

# Symptom Experience and Quality of Life in Colorectal Cancer Patients Undergoing Chemotherapy – A Secondary Publication

Ayoung Lee<sup>1</sup>, Jin-Hee Park<sup>2\*</sup>

<sup>1</sup>College of Nursing, Ajou University, Suwon, South Korea

<sup>2</sup>College of Nursing, Research Institute of Nursing Science, Ajou University, Suwon, South Korea

\*Corresponding author: Jin-Hee Park, [jhee@ajou.ac.kr](mailto:jhee@ajou.ac.kr)

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**Abstract:** *Objective:* To evaluate symptom experience and quality of life (QoL) and to identify the predictors of QoL among colorectal cancer patients undergoing chemotherapy. *Methods:* A cross-sectional study was conducted on 107 colorectal cancer patients at a university-affiliated hospital between June 1 and July 30, 2021. Functional Assessment of Cancer Therapy-Colorectal (FACT-C) and Memorial Symptom Assessment Scale-Short Form (MSAS-SF) were used to assess symptom experience and QoL of these patients. Data were analyzed using Pearson's correlation, *t*-test, ANOVA, and hierarchical multiple regression. *Results:* The mean QoL score for colorectal cancer patients was  $88.78 \pm 20.08$ . The most frequently experienced physical and psychological symptoms were numbness/tingling and worrying. Physical and psychological symptoms have a significant negative association with QoL. Perceived economic status was significantly associated with QoL in patients' general characteristics. The regression analyses showed that high psychological symptoms ( $\beta = -0.63, P < 0.001$ ), middle perceived economic status ( $\beta = -0.22, P = 0.009$ ), and low perceived economic status ( $\beta = -0.36, P < 0.001$ ) were statistically significant in predicting patients' low QoL. *Conclusion:* Symptom experience and QoL are essential variables that should be acknowledged when delivering health care to colorectal cancer patients. More attention to the reduction and comprehensive symptom management of psychological distress could improve QoL among colorectal cancer patients.

**Keywords:** Chemotherapy; Colorectal neoplasms; Quality of life; Symptoms

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## 1. Introduction

### 1.1. The need for research

Colorectal cancer accounts for 11.4% of all cancer patients and ranks fourth in incidence following thyroid, lung, and stomach cancers, with a 5-year relative survival rate of 74.3% as of 2015–2019<sup>[1]</sup>. Colorectal cancer incidence and survival rates have been increasing rapidly with early detection and aggressive treatment<sup>[2]</sup>. Consequently, the paradigm of cancer treatment is expanding to consider it as a chronic disease requiring

symptom management and quality of life (QoL) considerations <sup>[3]</sup>.

QoL refers to the overall well-being across physical, social, emotional, and functional aspects of life related to general health and disease treatment processes <sup>[4]</sup>. Since the QoL reflects the well-being status of colorectal cancer patients and can predict hospitalization duration and medical costs, it is used as an important indicator of treatment effectiveness in clinical settings <sup>[5]</sup>. Patients with advanced colorectal cancer receive chemotherapy to reduce tumor size before surgery to minimize the extent of colon resection or to prevent cancer recurrence and metastasis to other organs <sup>[2]</sup>. Chemotherapy is an effective treatment method for preventing colorectal cancer recurrence and increasing survival rates <sup>[6]</sup>. However, it induces systemic side effects, thereby compromising the QoL of colorectal cancer patients <sup>[7-10]</sup>. Therefore, interventions to enhance the QoL of colorectal cancer patients undergoing chemotherapy are required, necessitating a systematic approach to identify relevant factors for the development of such intervention programs.

Various factors influence the QoL of colorectal cancer patients undergoing chemotherapy, particularly peripheral neuropathy, fatigue, anxiety, and depression <sup>[7-10]</sup>. Chemotherapy-induced symptoms experienced by colorectal cancer patients include gastrointestinal symptoms such as nausea, vomiting, diarrhea, and constipation, as well as physical symptoms such as numbness and tingling in the hands and feet caused by specific medications <sup>[9,11]</sup>. Moreover, certain symptoms such as fatigue, nausea, and peripheral neuropathy persist as sequelae after chemotherapy, manifesting as psychological symptoms such as anxiety, fear, anger, and helplessness in colorectal cancer patients <sup>[3,7,11]</sup>. These physical and psychological symptoms cause significant distress to colorectal cancer patients, leading to decreased treatment adherence and diminished QoL <sup>[7-10]</sup>. Therefore, it is imperative to continuously assess the symptoms experienced by colorectal cancer patients undergoing chemotherapy and actively seek solutions to improve their QoL.

