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# Gender-specific differences in factors influencing supportive care needs in colorectal cancer patients

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## Abstract

**Background** Unmet supportive care needs reducing the quality of life of colorectal cancer (CRC) patients. As existing studies have indicated the supportive care needs of CRC patients of different genders differ, the main aim of this study was to investigate the factors influencing the supportive care needs of CRC patients based on gender.

**Methods** CRC patients were categorized by gender to compare each group's supportive care needs and demographic characteristics. Multiple linear regression analysis was employed to identify factors impacting the supportive care needs of patients by gender.

**Results** The study involved 257 males and 146 females CRC patients. Female patients reported higher levels of supportive care needs. Among male patients, those with higher education levels, higher anxiety, and a diagnosis of rectal cancer exhibited more significant supportive care needs. In contrast, anxiety was the only factor affecting supportive care needs for female patients.

**Conclusion** This study provides new insights into the factors influencing supportive care needs in CRC patients. It revealed distinct differences in the levels and determinants of supportive care needs between male and female patients. Specifically, a higher level of education and the presence of rectal cancer were associated with increased supportive care needs in male patients. Meanwhile, increased anxiety levels were linked higher supportive care needs across both genders.

**Keywords** Colorectal cancer, Supportive care needs, Influencing factors, Stratified analysis

## Background

The latest global cancer burden data released by the International Agency for Research on Cancer (IARC) of the World Health Organization in 2020 showed that the number of new colorectal cancer (CRC) cases in the world amounted to 1.93 million and the number of CRC deaths was 0.94 million [1]. According to the most recent Chinese cancer data, the number of new CRC cases was 0.56 million, accounting for one-third of the global population with CRC [2]. The number of deaths was 0.29 million, which has become a significant public health problem that threatens human health [2]. With

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the advancement of diagnosis and treatment technology, the 5-year survival rate of colorectal cancer patients has been increasing, and improving the quality of survival during the survival period is a vital nursing issue [3]. The treatment of colorectal cancer is mainly based on surgery, supplemented by radiotherapy, chemotherapy, and other treatments. In long-term treatment and rehabilitation, a series of measures should be taken to prevent or reduce patients' adverse reactions and complications to improve patients' comfort and quality of life, which is so-called supportive care [4]. Supportive care needs include "needs beyond surgery, radiotherapy and chemotherapy, medication and other treatments" categorized into physical, psychological, health care staff, information, social, and practical needs [5, 6]. Study shows that Chinese CRC survivors have a significantly higher proportion of unmet supportive care needs than other Western developed countries [7]. Unmet supportive care needs may persist and cause psychological distress, reducing the quality of life of patients [3, 8]. Patients preferred supportive care from doctors or nurses, such as lectures and demonstrations by healthcare professionals and one-on-one professional guidance [9]. Understanding the needs of patients allows us to identify those needs that are more urgent and make adjustments in the allocation of services and available resources. Therefore, to maximize the satisfaction of patients' supportive care needs and make better use of limited resources, it is necessary to clarify the supportive care needs and influencing factors of CRC patients to provide the basis for formulating relevant intervention strategies in the future.

Previous studies have revealed differences in supportive care needs among patients of different genders. Sakamoto et al. [10] conducted a cross-sectional survey of CRC patients undergoing chemotherapy, the results of multivariate regression showed that female colorectal cancer patients had significantly higher total needs relative to males. Also, Nair's [11] survey showed that the physical and psychological needs of male cancer patients were significantly lower than those of female patients. Therefore, the supportive care needs of CRC patients of different genders differ. In addition, previous studies have revealed the main factors affecting the supportive care needs of oncology patients regardless of gender. They indicated that sociodemographic factors (such as age, religious belief, education, family income, and marital status), and disease factors, including cancer type, current treatment, CRC family history, and metastasis impact patients' needs [12–17]. Besides, some results of some other studies suggest that anxiety and depression may be highly correlated with the supportive care needs of oncology patients [18, 19]. However, whether the above factors are associated with supportive care needs in different genders is still being determined. Considering the

gender variability in the impact of the above factors on patients, stratified analyses based on gender are needed if differences in supportive care needs between genders are to be clarified [20]. However, there are few stratified analyses of supportive care needs for CRC patients.

