreover, IBD is currently experiencing a rapid increase in Asian countries, which could lead to even higher incidence rates [21]. This trend presents a substantial and growing global health challenge [22, 23]. The previous research has consistently highlighted that individuals diagnosed with IBD are at a heightened risk of experiencing psychological issues, particularly anxiety, and depression when compared with the general population [11]. A recent study indicated that IBD patients are facing increasing healthcare costs. Patients with comorbid psychological disorders incur higher indirect healthcare costs than those without comorbidities, and they may have a worse prognosis [24]. Without intervention, the future disease burden on IBD patients is expected to significantly increase. The presence of these negative emotional states, along with sleep disturbance, has emerged as a significant risk factor that profoundly impacts the quality of life and long-term prognosis of IBD patients [25]. The findings of this study illuminate the substantial burden that digestive symptoms impose on IBD patients, underscoring the significance of comprehensive care and support for this patient population.

All IBD patients were categorized into groups based on the varying numbers of common gastrointestinal symptoms, resulting in the asymptomatic patient group, single symptom patient group, double symptoms patient group, and triple symptoms patient group. Analysis revealed that IBD patients frequently experience gastrointestinal symptoms, with 85.3% of patients reporting the presence of at least one gastrointestinal symptom (abdominalgia, diarrhea, or hematochezia) in their daily lives. As the number of gastrointestinal symptoms increased, so did the proportion of UC patients, up to 82.7% among those with experiencing all three gastrointestinal symptoms concurrently. This suggests that UC patients are more likely to exhibit multiple gastrointestinal symptoms, which can have implications for their prognosis and warrants clinical vigilance. In all groups with gastrointestinal symptoms, males were more likely to be affected, indicating a greater tendency for males to experience complications. Previous research has indicated a correlation between disease activity in IBD patients and psychological symptoms as well as their overall quality of life [8]. In our study, patients' disease stages aligned with their symptom presentation, with a higher

proportion of symptoms observed in patients with more severe disease activity. Patients with a shorter disease duration were also more likely to have multiple gastrointestinal symptoms, potentially due to the challenges of achieving complete disease control in a short timeframe. In IBD patients, obesity has been confirmed to be associated with a higher risk of recurrence, increased levels of anxiety, depression, fatigue, and pain, as well as higher healthcare utilization [26, 27]. Recent research has confirmed the association between obesity and depression, anxiety, and decreased quality of life. The frequency of anxiety was higher in the obese population (odds ratio 1.30; 95% confidence interval 1.20–1.41), and also in the overweight population (odds ratio 1.10; 95% confidence interval 1.00–1.21) [28]. Another meta-analysis indicates that obesity increases the risk of severe depression in children and adolescents (odds ratio 1.85; 95% confidence interval 1.41–2.43) [29]. Appropriate exercise has been shown to effectively reduce anxiety, and depression levels, and improve the quality of life in overweight and obese individuals [30]. Therefore, some researchers suggest that obese IBD patients should consider weight loss as a means to enhance their quality of life [31]. A cohort study has indicated a significant association between active smoking behavior and symptoms of anxiety and depression [32]. One guideline recommends encouraging IBD patients to quit smoking to prevent further exacerbation of anxiety and depression symptoms [33].

Further classification was conducted based on specific symptoms. The findings of this study reveal that among patients experiencing single gastrointestinal symptoms, both abdominalgia and diarrhea lead to increased levels of anxiety and depression. They also contribute to a decrease in quality of life, affecting all 4 dimensions used to assess the quality of life in IBD patients. However, they do not appear to influence patients' sleep quality. Furthermore, we observed that hematochezia increased patients' anxiety levels, but there was no direct association with depression, and the patients' sleep quality was not significantly affected. Simultaneously, hematochezia results in a decreased quality of life among patients, although it doesn't affect the social functioning dimension.

