

# Barriers to Colorectal Cancer Screening in Primary Care Settings: Attitudes and Knowledge of Nurses and Physicians

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## ABSTRACT

**Objective:** Healthcare providers (HCPs) play a critical role in reducing colorectal cancer (CRC) related morbidity and mortality. This study aimed at exploring the attitudes and knowledge of nurses and physicians working in primary care settings regarding CRC screening. **Methods:** A total of 142 HCPs (57.7% nurses and 42.3% physicians) participated in a cross-sectional survey. Data were collected using a Self-administered Questionnaire. The participants were clinically experienced (mean = 9.39 years; standard deviation [SD] = 6.13), regularly taking care of adults eligible for CRC screening (62%) and had positive attitudes toward CRC screening (83.1%). Most participants (57%) had low levels of knowledge about CRC screening (mean = 3.23; SD = 1.50). The participants were most knowledgeable about the recommended age for initiating screening (62.7%) and the procedures not recommended for screening (90.8%). **Results:** More than 55% did not know the frequency of performing specific

screening procedures, the upper age limit at which screening is not recommended, and the patients at high-risk for CRC. There were no significant differences between nurses' and physicians' attitudes and knowledge. The participants' perceptions about professional training (odds ratio [OR] = 2.17,  $P = 0.003$ ), colonoscopy (OR = 2.60,  $P = 0.014$ ), and double-contrast barium enema (OR = 0.53,  $P = 0.041$ ), were significantly associated with knowledge about CRC screening. **Conclusions:** The inadequate knowledge levels among nurses and physicians may be one of the barriers affecting CRC screening. Enhancing HCPs knowledge about CRC screening should be considered a primary intervention in the efforts to promote CRC screening and prevention.

**Key words:** Attitudes, cancer screening, colorectal cancer, knowledge, nurses, physicians, primary care

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## Introduction

Colorectal cancer (CRC) is one of the leading causes of cancer death in both developed and developing countries.<sup>[1,2]</sup> Worldwide, the estimated age-standardized rate of CRC is 20.6/100,000 in males and 14.3/100,000 in females.<sup>[1]</sup> In 2012, an estimated total of 1.4 million people were diagnosed with CRC, and this led to approximately 693,900 deaths.<sup>[3]</sup> Global cancer estimates show that the rate of CRC is also increasing in the Western Asian region (also called the Middle East), and this is mainly attributed to the increasing prevalence of risk factors for CRC.<sup>[3]</sup>

The age-standardized rate of CRC in the Middle East region is 17.6/100,000 in males and 12.4/100,000 in females.<sup>[3]</sup> The Middle East region is projected to experience an increase in cancer mortality of approximately 181%, over the next 15 years.<sup>[4]</sup> Reports from countries under the Gulf Cooperation Council in the Middle East region show that only 20.7% of CRC cases present to hospitals with localized disease.<sup>[5]</sup> This shows that a significant percentage (79%) of CRC cases report to hospitals with advanced stages of the disease, and this could be due to lack of effective screening, early detection, and diagnosis services.

Recent studies conducted in Oman, a country in the Middle East region and with a population of approximately 4 million people; show that CRC is among the five most common cancers.<sup>[6,7]</sup> In Oman, the age-adjusted incidence rates for CRC are 4.8/100,000 in men and 4.2/100,000 in women.<sup>[8]</sup> Although the incidence rate in Oman is slightly lower than those of surrounding and developed countries, the Omanis are affected by CRC at a younger age and the majority of those affected report with advanced disease (Stage III and Stage IV).<sup>[9,10]</sup> Therefore, unless specific interventions are implemented, the incidence rate of CRC in Oman and the Middle East region will continue to increase, especially because of the increasing risk burden arising from demographic, lifestyle, and epidemiological transitions.

One of the priority strategies that can be used to adequately address the growing trend of CRC in Oman and the Middle East region is the provision of structured CRC screening and early diagnosis services. CRC screening and cancer screening programs in general in Oman and the Middle East region as a whole are still inadequate and opportunistic.<sup>[7]</sup> Available literature shows that population-based CRC screening programs are lacking in most countries in the Middle East region<sup>[11]</sup> and no studies have attempted to document the current screening rates. Screening helps

to identify individuals with abnormalities suggestive of precancer or cancer states and to refer them to get prompt diagnosis and treatment. However, for healthcare providers (HCPs) to effectively health educate, recommend, refer, or conduct regular CRC screening for eligible individuals, they need to have adequate knowledge and understanding of the screening guidelines, and eligibility criteria. Studies carried out in countries where CRC is a highly utilized by the knowledge of HCPs about screening tests and their ability to explain the need to have the procedure done.<sup>[12,13]</sup> Literature also shows that there is a significant relationship between the knowledge of HCPs working in primary care settings regarding CRC screening and routine use of CRC screening.<sup>[14]</sup>

