

# Medication Adherence in Korean Patients with Inflammatory Bowel Disease and Its Associated Factors

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**Objectives:** It is important that inflammatory bowel disease (IBD) patients adhere to their prescribed medication regimens to avoid the repeat exacerbations, complications, or surgeries associated with this disorder. However, there are few studies on medication adherence in patients with IBD, especially in Asian populations. So, we analyzed the factors associated with medication adherence in Korean IBD patients.

**Methods:** Patients who had been diagnosed with Crohn's disease (CD) or ulcerative colitis (UC) more than 6 months previously and receiving oral medications for IBD were enrolled. Medication adherence was measured using the Medical Adherence Reporting Scale (MARS-5), a self-reported medication adherence measurement tool.

**Results:** Among 207 patients in the final study population, 125 (60.4%) had CD and 134 (64.7%) were men. The mean age was 39.63 years (SD, 13.16 years) and the mean disease duration was 10.09 years (SD, 6.33 years). The mean medication adherence score was 22.46 (SD, 2.86) out of 25, and 181 (87.4%) patients had score of 20 or higher. In multiple linear regression analysis, self-efficacy ( $\beta=0.341$ ,  $P<0.001$ ) and  $\geq 3$  dosing per day ( $\beta=-0.192$ ,  $P=0.016$ ) were revealed to be significant factors associated with medication adherence. Additionally, there was a positive correlation between self-efficacy and medication adherence ( $r=0.312$ ,  $P<0.001$ ). However, disease related knowledge, depression, and anxiety were not significantly associated with medication adherence.

**Conclusion:** To improve medication adherence among patients with IBD, a reduction in the number of doses per day and an improved self-efficacy will be helpful. (Ewha Med J 2022;45(2):35-45)

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## Key Words

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## Introduction

Inflammatory bowel disease (IBD) is a chronic inflammatory disease that occurs in the gastrointestinal tract that

includes Crohn's disease (CD) and ulcerative colitis (UC), and that may sometimes present with extraintestinal manifestations [1,2]. The prevalence of IBD is increasing in Asian countries including Korea [3-5]. Symptoms such as ab-

dominal pain, diarrhea, weight loss, and a bloody stool are common to IBD. If the inflammation is not well controlled in affected patients, complications including intestinal stricture, fistula, perforation, and cancer can occur [6–8]. IBD is also a progressive disease, and it is important therefore to maintain appropriate medical interventions to prevent disease progression and reduce complications [9,10]. Adherence to medication regimens is thus vital and several studies have indicated in this regard that the prognosis is poorer in non-adherent IBD patients [11].

Medication adherence indicates that patients are taking their medications as prescribed [12]. Tae et al. [13] reported previously in patients with IBD that the risk of recurrence was 2.9-times higher in patients with low medication adherence. Despite its importance, medication adherence in patients with IBD has been reported to be only 55%–70% in a prior Western study [14], and to range from 63.8%–77.7% in Korean IBD populations [13,15]. By contrast, medication adherence in patients with hypertension, which is representative of a highly prevalent chronic disease in Korea, is reported to be much higher at 85% [16].

Factors associated with medication adherence in patients with IBD include symptoms, multiple concomitant medications, and doctor–patient relationships [17]. Selinger et al. [18] reported that poor patient knowledge could lead to the aggravation of IBD or a delay in treatment as it can reduce medication adherence. The concept of self-efficacy, i.e., a personal belief in disease management, has also been found to be related to medication adherence in patients with IBD [19]. In addition, Jackson et al. [14] reported that psychological distress is associated with non-adherence.

To date, few studies have analyzed the factors associated with medication adherence in patients with IBD, especially in an Asian context [13,15,20,21]. It is difficult to apply the results of previous studies on medication adherence that have been conducted in Western patients with IBD [14,17,22,23] or in Korean patients with other chronic diseases [24]. Hence, in our present study we analyzed the factors associated with medication adherence in Korean patients with IBD using a structured questionnaire.

