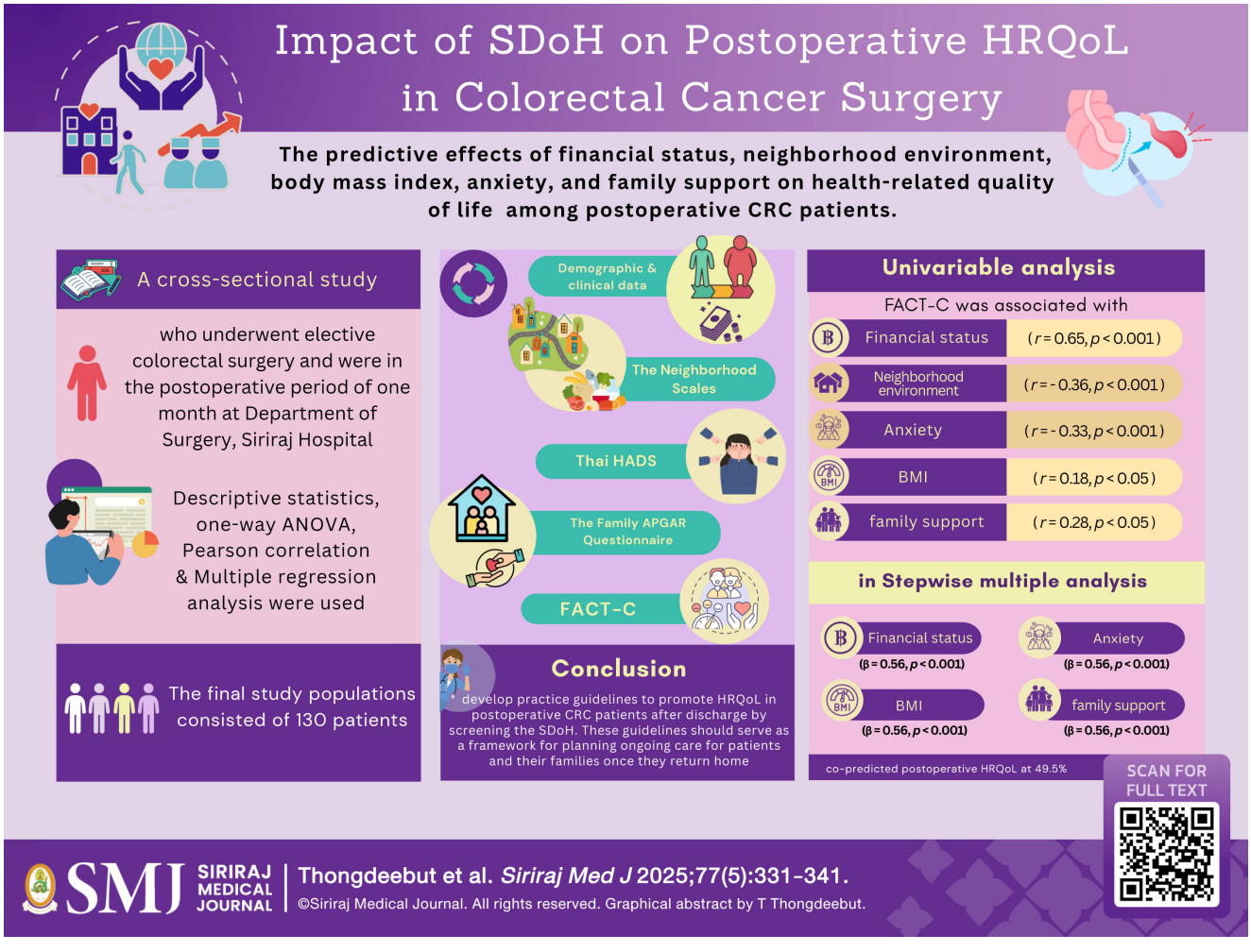
# Impact of Social Determinants of Health on Postoperative Health-Related Quality of Life Among Patients Undergoing Colorectal Cancer Surgery

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Received 3 January 2025 Revised 8 February 2025 Accepted 8 February 2025
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https://doi.org/10.33192/smj.v77i5.272984

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## ABSTRACT

**Objective:** This study aimed to investigate the predictive effects of social determinants of health–specifically financial status, neighborhood environment, body mass index, anxiety, and family support–on the health–related quality of life (HRQoL) among patients undergoing colorectal cancer (CRC) surgery.