Furthermore, the results indicate that as symptoms increase, patients' psychological state and quality of life are more severely impacted. Among patients with 2 gastrointestinal symptoms, regardless of which two, anxiety and depression are heightened, and quality of life deteriorates. A peculiar observation is that patients with solitary gastrointestinal symptoms commonly report that their sleep quality remains largely unaffected. This is even observed in patients with both abdominalgia and diarrhea simultaneously. However, it is noteworthy that once hematochezia manifests, whether in conjunction with abdominalgia or

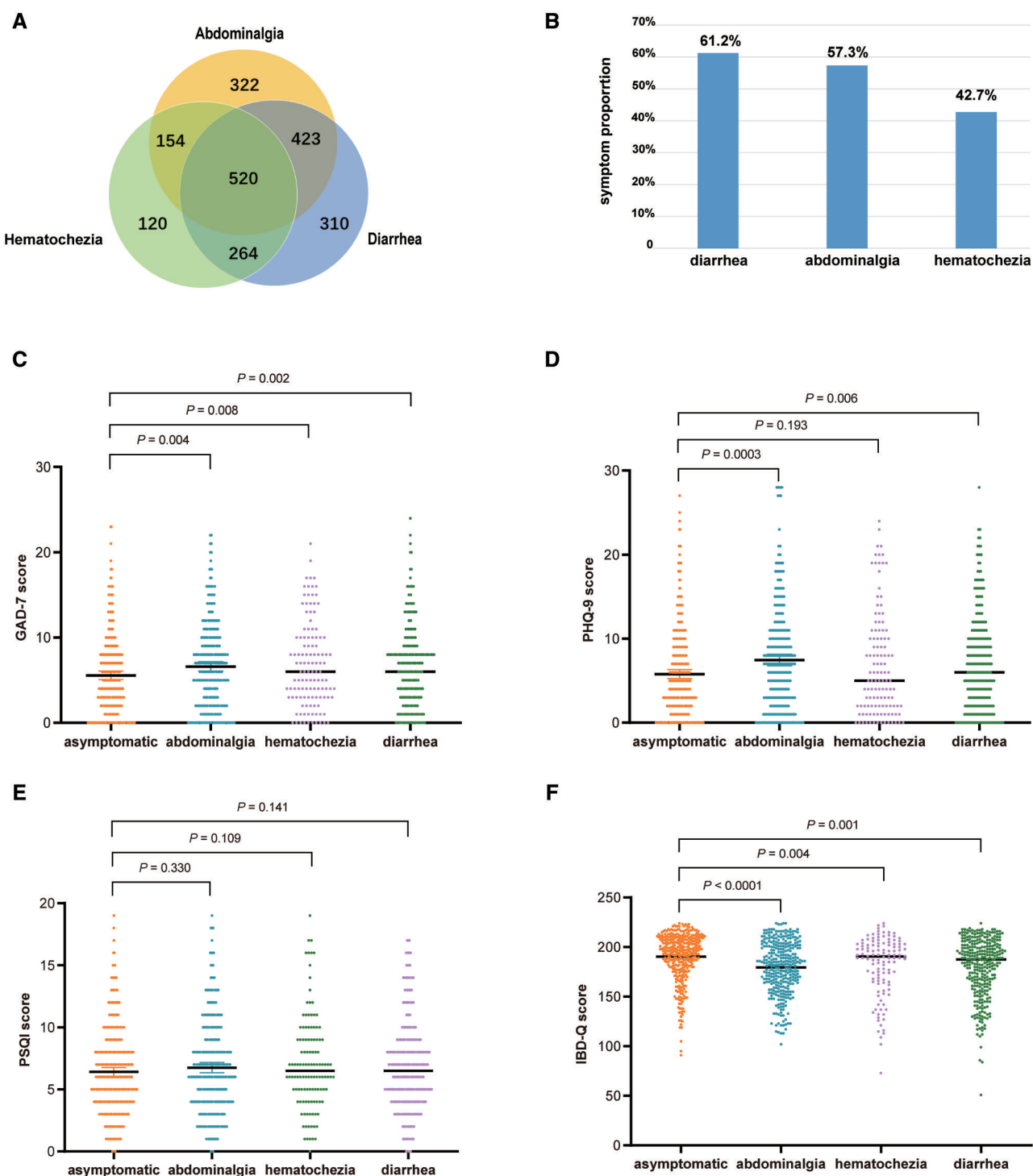


Figure 2. Patients distribution, scores of psychological symptoms, sleep quality and quality of life-related scales in IBD patients with the single symptom. (A) Distribution of patients with different numbers of symptoms. (B) The proportion of every symptom. (C) GAD-7 scores in single digestive symptom groups vs asymptomatic group. (D) PHQ-9 scores in single digestive symptom groups vs asymptomatic group. (E) PSQI scores in single digestive symptom groups vs asymptomatic group. (F) IBD-Q scores in single digestive symptom group vs asymptomatic group. GAD-7 = Generalized Anxiety Disorder 7, PHQ-9 = Patient Health Questionnaire-9, PSQI = Pittsburgh Sleep Quality Index, IBD-Q = Inflammatory Bowel Disease Questionnaire.

diarrhea, there is a discernible decline in sleep quality. The same trend is observed in patients with 3 gastrointestinal symptoms—increased anxiety, heightened depression, poorer sleep quality, and a decreased quality of life. However, surprisingly, the proportion of patients experiencing anxiety, depression, decreased sleep quality, and reduced quality of life among those with all 3 concurrent symptoms is even lower than among those with two