## Methods

### 1. Study population

Adult patients (aged 18 years and older) who had been visiting Asan Medical Center for more than 6 months after being diagnosed with CD or UC, and who were receiving oral medications for these conditions, were enrolled. Patients who were taking psychotropic agents were excluded. The study sample size was calculated using G-Power [25,26] (Version 3.1.9, Heinrich–Heine–Universität Dusseldorf, Dusseldorf, Germany), based on multiple regression analysis, a two-sided test significance level of 0.05, a median effect size of 0.15, power of 0.95, and 14 predictors. The minimum number of subjects was calculated as 199. As the dropout rate was assumed to be 10%, we distributed the questionnaire to 218 patients.

### 2. Data collection

Patient data were collected from 14–28 April 2021 through the use of a structured questionnaire. Information on disease activity and medications among the IBD cohort were collected from the electronic medical records. Information on these patients including age, gender, marital status, family living arrangements, education level, religion, socioeconomic status, and smoking history were collected as general characteristics. Other factors such as duration of disease, previous IBD-related hospitalizations, previous IBD-related surgeries, active disease history, number of medications, outpatient visit period, education experience on IBD, and disease activity information were collected as disease-related characteristics. Disease activity was evaluated using the Crohn's disease activity index (CDAI) in patients with CD and the partial Mayo score in patients with UC.

Medication adherence was evaluated using Medication Adherence Report Scale–5 (MARS–5) developed by Horne et al. [22] with permission from the original author. The tool was translated into Korean with verification of language accuracy. It was then translated back into English and again verified. Since this was the first use of this tool in Korea, the validity of the questionnaire translated into Korean was verified by 10 experts (3 gastroenterologists, 2 nursing professors, 3 IBD specialist nurses, and 2 nurses working in the gastroenterology department for more than 10 years). As a result of this further review, a content validity index of 0.8 or higher was

calculated. Finally, both the Korean and retranslated English versions of the MARS-5 tool were sent to the original author at his request for approval. The scores calculated by this questionnaire range from 5 to 25, with higher scores indicating a higher degree of medication adherence. A score of 20 points or less, i.e., 80% or below, was defined as low medication adherence [23].

The IBD knowledge measurement tool (IBD-KNOW, Inflammatory Bowel Disease Knowledge) which was previously developed by Yoon et al. [27], was used to evaluate disease-related knowledge among the cases in our current series. Permission to use this system was also obtained from the original author. The IBD-KNOW questionnaire consists of a total of 24 items which reflect various aspects of a patient's knowledge about IBD, such as anatomy, function, epidemiology, diet/lifestyle, general knowledge, medications, complications, surgery, reproduction, and vaccination. The responses can be "yes", "no", or "don't know". A correct answer is assigned 1 point, and an incorrect or "don't know" is scored as 0. The total score can range from 0 to 24, with a higher score indicating higher disease-related knowledge. IBD-KNOW was validated with a Cronbach  $\alpha$  of 0.952 at the time of its development.

Self-efficacy was evaluated using the inflammatory bowel disease self-efficacy scale (IBD-SES) developed originally by Keefer et al. [19] and previously translated into Korean by Lee et al. [28]. We used this questionnaire with permission from the original author and translator. The IBD-SES consists of a total of 29 questions that cover managing stress and emotions, managing medical care, managing symptoms and disease, and maintaining remission. Each question is assessed on a 10-point Likert scale with 10 being "totally sure"; 5, "somewhat sure"; and 1, "not sure at all." The total score can thus range from 29 to 290, with a higher score indicating higher self-efficacy. At the time of its development, the IBD-SES received a 0.96 using Cronbach  $\alpha$ , which was calculated as 0.97 by Lee et al. [28].

Anxiety and depression was evaluated using the hospital anxiety and depression scale (HADS) which has mainly been used in patients with cancer, and was developed by Zigmond et al. [29] and translated into Korean by Oh et al. [30]. HADS was used with permission from GL Assessment (London, UK). The 7 even-numbered questions in this tool comprise the depression subscale (HADS-D), and the 7 odd-numbered

questions the anxiety subscale (HADS-A). Each question is scored from 0 to 3 points, with a total possible score of 21 points on each subscale. Higher scores indicate higher levels of depression and anxiety. A score of 0 to 7 was defined as normal, 8 to 10 as indicating mild anxiety or depression, and 11 or higher as indicative of severe anxiety or depression.

