



# Awareness and Knowledge of Colorectal Cancer Screening Among Medical Students at the University of Aleppo: A Cross-Sectional Study

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## Abstract

**Background** Colorectal cancer (CRC) is the third leading cause of malignancy in Syria. The aim of our study was to assess the awareness and knowledge of CRC and its screening methods among medical students at the University of Aleppo.

**Methods** A cross-sectional study of medical students at the University of Aleppo was conducted using a self-administered 12-element questionnaire. The questionnaire consisted of demographics, awareness of CRC, knowledge of CRC and its screening methods. Awareness of CRC included three questions asking students if they ever heard of CRC and its screening methods. Knowledge of CRC was evaluated through three sets of questions about CRC risk factors, signs and symptoms, and preventative methods. The students were selected randomly during academic lectures. A  $\chi^2$  or Fisher's exact tests for categorical variables were used for statistical analysis, as appropriate. A two-sided  $p < 0.05$  was considered statistically significant. We stratified students based on pre-clinical versus clinical years and average academic score.

**Results** A total of 824 students completed the questionnaire. The majority of students were aware of CRC (98.9%) and CRC screening methods (79.8%). Students had poor knowledge of CRC risk factors (16.5% for non-modifiable factors and 11.7% for modifiable factors), signs and symptoms (52.6%), and protective factors (9.9%). Only 31.7% of students were able to identify the appropriate age to initiate screening for average-risk individuals. Clinical students had better awareness and knowledge of CRC and its screening methods. Clinical students with higher academic score showed better awareness and knowledge in some elements.

## Keywords

- colorectal cancer
- screening
- Syria
- medical students
- awareness
- knowledge

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**Conclusion** Our study reported high awareness and poor knowledge rates of CRC and its screening methods among medical students at the University of Aleppo. Although clinical students had higher awareness and knowledge of CRC compared to pre-clinical students, the impact of academic score revealed variable results.

## Introduction

Colorectal cancer (CRC) is the second cancer-related cause of death worldwide following lung cancer.<sup>1</sup> Although Western countries have the highest incidence of CRC, an upward trend in the incidence has been described in the Middle East, especially in the Eastern Mediterranean coast countries.<sup>2,3</sup> In Syria, CRC was the third-most occurring malignancy with 1,890 new cases in 2018 and 1,248 deaths in the same year.<sup>4,5</sup>

CRC screening aims to detect early-stage cancers and precancerous lesions in apparently healthy individuals, which may lead to a reduction in CRC incidence and mortality.<sup>6,7</sup> Although the guidelines of CRC screening vary between countries and regions, the majority of professional societies recommend colonoscopy, fecal immunochemical test (FIT), computed tomography (CT) colonography, FIT-fecal DNA, and flexible sigmoidoscopy as acceptable screening tools.<sup>7-9</sup> Several studies from the Middle East reported low rates of CRC awareness among populations.<sup>10,11</sup> Nonetheless, these studies reported high rates of positive attitude toward screening. Better knowledge was associated with employment, high education, and high income.<sup>12</sup> In addition, adherence to regular checkups and family physician visits aided in raising the willing to undergo screening.<sup>13</sup>

Healthcare workers' awareness and knowledge of CRC and its screening methods are the mainstay of CRC early detection, especially in countries that lack national screening programs.<sup>14</sup> With proper knowledge of screening, physicians can improve patients' compliance and alter their perceptions of the anticipated barriers and benefits.<sup>15</sup> Patients who receive CRC screening recommendations from their physicians have a higher chance to be up-to-date in CRC screening than patients who do not.<sup>16</sup> Doctors who have ample experience performed better in higher risk CRC settings.<sup>17</sup> Therefore, the World Health Organization (WHO) indicated that raising the level of medical staff awareness in this area is an important element of their adopted cancer control strategy.<sup>2,14</sup>

The lack of national CRC screening programs in Syria is a major health problem that require further evaluation with research studies. Data are scarce regarding the awareness and knowledge of CRC among people and healthcare workers in Syria. The aim of our study was to assess the awareness and knowledge of CRC and its screening methods among medical students at the University of Aleppo.