concurrent symptoms. This may be attributed to the limited sample size.

Stress and anxiety are known triggers for IBD flare-ups, and our study further emphasizes the need for psychological support and stress management interventions as part of the holistic care approach for IBD patients. A meta-analysis indicates that IBD patients with symptoms of depression have an increased risk of

Table 3. Psychological symptoms, sleep quality, and quality of life in IBD patients with double digestive symptoms

Score	Asymptomatic (n = 365)	Abdominalgia and hematochezia (n = 154)	P ^a	Hematochezia and diarrhea (n = 264)	P ^a	Diarrhea and abdominalgia (n = 423)	P ^a
GAD-7, median (IQR)	5 (2, 8)	7 (2, 10.5)	0.003	7 (3, 11)	<0.001	6 (2, 9)	0.015
Anxiety (GAD-7 ≥ 10), n (%)	64 (17.5)	47 (30.5)	0.001	87 (33.0)	<0.001	92 (21.7)	0.139
PHQ-9, median (IQR)	5 (2, 9)	7 (3, 12)	<0.001	7 (3, 11.75)	<0.001	6 (2, 10)	0.006
Depression (PHQ-9 ≥ 10), n (%)	76 (20.8)	55 (35.7)	<0.001	91 (34.5)	<0.001	127 (30.0)	0.003
PSQI, median (IQR)	6 (4, 8)	7 (4, 10)	0.007	7 (4, 10)	0.002	6.5 (4, 9)	0.220
Sleep disturbance (PSQI > 5), n (%)	201 (55.1)	106 (68.8)	0.004	168 (63.6)	0.031	249 (58.9)	0.283
IBD-Q, median (IQR)	196 (180, 208.5)	171.5 (150.75, 190.25)	<0.001	172.5 (145.25, 195)	<0.001	182 (156, 201)	<0.001
Poor quality of life (IBQ-Q < 169), n (%)	60 (16.4)	70 (45.5)	<0.001	121 (45.8)	<0.001	154 (36.4)	<0.001

GAD-7 = Generalized Anxiety Disorder 7, PHQ-9 = Patient Health Questionnaire-9, PSQI = Pittsburgh Sleep Quality Index, IBD-Q = Inflammatory Bowel Disease Questionnaire.

^a Compared with asymptomatic group.