Recent overseas research has shown a growing interest in the health issues and adaptation of colorectal cancer patients undergoing chemotherapy. Studies aimed at elucidating the impact of symptoms experienced by colorectal cancer patients undergoing chemotherapy on their QoL and developing interventions focused on improving QoL based on these symptoms are steadily increasing <sup>[3,5,7-10,12]</sup>. In contrast, in domestic studies, while there are research efforts to assess chemotherapy-related symptoms and QoL levels in colorectal cancer patients <sup>[13]</sup>, these studies often include patients who do not receive chemotherapy. In such cases, interpretation is limited because the severity of symptoms and prognosis varies depending on the treatment method <sup>[2]</sup>. Indeed, in a study targeting domestic colorectal cancer patients, symptom severity was lowest before chemotherapy initiation and significantly increased during chemotherapy <sup>[14]</sup>. Additionally, colorectal cancer patients experience more psychological distress compared to patients with other types of cancer <sup>[15]</sup>, and the more symptoms they experience, the lower their QoL <sup>[10]</sup>. In summary, research aimed at identifying the symptoms experienced by colorectal cancer patients undergoing chemotherapy and elucidating their impact on QoL should continue. However, in the domestic context, studies focusing solely on the relationship between symptom experience and QoL in colorectal cancer patients undergoing chemotherapy are scarce <sup>[14]</sup>.

Therefore, this study aims to confirm the extent of symptom experience and QoL in colorectal cancer patients undergoing chemotherapy, to understand the impact of symptom experience on QoL, and to provide basic data for the development of intervention programs focused on enhancing the QoL of colorectal cancer patients.

## 1.2. Research objectives

The objective of this study is to confirm the extent of symptom experience and QoL in colorectal cancer patients undergoing chemotherapy and to understand the impact of symptom experience on QoL. The specific

objectives are as follows:

- (1) To assess the symptom experience and QoL of the subjects.
- (2) To identify differences in QoL according to the demographic characteristics and disease-related characteristics of the subjects.
- (3) To understand the relationship between the subjects' symptom experience and QoL.
- (4) To identify factors influencing the QoL of the subjects.

## 2. Research methodology

### 2.1. Research design

This study is cross-sectional survey research aimed at confirming the extent of symptom experience and QoL in colorectal cancer patients undergoing chemotherapy and understanding the impact of symptom experience on QoL.

### 2.2. Study subjects

The subjects of this study were randomly selected from colorectal cancer patients undergoing chemotherapy in the inpatient and outpatient day wards of the Department of Colorectal Surgery and Oncology/Hematology at A University Hospital located in Gyeonggi Province, South Korea. The inclusion criteria for subjects were: (1) aged 19 years or older, (2) diagnosed with stage 2 or 3 primary colorectal cancer, and (3) receiving primary or adjuvant chemotherapy at the time of the study. Exclusion criteria for the subjects were: (1) cognitive impairment, (2) metastatic or recurrent colorectal cancer, and (3) receiving palliative chemotherapy. Patients receiving palliative chemotherapy for life extension or symptom relief purposes were excluded because they are in a different stage of active treatment and have different factors affecting QoL<sup>[16]</sup>.

The sample size was calculated using G\*Power 3.1.9.7 software. Based on a previous study<sup>[14]</sup>, the main factors influencing the QoL of colorectal cancer patients undergoing chemotherapy (age, gender, cancer stage at diagnosis, time since diagnosis, perceived economic status, physical symptoms, psychological symptoms) were considered predictive variables. With a significance level of 0.05, a median effect size of 0.15<sup>[13]</sup>, and a power of 0.80, the required sample size for multiple regression analysis was determined to be 103 participants. Considering a dropout rate of 20%, 129 questionnaires were distributed, and 107 questionnaires (83.2%) were returned, including a total of 107 participants in the final analysis.