## Methods

### Study Design

We conducted a cross-sectional study of medical students at the University of Aleppo–Faculty of Medicine during

the second semester of the academic year 2018–2019. The medical school at the University of Aleppo consists of one preparatory, two pre-clinical, and three clinical years. We included students only from the pre-clinical and clinical years because the preparatory year is a bridge to medical, dentistry, and pharmacy schools. We approached students during practical sessions to ensure that participants meet the eligibility criteria. Our selection method was completely random and students were approached during different dates and times of the week. We collected responses from students over a 1-month period. Students who were interested in the study received a 12-item questionnaire in a paper format and all responses were collected. All participants completed a written informed consent forms. We included all participants in the study and did not exclude any students. The study was approved by the Ethics Committee at the University of Aleppo.

### Questionnaire and Data Collection

There were 12 elements of the questionnaire in addition to questions about gender, class, and self-reported average academic score. The questionnaire was developed based on literature review and clinical knowledge of the research team. The questionnaire consisted of three main categories, awareness of CRC, knowledge of CRC, and knowledge of CRC screening. A final question regarding the potential of a student to recommend screening to family members and friend was subsequently added. Each of the three main categories consisted of multiple-choice questions and statements with three possible answers. Students responded to statements with (Yes), (No), or (I do not know) to eliminate random selection of correct answers. Awareness of CRC included three questions asking students if they ever heard of CRC, its screening methods, and the correct definition of the screening. Knowledge of CRC was evaluated through three sets of questions about CRC risk factors, signs and symptoms, and preventative methods. Knowledge of CRC screening methods was assessed through five sets of questions regarding the type of screening methods, appropriate age to initiate screening in average-risk individuals, and the outcomes of screening. Risk factors of CRC were divided into modifiable (e.g., obesity, red meat consumption, tobacco, and alcohol) and non-modifiable factors (e.g., age, sex, race, genetic factors, related syndromes). We also asked students about their perceptions of the barriers to CRC screening in the region. The questionnaire was administered in Arabic because Arabic is the official language in Syria and all medical subjects at the University of Aleppo–Faculty of Medicine are taught in Arabic. The structure of the

**Table 1** Characteristics of medical students

	Percentage (n)
Total	100 (824)
Gender*	
Female	52.4 (430)
Male	47.6 (390)
Class	
Second	17.3 (142)
Third	15.8 (130)
Fourth	26.7 (219)
Fifth	20.8 (171)
Sixth	19.4 (159)
Average score	
60%–69%	1.5 (12)
70%–79%	42.7 (345)
80%–89%	48.8 (394)
90%–100%	7.1 (57)

\*Four cases preferred not to report their gender.

questionnaire was built based on literature review and current knowledge of CRC and its screening methods. The questionnaire was distributed in a paper format and all responses were collected by the research team. A copy of the survey is included in Appendix A with an English translation.

### Statistical Analysis

We reported data as frequencies and rates and performed univariate analysis using  $\chi^2$  or Fisher's exact tests for categorical variables, as appropriate. The primary outcome of the study was the knowledge of CRC screening methods among medical students. The secondary outcomes were awareness of CRC, knowledge of CRC, and students' perceptions of barriers to CRC screening in the region. We divided medical students into pre-clinical and clinical groups. The pre-clinical group consisted of second- and third-year students and the clinical group consisted of fourth-, fifth-, and sixth-year students. We evaluated the difference in awareness and knowledge of CRC and its screening methods among both groups. In addition, we stratified clinical students based on their average academic scores into high-score group (80% and higher) and low-score group (below 80%). A two-sided  $p < 0.05$  was considered statistically significant. Data were entered in a Microsoft Excel (Redmond, Washington, USA)

document by the research team members. All statistical analyses were performed using STATA/IC (version 14.2; StataCorp LLC, College Station, TX, USA).

