RESEARCH ARTICLE

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Knowledge, Attitudes, and Practices Regarding Colorectal Cancer Screening Among Medical Residents: An Exploratory, Single-Center, Cross-Sectional Study from Egypt

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Abstract

Objective: Colorectal cancer (CRC) in Egypt has a high incidence of early-onset cases compared to Western countries. However, screening rates remain low, which may be attributed to a lack of physician awareness, as well as structural and logistical limitations. This study evaluated medical residents' knowledge, attitudes, and practices regarding CRC screening, their perceptions of patient barriers, and their awareness of the "100 Million Healthy Lives" national screening initiative. **Methods:** A self-administered, cross-sectional survey was conducted between September 10, 2023, and January 3, 2024, at Alexandria Main University Hospital (AMUH), Egypt. The survey was administered either face-to-face or online. We assessed the face, content, and structural validity of the questionnaire used. Descriptive statistics and bivariate analyses were performed, with associations evaluated using correlation and effect sizes. A significance level of $p < 0.10$ was adopted, given the exploratory nature of the study. **Results:** The study included 70 medical residents at AMUH. The majority were female (78.6%), with a mean age of 27.97 ± 1.3 years and an average of 2.6 ± 1.2 years of clinical experience. Only 55.7% were aware of the "100 Million Healthy Lives" CRC screening program. Overall, 72.9% of participants demonstrated adequate knowledge, 66.7% showed a positive attitude, and 51.4% exhibited good practice. A total of 15.7% recommended screening for asymptomatic patients "often/always," compared to 61.4% for symptomatic patients. Financial constraints (64.3%) and low patient awareness (60%) were the most frequently cited barriers. Adequate knowledge was significantly associated with a positive attitude (80.8% vs. 19.2%; $p = 0.078$; Phi = 0.282). **Conclusion:** Despite generally adequate knowledge, attitudes and practices regarding CRC screening among residents remain suboptimal, hindered by limited awareness of national resources and persistent structural barriers. Strengthening provider education, improving access to screening tools, and expanding awareness of national initiatives are essential to enhance early CRC detection in Egypt.

Keywords: Physicians- knowledge attitudes practice- Colorectal Cancer screening- patient barriers- Egypt

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Introduction

Colorectal cancer (CRC) is a leading cause of cancer-related mortality worldwide, affecting both developed and developing nations. As of 2022, CRC is the third most common cancer worldwide, with an estimated 1.9 million new cases and 903,859 deaths [1]. This burden is projected to rise to 3.2 million new cases by 2040 [2]. Global disparities in Colorectal Cancer (CRC) are profound, with morbidity and mortality rates varying by as much as ten-fold across different regions [3].

Historically, the burden of disease has been heaviest in High-Income Countries (HICs) such as Australia, New Zealand, the United States (U.S.), Hungary, and Norway. This prevalence is inextricably linked to 'Western' lifestyle factors, specifically physical inactivity, obesity, and the consumption of tobacco, alcohol, and animal-derived foods [4, 5]. Recent data, however, indicates a stabilization of rates in HICs, contrasted by a rising trend in Low- and Middle-Income Countries (LMICs) that is predicted to continue [3, 6]. A case in point is the Eastern Mediterranean Region (EMR), where increasing incidence over the past two decades has established CRC as the third most prevalent cancer and the fifth leading cause of mortality as of 2022 [7, 8]. Crucially, unlike the U.S. and parts of Europe, the EMR continues to struggle with

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significantly lower survival rates, underscoring critical inequities in treatment outcomes and access to care [9, 10].

In Egypt, an LMIC within the EMR, CRC is ranked as the 7th most common cancer and the 9th leading cause of cancer mortality, with an incidence rate of 9.8 per 100,000 cases recorded in 2022 [11]. Compared to patients in HICs, Egyptian patients are diagnosed at younger ages [12, 13] and later stages of CRC, often when it is too late to treat effectively [14]. Egypt recently recorded an alarming rate of 46.4% for early-onset CRC cases, defined as being diagnosed under the age of 50 [5, 12, 13]. In contrast, this figure is only 10% of the new cases in HICs [13, 15].

