

Health-Related Quality of Life, Functioning, and Physical Symptoms of Adult Omani Colorectal Cancer Survivors

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Abstract

Background: Colorectal (CRC) survivors often experience physical and psychological symptoms affecting their health-related quality of life (HRQoL). This study aimed to identify factors impacting HRQoL-related functioning and physical symptoms among adult Omani CRC survivors. **Methods:** A cross-sectional study of 124 adult CRC survivors was conducted at the two main oncology referral hospitals in Oman. A validated Arabic version of the European Organization for Research and Treatment of Cancer-Quality of Life Questionnaire 30 was used to collect data. **Results:** A total of 118 CRC survivors participated in the study (response rate: 95.2%). The mean age was 52 years and there were an equal number of male and female participants (n = 59 each; 50.0%). A total of 62 survivors (52.5%) had been diagnosed with CRC at stages III or IV. The overall score for global health was high (81.7). With regards to functioning, high mean scores were observed for domains of role (91.0) and social (90.7) functioning. In terms of symptoms, high mean scores were reported for constipation (25.4), insomnia (25.1), pain (20.1), and fatigue (18.9). Survivors under 60 years old ($\beta=15.5$, $p=.004$) and those with no comorbidities ($\beta=16.0$, $p=.001$) demonstrated better functional HRQoL. Being male was predictive of better functional HRQoL in the emotional ($\beta=13.9$, $p<0.008$), cognitive functioning ($\beta=12.5$, $p=.013$), role functioning ($\beta=14.0$, $p=0.006$) and physical functioning ($\beta=17.8$, $p<0.001$) domains. **Conclusions:** Healthcare professionals in Oman should implement measures to enhance the HRQoL of CRC survivors, particularly women and those with coexisting morbidities.

Keywords: Health-related quality of life- colorectal cancer- survivors- Oman

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Introduction

Colorectal cancer (CRC) is the third most commonly diagnosed type of cancer after breast and lung cancer, comprising 11% of all cancer diagnoses and affecting approximately 1.9 million individuals worldwide in 2018 (Xi and Xu, 2021). Although the incidence of CRC is increasing, particularly in younger populations (i.e., those aged <50 years) and among those residing in low- and middle-income countries (Siegel et al., 2019), survival rates have improved over the last several decades, mainly due to early diagnosis, advanced oncological treatment modalities, and palliative care (Brenner and Chen, 2018). This decline in mortality has led to a corresponding increase in the number of cancer survivors, with approximately 80% of CRC patients in the USA surviving the first year after diagnosis, and 62% surviving 5 years or more (Rawla et al., 2019).

Although the survival rate of CRC has increased over time, many survivors nevertheless experience

physical and psychological symptoms affecting their health-related quality of life (HRQoL). Thus, as overall survivorship has increased, HRQoL has become an important outcome measure to evaluate the full impact of the disease on the survivor's physical and psychological functioning (Marventano et al., 2013). Evidence shows that improvements in overall HRQoL and physical functioning are a vital indicator of treatment efficacy and survival (Shrestha et al., 2019). It has been found that a 10-point increase in baseline global HRQoL is associated with a 7% decreased risk of death (Braun et al., 2011).

The term 'HRQoL' refers to a multidimensional concept involving an individual's physical, emotional, and social functioning (Cella and Tulsky, 1993). Assessed over five main domains, HRQoL includes physical functioning (ability to perform basic daily activities of living), role functioning (ability to fulfil the normal responsibilities of one's role, for instance as a spouse, parent or community member), social functioning (ability to maintain relationships with other individuals),

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cognitive functioning (mental capacity and wellbeing), and psychological functioning (level of satisfaction with and perception of the value of one's own life) (Anatchkova and Bjorner, 2010; Christiansen et al., 2019). Symptoms of CRC survivors tend to be most prominent during the first three years of diagnosis, but long-term effects of treatment can persist (Rutherford et al., 2020). Survivors have reported a wide range of symptoms related to both the cancer and its treatment, including anxiety, distress, disrupted sleep, weakness, fatigue, lack of appetite, and the fear of CRC recurrence or the development of another cancer (Rutherford et al., 2020). Furthermore, CRC survivors may experience other issues, including a greater risk of prolonged unemployment and physical limitations when taking part in sustained activities (Xi and Xu, 2021; Denlinger and Barsevick, 2009).