**Materials and Methods:** A cross-sectional study was conducted with patients who underwent elective colorectal surgery and were in the postoperative period of one month in a super-tertiary hospital in Thailand. Data were collected using questionnaires and analyzed with descriptive statistics, one-way ANOVA, Pearson correlation, and multiple regression analysis.

**Results:** A total of 130 patients were enrolled, with 71 patients (54.6%) having fewer complications. Patients who have undergone CRC surgery had an average HRQoL score of 111.9 ± 11.9. Notably, the HRQoL after surgery was higher than before, reflecting an increase of 78.5%. The significant predictive factors of HRQoL were financial status ($\beta = 0.56$, $p < 0.001$), followed by anxiety ($\beta = -0.172$, $p = 0.011$), body mass index ($\beta = 0.171$, $p = 0.008$), and family support ($\beta = 0.15$, $p = 0.022$).

**Conclusion:** Nurses should develop practice guidelines to promote HRQoL in postoperative CRC patients after discharge by screening financial status, body mass index, anxiety, and family support. These guidelines should serve as a framework for planning ongoing care for patients and their families once they return home, ensuring that their physical, emotional, and social needs are effectively addressed during their recovery process.


**Keywords:** Quality of life; social determinants of health; financial status; body mass index; anxiety; family support; colorectal cancer (Siriraj Med J 2025; 77: 331-341)

## INTRODUCTION

Colorectal cancer (CRC) is the third most common cancer and the second leading cause of cancer-related deaths globally.[1] With advancements in early detection and treatment, the number of CRC survivors has risen substantially.[2] Colorectal surgeries are among the most common treatments for removing cancerous tumors.[3] Following surgery, additional treatments may be required based on the cancer's stage and the patient's overall health[4,5], resulting in better outcomes and an improved quality of life of the patient.[6] However, patients after CRC surgery may face long-term physical, psychological, and social challenges that persistently impact their health-related quality of life (HRQoL).[7-9]

The HRQoL of postoperative CRC patients is influenced by a complex interplay of factors that extend beyond the biological implications of the disease, individual factors, symptoms, complications arising from surgery and its clinical management.[10,11] Nevertheless, the social determinants of health (SDoH) are the concept of WHO; the World Health Organization suggests that health conditions are influenced not only by individual factors, genetics, or symptoms but also by social factors and environmental resources.[12]

SDoH are non-medical factors that play a crucial role in shaping health outcomes and overall well-being of individuals.[13] These include the conditions in which individuals are born, grow, live, and work, as well as the systems established to manage illness.[14] SDoH significantly influence the health outcomes of patients with cancer. For example, income, economic stability, neighborhood environment, Body Mass Index (BMI), anxiety, and family support.[16-23] In the literature, socioeconomic disparities have been associated with differences in cancer care, with factors such as financial security, lack of insurance, and limited access to transportation identified as major obstacles to achieving optimal health outcomes.[24] Furthermore, factors such as economic stability and the neighborhood environment have been linked to a reduced likelihood of poor mental and physical health in cancer survivors.[25] Moreover, food security was an important part of promoting an improved HRQoL, which could be measured by the BMI, indicating a person's overweight or underweight.[12,26]

In addition, CRC survivors exhibit an anxiety rate of 20.9%, primarily resulting from the challenges of coping with illness, treatment expectations, and decreased financial status. These factors are correlated to a deterioration in overall HRQoL.[21,27] Lastly, family support encourages patients to adopt healthy behaviors, leading to quality recovery after surgery.[28] Positive family support has a significant impact on improving quality of life in all dimensions.[22] Therefore, the purpose of this study is to investigate the predictors of HRQoL, including financial status, neighborhood environment, BMI, anxiety, and family support among patients undergoing CRC surgery.

Recognizing the impact of these factors on CRC patients is essential for developing tailored guidelines to improve their HRQoL. Despite the growing recognition of these factors, there is limited research focused on the impact of SDoH on HRQoL among postoperative CRC patients, mostly from studies focusing on long-term cancer survivors, particularly in countries with socioeconomic disparities. The results of this study would improve our comprehension of the social context of postoperative CRC patients and guide the creation and execution of effective support strategies.