### 3. Statistical analysis

The general characteristics, disease-related characteristics, disease-related knowledge, self-efficacy, depression and anxiety, and medication adherence of the current study subjects were analyzed in terms of frequency and percentage, or by mean values with SD. An independent *t*-test and one way ANOVA were used to analyze differences in medication adherence in accordance with the general characteristics and disease-related characteristics of the IBD patients, and a Scheffe test was used for post hoc analysis. Multiple linear regression analysis was used to identify factors affecting medication adherence. The variance inflation factor (VIF) ranged from 1.151–1.898 with no cases exceeding 10, and the tolerance limit ranged from 0.527–0.869, with all cases larger than 0.1 confirming that there was no multicollinearity problem. The multiple linear regression analysis model was suitable for the regression analyses with  $F=4.337$ ,  $P<0.001$ , and adjusted  $R^2=0.127$ , indicating an explanatory power of 12.7%. The correlation between the disease-related knowledge, self-efficacy, depression and anxiety and medication adherence variables was analyzed using Pearson's correlation analysis. Statistical significance was defined as  $P<0.05$ . All collected data were analyzed using IBM SPSS statistics for Windows, version 25.0 (IBM, Armonk, NY, USA).

### 4. Ethical considerations

The current study protocol was approved by the Institutional Review Board of Asan Medical Center, Seoul, Korea (IRB No. 2021-0452).

## Results

### 1. General and disease-related characteristics of the study subjects

The study questionnaire was distributed to all 218 enrolled IBD patients, with 207 of these cases (95.0%) responding ad-

equately to enable further analysis. Among these 207 patients, 134 (64.7%) were male, and the mean age at enrollment was 39.63 years (SD, 13.16 years), with the 30–39 year age group representing the largest sub–population (30.4%). One hundred and thirteen (54.6%) patients were married and 182 (87.9%) were living with their family. In terms of educational attainment, 159 (76.8%) patients had a university degree or

higher, 119 patients (57.5%) were non–religion, 67 (32.4%) had no occupation, and 179 (86.5%) patients were never smokers (Table 1).

The disease–related characteristics of our study participants are also presented in Table 1. There were 125 CD cases (60.4%) with a mean disease duration of 10.09 years (SD, 6.33 years). Ninety–four (45.4%) of the patients were receiving bi–

**Table 1.** General and disease-related characteristics of the current study population (n=207)

Characteristics	n (%)	Characteristics	n (%)
Gender (male)	134 (64.7)	Previous IBD-related hospitalization	131 (63.3)
Age (yr), mean±SD	39.63±13.16	Previous IBD-related surgery	76 (36.7)
Age range (yr)		Previous relapse	178 (86.0)
≤29	52 (25.1)	Medications	
30–39	63 (30.4)	5-ASA	162 (78.3)
40–49	46 (22.2)	Immunomodulators	128 (61.8)
50–59	28 (13.5)	Biologics	94 (45.4)
≥60	18 (8.7)	Steroids	11 (5.3)
Married	113 (54.6)	Route of medications	
Living status		PO only	121 (58.5)
With family member(s)	182 (87.9)	PO and parenteral	86 (41.5)
Alone	22 (10.6)	Number of medications	
With others	3 (1.5)	One	104 (50.2)
Education level		More than two	103 (49.8)
≤High school	48 (23.2)	Number of pills (per day), mean±SD	6.21±3.97
≥Bachelor's degree	159 (76.8)	Number of pills (per day)	
Religion		<5	73 (35.3)
Yes	88 (42.5)	≥5	134 (64.7)
No	119 (57.5)	Number of doses (per day)	
Occupation		Once	66 (31.9)
Yes	140 (67.6)	Twice	66 (31.9)
No	67 (32.4)	Three or more times	75 (36.2)
Monthly household income (Korean won)		Outpatient visit interval (days), mean±SD	73.77±35.66
<3 million	86 (41.5)	Outpatient visit interval (days)	
≥3 million	121 (58.5)	<28	31 (15.0)
Smoking		28–56	65 (31.4)
Yes	28 (13.5)	57–84	40 (19.3)
No	179 (86.5)	≥85	71 (34.3)
Disease		IBD education experience	170 (82.1)
Crohn's disease	125 (60.4)	Disease activity	
Ulcerative colitis	82 (39.6)	Remission	158 (76.3)
Disease duration (yr), mean±SD	10.09±6.33	Mild	34 (16.4)
Disease duration (yr)		Moderate	13 (6.3)
<5	50 (24.2)	Severe	2 (1.0)
5–9	52 (25.1)		
10–14	64 (30.9)		
≥15	41 (19.8)		