Studies conducted in the USA and Italy show that when HCPs working in primary care settings have adequate knowledge regarding CRC screening, they tend to implement the recommended CRC screening guidelines and track their patients to ensure receipt of the screening tests.<sup>[15,16]</sup> The experiences of the HCPs are also an important factor because they affect their ability to provide CRC screening services. The HCPs with personal experiences such as having a family member or caring for patient with CRC tend to offer or recommend CRC screening to all eligible patients.<sup>[17]</sup> Therefore, one of the important determinants of patients' ability to complete CRC screening as required by the evidence-based guidelines is the HCPs' recommendation.<sup>[18]</sup>

HCPs with adequate knowledge about CRC screening give proper recommendations to patients using scientific information sources and apply evidence-based cancer screening guidelines.<sup>[15]</sup> Unfortunately, lack of adequate knowledge about CRC screening guidelines by HCPs is common and promotes preconceived ideas about patients, screening tests, and generates reluctance to recommend CRC screening.<sup>[19]</sup> For instance, some HCPs may not be aware of the factors that place a patient at increased risk of CRC when to initiate screening, or which screening procedure to recommend.<sup>[20]</sup> Therefore, apart from patient-related barriers<sup>[21,22]</sup> and health care system barriers,<sup>[23,24]</sup> the level of the HCPs' knowledge regarding CRC screening can impede the uptake of CRC screening.

Considering the increasing magnitude of CRC, risk factors for CRC, and late reporting by those affected by CRC in the Middle East and Oman, there is a need to explore the HCPs' attitudes and knowledge about CRC screening. The aim of this study was to examine the attitudes and knowledge regarding CRC screening of nurses and

physicians working in primary care settings in Oman. This study focused on HCPs (nurses and physicians) working in primary care settings because they play a fundamental role in implementing the CRC screening guidelines to eligible patients through recommendations, health education, referral, and actual screening services. Primary care settings also provide HCPs with opportunities to see the same patients multiple times and to promote CRC screening through health education, referrals, and follow-up care.

## Methods

A descriptive and cross-sectional design were used to collect data from nurses and physicians working in Government Health Centers (GHC) in the City of Muscat (the Capital of Oman). Oman has a population of approximately 4 million people, and 27.3% of these reside in Muscat. Reports from the Oman Government's Ministry of Health show that the population in Muscat receives their primary care from 27 GHC, which are staffed by nurses, physicians, and other healthcare professions. The GHC are the first point of contact with the healthcare system and provide services that focus on prevention and screening services for communicable and noncommunicable diseases such as cancer, diabetes, cardiovascular diseases, and others. The GHC are responsible for initiating a referral to local and regional hospitals where necessary. The participants for this study (nurses and physicians) were working in the 27 GHC in Muscat.

### Ethics

The study received approval from the Research and Ethics Committee of the College of Nursing and the Directorate of Research and Studies of the Ministry of Health. The participants were required to read and sign a written consent form before data collection. The study did not collect any participants identifying information or any patient-related information.

### Procedure

The data were collected in the period of January-July 2014. All available nurses and physicians in the 27 GHC were targeted as participants. The participants had to meet the inclusion criteria of a nurse or physician officially employed by the GHC; involved in direct care of adult patients; qualified with a minimum of a diploma or associate degree in the respective profession; and registered by the respective professional council to practice in Oman. The HCPs who were on work leaves, and working exclusively in antenatal, pediatric, and adolescent clinics were excluded from the study.

On scheduled data collection days for the respective GHC, two research assistants (RA) went to meet and get permission from the center manager. The RA then proceeded to approach all the available HCPs (nurses and physicians) to explain the study purpose and procedures. The HCPs who agreed to participate were required to complete a written consent form and the study questionnaire written in English in a prescribed time of 1 h. All HCPs in Oman receive their professional training in English. The period of 1 h was given to limit disruption of patient care and discussion of questionnaire items with others.