## MATERIALS AND METHODS

### *Study design and setting*

This study was based on a cross-sectional study design in a super-tertiary hospital in Bangkok, Thailand, from April to July 2024. The study was approved by the Human Research Ethics Committee, Faculty of Nursing, Mahidol University, and the Faculty of Medicine Siriraj Hospital (MU-MOU CoA No. IRB-NS2023/843.1903).

### *Participants*

The participants comprised patients aged 18 and older, both male and female, who underwent colorectal cancer surgery and received post-operative follow-up care at the surgical unit. To be eligible, patients had to meet the following inclusion criteria: (1) a first-time diagnosis of CRC at stages 1 to 3B; (2) a post-operative period of 4 to 6 weeks; 3) having a Mini-Cog score ≥ 3 (patients aged ≥ 60 years); and 4) the ability to understand and communicate in Thai (speaking, listening, reading, and writing). The exclusion criteria included: (1) previous treatment with chemotherapy or radiation therapy; (2) a diagnosis of recurrent or metastatic cancer; (3) severe psychiatric disorders that could not be controlled, such as panic disorder, major depressive disorder, or schizophrenia; and (4) severe clinical symptoms, such as significant dyspnea or high fever.

The sample size for this study was determined using the G*Power software, with power of test 90%, a significance level (α) of 5%, and 5 independent variables. As no related studies were found in the literature review, the $R^2$ value could not be determined. An effect size of 0.15, representing a medium effect size, was selected based on the guidelines of Polit and Beck.[29] This effect size is considered appropriate for nursing research involving multiple predictors. The G*Power analysis determined that a sample size of 116 participants was required. To account for potential data incompleteness during collection, the sample size was increased by 10%, leading to a final total of 130 participants.

### *Data collection*

After patients agreed to participate in the study, they were asked to sign a written consent form. The data were collected using questionnaires and patient files. After obtaining informed consent and ascertaining eligibility, participants were asked to complete a demographic characteristic assessment. The Functional Assessment of Cancer Therapy-Colorectal (FACT-C) was administered at two timepoints: preoperatively (i.e., baseline), where patients were asked to recall their condition prior to surgery, and postoperatively (i.e., follow-up), four to six weeks after their elective CRC surgery. The Neighborhood Scales, Hospital Anxiety and Depression Scale (HADS), and Family APGAR questionnaires were administered simultaneously, taking approximately 45 to 60 minutes for each participant.

### *Measurement*

Baseline characteristics and clinical data: Part 1 demographic characteristics were obtained, including sex, age, body mass index, marital status, educational attainment, occupation, average monthly household income, financial status of household income, healthcare coverage, primary caregiver support, smoking status, alcohol consumption, and exercise habits. Part 2 clinical data were obtained, including diagnosis, stage of cancer, surgical approach, CEA tumor marker, complications, length of stay, presence of a stoma, and comorbidity.

The Neighborhood Scales by Auchincloss et al.[30] were used to evaluate neighborhood environment. This instrument was translated into Thai by Pawitra Jariyasakulwong and colleagues. This scale consists of 9 items, assessing two aspects: the walking environment and the availability of healthy food. It was interpreted from its scoring system (9-45 points) as high resources (9-21), moderate resources (22-33), and low resources (34-45). Cronbach's alpha coefficient of Thai version was 0.85.[31]

The Hospital Anxiety and Depression Scale (HADS) by Zigmond & Snaith[32] was used to evaluate only the anxiety subscale. This instrument was translated into Thai by Thana Nilchaikovit and colleagues. This scale consists of 7 items. It was understood from its scoring system (0-21 points) as non-anxiety (0-7), doubtful anxiety (8-10), confirm anxiety (11-21). Cronbach's alpha coefficient of Thai version was 0.85.[33]

The Family APGAR Questionnaire by Smilkstein et al.[34] was used to evaluate satisfaction from receiving family support and was translated into Thai by Pornthip Malatham and colleagues. This scale consists of 5 items. Scores are categorized as follows: high satisfaction (14-20),

moderate satisfaction (7-13), and low satisfaction (0-6). The questionnaire is used for family support in patients undergoing breast cancer surgery.[35] Cronbach's alpha coefficient of Thai version was 0.91.[36]