## Results

### Characteristics of Students

A total of 824 medical students completed the questionnaire that comprised 76.4% of the invited students. The majority of students were female (52.4%) and had an average academic score of 80% and higher (55.9%). Two-thirds of the students were in the clinical years, while one-third were in the pre-clinical years ([Table 1](#)).

### Awareness of Colorectal Cancer

The majority of students were aware of CRC (98.9%) and CRC screening methods (79.8%). However, only 38.9% of students defined screening correctly ([Table 2](#)). In comparison to pre-clinical students, clinical students were more aware of CRC (100% vs. 96.7%;  $p < 0.001$ ) and CRC screening methods (94.8% vs. 49.4%;  $p < 0.001$ ). Only half of clinical students compared to 18.7% of pre-clinical students defined screening correctly ( $p < 0.001$ ). Among clinical years, students with higher academic scores were significantly more aware of screening definition than students with lower academic scores (58.7% vs. 39.5%;  $p < 0.001$ ) ([Supplementary Table S1, available online only](#)).

### Knowledge of Colorectal Cancer

We evaluated students' knowledge of CRC in three categories: risk factors (modifiable, and non-modifiable), signs and symptoms, and protective factors. Students who were able to identify all elements of each category were considered knowledgeable of that category. Overall, non-modifiable and modifiable risk factors were identified by 16.5% and 11.5% of students, where clinical students were more knowledgeable than pre-clinical students ( $p < 0.001$ ). Clinical students were more knowledgeable than pre-clinical students in regard to signs and symptoms (70.6% vs. 16.1%;  $p < 0.001$ ) and protective factors of CRC (14.3% vs. 1.1%;  $p < 0.001$ ) ([Table 3](#)). Compared to clinical students with lower academic scores, clinical students with higher academic scores could identify signs and symptoms, and protective factors significantly higher (74.6% vs. 66.7%;  $p = 0.04$ ) (19.1% vs. 9.9%;  $p = 0.002$ ) respectively ([Supplementary Table S2, available online only](#)).

### Knowledge of Colorectal Cancer Screening Methods

Nearly one-third of clinical students and one-quarter of pre-clinical students identified the appropriate age to initiate

**Table 2** Awareness of colorectal cancer and screening methods

	Total % (n)	Pre-clinical % (n)	Clinical % (n)	p-Value
Awareness of CRC	98.9 (812)	96.7 (261)	100 (548)	< 0.001
Awareness of CRC screening methods	79.8 (647)	49.4 (131)	94.8 (515)	< 0.001
Awareness of screening definition	38.9 (315)	18.7 (50)	49.0 (264)	< 0.001

Abbreviation: CRC, colorectal cancer.

**Table 3** Knowledge of colorectal cancer

	Total % (n)	Pre-clinical % (n)	Clinical % (n)	p-Value
Risk factors				
Nonmodifiable	16.5 (133)	0 (0)	24.7 (133)	< 0.001
Modifiable	11.7 (94)	4.9 (13)	15.0 (81)	< 0.001
Signs and symptoms	52.6 (425)	16.1 (43)	70.6 (382)	< 0.001
Protective factors	9.9 (81)	1.1 (3)	14.3 (78)	< 0.001

**Table 4** Knowledge of colorectal cancer screening methods

	Total % (n)	Pre-clinical % (n)	Clinical % (n)	p-Value
CRC screening decreases the incidence of CRC	58.5 (478)	65.2 (176)	55.2 (302)	0.02
CRC screening decreases the mortality of CRC	87.6 (716)	81.5 (220)	90.7 (496)	0.001
CRC is a preventable disease	60.2 (489)	47.6 (128)	66.4 (361)	< 0.001
Knowledge of appropriate age to begin screening*	31.7 (260)	25.7 (69)	34.4 (189)	0.01
Screening methods				
Fecal occult blood test	79.0 (644)	59.9 (161)	88.5 (483)	< 0.001
CT colonography	55.2 (444)	48.1 (129)	58.8 (315)	< 0.001
Colonoscopy	89.4 (726)	83.6 (224)	92.3 (502)	< 0.001
Flexible sigmoidoscopy	84.3 (685)	75.8 (203)	88.4 (482)	< 0.001

Abbreviations: CRC, colorectal cancer; CT, computerized tomography.