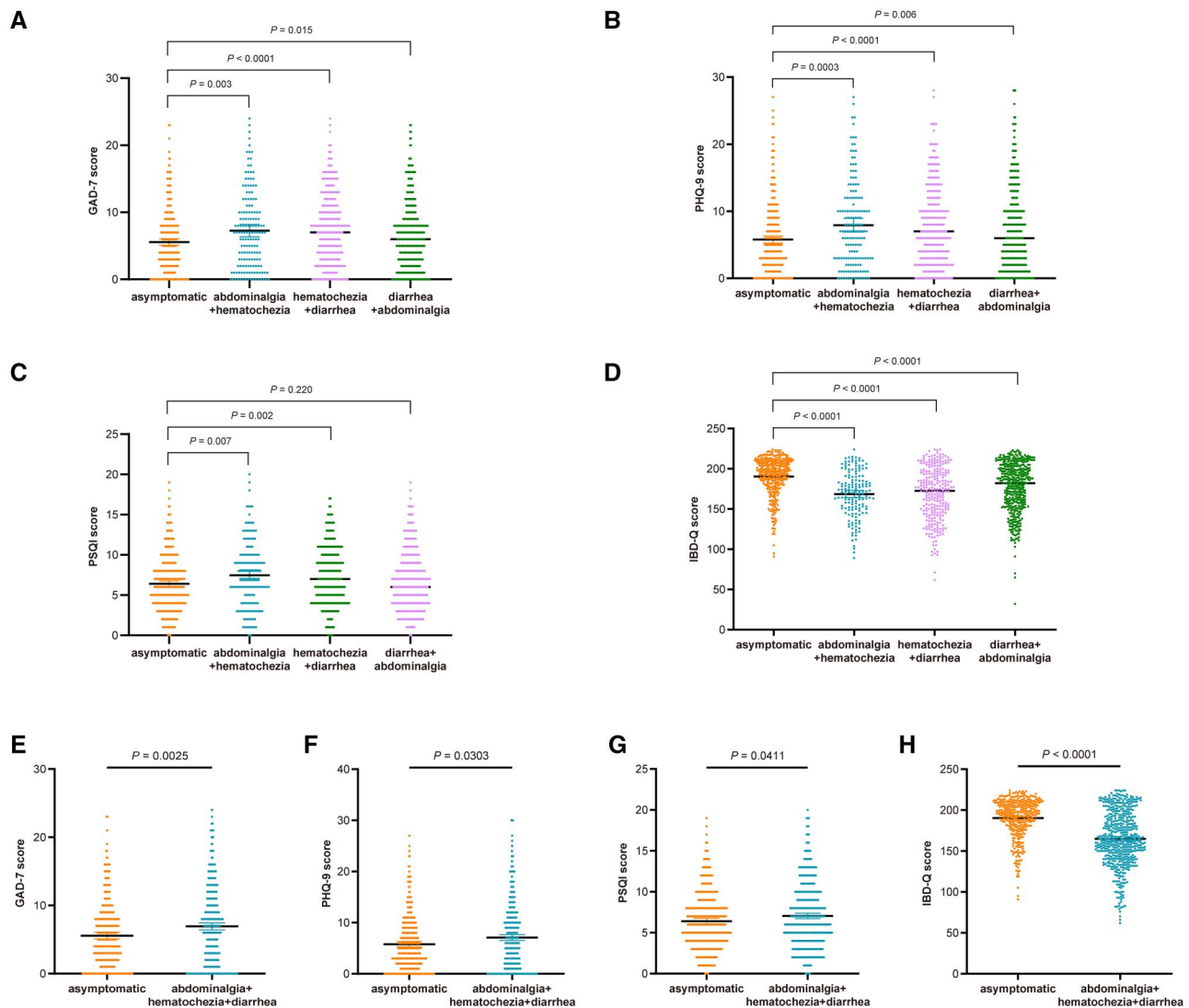


Figure 3. Scores of psychological symptoms, sleep quality and quality of life-related scales in IBD patients with double symptoms and patients with three symptoms. (A) GAD-7 scores in double digestive symptoms groups vs asymptomatic group. (B) PHQ-9 scores in double digestive symptoms groups vs asymptomatic group. (C) PSQI scores in double digestive symptoms groups vs asymptomatic group. (D) IBD-Q scores in double digestive symptoms groups vs asymptomatic group. (E) GAD-7 scores in three digestive symptoms group vs asymptomatic group. (F) PHQ-9 scores in three digestive symptoms group vs asymptomatic group. (G) PSQI scores in three digestive symptoms group vs asymptomatic group. (H) IBD-Q scores in three digestive symptoms group vs asymptomatic group. GAD-7 = Generalized Anxiety Disorder 7, PHQ-9 = Patient Health Questionnaire-9, PSQI = Pittsburgh Sleep Quality Index, IBD-Q = Inflammatory Bowel Disease Questionnaire.