Functional Assessment of Cancer Therapy-Colorectal (FACT-C) by Cella et al.[37] was used to evaluate health-related quality of life. This instrument was translated into Thai under the license of the Facit group.[38] This tool comprises 36 items that correspond to five domains: physical well-being, emotional well-being, social and family well-being, functional well-being, and colorectal cancer subscale. Scores range from 0 to 136, with higher scores reflecting better HRQoL. The Cronbach's alpha coefficient for the Thai version was 0.87.[39]

The Neighborhood Scales, HADS, Family APGAR Questionnaire, and FACT-C were applied to 30 patients with similar characteristics to the participants in this study, using Cronbach's alpha coefficient for these scales were 0.80, 0.81, 0.87 and 0.87, respectively.

### *Statistical analysis*

The data were analyzed using SPSS version 27. Descriptive statistics and one-way ANOVA were used to analyze baseline characteristics and clinical data, while Pearson correlation was used to assess the relationships between variables. Multiple regression analysis was used to analyze the power of predictive variables, with a significance level set at 0.05. Statistical analyses were performed according to the necessary assumptions for each test.

## RESULTS

### Baseline characteristics and relevant clinical data of HRQoL among postoperative CRC patients (n = 130)

The study sample consisted of 130 postoperative CRC patients. Their characteristics and clinical data are included in the univariate analysis, which was described in Table 1.

### The correlation between financial status, neighborhood environment, BMI, anxiety, family support, and HRQoL

Financial status was positively correlated with HRQoL at high level ($r$ = 0.65, $p$ < 0.001). The neighborhood environment and anxiety were negatively correlated with HRQoL at medium level ($r$ = - 0.36, $p$ < 0.001), ($r$ = - 0.33, $p$ < 0.001). BMI and family support were positively correlated with HRQoL at a low level ($r$ = 0.18, $p$ < 0.05), ($r$ = 0.28, $p$ < 0.05). However, family support was found to be correlated with financial status ($r$ = 0.19, $p$ < 0.05) and anxiety ($r$ = - 0.07, $p$ < 0.05), as shown in Supplementary content 1.

### Neighborhood environment, anxiety, family support, and HRQoL

More than half of the participants had a high neighborhood environment (89.2%), Additionally, 76.2% of participants reported no symptoms of anxiety, while 63.1% expressed high levels of satisfaction with family support. The overall HRQoL after CRC surgery had a mean score of 111.9±11.9. In addition, when comparing the quality of life before and after surgery, it was found that more than half of participants showed an increase in HRQoL based on the FACT-C, with 78.5% (Table 2).

### Stepwise multiple regression model

According to the results from stepwise multiple regression analyses, financial status, anxiety, body mass index and family support co-predicted postoperative HRQoL at 49.5% ($R^2$ = 0.495, $F$ = 30.632, $p$ < 0.001). Financial status had the highest significance in predicting postoperative HRQoL in CRC patients (Table 3).

## DISCUSSION

This study aimed to investigate the predictive effects of SDoH on postoperative HRQoL among patients undergoing CRC surgery. The findings of this study indicated that HRQoL in CRC patients was at a favorable level. Notably, HRQoL after surgery was higher than before surgery, reflecting an increase of 78.46%. This may be due to the CRC symptoms, where patients experience abdominal pain, alternating diarrhea and constipation, fatigue, weight loss, easy tiredness, and pallor.[40] Additionally, when they were unwell, they may have experienced a sense of losing their position as the family's primary caregiver[41], which resulted in a lower HRQoL. Additionally, 59 (55.4%) of the participants developed one or two grades of postoperative complications. A previous study found that more postoperative complications were related to poorer HRQoL than for patients without complications.[23,42,43] The experience of only minimal postoperative adverse effects, or none at all, led to a better HRQoL.[44] This is consistent with previous studies by Li et al.[45] as their study of patients after CRC surgery at 1, 3, and 5 months ($n$ = 70). The HRQoL of the discharged CRC patients in the study was at an adequate level and stayed fairly consistent over time, as indicated by FACT-C (102.5; 102.9; 103.0). Moreover, Chutikamo et al.[46] also found that the HRQoL of postoperative CRC patients, three months after surgery, was at a moderate to high level. Reudink et al.[47] also found that quality of life improves over time ($p$ <0.001), with recovery reaching pre-illness levels within a period of 6 months, as indicated by the EQ-5D index scores (0.82, $p$ = 0.01).