### 2.3. Research instruments

#### 2.3.1. Symptom experience

Symptom experience was measured with the Memorial Symptom Assessment Scale-Short Form (MSAS-SF) developed by Chang *et al.* and adapted by Nho *et al.*<sup>[17,18]</sup>. This tool measures the presence and distress or frequency of 32 symptoms. Depending on the subscale, physical symptoms are assessed with 12 items including fatigue, pain, appetite loss, drowsiness, constipation, dry mouth, feeling of restlessness, vomiting, taste changes, weight loss, feeling of bloating, and dizziness, rated from 0 (symptom absent) to 4 (symptom very distressing), while psychological symptoms are assessed with 6 items including worry, sadness, nervousness, sleep disturbance, irritability, and difficulty concentrating, rated from 0 (no symptom) to 4 (always). Scores range from 0 to 4, with higher scores indicating higher levels of symptom distress and frequency. During tool development, the reliability was Cronbach's  $\alpha = 0.82$  for physical symptoms and Cronbach's  $\alpha = 0.76$  for psychological symptoms. In a study by Lam *et al.* targeting colorectal cancer patients<sup>[19]</sup>, Cronbach's  $\alpha$  was 0.84 for physical symptoms and 0.85 for psychological symptoms, while in this study, Cronbach's  $\alpha$  was 0.89 for physical symptoms and 0.86 for psychological symptoms.

### 2.3.2. Quality of life

QoL was measured using the Korean version of the Functional Assessment of Cancer Therapy-Colorectal Version 4 (FACT-C) developed by Ward *et al.* [20]. The study content was registered on FACIT.org, and permission and guidelines for tool use were obtained. This tool consists of a total of 34 items divided into 5 subscales: physical well-being (7 items), social/family well-being (7 items), emotional well-being (6 items), functional well-being (7 items), and colorectal cancer-specific subscale (7 items). Each item is rated on a Likert 5-point scale ranging from 0 (not at all) to 4 (very much). The measured scores are calculated as the sum of scores from the five subscales to obtain a total score. Scores range from 0 to 136, with higher scores indicating higher QoL. During tool development, the reliability was Cronbach's  $\alpha = 0.91$ , and in this study, Cronbach's  $\alpha = 0.96$ .

### 2.4. Data collection and ethical considerations

This study was conducted from June 1st to July 30th, 2021, after receiving approval from the Institutional Review Board of A University Hospital (IRB-MEDSUR-21-174). Data collection was carried out after obtaining permission from the relevant departments and nursing departments at A University Hospital in Gyeonggi Province, South Korea. The researcher conducted surveys in both the inpatient and outpatient day wards. Subjects were informed about the purpose and content of the study, their right to participate, the voluntary nature of participation, their right to withdraw at any time, confidentiality of collected data, and data management methods. Surveys were distributed to subjects who voluntarily agreed to participate in the study by signing a consent form. For subjects unable to self-administer the questionnaire, the researcher read the questions aloud and recorded their responses. The time required to complete the questionnaire was approximately 20 minutes. Completed questionnaires were sealed in return envelopes, and participants were provided with a token of appreciation. Disease-related characteristics of the subjects were obtained from electronic medical records, and computers containing research information were password-protected for data management.

### 2.5. Data analysis

The collected data were analyzed using SPSS 25.0 software, and the specific analysis methods were as follows:

- (1) Demographic characteristics, disease-related characteristics, symptom experiences, and QoL of the subjects were analyzed using descriptive statistics.
- (2) Differences in QoL according to demographic characteristics and disease-related characteristics of the subjects were analyzed using independent *t*-tests and one-way analysis of variance (ANOVA), with post-hoc tests conducted using the Scheffé test.
- (3) The relationship between symptom experience and QoL of the subjects was analyzed using Pearson's correlation coefficient.
- (4) Factors influencing the QoL of the subjects were analyzed using hierarchical multiple regression.