CRC screening programs have proven to be effective and are consistently recommended by clinical practice guidelines [16] and are associated with an over 60% reduction in both CRC incidence and mortality [17]. For example, the faecal immunochemical test (FIT) screening tool was associated with a 33% lower risk of death from CRC [18]. Furthermore, evidence from a meta-analysis of 29 studies that included a total of 4,713,778 individuals indicates colonoscopy was associated with a 52% reduction in the incidence of CRC and a 62% reduction in CRC mortality [19].

Structurally, the Egyptian healthcare framework provides mechanisms for early detection and care. The 100 Million Healthy Lives campaign in Egypt was launched in October 2018, initially focusing on eliminating hepatitis C and screening for non communicable diseases such as diabetes and hypertension. In June 2023, the initiative was expanded to include a sub program for early detection of cancer, offering free screening for several common cancers, including colorectal cancer, across the country [20]. Screening services, colonoscopy, and therapeutic interventions are accessible and covered by the health insurance system, which encompasses the workforce, university students, and other support networks [21]. However, the existence of these resources has not translated into effective prevention. Adherence to standard guidelines is minimal, largely due to the absence of physician recommendations [22]. For instance, a nationwide survey revealed that only 2.3% of screening-eligible individuals were referred for CRC screening [23], highlighting a systemic failure that likely sustains the high prevalence of late-stage and early-onset presentations observed in the population.

Countries with high CRC screening utilization demonstrate that patient adherence is influenced by healthcare professionals' (HCPs') knowledge and recommendation of screening tests [24]. HCPs' knowledge of CRC screening guidelines and resources is consistently identified as a key driver of whether patients complete screening, and provider recommendation is one of the strongest predictors of adherence across multiple studies and reviews [25, 26]. Therefore, examining HCPs' understanding of CRC screening and their awareness of available resources is crucial for addressing the current gaps in screening implementation.

Previous studies indicate that physicians in Egypt primarily refer symptomatic patients for CRC screening rather than recommending it routinely for asymptomatic individuals [27]. Reported barriers from a qualitative study of 17 primary care physicians included patient refusal, physician forgetfulness, time constraints in acute care, lack of reminder systems, and poor test tracking [28]. According to the best of our knowledge, there are no survey studies that assess the current Egyptian physician knowledge and behavior towards CRC screening. To develop effective interventions for increasing CRC screening in Egypt, and thus reduce CRC-related incidence and mortality, more data is needed to understand physician knowledge, behavior, and barriers to guideline-concordant screening recommendations. Hence, this study aimed to explore the knowledge, attitudes, and perceptions of Egyptian medical residents in Alexandria, Egypt, regarding CRC screening for their patients.

Materials and Methods

Study design and setting

This exploratory single-center study employed a cross-sectional survey to evaluate Egyptian medical residents' knowledge, attitudes, and practices related to CRC screening. The survey was conducted in English between September 2023 and January 2024 at Alexandria Main University Hospital (AMUH), and participants had the option to take the survey online or be given the survey face-to-face. The online survey was uploaded to a Google Form and distributed through professional networks and communication channels such as email, WhatsApp, and Telegram. The face-to-face survey used printed copies of the same questionnaire and was administered by trained data collectors in AMUH. The majority of responses 60 (85.7%), were obtained through the face-to-face survey.

Sampling method and study population

Convenience and snowball sampling techniques included eligible participants working as residents in non-surgical departments in AMUH. At the time of medical residency in AMUH, residents would have completed a period of 6 months to a year working in a primary health care center as primary healthcare physicians before joining the resident program. Consequently, "years of practice" was calculated cumulatively, commencing from the start of their service as primary healthcare physicians. The study thereby incorporated the residents' prior knowledge and competencies, ensuring that their responses also reflected clinical experience gained in primary care settings before residency training. Intern doctors and board-certified physicians were excluded. Recruitment utilized a multi-pronged approach, including word-of-mouth communication, flyers strategically placed within AMUH, email outreach, and outreach on social media platforms.