IBD, inflammatory bowel disease; 5-ASA, 5-aminosalicylic acid; PO, per oral.

ologic agents and 11 (5.3%) patients were on a corticosteroid regimen. There were 121 (58.5%) patients in the series taking only oral medications and 104 (50.2%) taking only one kind of oral medication. The mean number of pills being taken per day was 6.21 (SD, 3.97), and the mean outpatient visit interval was 73.77 days (SD, 35.66 days).

## 2. Medication adherence, disease-related knowledge, self-efficacy, and anxiety and depression scores

The mean medication adherence score was 22.46 (SD, 2.86) out of 25, with 26 (12.6%) patients showing low adherence, defined as a score of 20 points or less. The mean disease-related knowledge score was 14.46 (SD, 4.63) out of 24, and the mean self-efficacy score in relation to IBD management was 203.21 (SD, 40.86) out of 290. With regard to the HADS responses, the mean depression score was 6.36 (SD, 3.36), with 24 (11.6%) patients indicating severe depression. The anxiety scores determined by the HADS responses had a mean of 5.85 (SD 3.64), with 23 (11.1%) patients showing severe anxiety (Table 2).

## 3. Medication adherence in accordance with general and disease-related characteristics

The observed differences in medication adherence among the study patients, in accordance with their general char-

acteristics, did not show statistical significance (Table 3). In terms of the disease-related characteristics of the study subjects, the patients with CD ( $P=0.015$ ) had a lower medication adherence than the patients with UC, and the patients with a previous IBD-related surgery ( $P=0.035$ ) also showed a lower medication adherence (Table 4). The patients who were taking steroids ( $P<0.001$ ) showed higher medication adherence, as did the patients who were taking only oral medications ( $P=0.040$ ), compared with the patients who were taking both oral and parenteral medications. There was no significant difference found in the medication adherence between the patients taking one medication and those on a regimen of two or more drugs. The medication adherence was lower in the patients who were taking medicines three or more times a day regimen, compared with those on a once per day regimen ( $P=0.008$ ).

## 4. Factors associated with medication adherence and correlations between disease-related knowledge, self-efficacy, depression, anxiety and medication adherence

Multiple linear regression analysis was performed to identify factors affecting medication adherence. Self-efficacy ( $\beta=0.341$ ,  $P<0.001$ ), and three or more daily doses ( $\beta=-0.192$ ,  $P=0.016$ , compared with a single daily dosage) were significant factors associated with medication adherence (Table 5).

**Table 2.** Disease-related knowledge, self-efficacy, depression, anxiety, and medication adherence in patients with IBD (n=207)

Variables	Score range	n (%)	Mean±SD
Disease related knowledge	0-24		14.46±4.63
Self-efficacy	29-290		203.21±40.86
Stress & emotions	9-90		61.41±16.56
Medical care	8-80		65.26±12.39
Symptoms and disease	7-70		43.89±12.88
Remission	5-50		32.78±8.69
Depression	0-21		6.36±3.36
Normal	0-7	131 (63.3)	
Mild	8-10	52 (25.1)	
Severe	>11	24 (11.6)	
Anxiety	0-21		5.85±3.64
Normal	0-7	149 (72.0)	
Mild	8-10	35 (16.9)	
Severe	>11	23 (11.1)	
Medication adherence	5-25		22.46±2.86
Low adherence	<20 (80%)	26 (12.6)	

IBD, inflammatory bowel disease.