## 3. Research results

### 3.1. Demographics and disease-related characteristics of subjects

The demographic and disease-related characteristics of the subjects are presented in **Table 1**. The mean age of the subjects was  $61.32 \pm 10.82$  years, with males comprising 64.5% of the sample. Among the subjects, 93.5% were married, and 81.3% lived with family. 57.9% of the subjects reported no religion, and the highest education level attained was high school graduation at 40.2%. 66.4% of the subjects were unemployed, and



45.8% perceived their economic status as “low.”

Regarding disease-related characteristics, the mean duration since diagnosis of colorectal cancer was  $9.55 \pm 15.41$  months. Stage 3 colorectal cancer accounted for 72.9% of cases, and 55.1% received third-line or higher chemotherapy. 88.8% of the subjects received adjuvant chemotherapy, and 51.4% received treatment as outpatients.

**Table 1.** Differences in quality of life according to demographic and clinical characteristics ( $n = 107$ )

Variables	Categories	<i>n</i> (%)	<i>M</i> ± <i>SD</i>	<i>t</i> or <i>F</i>	<i>P</i>
Age (year)			61.32 ± 10.82	1.86	0.161
	≤ 54	21 (19.6)	88.48 ± 21.37		
	55–64	45 (42.1)	92.80 ± 19.71		
	≥ 65	41 (38.3)	84.51 ± 19.38		
Gender	Men	69 (64.5)	89.43 ± 21.45	0.46	0.649
	Women	38 (35.5)	87.58 ± 17.52		
Marital status	Married	100 (93.5)	89.20 ± 19.33	0.83	0.411
	Unmarried	7 (6.5)	82.71 ± 30.15		
Living with family	Yes	87 (81.3)	89.03 ± 20.52	0.28	0.782
	No	20 (18.7)	87.65 ± 18.49		
Religion	Yes	45 (42.1)	87.67 ± 22.23	0.49	0.629
	No	62 (57.9)	89.58 ± 18.49		
Education	≤ Middle school	33 (30.8)	86.76 ± 16.32	0.70	0.499
	High school	43 (40.2)	91.58 ± 22.47		
	≥ College	31 (29.0)	87.03 ± 20.35		
Job	Employed	36 (33.6)	93.17 ± 22.21	-1.62	0.108
	Unemployed	71 (66.4)	86.55 ± 18.68		
Perceived economic status	High-class <sup>a</sup>	31 (29.0)	95.87 ± 18.64	4.65	0.012 (c < a, b)*
	Middle-class <sup>b</sup>	27 (25.2)	91.48 ± 16.47		
	Low-class <sup>c</sup>	49 (45.8)	82.80 ± 21.28		
Stage of cancer	Stage 2	29 (27.1)	92.69 ± 22.29	1.23	0.220
	Stage 3	78 (72.9)	87.32 ± 19.14		
Cycles of CTx	1 cycle	27 (25.2)	88.59 ± 21.68	0.01	0.996
	2 cycles	21 (19.6)	89.10 ± 23.65		
	≥ 3 cycles	59 (55.1)	88.75 ± 18.25		
Time period since diagnosis (month)			9.55 ± 15.41	2.94	0.057
	≤ 3	39 (36.4)	89.00 ± 20.81		
	4–6	39 (36.4)	93.64 ± 17.53		
	≥ 7	29 (27.1)	81.93 ± 20.97		
Type of CTx	Neoadjuvant CTx	12 (11.2)	94.00 ± 15.24	0.96	0.341
	Adjuvant CTx	95 (88.8)	88.12 ± 20.58		
The place where CTx was given	OPD	55 (51.4)	88.76 ± 20.62	0.01	0.995
	Admission	52 (48.6)	88.79 ± 19.69		

Abbreviations: M, mean; SD, standard deviation; CTx, chemotherapy; OPD, outpatient department. \*Scheffé test.

### 3.2. Symptoms experience and quality of life of subjects

The mean score for physical symptoms among subjects was  $0.89 \pm 0.58$  out of a maximum of 4 points. The symptom with the highest score was “numbness/tingling in hands and feet.” This was followed by “appetite loss,” “fatigue,” “taste changes,” “nausea,” “difficulty sleeping,” and “feeling of bloating.” The most frequently reported symptom was “numbness/tingling in hands and feet,” followed by “appetite loss,” “fatigue,” “nausea,” “taste changes,” and “hair loss.” The mean score for psychological symptoms among subjects was  $0.93 \pm 1.00$  out of 4, with “worry” showing the highest score and frequency, followed by “irritability,” “sadness,” and “nervousness” (Table 2).