In this study, based on the differences in supportive care needs among CRC patients of different genders, a stratified analysis is proposed to investigate the differences in the current status of supportive care needs and the factors influencing them in CRC patients of different genders.

## Methods

### Settings and study population

This cross-sectional study adheres to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Guidelines. It was approved by the Medical Ethics Committee of Soochow University (No. SUDA20200225H08), Suzhou, China. CRC patients volunteered to participate in this study after being informed of the purpose and content of the study and signed an informed consent form. Participants could enter, withdraw from, or discontinue the study as they wished. Participants' privacy was protected for research purposes only.

CRC patients admitted to the Oncology and Radiotherapy Departments of four level A tertiary hospitals from September 2020 to January 2022 were recruited by convenience sampling for a cross-sectional survey. The inclusion criteria are as follows: (i) over 18 years old; (ii) diagnosed with colorectal cancer; (iii) currently receiving chemotherapy, radiotherapy, or palliative treatment; (iv) agree to participate in this study. The exclusion criteria were as follows: (i) with severe cognitive or psychological difficulties, who were too unwell to participate; (ii) unable to communicate; (iii) unaware of their disease diagnoses; (iv) participating in other clinical studies related to supportive care needs.

The sample size was estimated according to Kendall's proposal that it is mostly 10 to 20 times the number of independent variables [21]. There were 15 variables involved in the statistical analysis. Considering a 15% attrition rate, the sample size required for this study was at least 345 patients.

### Data collection

After completing the medical ethical review, uniformly trained researchers went to each partner department to implement the on-site survey, explained the study's purpose, significance, and methodology to the study participants, signed the informed consent form, and then conducted one-on-one guided surveys. The participants completed the questionnaires by themselves. If the participants had difficulty reading the written questions, the

research assistants read the questions and options to the participants without making any implications. The questionnaires were completed, immediately recovered, and reviewed on-site to check for missing parts. Epidata 3.1 software was used for data input by two researchers.

## Measures

### General information questionnaire

Two components were included: socio-demographic information and disease information. Socio-demographic data included age, gender, marital status, education, employment status, religious beliefs, monthly per capita household income, and payment of medical expenses. Disease and treatment information included CRC family history, cancer type, metastasis, and current treatment.

### Supportive care needs

The Comprehensive Needs Assessment Tool in Cancer for Patients (CNAT) was developed by Shim et al., Korean scholars in 2011 [22]. It contains 59 entries covering somatic symptoms, mental health, healthcare professionals, knowledge and information, religious/spiritual/social support, hospital facilities, and practical support in 7 dimensions; each entry is categorized into 4 degrees: 0 = no need, 1 = low need, 2 = medium need, and 3 = high need. The Cronbach's alpha coefficient of the total scale was 0.97. It was introduced into China by Zhao [23] in 2017, and the domain scores were calculated by averaging the score for each domain with subsequent linear transformation to a scale of 0-100 based on the European Organization for Research and Treatment of Cancer (EORTC) scoring guideline [24]. The Cronbach's alpha value of the handwritten scale was 0.95, and the retest reliability coefficient was 0.82. In our study, the Cronbach's alpha value was 0.96.

### Anxiety and Depression

Hospital Anxiety Depression Scale (HADS) was developed by Zigmond and Snaith [25] in 1983 and is mainly used for anxiety and depression screening of hospital patients. The scale consists of 14 items divided into two subscales: anxiety (HADS-A) and depression (HADS-D). Each entry was scored on a scale of 0-3, with lower scores indicating lower levels of anxiety and depression. The subscale score cutoffs and their explanation were 0-7 for noncases, 8-10 for doubtful cases, and 11-21 for probable cases. The scale's internal consistency of the scale was good, and Cronbach's alpha values of each dimension were higher than 0.82. HADS is primarily designed to identify and assess symptoms of anxiety and depression rather than to provide a formal diagnosis. In this study, the Cronbach's alpha value of HADS-A was 0.87, and that of HADS-D was 0.86.