**Table 3.** Differences in medication adherence by general characteristics

Variable	Mean±SD	t or F-value	P-value
Sex		1.456	0.147
Male	22.67±2.65		
Female	22.07±3.18		
Age range (yr)		1.176	0.323
≤29	22.23±3.01		
30–39	22.30±3.02		
40–49	22.24±3.09		
50–59	22.79±2.35		
≥60	23.72±1.45		
Married		0.188	0.851
Yes	22.42±2.99		
No	22.50±2.70		
Living status		0.085	0.919
With family member	22.43±2.82		
Living alone	22.68±3.26		
Others	22.67±3.22		
Education level		1.386	0.167
≤High school	22.96±2.33		
≥Bachelor	22.31±2.99		
Religion		-1.363	0.175
Yes	22.77±2.72		
No	22.23±2.94		
Occupation		-1.738	0.084
Yes	22.22±2.96		
No	22.96±2.58		
Monthly household income (Korean won)		-0.072	0.942
<3 million	22.44±2.88		
≥3 million	22.47±2.85		
Smoking		-0.772	0.441
Yes	22.07±3.19		
No	22.52±2.81		

Self-efficacy ( $r=0.312$ ,  $P<0.001$ ) showed a positive correlation with medication adherence, whereas disease-related knowledge, depression, and anxiety had no significant correlation with medication adherence (Table 6).

## Discussion

We have here investigated medication adherence among Korean patients with IBD, and analyzed factors that associated with medication adherence, including disease-related knowledge, depression, and anxiety. Our findings indicated that 26 cases among our final study subjects of 207 (12.6%) patients had low medication adherence, defined as a score on the self-administered questionnaire 20 points or less (80% or

lower), and that the factors contributing to this low adherence were a reduced self-efficacy and a drug regimen of three or more daily doses. With another analysis, a positive correlation was evident between self-efficacy and medication adherence. Our current results for Korean patients with IBD indicated a better level of medication adherence compared to previously studied populations [13,15]. For example, Kim et al. [15] reported that 49.3% (32/67) of their CD patients and 48.0% (36/75) of their UC patients showed a low medication adherence. Tae et al. [13] reported that 36.2% (50/138) of the IBD patients in their study cohort were non-adherent to their drug regimens. In prior Western studies [14,17,22], the low adherence was reported to range from 29%–45% which is also higher than the rate found in our present study. The mean

**Table 4.** Differences in medication adherence by disease-related characteristics

Variable	Mean±SD	t or F-value	P-value
Disease		-2.450	0.015
CD	22.10±3.16		
UC	23.01±2.21		
Disease duration (yr)		2.557	0.056
<5	22.84±2.99		
5-9	22.92±2.23		
10-14	22.44±2.33		
≥15	21.44±3.83		
Previous IBD-related hospitalization		0.864	0.389
Yes	22.33±3.08		
No	22.68±2.42		
Previous IBD-related surgery		2.126	0.035
Yes	21.87±3.32		
No	22.80±2.50		
Previous relapse history		0.749	0.455
Yes	22.40±2.97		
No	22.83±2.00		
Concomitant steroid use		-5.039	<0.001
Yes	24.18±0.98		
No	22.36±2.90		
Route of medications		2.065	0.040
PO only	22.80±2.40		
PO and parenteral	21.98±3.34		
Number of medications		1.478	0.141
One	22.75±2.52		
More than two	22.17±3.15		
Number of pills (per day)		1.198	0.232
<5	22.70±2.59		
≥5	22.28±2.98		
Number of doses (per day)		4.950	0.008
Once <sup>a</sup>	23.12±2.06		a>c*
Twice <sup>b</sup>	22.68±2.99		
Three or more times <sup>c</sup>	21.68±3.17		
Outpatient visit interval (days)		2.300	0.079
<28	23.23±2.13		
28-56	21.77±3.44		
57-84	22.83±3.00		
≥85	22.55±2.34		
IBD education experience		-0.952	0.342
Yes	22.55±2.85		
No	22.05±2.90		
Disease activity		0.307	0.821
Remission	22.41±2.91		
Mild	22.68±2.88		
Moderate	22.77±2.46		
Severe	21.00±0.00		

CD, Crohn's disease; UC, ulcerative colitis; IBD, inflammatory bowel disease; PO, per oral.