\*In average-risk population.

screening in the average-risk population. The majority of clinical students identified fecal occult blood test (FOBT), flexible sigmoidoscopy, and colonoscopy as CRC screening tools. However, 55.2% of students identified CT colonography as a CRC screening tool (→ [Table 4](#)). Interestingly, more preclinical students than clinical students believed that CRC screening decreases the incidence of CRC (65.2% vs. 55.2%;  $p=0.02$ ). The majority of students in both groups (87.6%) believed that CRC screening decreases the mortality of CRC. Two-thirds of clinical students and 47.6% of pre-clinical students believed that CRC is a preventable disease ( $p<0.001$ ). In clinical students, there was a significant difference in identifying methods of screening between student with higher academic scores and students with lower academic scores except for FOBT (→ [Supplementary Table S3, available online only](#)).

### Barriers to Colorectal Cancer Screening in the Region

The majority of students believed that the lack of awareness (92.3%), lack of national screening programs (89.6%), and inadequate medical technology and support of screening programs (79.0%) are the main barriers to CRC screening in Aleppo, Syria (→ [Table 5](#)). About 10% of students believed that CRC screening is not necessary.

### Recommending Screening by Medical Students

In total, over 90% of students were willing to recommend CRC screening to family and friends. Some factors were noticed to have a significant association with higher tendency toward

**Table 5** Barriers to colorectal cancer screening in Aleppo, Syria

	Percentage (n)
Lack of awareness among people	92.3 (755)
Lack of national screening program	89.6 (724)
Inadequate medical technology and support of screening programs	79.0 (645)
Religious reasons	17.3 (141)
Lack of awareness among physicians	15.9 (130)
Distrust in western technology	15.3 (125)
No need for screening	9.7 (79)

this attitude. More female students (95%) were found to recommend screening than males (89.7%) ( $p<0.01$ ). In addition, advancement in academic years played a positive role in recommending screening, with 88.1% of recommendation rate among second-year students in comparison with 95.5% in fifth-year students, other academic years' students' rates fell in between ( $p=0.04$ ). Academic performance was also a significant factor, students with the highest average were all willing to recommend screening to friends and family, while the lowest were more hesitant with only 72.7% of recommendation rate ( $p<0.01$ ) (→ [Table 6](#)).

### Discussion

In our study, we evaluated the awareness and knowledge of CRC and its screening methods among medical students.

**Table 6** Association between recommending CRCs to family members and friends by students and other factors

	Recommend CRCs to family members and friends		
	Yes	No	p-Value
Total	742 (92.5)	60 (7.5)	–
Gender			< 0.01
Female	398 (95.0)	21 (5.0)	
Male	341 (89.7)	39 (10.3)	
Class			0.04
Second	118 (88.1)	16 (11.9)	
Third	111 (88.8)	14 (11.2)	
Fourth	205 (94.0)	13(6.0)	
Fifth	157 (94.0)	10 (6.0)	
Sixth	148 (95.5)	7 (4.5)	
Average score			< 0.01
60%–69%	8 (72.7)	3 (27.3)	
70%–79%	313 (93.4)	22 (6.6)	
80%–89%	354 (91.9)	31 (8.1)	
90%–100%	56 (100)	0	

Note: Total is different because some students did not answer this question.

Although the majority of students were aware of CRC and its screening methods, they demonstrated poor knowledge of CRC risk factors, signs and symptoms, and protective factors. Clinical students had better knowledge of CRC than pre-clinical students, which can be explained partially by exposure to clinical subjects and experience. Our study revealed that only 52.6% of students recognized the signs and symptoms of CRC, while their knowledge of CRC risk factors and protective factors ranged between 9.9% and 16.5%. These rates were consistent with the rates reported by other studies in the Middle East region.<sup>18–22</sup>