## Statistical analyses

To investigate the differences in general information and supportive care needs between male and female CRC patients separately, the researchers categorized all participants into male and female groups for subgroup comparisons. The general information variables are reported as either median (interquartile range) or mean plus standard deviation (depending on whether the continuous variables are normally distributed). Categorical variables are presented as counts (percentages). Scores for supportive care needs are reported as mean plus standard deviation, while scores for anxiety and depression are expressed as counts (percentages).

First, multiple linear regression analysis was performed to identify the factors influencing the supportive care needs of CRC patients. Then, comparisons between groups were conducted using rank sum tests for continuous variables and chi-square tests for categorical variables. Multiple linear regression analysis was performed to identify the factors influencing the supportive care needs of CRC patients based on gender. Data analysis was conducted using SPSS 27 software.  $P < 0.05$  was considered statistically significant.

## Results

### Patients' characteristics

This study included 403 CRC patients, comprising 257 males (64%) and 146 females (36%). The participants were grouped by gender for intergroup comparison (Table 1). The two groups showed significant differences in age, literacy level, religious belief, and family history of CRC. Specifically, male CRC patients were older, had a higher educational level, were less religious, and were more likely to have a family history of CRC compared to female patients (all  $P < 0.05$ ).

### Factors associated with supportive care needs in CRC patients

Table 2 presents the results of the multivariate linear regression model to identify the factors influencing supportive care needs in overall include patients. Female ( $P = 0.001$ ), junior college or higher education level ( $P = 0.003$ ), rectal cancer ( $P = 0.015$ ) and higher levels of anxiety ( $P < 0.001$ ) were linked to higher supportive care needs included CRC patients.

### Total and dimension scores of supportive care needs in CRC patients by gender

Table 3 presents the total and dimension scores for supportive care needs in CRC patients, categorized by gender. There was a statistically significant difference in the total supportive care needs score, with females averaging a score of  $42.56 \pm 18.60$ , compared to males, who averaged  $37.86 \pm 18.39$  ( $P = 0.015$ ). The scores for the four

**Table 1** Characteristics of the participants by gender (N=403)

Variables	Males (N=257)	Females (N=146)	P
Age (M, IQR/x±s)	62(14.00)	55.97±10.92	<0.001 <sup>a</sup>
Marital status N (%)			0.658
Married	242 (94.16)	139 (95.21)	
Single/Divorced/Widowed	15 (5.84)	7 (4.79)	
Education N (%)			0.049 <sup>a</sup>
< Junior college	127 (49.42)	87 (59.59)	
≥Junior college	130 (50.58)	59 (40.41)	
Employment status N (%)			0.438
In employment	139 (54.09)	78 (53.42)	
Unemployed	13 (5.06)	12 (8.22)	
Retired	105 (40.86)	56 (38.36)	
Religious belief N (%)			0.004 <sup>a</sup>
Yes	20 (7.78)	25 (17.12)	
No	237 (92.22)	121 (82.88)	
Per capita monthly income of family (RMB) N (%)			0.340
< 1000	20 (7.78)	12 (8.22)	
1000–2000	43 (16.73)	19 (13.01)	
2000–3000	60 (23.35)	47 (32.19)	
3000–4000	63 (24.51)	35 (23.97)	
> 5000	71 (27.63)	33 (22.60)	
Payment method of medical expenses N (%)			0.457
Self-paid	14 (5.45)	5 (3.42)	
Full reimbursement	5 (1.95)	1 (0.68)	
Partial reimbursement	238 (92.61)	140 (95.89)	
CRC family history N (%)			0.025 <sup>a</sup>
Yes	30 (11.67)	29 (19.86)	
No	227 (88.33)	117 (80.14)	
Cancer type N (%)			0.258
Colon cancer	158 (61.48)	98 (67.12)	
Rectal cancer	99 (38.52)	48 (32.88)	
Metastasis N (%)			0.921
Yes	210 (81.71)	118 (80.82)	
No	32 (12.45)	18 (12.33)	
Unclear	15 (5.84)	10 (6.85)	
Current treatment N (%)			0.621
Chemotherapy	239 (93.00)	139 (95.21)	
Chemotherapy + Radiotherapy	12 (4.67)	4 (2.74)	
Palliative treatment	6 (2.33)	3 (2.05)	
Anxiety N (%)			0.065
Noncases	201 (78.21)	100 (68.69)	
Doubtful cases	34 (13.23)	24 (16.44)	
Probable cases	22 (8.56)	22(15.07)	
Depression N (%)			0.935
Noncases	208 (80.93)	116 (79.45)	
Doubtful cases	29 (11.28)	18 (12.33)	
Probable cases	20 (7.78)	12 (8.22)	