**Table 2.** Descriptive statistics of symptom experience ( $n = 107$ )

Symptoms	M $\pm$ SD	n (%)	Range
Physical symptoms	$0.89 \pm 0.58$		0–4
Numbness and tingling	$1.68 \pm 1.45$	73 (68.2)	0–4
Appetite loss	$1.56 \pm 1.40$	68 (63.6)	0–4
Fatigue	$1.52 \pm 1.39$	67 (62.6)	0–4
Taste changes	$1.31 \pm 1.44$	58 (54.2)	0–4
Nausea	$1.26 \pm 1.37$	59 (55.2)	0–4
Difficulty sleeping	$1.15 \pm 1.32$	49 (45.8)	0–4
Feeling of bloating	$1.14 \pm 1.29$	55 (51.4)	0–4
Drowsiness	$1.08 \pm 1.24$	55 (51.4)	0–4
Changes in skin	$1.08 \pm 1.24$	49 (45.8)	0–4
Weight loss	$1.04 \pm 1.31$	53 (49.6)	0–4
Hair loss	$1.00 \pm 1.15$	57 (53.3)	0–4
Dizziness	$0.99 \pm 1.32$	53 (49.6)	0–4
Pain	$0.99 \pm 1.19$	48 (44.9)	0–4
Dry mouth	$0.96 \pm 1.10$	54 (50.3)	0–4
Itching	$0.84 \pm 1.12$	49 (45.8)	0–4
Don't look like self	$0.80 \pm 1.17$	44 (41.1)	0–4
Urination	$0.79 \pm 1.17$	42 (39.3)	0–4
Difficult concentrating	$0.78 \pm 1.03$	47 (43.9)	0–4
Constipation	$0.72 \pm 1.11$	40 (37.4)	0–4
Diarrhea	$0.66 \pm 1.04$	39 (36.4)	0–4
Vomiting	$0.64 \pm 1.09$	37 (34.6)	0–4
Swelling of arm	$0.55 \pm 0.87$	38 (36.5)	0–4
Mouth sores	$0.55 \pm 0.96$	34 (31.8)	0–4
Sweats	$0.42 \pm 0.82$	29 (27.1)	0–4
Shortness of breath	$0.40 \pm 0.84$	28 (26.2)	0–4
Difficulty swallowing	$0.40 \pm 0.78$	27 (25.2)	0–4
Sexual interest	$0.36 \pm 0.81$	25 (23.4)	0–4
Cough	$0.29 \pm 0.60$	26 (24.3)	0–4
Psychological symptoms	$0.93 \pm 1.00$		0–4
Worry	$1.12 \pm 1.30$	57 (53.3)	0–4
Irritability	$0.95 \pm 1.21$	51 (47.7)	0–4
Sadness	$0.85 \pm 1.10$	49 (45.8)	0–4
Nervousness	$0.81 \pm 1.15$	44 (41.1)	0–4

Abbreviations: M, mean; SD, standard deviation.

The mean score for overall QoL among subjects was  $88.78 \pm 20.08$  out of a maximum of 136 points. Subscales of QoL included physical well-being ( $20.21 \pm 6.31$ ), social/family well-being ( $17.21 \pm 5.40$ ), emotional well-being ( $17.21 \pm 5.23$ ), functional well-being ( $15.92 \pm 6.41$ ), and colorectal cancer-specific subscale ( $18.22 \pm 4.43$ ), as shown in **Table 3**.

**Table 3.** Descriptive statistics of quality of life ( $n = 107$ )

Variables	M $\pm$ SD	Min	Max	Range
FACT-C total	$88.78 \pm 20.08$	24	130	0–136
Physical well-being	$20.21 \pm 6.31$	1	28	0–28
Social/family well-being	$17.21 \pm 5.40$	1	28	0–28
Emotional well-being	$17.21 \pm 5.23$	0	24	0–24
Functional well-being	$15.92 \pm 6.41$	2	28	0–28
Colorectal cancer-specific subscale	$18.22 \pm 4.43$	3	28	0–28

Abbreviations: M, mean; SD, standard deviation; FACT-C, functional assessment of cancer therapy-colorectal.