Medical students are the future physicians who will care for patients, so their awareness and knowledge of CRC screening are an utmost priority, especially considering that CRC is a preventable disease. CRC signs and symptoms were recognized by 70.6% of clinical students, however their knowledge of modifiable CRC risk factors was poor (15%). Recognizing modifiable risk factors by medical students allow them to counsel their patients and prevent CRC. Similarly, their knowledge of protective factors was poor; therefore, they may not be able to provide their patients with information about preventing CRC. Our study did not include medical residents and physicians, but the poor knowledge of medical students in clinical years is concerning because there is a large knowledge gap that needs to be filled. Furthermore, only one-third of students in clinical years identified appropriate age to initiate CRC screening in average-risk individuals. Their poor knowledge can affect their clinical performance in counseling patients regarding CRC screening.<sup>17</sup>

Students with high academic score had better knowledge of screening definition, signs and symptoms, and protective factors of CRC compared to students with low academic

scores ([►Supplementary Tables S1-S3, available online only](#)). Although our study did not adjust for other confounders, the medical curriculum probably has an impact on students' clinical knowledge. In contrast, students with low academic scores had better knowledge of CRC screening methods compared to students with high academic scores. The lack of information about CRC screening methods in the medical curriculum could be a contributing factor to these results. Further evaluation of the medical curriculum is needed to identify knowledge gaps in CRC screening and fill them based on current guidelines.

CRC is the third-most common cancer in Syria; nonetheless, there are no national CRC screening programs, which is one of the main CRC screening barriers identified by the students. There were historic successful government-led campaigns about smoking cessation and polio vaccination with significant impact.<sup>23,24</sup> There is a need for a national CRC screening program that increases awareness among Syrians, educates medical care providers, and establishes screening centers in government-based clinics and hospitals. Another main CRC screening barrier perceived by the students was the lack of awareness among people, which can be improved through national educational campaigns.

Our study shed some light on the poor CRC knowledge among medical students and identified the weaknesses in their knowledge. These findings will help us improve the curriculum at the University of Aleppo–Faculty of Medicine and set an example for other universities in Syria to follow. Further studies are needed to evaluate CRC knowledge of residents and practicing physicians in Syria, which can guide future national campaigns. Based on the results of this study, we recommend reviewing and revising the curriculum at the University of Aleppo–Faculty of Medicine to include



information about CRC and its screening methods. In addition, assessing students' knowledge about CRC and its screening methods in graduation examination (i.e., National Standardized Medical Examination) would be helpful to emphasize this topic. We also recommend establishing a cancer screening center at the Aleppo University Hospital to provide CRC screening to the public. Several studies revealed that population-based CRC screening programs are effective in decreasing the incidence and mortality of CRC.<sup>6</sup> Therefore, establishing a national screening campaign is essential to decrease morbidity and mortality of CRC in Syria.

The majority of students were willing to recommend CRC screening to their family and friends, which reflects a positive attitude toward CRC screening. However, we should aspire to full screening commitment in our future physicians, especially that screening has been recommended by many societies with proven benefits. Students in clinical or advanced years are typically more exposed to clinical knowledge and perhaps some literature and societies' recommendations; therefore, it is expected to observe better attitude in supporting screening and recommending good screening behavior to family members or friends.

There are several limitations of our study. Inherited limitations of cross-sectional studies that affected our study included recall bias, selection bias, and the presence of confounders. Our study relied primarily on students' memories to answer the questionnaire; therefore, recall bias could affect the results. However, our study had a large sample size, which may mitigate the effect of this bias. In addition, we did not collect information about socioeconomic status, personal and family history of CRC, and living situation if the person lives with family, friends, or alone. As a cross-sectional study, we cannot conclude causalities and strong associations; however, our study provided essential descriptive data that can be used for future interventions regarding CRC screening in Syria.

## Conclusion

Our study reported high awareness and poor knowledge rates of CRC and its screening methods among medical students at the University of Aleppo. Although clinical students had higher awareness and knowledge of CRC compared to pre-clinical students, the impact of academic score revealed variable results. In addition, we identified the perceived barriers of colorectal cancer screening in Syria among medical students.

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### Conflict of Interest

None declared.

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