The HCPs were instructed to drop off the completed questionnaire in a box located in a specific room. On returning the questionnaire, the RA checked it for completeness before the drop off in the receiving box. The RA also tracked the questionnaires that were not returned on time by going to the HCPs respective workstations to retrieve them. A total of 241 HCPs were approached during the data collection period in all the 27 GHC, and 183 agreed to participate in the study. A total of 142 returned or were contactable to retrieve the questionnaire (response rate = 58.9%).

### Measures

A Self-administered Questionnaire (SAQ) was used to collect data from the HCPs. The items in the SAQ were developed by the investigators based on literature and the 2008 USA Preventive Services Task Force Guidelines for CRC screening.<sup>[25]</sup> The SAQ was comprised of sections collecting data about participants' demographic characteristics, clinical practice setting characteristics, attitudes, experiences, and knowledge about CRC screening. Participants' attitudes were measured using item seeking their perceptions about the adequacy of professional training regarding cancer prevention and screening; a rating of importance of CRC screening; rating of the benefit of CRC screening; and whether CRC is preventable. The experiences of participants with CRC were determined by asking them about having: A close relative who has suffered or been diagnosed with CRC; personally undergone CRC screening; received continuing education or reviewed literature about cancer prevention and screening; and a history of taking care of a patient with CRC.

The section about knowledge had seven items [Table 1], and these were developed using the 2008 USA Preventive Services Task Force guidelines for CRC screening.<sup>[25]</sup> Each correct answer to the seven items was scored as "1" and incorrect answer as "0." A total knowledge score (ranging from 0 to 7) was calculated by adding all the correct responses

**Table 1: Knowledge scale items and respective responses**

Knowledge scale items	Response options	Reliability statistics
What is the recommended age for initiating CRC screening in average-risk adults?	45 years 50 years* 60 years 75 years	Cronbach's alpha=0.766 Cronbach's alpha based on standardized items=0.705
Which of the following procedures is not recommended to be used for CRC screening?	Fecal occult blood testing Abdominal ultrasound* Sigmoidoscopy Colonoscopy	
According to international guidelines, how often should fecal occult blood testing for CRC screening be performed in eligible patients?	Every 6 months Every 1 year* Every 2 years Every 3 years	
According to international guidelines, how often should Sigmoidoscopy for CRC screening be performed in eligible patients?	Every 2 years Every 3 years Every 5 years* Every 10 years	
According to international guidelines, how often should colonoscopy for CRC screening be performed in eligible patients?	Every 1 year Every 2 years Every 5 years Every 10 years*	
International guidelines recommend against CRC screening in adults who are older than which age?	65 years 75 years 85 years* 90 years	
In your practice which category of patients do you consider to be at the highest risk for CRC for screening purposes?	If at least one 1 <sup>st</sup> degree relative had CRC diagnosis at age <50 years* A family history of ulcerative colitis Family history adenomatous polyps A personal history of diabetes	

\*Correct response, CRC: Colorectal cancer

on the knowledge scale. The SAQ was given to three experts in gastroenterology, nursing, and family medicine to review for accuracy, face, and content validity. The three reviewers recommended the SAQ and found it to be appropriate for use in Oman. The reviewers mainly recommended adding open-ended questions for participants to list manifestations and risk factors of CRC. After adjustments had been made, the SAQ was pretested among 22 nurses and physicians working at a University Hospital in Oman. The pretesting was done to establish clarity of items and the time required to complete the questionnaire. The SAQ required 25-35 min to complete. The CRC screening knowledge scale was found to have a Cronbach's alpha of 0.766.

### Statistical analysis

The data were managed and analyzed using Statistical Packages for Social Sciences (SPSS) version 20 (SPSS Inc., Chicago, IL, USA). Descriptive statistics was used to describe the participants' characteristics, experiences, attitudes and knowledge about CRC screening. The Fisher's exact test or Chi-square tests were used to examine the potential differences between nurses' and physicians' experiences, attitudes and knowledge regarding CRC screening. Preliminary analysis showed that the main outcome variable (knowledge about CRC screening) was not normally distributed (skewness =