Data collection tool

This self-administered questionnaire included five domains. The first domain collected demographic data such as age, gender, number of years of practice, and specialty. The second domain included three questions assessing participants' awareness of the 100 Million Healthy Lives CRC screening program, sources of information about CRC, and perceived barriers preventing patients from undergoing CRC screening from the

physicians' perspective.

The third domain evaluated CRC knowledge using 22 dichotomous items ("Yes/No"). The items assessed residents' understanding across four key areas: general CRC awareness (preventability and treatment), epidemiology (age and sex distribution), screening test characteristics, and lifestyle-related factors (diet, physical activity, risk factors). A total knowledge score was generated, and the modified Bloom's cut-off of 60% of the maximum attainable score was used to classify respondents as having adequate or inadequate knowledge, as previously used in KAP studies [29, 30].

The fourth domain measured physicians' attitudes towards the feasibility, acceptability, appropriateness, and patient desirability of implementing CRC screening programs. Four items were rated on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). Only participants who indicated awareness of the 100 Million Healthy Lives CRC screening program were eligible to complete this section. Attitude scores were categorized according to the median values. Participants who scored above the median value of 14 from our sample distribution were considered to have a positive attitude, while those who scored below or equal to the median were considered to have a negative attitude.

The final domain included four questions on self-reported practices related to CRC screening using a five-point Likert scale (1 = never to 5 = always). Items assessed the frequency of recommending asymptomatic patients for screening, referring suspected patients for fecal occult blood testing (FOBT), initiating conversations about physical activity levels, and successfully convincing at-risk patients to undergo CRC screening. Practice scores were classified using the sample median; scores above 14 reflected good practice, whereas scores at or below 14 indicated poor practice.

Survey development

To develop the survey, the researchers conducted a comprehensive literature review and sought expert input. The expert board consisted of five individuals with expertise in oncology, family medicine, public health, internal medicine, and clinical nutrition. The expert panel assessed item clarity and relevance to ensure face and content validity, and the research team refined domains and items through iterative consensus meetings. Internal consistency was evaluated using Cronbach's alpha. The overall reliability of the assessment tool was good, with a Cronbach's alpha of 0.71[31].

A pilot test was conducted with 10 randomly selected residents using cognitive interviews to assess comprehension, readability, wording, and cultural appropriateness. Feedback was used to revise the instrument with minimal changes before final deployment, and the average completion time was estimated at 10–15 minutes. All pilot participants were excluded from the final analysis.

Ethical considerations

The study received ethical approval from the Institutional Review Board at Alexandria University Faculty of Medicine (No. 00012098). The study adhered to international research ethics guidelines. Informed consent was obtained from all participants after explaining the research objectives and benefits. Participants had the right to withdraw at any time, and anonymity and confidentiality were maintained.

Statistical analysis

All collected data underwent thorough review and quality checks before being entered into the Statistical Package for Social Sciences (SPSS), version 27 (Armonk, NY: IBM Corp), for analysis. Numerical variables were presented as the mean and standard deviation (SD), while categorical variables were presented using number (N) and percentage (%). A chi-square test assessed the association between the categorical variables. Independent-samples t-tests were performed to compare means. Effect sizes were calculated to quantify the magnitude of observed differences and associations, facilitating interpretation and power estimation [32]. A significance level of $p < 0.10$ was adopted, given the modest sample size and exploratory nature of the study.

Results

Sociodemographic characteristics of the study participants

A total of 70 residents participated in the study. The majority were female (78.6%), while 21.4% were male. The participants had a mean age of 27.97 ± 1.3 years, with ages ranging from 26 to 30 years. The average years of clinical experience was 2.6 ± 1.2 years, with a range of 1 to 5 years. Participants represented a wide range of medical specialties. The most common specialties were Endocrinology (12.9%), Cardiology (11.4%), Gastroenterology (11.4%), Diabetes (10.0%), and Hematology (10.0%). Other specialties included Tropical Medicine (8.6%), Geriatrics (8.6%), Rheumatology (7.1%), Hepatology (7.1%), Nephrology (7.1%), and Oncology (5.7%). Regarding awareness of the national initiative of CRC screening, 55.7% of participants reported having heard about the "100 Million Healthy Lives" program launched by the Egyptian government for CRC screening (Table 1).