In Oman, CRC was found to be the most commonly diagnosed cancer in men in 2018 and the third most commonly diagnosed cancer in women after breast and thyroid cancer, with a significant increase in prevalence in recent years (Sultanate of Oman Ministry of Health, 2018). A total of 203 patients were diagnosed with CRC in 2018 with a median age at diagnosis of 58 years and age-standardized incidence rates of 12 and 9.1 per 100,000 individuals for males and females, respectively (Sultanate of Oman Ministry of Health, 2018; Al-Lawati et al., 2019). The majority of Omani CRC patients are male (58.6%) and are diagnosed at a relatively young age (median age of 56 years) and advanced stage (42.6% at stage III and 32.7% at stage IV) (Kumar et al., 2015). The median overall survival rate for Omani CRC patients is 43 months, with 5-year overall survival being 100% for those diagnosed at stage I and 60% for those diagnosed at either stage II or stage III (Kumar et al., 2015).

While the topic of HRQoL in CRC survivors has received some attention in more developed countries, no previous studies have yet been conducted in Oman to evaluate the impact of functional and physical symptoms of CRC survivors on HRQoL. It is reasonable to assume that the emotional, psychological, physical, and social needs of CRC survivors have increased in Oman over the last few decades as a result of increasing survivorship. The aim of this study was therefore to measure and identify factors impacting HRQoL-related functioning and physical symptoms among adult Omani CRC survivors.

Materials and Methods

Study design and target population

A cross-sectional study was conducted at the National Oncology Center (NOC) of the Royal Hospital (RH) and the Sultan Qaboos University Hospital (SQUH), both of which are located in Muscat, the capital city of Oman. These two institutions represent the two main referral oncology centers in the country. The majority of oncology patients from different regions of Oman are referred for diagnosis and treatment to one of these two centers (Al Lamki, 2016).

The target population consisted of adult Omanis (>18 years old) with histological diagnoses of CRC who had survived ≥ 6 months following the completion

of cancer treatment and who were attending follow-up appointments at the outpatient departments (OPDs) of either institution. Potential subjects were identified from the institutions' electronic medical records prior to their outpatient visits and invited to participate in the study. Only patients with stages 0, I, II, or III CRC or stage IV CRC with complete resection of the residual tumor for cure or complete remission with evidence of absent microscopic or macroscopic residual tumors (R0) were included. Patients with acute pain, stage IV CRC without R0, or known mental illnesses that could interfere with their comprehension or HRQoL were excluded from the study.

Sample size calculation

A total of 203 Omani patients were diagnosed with CRC in 2018, including 102 females (51%) and 101 males (50%) (Sultanate of Oman Ministry of Health, 2018). Thus, assuming that the frequency of CRC diagnoses per year is 203, the total number of patients diagnosed with CRC in the past 20 years was estimated to be 3,000. Based on these estimations, with an expected response rate of 90–96% at 5% precision (margin of error) and to a 95% confidence interval, the required sample size for this study was calculated to be between 59–133 participants.

Tool used to measure HRQoL

The European Organization for Research and Treatment of Cancer (EORTC) Study Group on Quality of Life has developed a self-administered cancer-specific quality of life questionnaire to determine HRQoL in CRC patients (Kaasa et al., 1995). The EORTC Quality of Life Questionnaire for Colorectal Cancer-30 (EORTC QLQ-C30) questionnaire includes a comprehensive list of 30 items assessing five domains of functioning (role, social, emotional, cognitive, and physical functioning) as well as various other aspects of HRQoL, such as financial difficulties and common physical symptoms of cancer, like loss of appetite, constipation, and diarrhea (Fayers et al., 2001).

The first 28 items in the EORTC QLQ-C30 questionnaire are scored on a 4-point Likert scale in terms of sufficiency from 1 (not at all) to 4 (too much). The last two items, which assess the participant's HRQoL and general health status, respectively, are scored on a 7-point Likert scale from 1 (very bad) to 7 (excellent). Using the EORTC scoring manual, obtained data from the questionnaire are first converted to raw scores before being converted again to standardized scores ranging from 0 to 100 (Fayers et al., 2001). Higher scores on the functional subscales are considered to exemplify a greater degree of functionality, thereby indicative of better HRQoL. For items in the functional subscales, scores of <33.3% are considered to indicate functional difficulties, while scores of $\geq 66.7\%$ signify good functioning (Fayers et al., 2001).

The reverse is true for scores on the symptom subscales, with higher scores signifying more severe and distressing symptoms and thus worse HRQoL. For items in the symptom subscales, scores of <33.3% are deemed to indicate less severe symptoms, while scores of $\geq 66.7\%$ signify more severe and distressing symptoms (Fayers et

al., 2001). The original EORTC QLQ-C30 questionnaire has been translated to Arabic and validated, with six out of nine subscales showing Cronbach's alpha coefficients of >.70 (Huijter et al., 2013). This validated Arabic version of EORTC QLQ-C30 was used in this study. Potential participants were asked if they were illiterate or if they were able to fill out the questionnaire by themselves while the researcher remained present for any questions or doubts. The researcher introduced the questionnaire and recorded responses for illiterate participants during interviews conducted in a private room.