**Table 2: Participants' characteristics**

Characteristic	Category	n = 142 Frequency (%)
Age in years (mean=32.53; SD=6.50)	≤40	129 (90.8)
	≥41	13 (9.2)
Nationality	Not Omani	18 (12.7)
	Omani	124 (87.3)
Gender	Female	131 (92.3)
	Male	11 (7.7)
Primary profession	Registered nurse	82 (57.7)
	Physician	60 (42.3)
Highest level of education	Associated degree	68 (47.9)
	Bachelors	59 (41.5)
	Masters	12 (8.5)
	Doctorate	3 (2.1)
Total years of clinical experience (mean=9.39; SD=6.13)	≤5	38 (26.8)
	≥6	104 (73.2)
Years spent working in the current unit or health center (mean=9.54; SD=6.12)	≤5	75 (52.8)
	≥6	67 (47.2)
Health center is affiliated with health professions' training institution	No	52 (36.6)
	Yes	90 (63.4)
Approximate number of patients cared for on a typical day (mean=40.16; SD=23.71)	≤30	65 (45.8)
	≥31	77 (54.2)
Approximate percentage of patients who pay for their own health care (private health insurance)	0	68 (47.9)
	25	69 (48.6)
	>50	5 (3.5)
How often in your current practice do you care for patient of age ≥50 years?	Rarely	13 (9.2)
	Often	88 (62.0)
	Very often	41 (28.9)

SD: Standard deviation

-0.441 and kurtosis = 1.970). Using the mean score as a guideline (mean = 3.23, standard deviation [SD] = 1.50), knowledge was categorized into a binary outcome (low knowledge level  $\leq 3.00$  and adequate knowledge level  $\leq 4.00$ ). Logistic regression analysis was used to assess the factors associated with participants' knowledge about CRC screening. The variables found to be significantly associated and those deemed to be important predictors of knowledge were used in the multivariable logistic regression model. The Pearson goodness-of-fit test was used to assess the final logistic model. The significance level was set at  $P \leq 0.05$  for all statistical tests.

## Results

### Participants' characteristics

The characteristics of the 142 HCPs recruited in the study are summarized in Table 2. The participants were nurses (57.7%) and physicians (42.3%). The majority were female (92.3%), had associate degree/diploma level (47.9%), or bachelor level professional education (41.5%), and worked at facilities that are affiliated with a health professions' training institution (63.4%). The majority of HCPs were

often (62%) taking care of adult patients eligible for CRC screening and 75-100% of their patients had government health insurance (96.5%).

### Participants' experiences and attitudes toward colorectal cancer screening

The results presented in Table 3 show that the majority of the participants had little or no experience with CRC screening (97%). Very few nurses and physicians had taken care of a patient with CRC (16.2%), or regularly saw patients with a history of CRC (17.6%), or engaged in activities to enhance their knowledge about cancer prevention, or screening (<26%). However, significantly more physicians compared to nurses had taken care of patients with CRC ( $P = 0.048$ ) and had read scientific literature related to cancer screening ( $P = 0.008$ ).

The participants also had minimal personal experience with CRC since <15% had personally undergone any CRC screening procedure or had a relative affected by CRC. The majority of nurses and physicians were of the opinion that professional training did not address or

Table 3: Participants experiences and attitudes toward colorectal cancer screening

Item	Response	n = 142 Frequency (%)	Primary profession		$\chi^2$ and P
			Registered nurse n = 82 Frequency (%)	Physician n = 60 Frequency (%)	
Has a relative who was diagnosed or suffered CRC	No	121 (85.2)	72 (87.7)	49 (81.7)	$\chi^2=1.036$ $P=0.309$
	Yes	21 (14.8)	10 (12.3)	11 (18.3)	
Personally underwent any procedure to screen for CRC	No	127 (89.4)	76 (92.7)	51 (85)	$\chi^2=0.100$ $P=0.752$
	Yes	15 (10.6)	6 (7.3)	9 (15)	
Continuing education activities related to cancer prevention and screening in past 3 years	No	111 (78.2)	61 (74.4)	50 (83.3)	$\chi^2=1.325$ $P=0.250$
	Yes	31 (21.8)	21 (25.6)	10 (16.7)	
Recently read a scientific journal article or literature related to cancer screening	No	106 (74.6)	68 (82.9)	38 (63.3)	$\chi^2=7.029$ $P=0.008$
	Yes	36 (25.4)	14 (11)	22 (36.7)	
Has taken care of a patient with CRC in Oman	No	119 (83.8)	73 (89)	46 (76.7)	$\chi^2=3.898$ $P=0.048$
	Yes	23 (16.2)	9 (11)	14 (23.3)	
Sees patients with history of CRC in clinical practice	Less often	117 (82.4)	70 (85.4)	47 (78.3)	$\chi^2=1.181$ $P=0.277$
	Often	25 (17.6)	12 (14.6)	13 (21.7)	
Experience in working with patients who require CRC screening	No Experience	61 (43)	38 (46.3)	23 (38.3)	$\chi^2=0.939$ $P=0.625$
	Little experience	77 (54.2)	42 (51.2)	35 (58.3)	
	Good experience	4 (2.8)	2 (2.4)	2 (3.3)	
Believes that CRC is preventable	No	34 (23.9)	17 (20.7)	17 (28.3)	$\chi^2=1.099$ $P=0.294$
	Yes	108 (76.1)	65 (79.3)	43 (71.7)	
Believes that CRC screening is of any benefit	No	24 (16.9)	16 (19.5)	8 (13.3)	$\chi^2=4.725$ $P=0.030$
	Yes	118 (83.1)	66 (80.5)	52 (86.7)	
Opinion about importance of CRC screening	Important	28 (19.7)	17 (20.7)	11 (18.30)	$\chi^2=2.869$ $P=0.238$
	Very important	62 (43.7)	31 (37.8)	31 (51.7)	
	Extremely important	52 (36.6)	34 (41.5)	18 (30)	
Perceived adequacy of professional training in regard to cancer prevention and screening	Not addressed	55 (38.7)	35 (42.7)	20 (33.3)	$\chi^2=5.724$ $P=0.057$
	Inadequate	46 (32.4)	20 (24.4)	26 (43.3)	
	Adequate	41 (28.9)	27 (32.9)	14 (23.3)	