Sources of CRC information and perceived screening barriers

Regarding sources of information utilized by medical residents regarding CRC, the medical school curriculum was the most frequently cited source (67.1%). Scientific websites (30.0%) were the next most common, followed by consulting with colleagues (24.3%). Less than one-fifth of the participants reported using research articles (18.6%), and social media was the least utilized source (4.3%) (Figure 1).

Physicians' perceptions of barriers that prevent patients from undergoing CRC screening included "Shortage of money," reported by 64.3% of participants, followed by "Less awareness" among the patient (60%). Other factors included "No interest in screening" (30%), "Shortage of time" (14.3%), and "Fear of stigma" (12.9%).

Table 1. Demographic Characteristics

Variables	Total	N= 70 (100)
Gender	Male	15 (21.4)
	Female	55 (78.6)
Age	Mean ± SD	27.97 ± 1.3
	Minimum-Maximum	26 - 30
Years of experience	Mean ± SD	2.6 ± 1.2
	Minimum-Maximum	5-Jan
Specialties	Endocrinology	9 (12.9)
	Cardiology	8 (11.4)
	Gastroenterology	8 (11.4)
	Diabetes	7 (10.0)
	Hematology	7 (10.0)
	Tropical Medicine	6 (8.6)
	Geriatrics	6 (8.6)
	Rheumatology	5 (7.1)
	Hepatology	5 (7.1)
	Nephrology	5 (7.1)
	Oncology	4 (5.7)

N, Frequency; (%), percentage

Knowledge regarding CRC

Overall, the majority of the residents showed adequate level of knowledge (72.9%, N=51). Regarding individual items, the highest level of correct knowledge was demonstrated on general cancer awareness. High accuracy was also noted concerning established risk factors, with over 80% correctly identifying the increased risk from smoking (81.4%) and family history (85.7%).

However, knowledge gaps were apparent concerning nutritional facts. Awareness was notably low regarding the protective effect of milk (10.0%) and calcium supplements (8.6%) against CRC risks (Table 2).

Attitude towards 100 Million Healthy Lives Initiative - Early Cancer Detection

Only 39 participants (55.7%) reported being aware of the "100 Million Healthy Lives" CRC screening program, and thus were directed to this section. Among this subgroup, 66.7%(N=26) demonstrated a positive attitude toward accessing the CRC screening program.

Findings of item-specific responses showed strong supportive attitudes across multiple domains. The highest level of agreement was observed for Provider Acceptance, with 74.4% of participants agreeing or strongly agreeing that colleagues in their practice location would accept the CRC screening program. Also, 61.6% of participants agreed or strongly agreed that the program is appropriate for their patients. The feasibility of Implementation received agreement from 53.9% of participants, while the Patient Desire domain showed slightly higher agreement

Table 2. Participants' Knowledge Regarding CRC (N = 70)