Statistical analysis

Descriptive statistics including frequencies, percentages, means, and standard deviations were used to report the participants' sociodemographic and clinical characteristics and EORTC QLQ-C30 scores. Univariate comparisons between EORTC QLQ-C30 scores and sociodemographic and clinical variables were evaluated using a t-test or analysis of variance. Variables with p values of 0<0.05 in the univariate analysis were included in the multivariate linear (enter) regression for further adjustment in order to identify independent predictors associated with EORTC QLQ-C30 scores. All analyses were performed using the Statistical Package for the Social Sciences (SPSS), version 27.0 (IBM Corp., Armonk, NY, USA), set at a 5% level of significance.

Ethics

The study has been approved by the Medical Research and Ethics Committee of the College of Medicine and Health Sciences at Sultan Qaboos University (MREC#2186), as well as the Research and Ethical Review and Approval Committee of the RH (#115/2020).

Results

Characteristics of the participants

Of the 124 CRC survivors invited to take part in the study, a total of 118 agreed to participate (response rate: 95.2%). The majority (n = 70; 59.3%) were recruited from the SQUH oncology OPD, while the remaining participants (n = 48; 40.7%) were recruited from the NOC RH oncology OPD. The mean age was 52.0 ± 11.7 years (range: 26–80 years). There were an equal number of female and male participants (n = 59 each; 50.0%). Most of the survivors were married (n = 92; 78.0%); the remaining participants were either single (n = 6; 5.1%), widowed (n = 17; 14.4%), or divorced (n = 3; 2.5%). In terms of education, more than half of the participants had a general diploma (n = 62; 52.4%), while 22 (18.6%) had a university-level or higher qualification and 34 (28.8%) had no formal education. Less than half were unemployed (n = 50; 42.3%), 31 (26.3%) were employed, and 37 (31.4%) were retired. Most survivors were from the Al-Batinah (n = 35; 29.7%) or Muscat (n = 33; 28.0%) regions of Oman. Of the 96 participants who responded to the question regarding their income status, 40 (41.7%) had an income of 500–1,000 Omani Rials, whereas only six (6.3%) had an income of >2,000 Omani Rials (see Table 1).

With regards to the location of the cancer, the colon

was affected in the majority of the participants (n = 78; 66.1%), followed by the rectum (n = 28; 23.7%) and the colorectal junction (n = 12; 10.2%). Approximately half of the survivors had been diagnosed with stage III

Table 1. Sociodemographic and Clinical Characteristics of the Study Participants (N=118).

Characteristic		n (%)
Sociodemographic		
Age (years) (mean ± SD*)		52.0 ± 11.7
Gender	Male	59 (50.0)
	Female	59 (50.0)
Marital status	Single	6 (5.1)
	Married	92 (78.0)
	Divorced	3 (2.5)
	Widowed	17 (14.4)
Education level	No formal education	34 (28.8)
	School education	62 (52.4)
	University and postgraduate	22 (18.6)
Employment status	Unemployed	50 (42.3)
	Retired	37 (31.4)
	Employed	31 (26.3)
Governorate of residence	Muscat	33 (28.0)
	Al Batinah	35 (29.7)
	Ash Sharqiyah	14 (11.9)
	Ad Dhahirah	6 (5.1)
	Ad Dakhiliyah	16 (13.6)
	Musandam	1 (0.8)
	Dhofar	12 (10.2)
	Al Buraymi	1 (0.8)
Clinical		
Tumor location	Colon	78 (66.1)
	Rectum	28 (23.7)
	Colorectal junction	12 (10.2)
Stage of cancer	0	1 (0.8)
	I	11 (9.3)
	II	44 (37.3)
	III	58 (49.2)
	R0	4 (3.4)
Number of comorbidities	0	59 (50.0)
	1	28 (23.7)
	≥2	31 (26.3)
Treatment modality	Surgery alone	25 (21.2)
	Surgery plus chemotherapy	67 (56.8)
	Surgery, chemotherapy, and radiotherapy	26 (22.0)
Time since diagnosis (years)	<3	37 (31.4)
	3–5.9	47 (39.8)
	≥6	34 (28.8)
Mean ± SD		4.6 ± 2.7
Colonostomy	No	107 (90.7)
	Yes	11 (9.3)

SD, Standard Deviation

Table 2. EORTC QLQ-C30 Scores of the Study Participants (N=118).