\*Scheffe test.

**Table 5.** Factors associated with medication adherence

Variable	B	SE	$\beta$	t-value	P-value	Tolerance	VIF
Disease	0.423	0.485	0.073	0.870	0.385	0.610	1.640
Previous IBD-related surgery	-0.452	0.495	-0.076	-0.911	0.363	0.603	1.659
Route of medications	-0.383	0.404	-0.066	-0.948	0.344	0.869	1.151
Number of doses (per day) (Reference : Once)							
Twice	-0.154	0.470	-0.025	-0.327	0.744	0.715	1.398
Three or more times	-1.136	0.466	-0.192	-2.441	0.016	0.687	1.457
Disease-related knowledge	-0.002	0.044	-0.003	-0.043	0.966	0.816	1.225
Self-efficacy	0.024	0.006	0.341	4.017	<0.001	0.589	1.699
Depression	0.078	0.076	0.092	1.026	0.306	0.527	1.898
Anxiety	0.007	0.068	0.009	0.102	0.919	0.569	1.756

F(P)=4.337 (<0.001), R<sup>2</sup>=0.165, adjusted R<sup>2</sup>=0.127, Durbin-Watson=2.108

VIF, variance inflation factor; IBD, inflammatory bowel disease.

**Table 6.** Correlations between disease-related knowledge, self-efficacy, depression, anxiety and medication adherence

Variable	Disease-related knowledge	Self-efficacy	Depression	Anxiety	Medication adherence
Disease-related knowledge	1				
Self-efficacy	0.003 (0.970)	1			
Depression	0.048 (0.495)	-0.586 (<0.001)	1		
Anxiety	0.106 (0.130)	-0.535 (<0.001)	0.603 (<0.001)	1	
Medication adherence	-0.090 (0.195)	0.312 (<0.001)	-0.121 (0.082)	-0.135 (0.052)	1

Values are presented as r (P).

MARS-5 score was 22.46 (SD, 2.86) in our current study, which is similar to that reported previously by Stone et al. [23] of 22.5 (SD, 2.2).

We found from our present analyses that self-efficacy (P<0.001) and regimens requiring three or more dosages per day (P=0.016) were associated with medication adherence, respectively. These results are consistent with the findings of a previous study [31] in which a requirement for three or more doses per day was also reported to be associated with poor medication adherence. Jackson et al. [14] reported that psychological distress and patient beliefs regarding medications were associated with non-adherence. Notably however, depression and anxiety were not associated with medication adherence in our present study series. Patient beliefs and attitudes about treatment were reported to be related to medication adherence in other previous studies [22,32], but we did not investigate these factors in our current investigations.

No significant correlation was found in our present study between disease-related knowledge and medication adher-

ence. Previously, Lim et al. [33] had reported that the patients with higher level of IBD knowledge showed better adherence among Korean pediatric patients with IBD. In addition, Ashok et al. [34] reported that a higher disease-related knowledge led to a higher degree of medication compliance among patients with IBD. However, other studies [18,35] reported no correlation between disease-related knowledge and medication adherence, which is consistent with our present study results. Hence, the relationship between disease-related knowledge and medication adherence is not yet fully clear. The tool we used herein to assess disease-related knowledge (IBD-KNOW) [27] includes questions on anatomy, function, epidemiology, diet/lifestyle, general knowledge, medication, complications, surgery, reproduction, and vaccination. However, the ages of our current IBD subjects had a wide range, which led to differences in the proportion of correct answers by field of interest. We contend therefore that it is necessary to educate patients after confirming their knowledge level in each of these fields.