<sup>a</sup>P<0.05

**Table 2** Results of multivariate linear regression analysis in included CRC patents (N=403)

Variables	B	SE	$\beta$	t	P	VIF
(Constant)	28.14	9.03		3.12	0.002	
Gender (ref: male)						
Female	3.76	1.81	0.10	2.06	0.038 <sup>a</sup>	1.14
Age	0.052	0.09	0.030	0.56	0.577	1.59
Marital status (ref: married)						
Single/Divorced/Widowed	7.34	3.75	0.090	1.96	0.051	1.10
Education (ref: < Junior college)						
≥Junior college	7.09	2.40	0.15	2.96	0.003 <sup>a</sup>	1.27
Employment status (ref: In employment)						
Unemployed	-2.33	3.56	-0.03	-0.65	0.514	1.12
Retired	0.23	2.01	0.006	0.115	0.909	1.47
Religious belief (ref: yes)						
No	-0.84	2.65	-0.01	-0.32	0.750	1.06
Monthly per capita household income (RMB) (ref: <1000)						
1000–2000	0.68	3.65	0.01	0.19	0.852	2.64
2000–3000	0.90	3.44	0.02	0.26	0.794	3.50
3000–4000	-0.08	3.52	-0.002	-0.02	0.982	3.46
≥4000	-2.63	3.57	-0.06	-0.74	0.461	3.70
Payment of medical expenses (ref: self-paid)						
Full reimbursement	0.68	3.65	0.01	0.19	0.852	2.64
Partial reimbursement	0.90	3.44	0.02	0.26	0.794	3.50
CRC family history (ref: yes)						
No	-0.58	2.36	-0.01	-0.25	0.807	1.06
Cancer type (ref: colon cancer)						
Rectal cancer	4.32	1.77	0.11	2.44	0.015 <sup>a</sup>	1.11
Metastasis (ref: yes)						
No	-0.83	2.54	-0.02	-0.33	0.745	1.07
Unclear	4.12	3.44	0.05	1.20	0.231	1.04
Current treatment (ref: chemotherapy)						
Chemotherapy + Radiotherapy	4.98	4.36	0.05	1.14	0.254	1.10
Palliative treatment	8.17	5.64	0.07	1.45	0.149	1.06
Anxiety (ref: non-cases)						
Doubtful cases	12.94	2.66	0.25	4.87	<0.001 <sup>a</sup>	1.32
Probable cases	20.91	3.45	0.35	6.05	<0.001 <sup>a</sup>	1.76
Depression (ref: non-cases)						
Doubtful cases	1.60	2.97	0.03	0.54	0.591	1.38
Probable cases	1.61	3.83	0.02	0.42	0.674	1.63

<sup>a</sup>P<0.05**Table 3** The need scores of each dimension in CRC patients by gender (N=403)

Need dimension	Males (N=257)		Females (N=146)		P
	M, IQR	$\bar{x} \pm s$	M, IQR	$\bar{x} \pm s$	
Physical symptoms	8.33, 22.22	14.09 ± 17.47	11.11, 20.40	18.74 ± 20.40	0.012 <sup>a</sup>
Psychological problems	6.66, 23.33	16.05 ± 22.53	13.33, 33.33	21.85 ± 26.74	0.022 <sup>a</sup>
Health care staff	79.17, 54.17	69.36 ± 32.41	91.67, 46.88	75.97 ± 29.89	0.044 <sup>a</sup>
Information	73.33, 40.00	65.65 ± 26.42	80.00, 31.17	69.57 ± 26.65	0.095
Social/Religious/Spiritual support	20.00, 26.67	24.23 ± 25.85	20.00, 33.33	31.63 ± 27.82	0.002 <sup>a</sup>
Hospital facilities and services	45.83, 50.00	47.65 ± 30.57	50.00, 42.71	49.54 ± 28.47	0.460
Practical support	22.22, 36.11	31.80 ± 27.12	33.33, 33.33	34.87 ± 27.72	0.227
Total <sup>b</sup>	38.42, 23.73	37.86 ± 18.39	41.24, 24.29	42.56 ± 18.60	0.015 <sup>a</sup>