Item	Mean score \pm SD	n (%)		
		Scores of <33.3%	Scores of \geq 66.7%	
Global health status/ HRQoL	81.7 \pm 18.9	3 (2.5)	88 (74.6)	
Functional scale ^a	Role functioning	91.0 \pm 17.8	1 (0.8)	98 (83.1)
	Social functioning	90.7 \pm 21.4	4 (3.4)	101 (85.6)
	Emotional functioning	85.0 \pm 21.5	4 (3.4)	96 (81.4)
	Cognitive functioning	86.7 \pm 19.9	1 (0.8)	93 (78.8)
	Physical functioning	83.2 \pm 19.9	4 (3.4)	97 (82.2)
Symptom scale ^b	Fatigue	18.9 \pm 20.9	88 (74.6)	2 (1.7)
	Nausea/vomiting	6.8 \pm 14.7	106 (89.8)	1 (0.8)
	Pain	20.1 \pm 24.2	75 (63.6)	4 (3.4)
	Dyspnea	10.7 \pm 20.8	89 (75.4)	1 (0.8)
	Insomnia	25.1 \pm 34.5	67 (56.8)	13 (11.0)
	Appetite loss	7.1 \pm 15.6	96 (81.4)	0 (0.0)
	Constipation	25.4 \pm 34.5	67 (56.8)	13 (11.0)
	Diarrhea	11.1 \pm 21.8	88 (74.6)	3 (2.5)
	Financial difficulties	12.7 \pm 25.0	87 (73.7)	5 (4.2)

EORTC QLQ-C30, European Organization for Research and Treatment of Cancer Quality of Life Questionnaire for Colorectal Cancer-30; SD, Standard Deviation; QoL, Quality Of Life; ^aFor items in the functional scale, scores of <33.3% were considered to indicate functional difficulties, while scores of \geq 66.7% signified good functioning. ^bFor items in the symptom scale, scores of <33.3% were deemed to indicate less severe symptoms, while scores of \geq 66.7% signified more severe and distressing symptoms which could impact QoL.

cancer (n = 58; 49.2%), 44 (37.3%) with stage II cancer, 11 (9.3%) with stage I cancer, and four (3.4%) with stage IV cancer at R0. Only one survivor (0.8%) was diagnosed with stage 0 cancer. Half of the participants had no comorbidities (n = 59; 50.0%), whereas the rest had one (n = 28; 23.7%), two (n = 15; 12.7%), or three or more (n = 16; 13.6%) comorbidities. More than half (n = 67; 56.8%) had received a combination of surgery and chemotherapy as cancer treatments, while 25 (21.2%) had received surgery alone and 26 (22.0%) had received a combination of surgery, chemotherapy, and radiotherapy. A total of 27 participants (22.9%) had been diagnosed with CRC less than three years previously, 47 (39.8%) within the last 3–6 years, and 34 (28.8%) more than six years previously. The mean time since diagnosis was 4.6 \pm 2.7 years (range: 1–15 years). A total of 11 survivors (9.3%) had undergone a colonostomy (see Table 1).

EORTC QLQ-C30 scores

Table 2 shows the mean scores for items in the EORTC QLQ-C30 tool as well as the frequencies and percentages of respondents who reported scores of <33.3% and \geq 66.7% for each item. Overall, the mean QLQ-C30 score for global health status was 81.7. For the functional subscales, higher mean scores were observed for the HRQoL domains of role functioning (91.0) and social functioning (90.7), while the lowest mean score was seen in the physical functioning domain (83.2). Mean cognitive and emotional functioning scores were 86.7 and 85.0, respectively.

For the symptom subscales, the highest mean scores were observed for constipation and insomnia (25.4 and 25.1, respectively), followed by pain and fatigue (20.1 and 18.9, respectively). On the other hand, the least

troubling symptoms appeared to be nausea/vomiting and loss of appetite (mean scores of 6.8 and 7.1, respectively). Overall, three participants (2.5%) had poor HRQoL based on their global health status scores (based on scores of <33.3%); moreover, four (3.4%) reported both poor emotional and poor social functioning. The symptoms which accounted for poor functioning among the majority of participants were insomnia and constipation (based on scores of \geq 66.7%). In total, 13 participants (11.0%) reported severe insomnia and constipation (see Table 2).