CRC: Colorectal cancer

inadequately prepared them regarding cancer prevention and screening (71.1%). The attitudes of participants toward CRC screening were mostly positive as indicated by their beliefs in statements such as CRC is preventable (76.1%), and CRC screening is beneficial (83.1%). There were no major differences in nurses' and physicians' attitudes toward CRC screening.

### Participants' knowledge regarding colorectal cancer screening

The results presented in Table 4 show that the sample means score for knowledge level was 3.23 (SD = 1.50), and the majority of the participants (57%) had low knowledge about CRC screening. The nurses and physicians were mostly knowledgeable about aspects such as the recommended age for initiating CRC screening (62.7%) and the procedures not recommended for CRC screening (90.8%). However, <45% of the participants had correct knowledge about the frequency of performing recommended CRC screening procedures (fecal occult blood testing [FOBT], flexible sigmoidoscopy and colonoscopy), the upper age limit at which CRC screening is not recommended, and the type of patients considered to be at high-risk for CRC. There were no significant differences in the overall nurses' and physicians' CRC screening knowledge levels ( $P = 0.268$ ). However, there was a significant difference between nurses' and physicians' knowledge on one item (frequency of FOBT in eligible patients,  $P = 0.041$ ).

### Factors associated with participants' level of knowledge about colorectal cancer screening

Table 5 shows that the factors which were significantly associated with the participants' knowledge about CRC screening were; number of patients seen with private health insurance ( $P = 0.009$ ); having a relative who was diagnosed or suffered from CRC ( $P = 0.047$ ); having taken care of a patient with CRC ( $P = 0.005$ ); perceived adequacy of professional training in regard to cancer prevention and screening ( $P = 0.000$ ); and beliefs about the effectiveness of FOBT ( $P = 0.007$ ); flexible sigmoidoscopy ( $P = 0.001$ ); double-contrast barium enema ( $P = 0.029$ ); and colonoscopy ( $P = 0.000$ ). The logistic regression analysis presented in Table 6 shows that the significant predictors of participants' level of knowledge about CRC screening were their perceptions about; adequacy of professional training in regard to cancer prevention and screening (odds ratio [OR] = 2.17, CI = 1.32-3.64), effectiveness of screening colonoscopy (OR = 2.60, CI = 1.21-5.58), and double-contrast barium enema (OR = 0.53, CI = 0.29-0.97).

The Wald test was used to evaluate whether or not the logistic coefficient for each of the predictors was different from zero. Therefore, nurses' and physicians' perceptions about their professional training in cancer prevention and screening, and beliefs about the effectiveness of CRC screening procedures are significant predictors of their level of knowledge regarding CRC screening. The Hosmer-Lemeshow test of goodness — of-fit results