### 3.3. Differences in quality of life according to demographic and disease-related characteristics

The difference in QoL according to demographic and disease-related characteristics showed statistical significance only in perceived economic status ( $F = 4.65$ ,  $P = 0.012$ ). Scheffé posthoc analysis revealed that the QoL score of subjects who perceived economic status as “high-class” ( $95.87 \pm 18.64$ ) was significantly higher than those who perceived it as “middle-class” ( $91.48 \pm 16.47$ ) or “low-class” ( $82.80 \pm 21.28$ ), as shown in **Table 1**.

### 3.4. Relationship between symptom experience and quality of life of subjects

There was a statistically significant negative correlation between subjects’ physical symptoms ( $r = -0.39$ ,  $P < 0.001$ ) and psychological symptoms ( $r = -0.67$ ,  $P < 0.001$ ) and their QoL. In other words, higher levels of physical symptoms and psychological symptoms in colorectal cancer patients were associated with lower QoL (**Table 4**).

**Table 4.** Correlation between quality of life and symptom experience ( $n = 107$ )

Variables	FACT-C	PWB	SWB	EWB	FWB	CCS
	r (P)	r (P)	r (P)	r (P)	r (P)	r (P)
Physical symptoms	-0.39 ( $< 0.001$ )	-0.62 ( $< 0.001$ )	0.16 (0.092)	-0.19 (0.054)	-0.29 (0.003)	-0.47 ( $< 0.001$ )
Psychological symptoms	-0.67 ( $< 0.001$ )	-0.58 ( $< 0.001$ )	-0.22 (0.025)	-0.54 ( $< 0.001$ )	-0.53 ( $< 0.001$ )	-0.54 ( $< 0.001$ )

Abbreviations: FACT-C, functional assessment of cancer therapy-colorectal; PWB, physical well-being; SWB, social/family well-being; EWB, emotional well-being; FWB, functional well-being; CCS, colorectal cancer-specific subscale.

### 3.5. Factors influencing the quality of life of subjects

The results of hierarchical multiple regression analysis conducted to analyze factors influencing the QoL of subjects are presented in **Table 5**. In the first step, perceived economic status, which showed a significant association with QoL in univariate analysis, was entered as a dummy variable. In the second step, after

controlling for perceived economic status, physical symptoms and psychological symptoms were included to identify the net effect of symptom experience on the QoL of colorectal cancer patients receiving chemotherapy. Prior to conducting hierarchical multiple regression analysis, the assumptions of regression analysis were tested. The Durbin-Watson statistic was 2.10, close to 2, indicating no autocorrelation in residuals and thus meeting the assumption of independence of residuals. Tolerance values for assessing multicollinearity ranged from 0.69 to 0.74, all below 1.0, and variance inflation factors ranged from 1.36 to 1.45, all below 10.0, indicating no multicollinearity issues. Residuals showed normality in the normal P-P plot and scatterplots demonstrated that residuals were evenly distributed around zero, satisfying the assumptions of normality and homoscedasticity of errors. Furthermore, Cook's distance for assessing outliers was below 0.06, well below the threshold of 1.0, indicating the absence of outliers.

The results of hierarchical multiple regression analysis indicated that in the first step, when perceived economic status was entered, it accounted for 6% of the variance in QoL ( $F = 4.65, P = 0.012$ ), with perceived economic status "low-class" ( $\beta = -0.33, P = 0.004$ ) emerging as a significant influencing factor. In the second step, after adding physical symptoms and psychological symptoms, the adjusted R-squared increased to 52% ( $F = 30.17, P < 0.001$ ). Psychological symptoms ( $\beta = -0.63, P < 0.001$ ), perceived economic status "middle-class" ( $\beta = -0.22, P < 0.009$ ), and perceived economic status "low-class" ( $\beta = -0.36, P < 0.001$ ) emerged as statistically significant influencing factors. Thus, it was observed that subjects reporting higher levels of psychological symptoms and perceiving lower economic status had lower QoL.