Predictive factors for EORTC QLQ-C30 scores

In order to determine predictive factors for HRQoL, the sociodemographic and clinical characteristics of the survivors were compared in the univariate analysis, including age (<60 versus \geq 60 years old), gender (male versus female), the location of the cancer (colon or rectum versus colorectal junction), treatment modalities received (surgery versus combined treatments), and the presence or absence of comorbidities. These factors were included in the linear regression to determine their predictive potential with regards to different aspects of HRQoL.

Table 3 shows the results of the linear regression model analysis for items in the EORTC QLQ-C30 tool. Associations between the characteristics of the survivors and their EORTC QLQ-C30 scores revealed significant differences in global health status according to age ($\beta=26.5$, $p<0.001$), comorbidities ($\beta=14.1$, $p=0.002$), and cancer location (colon: $\beta=54.9$, $p<0.001$; rectum: $\beta=49.5$, $p<0.001$). However, no significant associations were observed between global health status and gender or type of treatment modality. In particular, survivors under 60 years of age and those who had no comorbidities had better global health status scores compared to those

Table 3. Linear Regression Model for Associations between EORTC QLQ-C30 Scores and Sociodemographic and Clinical Characteristics

Item	β (p value) ^a					
	Age ^b	Gender ^c	Comorbidities ^d	Treatment modality ^e	Location of cancer	
					Colon ^f	Rectum ^g
Global health status	26.51 (<0.001)	5.25 (.271)	14.11 (0.002)	3.49 (0.564)	54.90 (<0.001)	49.51 (<0.001)
Functional scale						
Physical functioning	28.28 (<0.001)	17.80 (<0.001)	11.03 (0.005)	0.20 (0.969)	49.24 (<0.001)	50.75 (<0.001)
Role functioning	16.31 (0.002)	14.04 (0.006)	18.83 (<0.001)	-1.61 (0.802)	65.27 (<0.001)	62.81 (<0.001)
Emotional functioning	17.23 (0.002)	13.95 (0.008)	12.60 (0.011)	2.84 (0.663)	60.59 (<0.001)	60.23 (<0.001)
Cognitive functioning	20.15 (<0.001)	12.57 (0.013)	21.43 (<0.001)	2.69 (0.670)	57.18 (<0.001)	52.73 (<0.001)
Social functioning	15.53 (0.004)	4.55 (0.367)	16.06 (0.001)	4.97 (0.436)	72.88 (<0.001)	65.36 (<0.001)
Symptom scale						
Fatigue	7.78 (0.063)	-2.78 (0.487)	-10.80 (0.005)	4.25 (0.402)	7.53 (0.139)	7.92 (0.178)
Nausea/vomiting	9.16 (0.001)	-0.68 (0.800)	3.66 (0.150)	-1.28 (0.706)	-1.95 (0.566)	-1.07 (0.786)
Pain	5.39 (0.254)	-0.71 (0.875)	-9.23 (0.033)	1.42 (0.804)	10.51 (0.070)	15.64 (0.020)
Dyspnea	-2.37 (0.554)	2.17 (0.573)	3.19 (0.382)	7.11 (0.146)	8.61 (0.080)	7.92 (0.162)
Insomnia	8.69 (0.198)	-4.09 (0.527)	-6.34 (0.302)	3.93 (0.632)	16.43 (0.047)	19.04 (0.046)
Loss of appetite	5.03 (0.098)	-2.30 (0.428)	2.50 (0.365)	1.23 (0.738)	1.55 (0.675)	5.96 (0.163)
Constipation	17.96 (0.009)	7.86 (0.229)	-13.81 (0.027)	6.16 (0.456)	-4.55 (0.583)	3.77 (0.694)
Diarrhea	10.00 (0.016)	6.43 (0.106)	9.04 (0.017)	-4.55 (0.365)	-4.80 (0.340)	-2.07 (0.721)
Financial difficulties	15.35 (0.001)	5.46 (.231)	-0.70 (.871)	0.85 (.882)	-3.01 (.601)	0.61 (.927)

^aThe level of statistical significance was set at $p < 0.05$; ^bAge: 0 ≥ 60 years, 1 < 60 years. ^cGender: 0 = female, 1 = male. ^dComorbidities: 0 ≥ 1 , 1 = 0. ^eTreatment modality: 0 = combined treatment, 1 = surgery. ^fColon: 0 = no, 1 = yes. ^gRectum: 0 = no, 1 = yes.

who were 60 years of age or older and those with one or more comorbidities. In addition, participants who were diagnosed with colon or rectal cancer had better global health status scores, and thus HRQoL, compared to those diagnosed with cancer of the colorectal junction.