Table 4: Participants knowledge about colorectal cancer screening

Item	Response or category	n = 142 Frequency (%)	Primary profession		$\chi^2$ and P
			Registered nurses n = 82 Frequency (%)	Physicians n = 60 Frequency (%)	
Participants score on the CRC screening knowledge scale (mean=3.23, SD=1.50)	Low ( $\leq 3.00$ )	81 (57)	50 (61)	31 (51.7)	$\chi^2=1.225$ $P=0.268$
	Adequate ( $\geq 4.00$ )	61 (43)	32 (39)	29 (48.3)	
Recommended age for initiating CRC screening (average risk adults)	Incorrect	53 (37.3)	31 (37.8)	22 (36.7)	$\chi^2=0.019$ $P=0.890$
	Correct	89 (62.7)	51 (62.2)	38 (63.3)	
Procedures not recommended to be used for CRC screening	Incorrect	13 (9.2)	6 (7.3)	7 (11.7)	$\chi^2=0.788$ $P=0.375$
	Correct	129 (90.8)	76 (92.7)	53 (88.3)	
Frequency of fecal occult blood testing for CRC screening in eligible patients	Incorrect	80 (56.3)	52 (63.4)	28 (46.7)	$\chi^2=3.951$ $P=0.041$
	Correct	62 (43.7)	30 (36.6)	32 (53.3)	
Frequency of flexible sigmoidoscopy for CRC screening in eligible patients	Incorrect	88 (62)	54 (65.9)	34 (56.7)	$\chi^2=1.241$ $P=0.265$
	Correct	54 (38)	28 (34.1)	26 (43.3)	
Frequency of colonoscopy for CRC screening in eligible patients	Incorrect	132 (93)	77 (93.9)	55 (91.7)	$\chi^2=0.019$ $P=0.891$
	Correct	10 (7)	5 (6.1)	5 (8.3)	
Age of older adults at which CRC is not recommended	Incorrect	84 (59.2)	49 (59.8)	35 (58.3)	$\chi^2=0.029$ $P=0.865$
	Correct	58 (40.8)	33 (40.2)	25 (41.7)	
Category of patients considered to be at the highest risk for CRC for screening purposes	Incorrect	85 (59.9)	51 (62.2)	34 (56.7)	$\chi^2= 0.441$ $P=0.507$
	Correct	57 (40.1)	31 (37.8)	26 (43.3)	

SD: Standard deviation, CRC: Colorectal cancer

Table 5: Factors associated with colorectal cancer screening knowledge of healthcare providers

Factor	Category	Level of knowledge category		$\chi^2$ or FET and P
		Low n = 81 Frequency (%)	Adequate n = 61 Frequency (%)	
Level of professional education attained	Diploma	41 (50.6)	15 (24.6)	$\chi^2=4.132$ P=0.234
	Bachelors	34 (42)	25 (41)	
	Masters or doctorate	6 (7.4)	21 (34.4)	
Approximate percentage of patients who pay for their own healthcare	0%	31 (38.3)	37 (60.7)	FET=8.721 P=0.009
	25%	48 (59.3)	21 (34.4)	
	>50%	2 (2.5)	3 (4.9)	
Has a relative who was diagnosed or suffered CRC	No	73 (90.1)	48 (78.7)	$\chi^2=3.610$ P=0.047
	Yes	8 (9.9)	13 (21.3)	
Has taken care of a patient with CRC in Oman	No	74 (91.4)	45 (73.8)	$\chi^2=7.929$ P=0.005
	Yes	7 (8.6)	16 (26.2)	
Perceived adequacy of professional training in regard to cancer prevention or screening	Not addressed	43 (53.1)	12 (19.7)	$\chi^2=16.527$ P=0.000
	Inadequate	21 (25.9)	25 (41)	
	Adequate	17 (21)	24 (39.3)	
Beliefs about fecal occult blood testing performed by a health care profession as a CRC screening test	Not effective	22 (27.2)	4 (6.6)	$\chi^2=19.519$ P=0.007
	Somewhat Effective	33 (40.7)	24 (39.3)	
	Very effective	26 (32.1)	33 (54.1)	
Beliefs about flexible sigmoidoscopy for CRC screening	Not effective	25 (30.9)	3 (4.9)	FET=15.78 P=0.001
	Somewhat Effective	22 (27.2)	18 (29.5)	
	Very effective	34 (46.9)	40 (65.6)	
Beliefs about colonoscopy for CRC screening	Not effective	21 (25.9)	3 (4.9)	FET=27.30 P=0.000
	Somewhat effective	28 (34.6)	8 (13.1)	
	Very effective	31 (38.3)	50 (82)	
Beliefs about double-contrast barium enema for CRC screening	Not effective	25 (30.9)	7 (11.5)	$\chi^2=8.991$ P=0.029
	Somewhat effective	23 (28.4)	21 (34.4)	
	Very effective	33 (40.7)	33 (54.1)	

FET: Fishers exact test, CRC: Colorectal cancer

( $\chi^2 [8, n = 142] = 10.58, P = 0.227$ ) shows that the model predicted values were not significantly ( $P > 0.005$ ) different from the observed values.