Question	Right Answer	
	N	%
1. CRC is preventable.	45	64.30%
2. CRC is treatable.	55	78.60%
3. CRC affects females more than males.	68	97.10%
4. The FOBT test is more sensitive than the FIT test.	57	81.40%
5. The most common age of development CRC in Egypt is 50s?	42	60.00%
6. Malnutrition is associated with relapse and progression of CRC.	52	74.30%
7. Physical activity decreases the risk of developing CRC.	52	74.30%
8. Regular physical activity reduces the negative side effects of cancer treatment.	54	77.10%
9. A minimum of 150 minutes of moderate intensity exercise per week is recommended for adults.	45	64.30%
10. Sugar overconsumption increases the risk of developing.	44	62.90%
11. Spicy food increases the risk of developing CRC.	33	47.10%
12. Processed meat increases the risk of developing CRC.	54	77.10%
13. Fried/fatty food increases the risk of developing CRC.	42	60.00%
14. Caffeine increases the risk of developing CRC.	54	77.10%
15. Calcium supplements decrease the risk of developing CRC.	6	8.60%
16. Multivitamin supplements decrease the risk of developing CRC.	37	52.90%
17. Whole grains decrease the risk of developing CRC.	42	60.00%
18. Milk decreases the risk of developing CRC.	7	10.00%
19. Alcohol consumption increases the risk of developing CRC.	42	60.00%
20. Smoking increases the risk of developing CRC.	57	81.40%
21. Old age increases the risk of CRC.	59	84.30%
22. Family history increases the risk of CRC.	60	85.70%
Overall Adequate Knowledge*	51 (72.9%)	

N, Frequency; (%), percentage; CRC, colorectal cancer; FOBT, faecal occult blood test; FIT, faecal immunochemical test; *Adequate Knowledge = score ≥60% correct

Table 3. Participants' Attitude Regarding the 100 Million Healthy Lives Screening Program (N = 39)

Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Implementing this CRC screening program in my practice location is feasible	3 (7.7%)	0 (0%)	15 (38.5%)	17 (43.6%)	4 (10.3%)
Providers in my practice location will accept this CRC screening program	2 (5.1%)	0 (0%)	8 (20.5%)	25 (64.1%)	4 (10.3%)
The 100 Million Healthy Lives CRC screening program is appropriate for the patients I care for.	3 (7.7%)	0 (0%)	12 (30.8%)	20 (51.3%)	4 (10.3%)
Patients in my clinic/hospital would desire to participate in this CRC screening program.	1 (2.6%)	2 (5.1%)	14 (35.9%)	17 (43.6%)	5 (12.8%)
Overall Positive Attitude			26 (66.7%)		

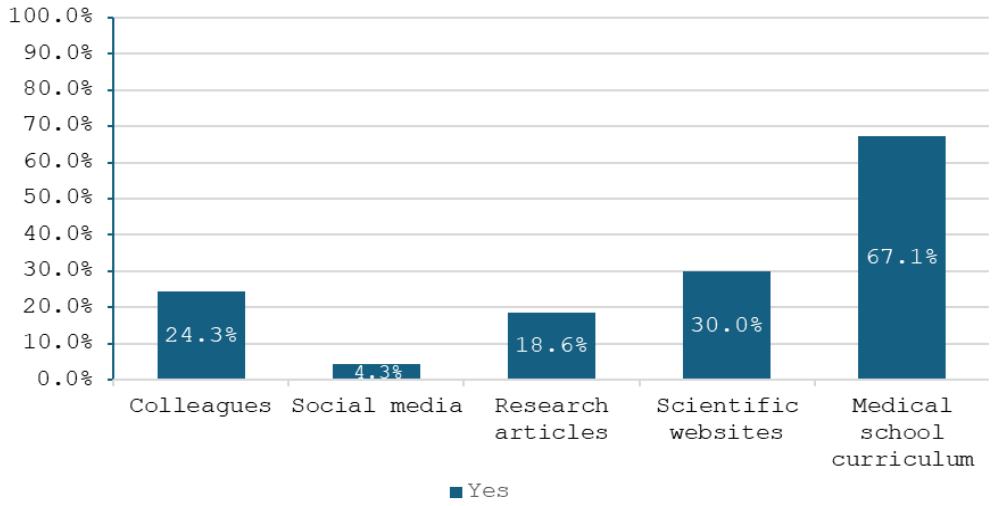

Figure 1. Source of Information about CRC (N=70)

(56.4%) (Table 3).