**Table 5.** Influencing factors on quality of life

Variables	Model 1					Model 2				
	B	SE	$\beta$	<i>t</i>	<i>P</i>	B	SE	$\beta$	<i>t</i>	<i>P</i>
(Constant)	95.87	3.49	-	27.9	< 0.001	114.91	3.42	-	33.61	< 0.001
Perceived economic status										
Middle-class*	-4.39	5.11	-0.10	-0.86	0.392	-9.93	3.71	-0.22	-2.68	0.009
Low-class*	-13.08	4.46	-0.33	2.93	0.004	-14.31	3.20	-0.36	-4.48	< 0.001
Physical symptoms						-2.58	2.03	-0.10	-1.27	0.207
Psychological symptoms						-15.08	1.87	-0.63	-8.07	< 0.001
R <sup>2</sup>	0.08					0.54				
Adjusted R <sup>2</sup>	0.06					0.52				
R <sup>2</sup> change						0.46				
F ( <i>P</i> )	4.65 (0.012)					30.17 (< 0.001)				

Abbreviation: SE, standard error. \*High-class as the reference group.

## 4. Discussion

This study attempted a cross-sectional survey to examine the symptom experience and QoL among colorectal cancer patients receiving chemotherapy and to elucidate the impact of symptom experience on QoL. The discussion of key research findings is as follows.

The QoL among colorectal cancer patients was found to be 88.78 out of a maximum of 136 points. This score is similar to the 87.69 points reported by AlFayyad *et al.* using the same instrument to measure the QoL of colorectal cancer patients<sup>[5]</sup>. However, when compared to the 93.65 points reported by Goździewicz

*et al.* [9], it appears slightly lower. This difference can be attributed to the characteristics of the subjects included in the studies. Unlike the study by Goździewicz *et al.*, which focused only on colorectal cancer patients receiving adjuvant chemotherapy, both this study and the study by AlFayyad *et al.* included patients receiving both adjuvant and neoadjuvant chemotherapy, leading to this discrepancy. Specifically, patients receiving neoadjuvant chemotherapy for colorectal cancer, who undergo chemotherapy before surgery, often experience higher psychological distress due to vague anxiety about surgery and other treatments [5,21], along with severe side effects of chemotherapy. Therefore, it is thought that studies including patients receiving neoadjuvant chemotherapy may show relatively lower QoL scores compared to those focusing solely on patients receiving adjuvant chemotherapy. On the other hand, a study by Lewis *et al.* conducting a 24-month follow-up from the time of colorectal cancer diagnosis found that the QoL of patients receiving chemotherapy was lower than that of those receiving only radical surgery [21]. This indicates that while surgery for colorectal cancer improves symptoms and enhances QoL [22], symptoms induced by chemotherapy have a continuous negative impact on the QoL of colorectal cancer patients [10,14]. Hence, longitudinal studies focusing on early-stage colorectal cancer patients receiving chemotherapy are needed to assess the degree of change in QoL associated with chemotherapy agents and related factors.

The level of symptom experience among colorectal cancer patients was 0.89 points for physical symptoms and 0.93 points for psychological symptoms. This is comparable to the range of 0.78 to 0.86 points reported in a longitudinal study assessing symptom distress using the Symptom Distress Scale among colorectal cancer patients receiving chemotherapy [14]. Examining the main results of physical symptoms in this study, the most severe symptom in terms of distress was “numbness/tingling in hands and feet.” Following that, “appetite loss” and “fatigue” were observed, with scores indicating significant distress levels above 1.5 points [17]. This aligns with findings from Röhrli *et al.* [11], who tracked symptom severity in colorectal cancer patients receiving chemotherapy over six months, reporting “numbness/tingling in hands and feet” as the most distressing physical symptom, consistent with this study’s results. “Numbness/tingling in the hands and feet” is a symptom induced by oxaliplatin-based chemotherapy, with severity increasing with cumulative dosage, often manifesting as peripheral neuropathy [2,6,11]. Additionally, “appetite loss” and “fatigue” are common complaints among cancer patients undergoing chemotherapy, with “fatigue,” which can be described as exhaustion, being the most frequently reported symptom [23]. Therefore, given the variety of physical symptoms experienced by colorectal cancer patients due to chemotherapy [11], it is imperative to develop self-management enhancement programs through pre-emptive education on physical symptoms to enable appropriate coping strategies when symptoms occur.