<sup>a</sup>P<0.05<sup>b</sup> the data were normally distributed

dimensions-physical symptoms, psychological issues, healthcare staff, and social/religious/spiritual support-also varied significantly between genders (all  $P < 0.05$ ). In all total and dimensions scores, females exhibited higher scores than males. Among the dimension scores, both males and females reported the highest scores related to healthcare staff.

#### **Gender-Specific factors associated with supportive care needs in CRC patients**

Table 4 presents the results of the multivariate linear regression model stratified by gender, as the factors influencing supportive care needs vary between genders. Male CRC patients with a junior college education or higher exhibited more significant supportive care needs compared to those with lower educational levels ( $P = 0.038$ ). Additionally, male participants with rectal cancer showed higher supportive care needs than those with colon cancer ( $P < 0.05$ ). Notably, higher levels of anxiety were linked to higher supportive care needs in both genders ( $P < 0.001$ ).

#### **Discussion**

In this cross-sectional study, we found that the level of supportive care needs differed between males and females with CRC and that the influencing factors differed. In this study, the multiple linear regression analysis of the factors influencing the supportive care needs of all the included CRC patients also pointed out that gender is an important factor influencing the supportive care needs. Therefore, gender-specific care measures should be developed to meet the supportive care needs of gender-specific patients.

Based on the above analysis, we further explored the gender differences in CRC patients' supportive care needs. Our results indicate that female CRC patients have higher levels of supportive care needs, particularly regarding physical symptoms, psychological issues, healthcare staff, and social/religious/spiritual support. Women tend to have greater responsibilities at home and work, which make the psychological and financial burdens of illness more significant for them. Changes in social roles contribute to more supportive care needs [26]. Zhao's [27] study of cancer patients in China found that women had more unmet needs than men, especially in terms of psychological needs. This may be linked to the tendency of women to be more emotionally aware and to reflect more deeply on their health conditions. Therefore, it is essential to pay greater attention to women's needs for symptom management, psychological support, and social/religious/spiritual assistance.

Notably, the need for healthcare staff scored the highest for both men and women, which suggests that CRC patients lack the help and support of healthcare

professionals to meet their healthcare needs, especially during the ambulatory period, which may be related to the shortage of professionals [28]. This is consistent with other studies. Maria et al. [29] revealed that CRC patients were generally dissatisfied with the diagnostic and therapeutic information they received. Most of the patients, especially those with stoma, had limitations in daily life and activities after treatment and often wished to receive guidance on rehabilitation and health care. Therefore, medical staff should promptly assess the supportive care needs of patients and continuously strengthen their professional skills, observation, and communication skills to meet the needs of patients in all aspects and provide them with appropriate and adequate support.

Further, our study also gave particular results regarding the factors that influence supportive care needs. Unlike female CRC patients, male CRC patients with a higher education level, rectal cancer indicated a higher level of supportive care needs. This provides substantial evidence for identifying groups of colorectal cancer patients who are more likely to have higher supportive care needs based on gender. Specifically, this study showed that male patients with higher education levels were more likely to have high supportive care needs, unlike existing studies in China [12, 30]. The reason may be that patients with higher education levels are generally more likely to acquire and learn about the disease they are suffering, thus showing higher supportive care needs and expecting more information support in pursuit of a better quality of life. In addition, studies have shown that well-educated male patients are more eager to be involved in healthcare decision-making, which may account for the high need for supportive healthcare professionals in this population [31, 32]. A study by McMullen [33] showed that patients with rectal cancer tended to show higher levels of unmet need. Rectal cancer treatment is more complex compared to colon cancer, and the effects of surgery, radiotherapy, etc., are more long-lasting for rectal cancer patients, regardless of whether the patient has a permanent stoma or not [34]. Our study yielded similar results, and in future clinical practice, more attention should be paid to the needs of rectal cancer patients, and appropriate nursing care methods should be developed to meet their supportive care needs.