**TABLE 1.** Baseline characteristics and relevant clinical data of HRQoL among postoperative CRC patients. ($n$ = 130)

| Variables | Total n (%) | *F* | *p*-value |
|---|---|---|---|
| **Sex** | | **0.55** | **0.58** |
| Male | 79 (60.8) | | |
| Female | 51 (39.2) | | |
| **Age (years)** | | **0.01** | **0.99** |
| 20-39 | 6 (4.6) | | |
| 40-59 | 34 (26.2) | | |
| ≥ 60 | 90 (69.2) | | |
| **Mean ±SD (years)** | **63.03±11.80** | | |
| **BMI (kg/m²)** | | | |
| < 18.5 | 11 (8.5) | | |
| 18.5 – 22.9 | 47 (36.2) | | |
| 23 – 24.9 | 28 (21.5) | | |
| 25 – 29.9 | 34 (26.2) | | |
| ≥ 30 | 10 (7.6) | | |
| **Mean ±SD (kg/m²)** | **23.8±4.7** | | |
| **Status** | | **0.30** | **0.74** |
| Single | 11 (8.5) | | |
| Married | 101 (77.7) | | |
| Divorce | 18 (13.8) | | |
| **Educational attainment** | | **15.01** | **<0.001*** |
| Elementary | 19 (14.6) | | |
| High school graduate | 33 (25.4) | | |
| Associate degree/ Vocational Certificate | 18 (13.9) | | |
| ≥ Bachelor's degree | 60 (46.1) | | |
| **Healthcare coverage** | | **12.47** | **<0.001*** |
| Universal Health Coverage | 61 (46.9) | | |
| Civil Service Medical Benefits Scheme | 49 (37.7) | | |
| Social Security Scheme | 11 (8.5) | | |
| Private | 9 (6.9) | | |
| **Household income (Thai baht/month)** | | **34.80** | **<0.001*** |
| ≤ 10,000 | 18 (13.8) | | |
| 10,001 - 20,000 | 15 (11.5) | | |
| 20,001 - 30,000 | 17 (13.2) | | |
| > 30,000 | 80 (61.5) | | |
| **Mean ±SD (THB)** | **52,906.2±55,689.2** | | |
| **Financial status** | | | |
| Adequate | 74 (57.0) | | |
| Inadequate | 56 (43.0) | | |

**TABLE 1.** Baseline characteristics and relevant clinical data of HRQoL among postoperative CRC patients. ($n$ = 130) (Continue)

| Variables | Total n (%) | *F* | *p*-value |
|---|---|---|---|
| **Primary caregiver support** | | **3.79** | **0.003*** |
| None | 8 (6.2) | | |
| Child/Grandchild | 58 (44.6) | | |
| Husband/Wife | 53 (40.7) | | |
| Parents | 4 (3.1) | | |
| Siblings | 4 (3.1) | | |
| Friends | 3 (2.3) | | |
| **Alcohol consumes** | | **0.82** | **0.44** |
| Never | 82 (63.1) | | |
| Ex-alcohol | 33 (25.4) | | |
| Current alcohol | 15 (11.5) | | |
| **Smoking status** | | **3.98** | **0.02*** |
| Never | 92 (70.8) | | |
| Ex-smoker | 34 (26.1) | | |
| Current smoker | 4 (3.1) | | |
| **Exercise** | 81 (62.3) | **0.44** | **0.66** |
| **Colon cancer** | 81 (62.3) | **6.88** | **0.01*** |
| **Staging of cancer** | | **2.58** | **0.08** |
| I | 16 (12.3) | | |
| II | 68 (52.3) | | |
| III | 46 (35.4) | | |
| **Surgical approach** | | **2.82** | **0.007*** |
| Open | 102 (78.5) | | |
| Laparoscopy | 28 (21.5) | | |
| **CEA tumor maker** | | **1.40** | **0.16** |
| 0 - 5 ng/mL | 95 (73.1) | | |
| > 5 ng/mL | 35 (26.9) | | |
| **The Clavien-dindo classification of surgical complication** | | **0.04** | **0.96** |
| No complication (grade 0) | 71 (54.6) | | |
| Grade 1 | 49 (37.7) | | |
| Grade 2 | 10 (7.7) | | |
| **Postoperative length of stay (days)** | | **0.58** | **0.63** |
| < 5 | 6 (4.6) | | |
| 5 – 7 | 66 (50.8) | | |
| 8 – 10 | 42 (32.3) | | |
| > 10 | 16 (12.3) | | |
| **Mean±SD (days)** | **8.14±0.3** | | |
| **Stoma** | **59 (45.4)** | **6.45** | **<0.001**** |
| **Comorbidity** | **89 (68.5)** | **0.01** | **0.99** |