Among psychological symptoms in colorectal cancer patients, the symptom with the highest score was “worry”. “Worry” can be expressed as anxiety [24], and stage 2 and stage 3 colorectal cancer patients often experience anxiety due to deep fears of recurrence [25]. Previous studies on psychological symptoms in colorectal cancer patients support this finding. Mols *et al.* reported that anxiety levels were higher than depression levels in colorectal cancer patients [26], while Drury *et al.* also found that anxiety was the most prevalent psychological symptom [27], corroborating the results of this study. Furthermore, considering the findings of Trudel-Fitzgerald *et al.* [28], who conducted follow-up studies after colorectal cancer diagnosis, where they mentioned that as anxiety symptoms worsened, unhealthy lifestyle behaviors (diet, physical activity, alcohol consumption, smoking, body mass index) led to a decrease in QoL, individualized symptom management programs such as emotional support to reduce anxiety levels are needed.

This study conducted hierarchical multiple regression analysis to identify factors influencing the QoL in colorectal cancer patients. The results indicated that psychological symptoms and perceived economic status

were significant factors affecting the QoL in colorectal cancer patients receiving chemotherapy. Psychological symptoms have been identified as a major factor affecting the QoL in colorectal cancer patients receiving chemotherapy in studies by Han *et al.* and Lu *et al.* [3,7], which is consistent with the findings of this study. Colorectal cancer patients experience more psychological distress and have difficulty in social interactions compared to patients with other types of cancer [15,27]. The psychological symptoms such as anxiety and depression occurring during the treatment process along with the psychological pressure of cancer, adversely affect the QoL in colorectal cancer patients [26,28]. Therefore, it is necessary to enhance understanding and awareness of psychological education interventions for symptom management [12]. On the other hand, physical symptoms did not emerge as factors influencing the QoL in colorectal cancer patients. This result may be attributed to the administration of medications such as antiemetics to prevent side effects before chemotherapy, and prompt management of any side effects that may occur, allowing for improvement in physical symptoms [2]. However, there are studies suggesting that physical symptoms are factors influencing QoL in colorectal cancer patients [9,10], so further research on this aspect is needed.

The perceived economic status has been identified as a major factor affecting the QoL in colorectal cancer patients in many previous studies, supporting the findings of this study [27,29,30]. In this study, 66.4% of the participants were unemployed, and 45.8% of them reported a low perceived economic status. It has been reported that 4 out of 10 colorectal cancer patients experience economic burden and stress related to cancer, which can lead to a decline in QoL [30]. Considering that colorectal cancer patients may experience a decrease in QoL due to economic stress related to cancer [27,30], interventions are needed to reduce the level of stress caused by economic burden.

The study contributes to the understanding of the need to consider psychological symptoms and perceived economic status for improving the QoL of colorectal cancer patients receiving chemotherapy, providing essential data for the development of intervention programs. However, since this study randomly sampled colorectal cancer patients receiving chemotherapy at a single university hospital, there are limitations to generalizing the results to all colorectal cancer patients. Additionally, including colorectal cancer patients receiving chemotherapy at various stages may introduce variability in the effects depending on the treatment phase, so caution is needed when interpreting the study findings.

## 5. Conclusion

This study is a cross-sectional survey aimed at examining the experience of symptoms and the level of QoL in colorectal cancer patients receiving chemotherapy and investigating the impact of symptom experience on QoL. Based on this study, the factors influencing the QoL of colorectal cancer patients receiving chemotherapy are psychological symptoms and perceived economic status. To improve the QoL of colorectal cancer patients, it is necessary to regularly assess psychological symptoms during chemotherapy and develop individualized symptom management intervention programs tailored to each symptom. Additionally, considering that the QoL tends to be lower in colorectal cancer patients with lower perceived economic status, fundamental solutions such as institutional support to reduce economic burden are needed. Therefore, considering the factors influencing the QoL of colorectal cancer patients, longitudinal studies are recommended to assess symptom experience and changes in QoL before and after starting chemotherapy.

## Disclosure statement

The authors declare no conflict of interest.



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