Table 4. Psychological symptoms, sleep quality, and quality of life in IBD patients with 3 digestive symptoms

Score	Asymptomatic (n = 365)	Abdominalgia, hematochezia, and diarrhea (n = 520)	P
GAD-7, median (IQR)	5 (2, 8)	6 (2, 11)	0.002
Anxiety (GAD-7 ≥ 10), n (%)	64 (17.5)	157 (30.2)	<0.001
PHQ-9, median (IQR)	5 (2, 9)	6 (1, 11)	0.030
Depression (PHQ-9 ≥ 10), n (%)	76 (20.8)	167 (32.1)	<0.001
PSQI, median (IQR)	6 (4, 8)	6 (4, 10)	0.041
Sleep disturbance (PSQI > 5), n (%)	201 (55.1)	312 (60.0)	0.143
IBD-Q, median (IQR)	196 (180, 208.5)	163.0 (144.0, 191.8)	<0.001
Poor quality of life (IBQ-Q < 169), n (%)	60 (16.4)	297 (57.1)	<0.001

GAD-7 = Generalized Anxiety Disorder 7, IQR = interquartile range, PHQ-9 = Patient Health Questionnaire-9, PSQI = Pittsburgh Sleep Quality Index, IBQ-Q = Inflammatory Bowel Disease Questionnaire.

Table 5. Psychological symptoms, sleep quality, and quality of life in IBD patients with different numbers of digestive symptoms

Score	Asymptomatic (n = 365)	Single symptom (n = 752)	Double symptoms (n = 841)	Three symptoms (n = 520)	P ^a	P ^b	P ^c	P ^d	P ^e	P ^f	P ^g
GAD-7	5 (2, 8)	6 (3, 9)	6 (3, 10)	6 (2, 11)	0.002	<0.001	<0.001	0.002	0.477	0.554	0.953
PHQ-9	5 (2, 9)	6 (2, 10)	6 (2, 11)	6 (1, 11)	<0.001	<0.001	<0.001	0.030	0.347	0.053	0.294
PSQI	6 (4, 8)	6 (4, 9)	7 (4, 9)	6 (4, 10)	0.244	0.098	0.007	0.041	0.198	0.644	0.531
IBD-Q	196 (180, 208.5)	185.5 (163, 202)	177 (151, 198.5)	163.0 (144.0, 191.8)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

GAD-7 = Generalized Anxiety Disorder 7, PHQ-9 = Patient Health Questionnaire-9, PSQI = Pittsburgh Sleep Quality Index, IBQ-Q = Inflammatory Bowel Disease Questionnaire.

^a Compared in the four groups.

^b Single symptom compared with asymptomatic.

^c Double symptoms compared with asymptomatic.

^d Three symptoms compared with asymptomatic.

^e Double symptoms compared with single symptom.

^f Three symptoms compared with double symptoms.

^g Three symptoms compared with single symptom.

disease exacerbation, treatment escalation, hospitalization, emergency department visits, and surgery. Similarly, IBD patients with symptoms of anxiety have a significantly increased overall risk of treatment escalation, hospitalization, emergency department visits, and adverse outcomes [34]. Previous research has confirmed that there is a bidirectional relationship between IBD and symptoms such as anxiety and depression [9]. A study comparing individuals with newly diagnosed depression with those without depression found that the depression group had an increased risk of developing Crohn's disease (hazard ratio = 6.7; 95% confidence interval 1.65–11.95) and ulcerative colitis (hazard ratio = 2.70; 95% confidence interval 1.92–3.95) [35]. Another cohort study that focused on IBD patients and matched control individuals examined the occurrence of depression before and after an IBD diagnosis. The study found that the risk of both anxiety and depression increased during the year of IBD diagnosis [36]. Previous studies have posited that this bidirectional association is mediated through the gut-brain axis [37]. Abdominalgia, as one of the common gastrointestinal symptoms accompanying IBD, has been confirmed to induce anxiety and depression in patients by affecting the gut-brain axis [38–40]. An analysis of the National Health and Nutrition Examination Survey database also suggests a correlation between chronic diarrhea and depression, with a possible mechanism being the disruption of the gut-brain axis due to intestinal microbiota imbalance [41, 42]. Unfortunately, current research on the impact of hematochezia on the psychological, sleep quality, and quality of life aspects in IBD patients is not comprehensive. Our study can provide reliable clinical data for future research in this area as a reference point.