**p < 0.001, *p < 0.05

**TABLE 2.** Health-related quality of life, neighborhood environment, anxiety, and family support in postoperative CRC patients. (n = 130)

| Variables | Mean±SD | Median (IQR) | Min | Max |
|---|---|---|---|---|
| HRQoL before surgery (i.e. baseline) | 95.12±16.13 | 94.5 (88-103) | 52 | 123 |
| HRQoL after surgery | 111.93±11.89 | 110 (98.8-127) | 77 | 136 |
| Neighborhood environment | 16.2±4.6 | 15 (13-19) | 9 | 38 |
| Anxiety | 5.2±3.2 | 4 (3-7) | 0 | 15 |
| Family support | 14.1±4.5 | 15 (12.8-17.3) | 3 | 20 |

**Abbreviations:** HRQoL; Health-related quality of life, IQR; inter quartile range

**TABLE 3.** Parameters of the generalized stepwise multiple linear regression analysis for exploring the potential influences of the study variables on health-related quality of life. (n = 130)

| Variables | b | SE | β | t | *p* value |
|---|---|---|---|---|---|
| **Constant** | 65.841 | 7.080 | | 9.300 | <0.001 |
| Financial status | 9.871 | 1.182 | 0.564 | 8.350 | <0.001** |
| BMI | 0.591 | 0.220 | 0.171 | 2.684 | 0.008* |
| Anxiety | -0.878 | 0.340 | -0.172 | -2.587 | 0.011* |
| Family support | 0.540 | 0.233 | 0.150 | 2.315 | 0.022* |

$SE_b$ = 11.643, R = 0.704, $R^2$ = 0.495, Adjusted $R^2$ = 0.479, F = 30.632, $p < 0.05$*, $p < 0.01$**

In the present study, we observed the influence of the SDoH factors—including financial status, neighborhood environment, BMI, anxiety, and family support—in improving the HRQoL of patients undergoing CRC surgery. This result indicates that more than 80 (61.5%) reported a monthly household income of at least 30,000 baht, and 74 (57%) participants with adequate financial status reported a significantly better HRQoL, indicating a positive correlation between financial stability and well-being.[2] Moreover, the majority of the participants held a bachelor's degree or higher (46.1%), use the universal health coverage (46.9%), and have a family member as a caregiver (91.5%). The support from these sources enabled the participants to have adequate income to access quality healthcare and essential resources that promote health after CRC surgery.[48] Similarly, Han et al.[49] found that for gastrointestinal cancer survivors in the US, low economic stability and poor health care access significantly contributed to poor HRQoL. Furthermore, Robinson et al.[15] found that CRC survival in the US with average household income less than $30,000 and lower neighborhood socioeconomic status, was associated with a poor HRQoL.