## Discussion

This study explored the nurses' and physicians' attitudes and knowledge regarding CRC screening. The nurses and physicians were working in primary care settings in a country and region where the number of people affected by CRC is increasing. The findings demonstrate that the participants had good attitudes about CRC screening, but their experiences and knowledge regarding CRC screening was inadequate. The attitudes of the nurses and physicians about CRC screening could be attributed to the influence of the general expectations of the public and profession to provide cancer preventive care services. Other studies have also reported positive attitudes among physicians, and these are demonstrated in results showing rating of CRC screening as very important (>90%) and high rates (80%) of receipt of screening tests among those who are over the age over 50 years.<sup>[16]</sup> The majority of nurses and physicians in this study were of the view that CRC is a

Table 6: Predictors of colorectal cancer screening level of knowledge

Factor	B	Wald	P	Exp(B)	95% CI	
					Lower	Upper
Perceived adequacy of professional training in cancer prevention and screening	0.783	9.105	0.003	2.188	1.316	3.638
Beliefs about effectiveness of fecal occult blood testing performed by health care provider	0.260	0.975	0.323	1.297	0.774	2.174
Beliefs about effectiveness of colonoscopy	0.955	6.012	0.014	2.599	1.211	5.576
Beliefs about effectiveness of double-contrast barium enema for CRC screening	0.636	4.176	0.041	0.530	0.288	0.974
Percentage of patients cares for who pay for their own health care	-0.614	2.647	0.104	0.541	0.258	1.134
Has a relative who was diagnosed or suffered CRC	-0.200	0.129	0.719	0.819	0.275	2.36
Constant	-3.509	8.742	0.003	0.030		

CI: Confidence interval, CRC: Colorectal cancer

preventable disease (76.1%) and rated highly the benefits of CRC screening (83.1%).

However, the majority of both nurses and physicians had inadequate knowledge levels regarding CRC screening. This lack of adequate knowledge by nurses and physicians may be stemming from deficiencies in the curricula used to prepare health care professionals, lack of relevant continuing education programs for health care professional, and ill-equipped clinical practice settings. The lack of adequate knowledge could also be due to lack of regular clinical experiences with CRC since the prevalence of the disease is still low in Oman. The participants in the current study mostly had attained diploma or bachelor's level professional education (89.4%), rated their experience in working with clients who require CRC screening as little or no experience (97.2%) and felt that their professional training was inadequate and lacking in aspects related to cancer prevention and screening (71.1%).

The nurses and physicians were mostly knowledgeable about two basic aspects of CRC screening, i.e., the recommended age for initiating screening (62.7%) and the procedures not recommended for screening (90.8%). The participants were less knowledgeable about specific and clinically relevant aspects of CRC screening such as the frequency of performing specific common screening tests (FOBT, flexible sigmoidoscopy, and colonoscopy) in eligible patients of average risk, the age above which screening is not recommended and patients considered to be at the highest risk for CRC. These findings highlight the inadequate knowledge of nurses and physicians as a major barrier to CRC screening.

Literature shows that most of the studies exploring knowledge regarding CRC screening have mostly focused on physicians, and very few have been conducted among nurses. One study which involved medical doctors, doctors of osteopathic medicine, nurse practitioners, physician assistants, and nurse midwives was conducted in a native Indian Health Services System in the USA and found that participants had inadequate knowledge regarding appropriate age to initiate screening, appropriate use of tests, and the appropriate time intervals to repeat screening.<sup>[26]</sup> Haverkamp *et al.* reported that 77% of the participants recommend starting CRC screening for average risk patients at age 50, but 22% recommended flexible sigmoidoscopy at intervals other than every 5 years, and 43% recommended a colonoscopy at intervals other than every 10 years.<sup>[26]</sup>

Similar to this study, physicians in the State of Washington in the USA were also found to have good attitudes about CRC screening, but with inadequate knowledge since those who recommended FOBT, flexible sigmoidoscopy and colonoscopy in agreement with the American

Cancer Society Guidelines were 58%, 49%, and 57%, respectively.<sup>[16]</sup> Another study conducted in the USA among nurse practitioners and obstetricians/gynecologist working in primary care settings showed that <56% were able to identify the correct age to initiate CRC screening in patients at average risk and 55% thought that it was never appropriate to discontinue CRC screening regardless of age.<sup>[14]</sup> It is important to note the studies referred to above included nurses who were performing advanced practice roles and unlike in this study.