Significant differences were identified between physical, role, cognitive and emotional functioning scores based on age, comorbidities, gender, and cancer location. In particular, participants under 60 years of age, male participants, those without comorbidities, and those with colon or rectal cancer demonstrated significantly better functioning compared to their respective counterparts. Significant associations were identified between social functioning scores and age ($\beta=15.5$, $p=.004$) and comorbidities ($\beta=16.0$, $p=.001$), with survivors under 60 years old and those with no comorbidities demonstrating better functioning. Gender was found to have a strong significant association with four out of five items in the functional subscales; specifically, being male was found to be predictive of better physical functioning ($\beta=17.8$, $p<0.001$), emotional functioning ($\beta=13.9$, $p<0.008$), cognitive functioning ($\beta=12.5$, $p=0.013$), and role functioning ($\beta=14.0$, $p=0.006$). However, there was no significant association between gender and social functioning ($\beta=4.5$, $p=0.367$).

Moreover, the absence of comorbidities was predictive of better scores in all functional domains, including emotional ($\beta=12.6$, $p=0.011$), role ($\beta=18.8$, $p<0.001$), physical ($\beta=11.0$, $p=0.005$), cognitive ($\beta=21.4$, $p<0.001$), and social ($\beta=16.0$, $p=0.001$) functioning. Similarly, strong and significant associations were noted between cancer location and all functional domains, with p values

of <0.001 . Thus, having colon or rectal cancer rather than cancer of the colorectal junction resulted in better HRQoL outcomes in terms of general health status and emotional, cognitive, social, role and physical functioning. However, no significant associations were observed between any of the functional domains and treatment modality.

With regards to specific items on the symptom subscales, strong significant associations were identified between age and nausea/vomiting ($\beta=9.1$, $p=.001$), constipation ($\beta=17.9$, $p=.009$), diarrhea ($\beta=10.0$, $p=.016$), and financial difficulties ($\beta=15.3$, $p<.001$), with participants under 60 years old reporting higher scores for these symptoms. However, no significant associations were reported between gender and any of the symptom items, thus indicating that gender was not predictive for the development of general cancer symptoms. In contrast, significant associations were noted between comorbidity groups with regards to fatigue ($\beta=-10.8$, $p=0.005$), pain ($\beta=-9.2$, $p=0.033$), constipation ($\beta=-13.8$, $p=0.027$), and diarrhea ($\beta=9.0$, $p=0.017$), with survivors with one or more comorbidities more frequently complaining of these symptoms.

No significant associations were observed between treatment modality and any of the items in the symptom subscales. However, there was a significant association between colon cancer and insomnia ($p=0.047$), indicating that participants with colon cancer had higher scores for this symptom compared to patients with cancer of the colorectal junction. Similarly, participants with rectal cancer reported significantly higher scores for both pain ($\beta=15.6$, $p=0.020$) and insomnia ($\beta=19.0$, $p=0.046$) compared to those with cancer of the colorectal junction,

indicating that these symptoms were of greater severity among the former group.

Discussion

To the authors' knowledge, this is the first study conducted in Oman to identify factors affecting HRQoL-related functioning and physical symptoms among Omani CRC survivors. The average age of the participants was 52 years and almost half had been diagnosed with CRC at stage III. These findings support those reported by previous studies which show that the majority of Omani patients with CRC present at advanced stages and at a young age (Kumar et al., 2015; Al Suqri et al., 2021). Increased rates of obesity and Westernized lifestyles, low awareness of CRC risk factors and symptoms, the lack of a national screening program, and cultural barriers with regards to the uptake of colonoscopies may be linked to the increased incidence of CRC and delays in CRC diagnosis in Oman (Al-Azri et al., 2019, 2020). On the other hand, lifestyle modifications (including dietary changes and regular exercise), early CRC detection, and improved treatment modalities may contribute to lowering the incidence of this cancer, as well as improving the survival rate (Ballard-Barbash et al., 2012). Patients who are diagnosed with CRC at an early stage (stage I) tend to report more positive trends in HRQoL compared to patients diagnosed at later stages (stages III or IV) (Marventano et al., 2013).