Furthermore, the majority of the participants were married (77.7%), and more than half of the participants (63.1%) reported a high level of satisfaction with family support. Marital status, often considered a proxy for family support, was found to be significantly associated with better general and mental HRQoL.[50] Family support is an important determinant for the ability of patients undergoing CRC to cope with illness situations.[51] Studies have found that social support, especially from family, is closely related to patients' quality of life.[52] Furthermore, it plays a crucial role in promoting good health behaviors, as

well as promoting the post-treatment rehabilitation process, and self-efficacy, thereby contributing to the improvement of HRQoL.[53] Similarly, a study by Costa et al.[54] examined 144 patients with CRC treatment and found that family support and professional social support are important factors that contributed to the improvement of HRQoL. In addition, psychosocial interventions effectively reduce distress and enhance quality of life. Conversely, lower family support is associated with poorer psychological well-being and QOL in CRC patients.[55] This result may indicate that 10 (7.7%) participants experienced anxiety, with the mean HADS score being 5.2±3.2 during their postoperative periods. It can be stated that family support and mild postoperative complications prevented the patients from experiencing psychological distress, resulting in a high HRQoL.[56] Anxiety was found to be associated with poorer postoperative HRQoL in our study. Similarly, a study by Siddiqui et al.[57] which examined CRC patients who received any form of treatment, found that anxiety significantly affected HRQoL. Mols et al.[27] also found that anxiety symptoms in CRC survivors were inversely associated with all EORTC QLQ-C30 scales, with the smallest correlation observed in physical functioning and the largest for role functioning.

Previous findings have suggested that high BMI was protective against HRQoL deterioration, but BMI > 30 kg/m$^2$ is associated with lower physical function in CRC,[58,59] on the other hand, postoperative CRC patients who were underweight (BMI <18.5 kg/m$^2$) reported worse quality of life.[60] The results of this study showed a significant increase in BMI; individuals more than 75 (57.7%) were normal to overweight (BMI 18.5-24.9 kg/m$^2$) with the average BMI being classified as overweight. Most cancer patients demonstrate positive health behaviors, such as making healthy dietary choices following surgery,[61] and effectively managing their BMI, which in turn plays a significant role in enhancing their overall HRQoL. The findings are consistent with Li et al.[45] who reported that patients who underwent CRC surgery at 1, 3, and 5 months showed an increase in BMI over time, and that patients with moderate obesity were likely to have better HRQoL.

The neighborhood environment was not recognized as a major factor influencing HRQoL in this study. This may be attributed to the fact that the majority of participants (89.2%) reported a high level of neighborhood environment. Moreover, most of the participants live in urban areas, which allows them access to resources that facilitate postoperative recovery, with no significant differences. However, previous studies found that the neighborhood environment has a positive impact on HRQoL regarding CRC survivors.[22] Therefore, it is important to promote the availability of neighborhood environment that supports HRQoL among postoperative CRC in both urban and rural communities.

However, there are some limitations that should be noted. Our analyses on predictive of HRQoL were cross-sectional, precluding causal inferences, and the findings may not be generalizable due to its single-setting nature and the exclusion of patients receiving chemotherapy or radiation therapy. Additionally, the data on clinical and HRQoL baseline were based on self-report, which is why we cannot completely exclude the possibility of recall bias. The neighborhood environment was only partially assessed. However, the validation of this factor in a subset of 30 patients revealed a concordance of about 80%.

## CONCLUSION

This study highlighted the impact of SDoH on HRQoL in postoperative CRC patients after discharge. Financial status was the most significant factor in predicting HRQoL. Therefore, it is essential for nursing practitioners to develop practice guidelines aimed at enhancing HRQoL for postoperative CRC patients after discharge. This can be achieved by implementing screening protocols to assess financial status, BMI, anxiety levels, and family support. The results of these assessments should guide the creation of personalized care plans that address the unique needs of patients and their families as they transition back home.

### Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

## ACKNOWLEDGEMENTS

The authors wish to extend their thanks to all the research participants, as well as the medical and nursing staff at the institution where the data were collected.

## DECLARATION

### Grants and Funding Information

None

### Conflict of Interests

The authors declare no conflict of interest.

### Registration Number of Clinical Trial

None

### Author Contributions

Conceptualization and methodology: T.T., S.D., W.P., V.L.; Data collection, data acquisition and data analysis: T.T., S.D., W.P.; Drafting the manuscript T.T., S.D. All authors have read and agreed to the final version of the manuscript.

### Use of artificial intelligence

Not applicable

### Ethics Statement

The study was approved by Human Research Ethics Committee, Faculty of Nursing, Mahidol University, and the Faculty of Medicine Siriraj Hospital (MU-MOU CoA no. IRB-NS2023/843.1903).

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