Anxiety was the sole influencing factor for female CRC patients and was one of the significant factors in male CRC patients. Consistent with previous studies, patients with higher levels of anxiety tend to experience greater psychological needs, resulting in elevated supportive care needs [35, 36]. Therefore, it is essential to assess anxiety levels in all CRC patients, with particular attention given to those identified as doubtful or probable cases. Additionally, since no gender difference was observed in the relationship between anxiety levels and supportive care

**Table 4** Results of multivariate linear regression analysis by gender (N=403)

Variable	Males (N = 257)					Females (N = 146)						
	B	SE	β	t	P	VIF	B	SE	β	t	P	VIF
(Constant)	39.82	11.07		3.60	<0.001 <sup>a</sup>		22.12	14.49		1.53	0.129	
Age	-0.07	0.13	-0.04	-0.50	0.619	1.82	0.19	0.14	0.11	1.35	0.181	1.38
Marital status (ref: married)												
Single/Divorced/Widowed	8.37	4.74	0.11	1.76	0.079	1.16	3.20	7.19	0.04	0.45	0.657	1.33
Education (ref: < Junior college)												
≥Junior college	6.53	3.12	0.14	2.09	0.038 <sup>a</sup>	1.43	4.46	4.26	0.08	1.05	0.296	1.26
Employment status (ref: in employment)												
Unemployed	1.68	5.06	0.02	0.33	0.740	1.15	-6.45	5.39	-0.10	-1.20	0.234	1.23
Retired	2.76	2.78	0.07	0.99	0.322	1.76	-2.65	3.17	-0.07	-0.84	0.404	1.34
Religious belief (ref: yes)												
No	-0.42	3.94	-0.01	-0.11	0.916	1.05	-0.27	3.69	-0.01	-0.07	0.943	1.09
Monthly per capita household income (RMB) (ref: <1000)												
1000–2000	-0.47	4.76	-0.01	-0.10	0.922	2.96	5.04	6.35	0.09	0.79	0.429	2.58
2000–3000	1.49	4.65	0.03	0.32	0.749	3.63	0.23	5.50	0.01	0.04	0.967	3.73
3000–4000	2.42	4.69	0.06	0.52	0.606	3.82	-3.75	5.86	-0.09	-0.64	0.524	3.53
≥4000	-1.10	4.70	-0.03	-0.23	0.815	4.15	-3.39	6.11	-0.08	-0.56	0.580	3.68
Payment of medical expenses (ref: self-paid)												
Full reimbursement	0.09	9.27	0.00	0.01	0.992	1.54	-4.40	18.76	-0.02	-0.23	0.815	1.35
Partial reimbursement	-5.45	4.84	-0.08	-1.13	0.261	1.50	2.46	8.42	0.03	0.29	0.771	1.57
CRC family history (ref: yes)												
No	-3.11	3.32	-0.05	-0.94	0.350	1.06	1.75	3.60	0.04	0.49	0.627	1.16
Cancer type (ref: colon cancer)												
Rectal cancer	6.28	2.28	0.17	2.76	0.006 <sup>a</sup>	1.15	1.29	3.10	0.03	0.42	0.678	1.20
Metastasis (ref: yes)												
No	1.41	3.28	0.03	0.43	0.668	1.10	-2.13	4.32	-0.04	-0.49	0.623	1.14
Unclear	2.47	4.60	0.03	0.54	0.592	1.09	10.46	5.64	0.14	1.85	0.066	1.15
Current treatment (ref: chemotherapy)												
Chemotherapy + Radiotherapy	3.71	5.21	0.04	0.71	0.477	1.13	11.48	8.72	0.10	1.32	0.190	1.14
Palliative treatment	7.69	7.19	0.06	1.07	0.286	1.11	13.28	9.75	0.10	1.36	0.176	1.08
Anxiety (ref: non-cases)												
Doubtful cases	11.46	3.52	0.21	3.26	<0.001 <sup>a</sup>	1.33	14.55	4.30	0.29	3.39	<0.001 <sup>a</sup>	1.43
Probable cases	19.29	5.16	0.29	3.74	<0.001 <sup>a</sup>	1.96	24.42	5.11	0.47	4.78	<0.001 <sup>a</sup>	1.88
Depression (ref: non-cases)												
Doubtful cases	1.60	3.94	0.03	0.40	0.686	1.46	2.17	4.87	0.04	0.44	0.657	1.44
Probable cases	2.98	5.13	0.04	0.58	0.561	1.77	-0.31	6.15	0.00	-0.05	0.960	1.61