Based on their EORTC QLQ-C30 scores, most Omani CRC survivors in the present study demonstrated good HRQoL (mean score: 81.7 out of 100). Similar findings have been reported among CRC survivors in other Arab countries, such as Jordan (mean score: 79.7) (Abu-Helalah et al., 2014). However, lower HRQoL scores have been reported in Saudi Arabia (mean score: 67.1) (Ahmed et al., 2018). The lower HRQoL score in the Saudi Arabian study could be because the researchers included participants with all stages of CRC, many of whom were still under the influence of acute cancer treatment (Ahmed et al., 2018). The average time since diagnosis in our study was 4.6 years and all survivors had completed their first six months of treatment; these factors could minimize the acute psychosocial impact of the cancer diagnosis and the side-effects of treatment (Hung et al., 2013). Indeed, the prevalence of psychological symptoms of anxiety is usually high following cancer treatment, particularly if the patient has been diagnosed at a late stage (III or IV), thereby resulting in low HRQoL in the first six months of diagnosis (Cardoso et al., 2015). While up to 75% of patients diagnosed with cancer experience psychological distress, physical and psychological symptoms affecting HRQoL, such as pain, usually improve with time (Hung et al., 2013; Sitlinger and Zafar, 2018).

Of the various symptoms affecting HRQoL assessed in the current study, the highest mean scores were observed for constipation and insomnia. A previous study conducted in Ireland found insomnia to be one of the top three most distressing symptoms among CRC survivors, along with fatigue and flatulence (Gorman et al., 2018). A Jordanian study similarly found the most distressing symptoms

among CRC survivors to be insomnia, constipation, and financial difficulties (Abu-Helalah et al., 2014). While insomnia was indeed one of the most distressing symptoms in the current study, Omani patients did not appear to be troubled by financial difficulties, likely because cancer treatments are provided for free by the Omani Government. However, Jordanian patients also receive free cancer treatment and management services; as such, the reason for this discrepancy in findings is unclear (Abu-Helalah et al., 2014). It is possible that Jordanian patients face other costs not encountered by patients in our study, such as expenses related to loss of productivity and transport arrangements (Mehlis et al., 2020). In Western countries such as the USA, cancer patients are responsible for the vast majority of treatment cost; as such, financial distress tends to represent a greater burden than physical, social, family, and emotional distress when it comes to HRQoL (Sitlinger and Zafar, 2018). Flatulence, abdominal pain, and fatigue were other symptoms found to cause considerable distress to CRC survivors in the current study. Previous research has similarly indicated that fatigue is one of the most distressing symptoms of CRC survivors (Santin et al., 2015).

Data regarding the effect of age on both physical and functional aspects of HRQoL among CRC survivors are somewhat controversial. Some studies report that age does not have significant effect on HRQoL, whereas others report lower HRQoL scores with increasing age (Marventano et al., 2013). In the current study, older patients (i.e., those over 60 years of age) and those with one or more comorbidities were found to have significantly lower HRQoL scores compared to younger patients or those without comorbidities. Older age is associated with an increased risk of cancer and other chronic diseases, including those causally associated with increased cancer risk, such as hepatitis B, diabetes, arthritis, and Alzheimer and Parkinson diseases (Sarfati et al., 2016). Older cancer survivors, those with recent diagnoses of cancer, and those with specific comorbidities—such as anxiety, depression, urinary disorders, or heart disease—have reported lower HRQoL scores compared to the general population, particularly if they have undergone combined cancer treatments (Marventano et al., 2013; Neuner et al., 2014).

Likewise, patients with coexisting morbidities are generally less likely to receive curative treatment for their cancer compared to those without comorbidities, a factor which decreases HRQoL (Gross et al., 2007). Furthermore, a recent study showed that Omani patients with CRC were more likely to be diabetic (Al Bahrani et al., 2021). Patients with coexisting morbidities such as diabetes are more likely to have additional disease burden affecting their HRQoL (Sarfati et al., 2016). Indeed, patients in this study with more comorbidities were more likely to complain of symptoms such as fatigue, pain, constipation, and diarrhea compared to patients without comorbidities and those who were under 60 years of age. Moreover, the absence of comorbidities in our study was predictive of better HRQoL scores in all functional subscale domains, including emotional, role, physical, cognitive, and social functioning. In general, the higher the burden of co-existing comorbidities in a patient and the greater their

health care needs, the more likely it is that the patient will have impaired HRQoL (Sarfaty et al., 2016).

Gender was also found to have a significant impact on HRQoL scores in the present study, with male participants demonstrating significantly better emotional, cognitive, role, and physical functioning compared to female participants. Female CRC survivors tend to report worse HRQoL and psychological wellbeing than male survivors; this is likely related to the fact that depression rates are higher in females and women demonstrate greater sensitivity to the external environment (Krouse et al., 2009). Furthermore, women more often experience forms of violence associated with an increased prevalence of anxiety, depressive disorders, and post-traumatic stress (Oram et al., 2017). In Oman, it is possible that prevailing sociocultural expectations regarding division of labor, in which women are expected to take on the majority of responsibility in terms of raising children and performing household chores, may put them at higher risk of emotional and cognitive problems contributing to poorer HRQoL (Afifi, 2007).