The findings of this study are similar to findings of others that have been conducted in countries that are geographically close to Oman or the Middle East.<sup>[27]</sup> A study recently conducted in Jordan found that the knowledge of the majority (69.1%) of nurses and physicians working in primary care settings was very poor.<sup>[27]</sup> In Turkey, a study conducted among health professional working in a hospital setting found good knowledge about general aspects such as CRC incidence rate, general signs, and symptoms, but not about CRC early screening and diagnosis.<sup>[28]</sup> Another study conducted among nurses working in a Turkish State Hospital also found that participants had good knowledge about basic aspects such as the signs and symptoms of CRC (76.5%) and common risk factors for CRC (77.4%), but not the methods or tests used for CRC screening such as FOBT.<sup>[29]</sup>

It seems the lack of adequate knowledge regarding CRC screening is not unique to the nurses and physicians in our study, but a common phenomenon in both developed and developing countries. This suggests that lack of adequate knowledge regarding CRC screening among health care providers could be one of the major barriers that need urgent attention by the efforts to enhance CRC screening. Therefore, the call for further educational efforts targeting health care professionals is still valid in the fight against CRC because the lack of knowledge is still common and contributing to the underutilization of screening at-risk populations.<sup>[19]</sup> Nurses and physicians need be knowledgeable about the CRC screening guidelines to provide appropriate health education, counseling, screening, and referrals. The knowledge of nurses and physicians can be improved through focused efforts to update the curricula used during basic professional training with evidence-based content about cancer prevention and screening. For the nurses and physicians already in practice increasing access to evidence-based cancer screening protocols or guidelines and continuing education focusing on cancer screening can be of benefit.

In this study, the HCPs' level of knowledge regarding CRC screening was significantly associated with perceptions



about the adequacy of professional training regarding cancer prevention and screening ( $P = 0.003$ ), the effectiveness of screening colonoscopy ( $P = 0.014$ ), and double-contrast barium enema ( $P = 0.041$ ). Similarly, a study which involved 2202 primary care physicians found that CRC cancer survivorship of the patients was strongly associated with reports of inadequate training.<sup>[30]</sup> Other studies have reported different factors which are associated with health care professional's knowledge regarding CRC screening and these include; practicing for more than 10 years; practicing in a multispecialty group, and having an older patient population.<sup>[14]</sup> In this study, the above three factors had no significant relationship with nurses' and physicians' knowledge regarding CRC screening. The factors associated with nurses' and physicians' knowledge regarding CRC screening provide us with information about some of the aspects that can be monitored as indicators of successful strategies used to enhance nurses and physicians knowledge such as curriculum revisions, continuing education, and others.

### Limitations

The small and convenience sample may limit generalization of the results to all nurses and physicians in Oman primary care settings. Further, the design (descriptive cross-sectional) and focus of the study could not allow for actual verification of HCPs practices related to CRC screening. The study did not collect data about the number of patients eligible for CRC screening who do not get screened according to the recommended guidelines. The study used the SAQ, which was developed by the investigators. However, the study is the first to address the attitudes and knowledge of HCPs regarding CRC screening in Oman and adds significant value to our understanding of the major barriers to CRC screening in settings where this disease is emerging as a major health problem.

### Conclusion

In Oman, this is the first study that has specifically explored nurses' and physicians' attitudes and knowledge regarding CRC screening. The findings show that nurses and physicians working in primary care settings have inadequate knowledge regarding CRC screening, despite their critical role in health education, counseling, and referral of patients who are eligible for screening. Therefore, one of the major barriers to uptake of CRC screening by eligible patients is inadequate knowledge among health care professionals. When nurses and physicians have inadequate knowledge regarding CRC screening and cancer screening guidelines for both average- and high-risk patients, this can significantly

contribute to underutilization of screening by eligible individuals. Strategies to enhance CRC screening should also consider integrating targeted efforts to address the deficiencies in curricula used to train nurses and physicians, increasing access to continuing professional education programs focusing on cancer prevention and screening, and access to evidence-based protocols and guidelines about CRC screening in clinical practice settings.

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### Conflicts of interest

There are no conflicts of interest.

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