In recent years, researchers have been paying increased attention to the bidirectional relationship between sleep disorders and

IBD. A meta-analysis revealed no clear evidence of objective sleep disorders in IBD [43]. However, another meta-analysis showed that IBD patients experience significant sleep disturbances, and as they age, these disturbances become more pronounced [44]. Our findings indicate that sleep disturbances may be associated with the number of gastrointestinal symptoms, with IBD patients experiencing both sleep and gastrointestinal symptoms showing a more significant decline in sleep quality. However, future rigorous large-scale prospective studies are needed to confirm this observation.

The impact of digestive symptoms on the quality of life of IBD patients was profound. Participants reported disruptions in daily activities, work productivity, and social interactions due to the burden of their symptoms. Frequent hospital visits and medication regimens further compounded these issues, leading to reduced overall satisfaction with life. Research has long confirmed that positive psychological factors contribute to improving the quality of life for IBD patients [45, 46]. Thus, healthcare providers must consider the broader implications of digestive symptoms beyond the physical realm and collaborate with patients to develop personalized treatment plans that address both physical and emotional well-being.

At present, with the increasing incidence and recurrence rates of IBD, along with the high healthcare costs associated with IBD, both outpatient and inpatient healthcare providers should evaluate patients' conditions and prognosis from multiple dimensions. Clinical symptom presentation is an important tool in the assessment process, and our research has confirmed the link between gastrointestinal symptoms and psychological, sleep quality, and quality of life outcomes. This has significant implications for the healthcare management of IBD patients.

However, our study has some limitations that should be acknowledged. First, the cross-sectional design of the study limits the establishment of causal relationships between digestive symptoms and psychological well-being. Longitudinal studies are needed to provide a better understanding of the temporal relationship between these variables. The study's reliance on self-report measures for symptom severity and psychological states may also introduce response bias. Another limitation is the inability to account for the psychological impacts among patients who have undergone surgical interventions. Particularly, for those who have undergone procedures such as intestinal ostomy, post-surgery adjustments and changes in body image might affect their psychological well-being variably. These factors could potentially influence the observed outcomes and constitute a limitation in our study. Future research could focus on investigating the substantive impact of surgical interventions on the psychological well-being and quality of life of IBD patients, aiming for a comprehensive understanding of the potential effects of surgical interventions on patient mental health.

Conclusions

Compared with IBD patients with no gastrointestinal symptoms, those with accompanying gastrointestinal symptoms are more likely to experience higher levels of anxiety, depression, and sleep disturbance, and their quality of life is more profoundly affected. The effect increased with the increase in the number of symptoms. As healthcare providers, we need to adopt a patient-centered approach to care that recognizes the multidimensional nature of IBD and its effects on patients' lives. Further research is needed to explore the potential benefits of integrated care models and novel interventions to improve the overall well-being of patients with IBD.

Authors' Contributions

S.W., C.T., C.J., J.S., K.W., and W.D. were responsible for conception and design; W.D. and K.W. were responsible for administrative support; S.W., C.L., K.W., Z.L., and W.D. were responsible for provision of study materials or patients; S.W. and C.L. were responsible for collection and assembly of data; S.W. was responsible for data analysis and interpretation; all authors wrote, read and approved the final version of the manuscript.

Funding

This work was supported by the National Natural Science Foundation of China [grant number 82170549].