<sup>a</sup>P < 0.05

needs, it is crucial to thoroughly evaluate supportive care needs in both male and female CRC patients with higher anxiety levels. This evaluation will help develop targeted interventions tailored to address their high-need dimensions effectively.

Previous studies have found that depression was an influential factor for supportive care needs, but the converse was reported in our logistic regression result [37]. Since anxiety and depression are highly correlated, it may have been neglected in existing studies to control for one of the variables and thus explore the effect of the other variable separately [10]. Moreover, psychological factors can be complexly influenced by cultural background, religion, etc., resulting in different findings in different regions [15].

This study has several implications for clinical practice. First, the fact that the levels of supportive care needs identified in the study were not the same for males and females with CRC and were higher for females suggests that there is a need to raise awareness among health and psychosocial care professionals and general practitioners of the need for high levels of supportive care for female as a result of colorectal cancer. They should be aware of unmet needs among CRC patients for assessment and timely intervention. Secondly, the factors influencing the supportive care needs of male and female CRC patients differ, suggesting that we should identify the population that needs attention based on gender-specific factors. When developing relevant interventions in the future, there should be a different focus on patients of different genders. For example, among male patients, identification of population characteristics such as higher education and rectal cancer could be incorporated into the design considerations of intervention programs. In addition, the finding of anxiety as a common influencing factor for the supportive care needs of male and female CRC patients suggests that psychosocial support and counseling need to be developed and provided for CRC patients to meet their needs.

Several limitations in this study are worthy of consideration. First, it was conducted in four hospitals in the same city, affecting the generalizability of the findings. Second, although this study has collected a statistically significant sample size, the difference in the incidence of colorectal cancer among men and women makes it difficult to ensure an average sample size among the stratified groups. In addition, only a cross-sectional survey was conducted without considering the dynamic changes and the long-term effects of influential factors on the supportive care needs of CRC patients. Prospective studies are needed to determine whether the significant factors in this study are independent predictors of high levels of supportive care needs over time and whether measures

that can lower anxiety levels are more responsive to patients' supportive care needs.

## Conclusion

The level of supportive care needs varied between male and female CRC patients, with distinct factors influencing each group. In male patients, a higher level of education and the presence of rectal cancer were associated with increased supportive care needs, whereas these factors did not significantly affect female patients. However, increased anxiety was linked to higher supportive care needs in CRC patients of both genders.

## Implications for practice

We want to make the following recommendations for clinical practice. First, we should pay more attention to the supportive care needs of female CRC patients, whether in the dimension of physical symptoms, psychological problems, health care staff, or social/religious/spiritual support. Moreover, we should assess the sociodemographic information and mental status of different genders separately before they start treatment. When assessing and giving supportive care to male CRC patients, the patient's level of education, tumor site, and anxiety level should be taken into account. Meanwhile, anxious female CRC patients may have more supportive care needs that the clinical staff should identify needs and fulfill promptly.

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## Author contributions

All authors contributed to the study's conception and design. Material preparation, data collection and analysis were performed by Jiyin Zhang, Bei Dong, Haiyan Dong, Daoxia Guo and Yang Yuan. The first draft of the manuscript was written by Jiyin Zhang and Li Tian. All authors read and approved the final manuscript.

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## Data availability

The data that support the findings of this study are available on request of the corresponding author. The data are not publicly available due to them containing information that could compromise research participant and participating site privacy/consent.

## Declarations

### Ethics approval and consent to participate

This study was approved by the Medical Ethics Committee of Soochow University (No. SUDA20200225H08), Suzhou, China. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical

standards. Written informed consent was obtained from each participant in this study.

#### Consent for publication

Not applicable.

#### Competing interests

The authors declare no competing interests.

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