We found no correlation between anxiety, depression and medication adherence in our present analyses, consistent with the prior study results of Selinger et al. [18] However, Jackson et al. [14] reported that depression and anxiety do affect medication adherence, and Nahon et al. [36] found that higher anxiety correlated with a lower medication adherence among the patients with IBD. In addition, Park et al. [37] reported that patients with chronic disease such as hypertension, diabetes, and dyslipidemia have higher rates of depression and lower medication adherence. As the effects of different variables on medication adherence have been reported in a variety of ways, further studies are needed to identify the factors that link depression/anxiety with medication adherence in IBD.

The mean score for disease-related knowledge in our study was 14.46 out of 24. This is higher score than that described in previous studies. Kim et al. [15] reported a mean disease-related knowledge score of 9.0 in patients with CD and 8.2 in patients with UC using the same knowledge measurement tool [38]. Yoon et al. [27] reported a disease-related knowledge score of 13.3 in patients with IBD at the time in which the IBD-KNOW tool was developed. Our present study had more frequent histories of IBD-related hospitalizations (63.3% vs. 36.6%) and surgeries (36.7% vs. 4.9%) than was reported in a previous study [15]. We speculate that patients who experienced an IBD-related hospitalization or an IBD-related surgery would take a greater interest in their condition and thus make more of an effort to acquire disease-related knowledge. This may underlie our current findings for this variable. In a previous study from the United States, the disease-related knowledge score for patients with IBD was 14.8 [39], which is similar to the score in our current study. The overall low disease-related knowledge scores in Korea for IBD may be due to a lower prevalence of this disorder compared to other chronic disease such as hypertension and diabetes. As a result of this however, even medical staff in local community hospitals are commonly transferring IBD patients to tertiary hospitals due to their lack of knowledge and experience, leading to an insufficient amount of publicity and awareness of IBD among many Korean medical institutions.

The measure of self-efficacy in our present study (209 points out of 290 points) was slightly higher than that obtained by Keefer et al. [19] (194.9 points out of 290 points) using the

same measurement tool (IBD-SES). The IBD-SES can evaluate 4 areas, the scores of which can then be expressed as a percentage. In our present study, managing medical care was 81.53%, managing stress and emotions was 68.23%, maintaining remission was 65.52%, and managing symptoms and disease was 62.7%. This suggests that strategies are needed in Korean patients with IBD to improve the management of symptoms and disease and to maintain remission.

The mean scores for depression and anxiety in this study were 6.37 and 5.85, respectively, with 77 of our patients (37.2%) showing mild to severe depression, and 58 (28.0%) displaying mild to severe anxiety. In a previous IBD cohort study [15], the prevalence of depression and anxiety were measured at 19.7% and 42.9%, respectively, using the same tool. Hence, more patients experienced depression and fewer experienced anxiety among our study population. Of note in particular, 24 (11.6%) of our current IBD patients had severe depression. In a previous Western study, Graff et al. [40] reported that the rate of depression within 1 year of the diagnosis of IBD was about twice as high as in patients without IBD, whereas anxiety did not show a difference, and that about 17% of their IBD cases experienced a major depressive disorder. Depression was less frequent in our current study, but it must be noted that we excluded patients receiving psychotropic drugs.

This study had several limitations of note. First, the study subjects were enrolled from a single tertiary center within a short period of time, which will likely have caused some selection bias. Second, there is a possibility that medication adherence was overestimated due to the use of a self-reported questionnaire. Third, although valid questionnaires used in previous studies were used, there is no gold standard for evaluating disease-related knowledge, depression and anxiety, or medication adherence. It remains necessary to analyze a larger number of IBD patients over a sufficient period in the future using more accurate measurement tools.

In conclusion, our present study is the first to investigate the relationship between medication adherence and self-efficacy in Korean patients with IBD using previously verified measurement tools [19,22,27–30] that enhanced the reliability and validity of the data. Our findings indicate that reducing the number of medication doses per day and improving self-ef-

ficacy will help to improve medication adherence among patients with IBD. Our current results thus provide useful basic data for the development of nursing interventions that can improve medication adherence in this patient population.

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