Acknowledgements

The authors would like to thank 42 participating institutions and associated IBD physicians for their help in this study, listed below (in no particular order): Renmin Hospital of Wuhan University (Ping An and Jixiang Zhang), Xijing Hospital, Air Force Medical University (Min Chen), Peking Union Medical College Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College (Hong Lyv), the Second Affiliated Hospital of Xi'an Jiaotong University (Fenrong Chen, Sumei Sha), Peking University First Hospital (Yuling Tian), Peking University Third Hospital (Jun Li), Beijing Friendship Hospital, Capital Medical University (Ye Zong and Haiying Zhao), Ruijin Hospital, Shanghai Jiaotong University School of Medicine (Tianyu Zhang), First Affiliated

Hospital of Sun Yat-sen University (Baili Chen, Ren Mao, Yao He, and Shenghong Zhang), General Hospital, Tianjin Medical University (Hailong Cao, Shuai Su, Wenyao Dong, and Lili Yang), Second Hospital of Hebei Medical University (Qian Liu and Rongrong Zhan), Sir Run Run Shaw Hospital, Zhejiang University School of Medicine (Jing Liu), the First Affiliated Hospital of Wenzhou Medical University (Xiangrong Chen, Xiaowei Chen, and Lingyan Shi), the Affiliated Hospital of Medical School of Ningbo University (Jinfeng Wen), Jiangsu Province Hospital, the First Affiliated Hospital of Nanjing Medical University (Jingjing Ma), Jiangsu Province Hospital of Chinese Medicine (Lei Zhu), Nanjing General Hospital of Nanjing Military Region (Juan Wei), the Second Affiliated Hospital of Soochow University (Han Xu), Shengjing Hospital of China Medical University (Nan Nan and Feng Tian), the First Affiliated Hospital of Dalian Medical University (Xiuli Chen and Jingwei Mao), Union Hospital, Tongji Medical College, Huazhong University of Science and Technology (Liangru Zhu), Zhongnan Hospital of Wuhan University (Mei Ye), Xiangya Hospital of Central South University (Shuijiao Chen), the Second Xiangya Hospital of Central South University (Hanyu Wang), Sichuan Provincial People's Hospital, University of Electronic Science and Technology of China (Xue Yang and Yinghui Zhang), the First Affiliated Hospital of Anhui Medical University (Juan Wu), Qilu Hospital, Shandong University (Xiaoqing Jia), the Affiliated Hospital of Qingdao University (Xueli Ding, Jing Guo, and Ailing Liu), the First Hospital of Jilin University (Haibo Sun and Jing Zhan), the First Affiliated Hospital of Kunming Medical University (Yating Qi), General Hospital of Ningxia Medical University (Shaoqi Yang and Ting Ye), the Second Affiliated Hospital of Zhengzhou University (Sumin Wang and Dandan Wang), the First Affiliated Hospital of Guangxi Medical University (Xiaoping Lyu, Junhua Fan, and Shiquan Li), Chongqing General Hospital (Chongqing Hospital, University of Chinese Academy of Sciences) (Lingya Xiang), the First Affiliated Hospital of Xinjiang Medical University (Ping Yao and Hongliang Gao), the Second Affiliated Hospital of Harbin Medical University (Wanying Li), the First Affiliated Hospital of the University of Science and Technology of China, Anhui Provincial Hospital (Xuemei Xu), Daping Hospital, Army Medical University (Zhuqing Qiu), Affiliated Hangzhou First People's Hospital, Zhejiang University School of Medicine (Wen Lyu), the Affiliated Hospital of Southwest Medical University (Xiaolin Zhong), General Hospital of Southern Theater Command of People's Liberation Army (Ang Li, Xiangqiang Liu, and Yanchun Ma), Suzhou Municipal Hospital (North District), and Nanjing Medical University Affiliated Suzhou Hospital (Zhi Pang). In addition, the authors would like to thank the editors and the anonymous reviewers for their valuable comments and suggestions to improve the quality of the paper.

Conflicts of Interest

The authors declare no conflict of interest.

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Gastroenterology Report, 2024, **12**, goae019

<https://doi.org/10.1093/gastro/goae019>

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