Practice toward CRC Screening and Prevention

Analysis of practice items showed that 51.4% (N=36) of medical residents demonstrated Good Practice, while 48.6% (N=34) had Poor Practice

Residents showed the lowest engagement in recommending CRC screening to asymptomatic patients. Only 15.7% reported recommending screening "Often/Always," whereas the majority (51.4%) did so only "Sometimes," and over one-third (32.9%) "Rarely/Never." Practice improved considerably when symptoms or suspicion were present. Referral for FOBT kits was performed "Often/Always" by a combined 61.4%. Engagement in lifestyle counseling was moderate, with 50.0% initiating discussions about physical activity "Often/Always," while one-third (34.3%) did so only "Sometimes." Regarding outcomes, 52.9% reported being successful in motivating at-risk patients to screen "Often" or "Always" (Table 4).

Correlation between knowledge and sociodemographic factors

Among the 70 participants, there were no significant differences in age (mean ± SD: 27.94 ± 1.27 vs. 28.05 ± 1.43 years; p = 0.754; Cohen's d = -0.085) or years of clinical practice (2.61 ± 1.23 vs. 2.79 ± 1.36 years; p = 0.596; Cohen's d = -0.143) between those with adequate and inadequate knowledge. Knowledge was also not significantly associated with gender (p = 0.206; Phi = 0.151), medical specialty (p = 0.895; Cramer's V = 0.266), or awareness of the national "100 Million Healthy Lives"

Table 4. Distribution of Practice Toward CRC Screening and Prevention (N = 70)

Practice Item	Never	Rarely	Sometimes	Often	Always
1. How often do you recommend asymptomatic patients to have CRC screening?	6 (8.6)	17 (24.3)	36 (51.4)	8 (11.4)	3 (4.3)
2. How often do you refer suspected patients for FOBT kits?	5 (7.1)	5 (7.1)	17 (24.3)	26 (37.1)	17 (24.3)
3. How often do you initiate conversations about physical activity/inactivity?	3 (4.3)	8 (11.4)	24 (34.3)	22 (31.4)	13 (18.6)
4. How often are you successful in motivating at-risk patients to screen for CRC?	3 (4.3)	10 (14.3)	20 (28.6)	30 (42.9)	7 (10.0)
Overall Good Practice			36 (51.4%)		

Table 5. Association between Pparticipants' Knowledge Level and Their Attitude and Practice Levels

Variable	Adequate Knowledge (n=51)	Inadequate Knowledge (n=19)	P-value*	Effect Size
Attitude Level (N=39), n (%)			[1]0.078*	0.282 (Phi)
Positive Attitude	21 (80.8%)	5 (19.2%)		
Negative Attitude	7 (53.8%)	6 (46.2%)		
Practice Level (N=70), n (%)			[1]0.509	0.079 (Phi)
Good Practice	25 (69.4%)	11 (30.6%)		
Poor Practice	26 (76.5%)	8 (23.5%)		

[1], Chi-Square test; * Statistical significance P value <0.1. Effect size, Phi for 2×2 tables.

initiative (p = 0.902; Phi = 0.015) (Table S1).

Certain specialties, such as hepatology (100% adequate knowledge), tropical medicine (83.3%), and rheumatology (80%), had higher proportions of adequate knowledge. Additionally, females tended to have slightly higher adequate knowledge than males (76.4% vs. 60%). Overall, while no statistically significant correlations were observed, the effect sizes and descriptive patterns suggest minor trends that may be explored in larger studies.

Correlation between knowledge, attitude, and practice levels

Table 5 presents the association between participants' knowledge level and their attitude and practice levels. A statistically significant association was observed between knowledge and attitude (p = 0.078; Phi = 0.282). Among participants with a positive attitude (N = 26), the majority had adequate knowledge (80.8%), whereas only 19.2% had inadequate knowledge. In contrast, knowledge level did not significantly differ according to reported practice, with adequate knowledge observed in 69.4% of participants with good practice and 76.5% of those with poor practice (p = 0.509; Phi = 0.079), indicating a small and non-significant association.