One interesting finding of the current study was the association between cancer location and HRQoL, in which participants with rectal or colon cancer demonstrated better HRQoL outcomes than participants with cancer of the colorectal junction in terms of general health status and emotional, cognitive, social, role, and physical functioning. There is emerging data to suggest that colorectal cancer is not a single type of cancer and that right- and left-sided lesions may differ in terms of etiology, pathogenesis, biologic behavior, response to chemotherapy, and patient outcome (Benedix et al., 2010). Furthermore, different treatment modalities are recommended for left- and right-sided CRC, with different side-effects. Left-sided CRC patients appear to benefit more from chemotherapy and have a better prognosis and survival rate, whereas right-sided CRC patients are diagnosed at more advanced stages and do not respond well to chemotherapy, with a greater chance of recurrence (Baran et al., 2018).

Limitations

This study has certain limitations. First, the cross-sectional nature of the study could have exposed the results to errors related to recall, response, and/or personal bias. Second, although we used the official Arabic version of the EORTC QLQ-CR30 which has high validity and reliability, the self-assessed nature of the tool entails a degree of subjectivity that cannot be eliminated, particularly for patients who were diagnosed with CRC many years previously. Third, although most of our data were collected using self-administered questionnaires, illiterate patients (28.8%) were interviewed face-to-face and therefore we cannot rule out the possibility of subjective bias on the part of the interviewers. Finally, data were collected during the ongoing coronavirus disease 2019 (COVID-19) pandemic; hence, the impact of such an unprecedented and stressful large-scale event on the patients cannot be ruled out. In response to the COVID-19 pandemic, routine and non-urgent appointments for cancer patients were cancelled in many countries, including Oman, resulting in considerable

delays in cancer treatment and follow-up (Al-Azri, 2021). As such, it is possible that this could have caused additional stress and frustration to the cancer patients in our study, thereby opening the findings to potential bias.

In conclusion, this study found that more than half of Omani CRC survivors were diagnosed at late stages (stages III or IV), a finding which supports those reported by previous research (Kumar et al., 2015; Al Bahrani et al., 2021). Although the overall HRQoL of Omani CRC survivors in terms of physical, role, emotional, cognitive, and social functioning was high, elderly survivors, female survivors, and those with comorbidities demonstrated lower HRQoL scores compared to their respective counterparts. As such, greater attention should be paid to such groups in order to improve their quality of life, including referring patients to specialists so as to better control existing comorbidities and symptoms of psychological distress.

In addition, public awareness initiatives are needed in Oman in order to promote healthy lifestyle modifications (i.e., moderate physical activity and the consumption of more fruit and vegetables and low-fat diets) so as to lower the incidence of comorbidities, a correlate of HRQoL (Ballard-Barbash et al., 2012; Marventano et al., 2013). Furthermore, educational measures are needed to enhance public awareness of CRC symptoms and the importance of seeking early medical help, thereby improving timely diagnosis and survivorship, as well as HRQoL (Al-Azri et al., 2019, 2020; Buccafusca et al., 2019).

Finally, participants in this study most frequently reported HQOL-related symptoms of constipation, insomnia, pain, and fatigue. Thus, healthcare professionals and oncologists should address such symptoms when consulting with CRC survivors. Encouraging CRC survivors to express their feelings and concerns, building better patient-healthcare professional relationships, referring patients to specialized counselling as needed, and improving current methods of symptom evaluation are various ways in which physicians could help improve the HRQoL of CRC survivors.

Author Contribution Statement

Maryam Al-Shandudi, MD, MSc, conceived of the study and participated in the data collection, data analysis, and manuscript preparation; Mansour Al-Moundhri, MBChB, MRCP (UK), FRACP, MD, conceived of the study and participated in the data collection; Moon Fai Chan participated in the data analysis and manuscript preparation; Thuraya Al-Hajri, MD, FRCPC, conceived of the study and participated in the data collection; Muna Al-Balushi, MSc, conceived of the study and participated in the data collection; Mohammed Al-Azri, MD, MRCPG(Int), FRCGP(Int), MMedSci(UK), PhD(UK), conceived of the study and participated in the manuscript preparation. All authors read and reviewed the final version of the manuscript submitted for publication.

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General

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Ethical Approval

This study was approved by the Medical Research and Ethics Committee of the College of Medicine and Health Sciences at Sultan Qaboos University (MREC#2186), as well as the Research and Ethical Review and Approval Committee of the Royal Hospital (#115/2020).

Data Availability

Data are available from the authors upon written request.

Conflict of Interest

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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