Discussion

CRC is emerging as a critical public health crisis in LMIC countries like Egypt. Public awareness and healthcare professionals' knowledge are critical factors influencing CRC prevention, early detection, and optimal treatment [33]. Although Egypt provides free CRC screening and treatment through its public healthcare system, the success of these efforts ultimately relies on whether frontline physicians are adequately informed, motivated, and engaged. Despite this, limited evidence exists related to physicians' awareness of CRC screening guidelines and national early detection programs. This study provides a comprehensive evaluation of knowledge, attitudes, and practices regarding CRC screening among Egyptian medical residents at AMUH.

Our findings reveal that only half of residents were aware of the "100 Million Healthy Lives" CRC national screening program, indicating insufficient dissemination of public health initiatives among medical trainees. This initiative, part of the National Multisectoral Action Plan for the Prevention and Control of Noncommunicable Diseases, was initially launched to support breast cancer control before expanding to other cancers, including CRC [34, 35].

This gap aligns with studies in Egypt and the wider Eastern Mediterranean Region (EMR), where physicians often lack comprehensive knowledge of national preventive programs, despite their central role in influencing patient adherence [36, 37]. This underscores the need for structured educational efforts during residency and continuing professional development to ensure alignment between national policy and clinical practice.

Knowledge Gaps

Although overall knowledge was relatively high, our study identified critical gaps in awareness of lifestyle and dietary prevention strategies. For example, only 8.6% recognized calcium supplementation and 10% recognized milk consumption as protective against CRC. These findings indicate that knowledge remains heavily weighted toward epidemiology and high-risk factors (e.g., smoking, family history) but is weaker in preventive lifestyle interventions. This aligns with a previous study in Saudi Arabia, where physicians were knowledgeable about screening initiation but lacked understanding of behavioral prevention [38]. Addressing these gaps is essential, as lifestyle modification remains a key component of CRC prevention. Notably, adequate knowledge was significantly associated with a positive attitude (80.8% vs. 19.2%), with a small-to-moderate effect size (p = 0.078; Phi = 0.282).

Attitudes Toward CRC Screening

Among residents aware of the national initiative, two-thirds demonstrated positive attitudes toward CRC screening. Correlation analysis showed that adequate knowledge was significantly associated with a positive attitude (80.8% vs. 19.2%), with a small-to-moderate effect size (p = 0.078; Phi = 0.282). This is reinforcing the interdependence between knowledge and attitudinal orientation, aligning with previous studies [39]. Residents expressed strong confidence in provider acceptance, perceived appropriateness for patients, and the feasibility of integrating screening into clinical practice. These findings are consistent with the literature demonstrating that physicians' attitudes strongly influences guideline adherence and preventive care behaviors [40]. Importantly, the observed trends suggest that interventions improving knowledge may have downstream benefits in shaping favorable attitudes, creating a reinforcing loop conducive to effective screening promotion.

Physician practice and Barriers

Physician recommendation is one of the strongest predictors of patient engagement in CRC screening [26]. Despite national insurance coverage for CRC screening, patient uptake remains low, with several studies citing limited provider recommendation as a major barrier [41, 42]. Allam et al. in a national-level study found only 2.3% of patients had ever been advised to undergo CRC screening despite being eligible, reflecting systemic disengagement at the provider level [23].

In the current study, residents recommended screening often/always for only 15.7% of asymptomatic patients, versus 61.4% FOBT referrals for symptomatic cases. This disparity underscores a persistent tendency toward reactive rather than preventive practice, a pattern documented across LMIC healthcare settings where competing workload demands, limited time, and low perceived patient readiness often shift clinical priorities toward acute complaints rather than routine screening [43]. Screening programs for CRC can impact population health meaningfully only when asymptomatic individuals who fulfil standard screening criteria are systematically identified and invited to participate. Strengthening provider training, streamlining workflow, and embedding prompts into electronic systems may help shift practice from reactive to proactive screening [44].

Furthermore, engagement in lifestyle counseling was moderate, with 50% routinely initiating discussions on physical activity. This moderate level of counseling reflects findings where physicians acknowledge the importance of physical activity but may face barriers in consistently addressing it during clinical visits [45]. Interestingly, good practice was not significantly associated with knowledge, indicating that other structural constraints, such as time limitations, clinic workflow, or system-level barriers, may limit practice regardless of individual motivation. Similar patterns have been observed in other studies where positive attitudes did not translate into routine preventive recommendations [46].

With regards to barriers, financial constraint was the most commonly reported. While this should not be a concern in Egypt due to the national screening program that provides free screening for CRC, the physicians' lack of awareness of this program decreases utilization of these services. Since optimal uptake should be targeted, proper education of healthcare staff, including physicians, as well as the general population, appears to be the two most crucial next steps.

Educational Interventions and System-Level Solutions

These findings highlight the importance of comprehensive educational interventions for both healthcare professionals and the public to promote the adoption of guideline-concordant CRC screening. For instance, an Egyptian team at Alexandria University developed an intervention focused on training medical students and healthcare providers to increase CRC screening awareness at primary healthcare units. This approach encouraged the adoption of faecal occult blood test (FOBT) kits by the public, leading to improved screening uptake [47]. Similarly, targeted training for primary care physicians (PCP) showed impactful results. Selby et al. showed that using training seminars for PCP resulted in an over 4-fold increase in the proportion of physicians who anticipated offering CRC screening to their patients [48]. Indeed, one study in Georgia indicated that primary care interventions led by trained physicians have achieved increases of nearly 50% in CRC screening participation [49]. Our findings reinforce the need for sustained physician education to optimize national screening efforts and bridge policy–practice gaps.

Implications and Future Directions

Our findings carry important implications for CRC prevention in Egypt. First, national screening initiatives must be systematically incorporated into undergraduate medical education and residency training. Second, continuing medical education should emphasize lifestyle counseling and preventive strategies, complementing knowledge of clinical risk factors. Third, system-level interventions, including electronic reminders, standardized referral pathways, and patient education materials, should be implemented to facilitate routine screening. Lastly, future studies should examine multiple centers, include long-term follow-up, and evaluate the impact of targeted interventions on actual screening uptake.

Limitations and Recommendations

A key limitation of this study is its single-centre exploratory design, resulting in a relatively small sample size. The cross-sectional design prevents establishing causal inferences. Also, participants may have provided responses they perceive as socially desirable, rather than their true beliefs or behaviors. Despite this limitation, the study provides valuable insights into the current knowledge and practices of Egyptian physicians at academic medical centers regarding CRC screening for their patients. It underscores the critical need for educational programs for healthcare staff. We recommend further research to validate the questionnaire through psychometric analysis and larger-scale studies to explore potential differences in healthcare workers' knowledge, attitudes, and screening practices across specialties.

In conclusion, our study has provided valuable insights related to Egyptian residents' knowledge, attitudes, and practices regarding CRC screening and associated risk factors. Limited familiarity with national screening initiatives and low recommendation rates for asymptomatic patients highlight missed opportunities for early detection. Overall, the majority of the residents demonstrated adequate knowledge and practice as well as a positive attitude towards CRC screening. Moreover, financial constraints, time limitations, and a lack of awareness emerged as key obstacles to CRC screening. Strengthening physician education and integrating national guidelines into training are essential to improving screening uptake. Coordinated system-level interventions and targeted awareness strategies are urgently needed to optimize the impact of CRC prevention efforts in Egypt.

Author Contribution Statement

Conceptualization, K.A., A.G., B.A.M., I.A., W.A., M.F., L.B.B.; methodology, K.A., A.G, B.A.M., I.A., A.M.T., A.A.A., L.B.B.; formal analysis, A.G, B.A.M., I.A., A.M.T., A.A.A.; data curation, B.A.M., I.A., A.M.T., A.A.A.; writing—original draft preparation, K.A., A.G., B.A.M., I.A., A.M.T., A.A.A., L.B.B.; writing-review and editing, K.A., A.G., B.A.M., I.A., A.M.T., A.A.A., L.B.B.; supervision, W.A., M.F. All authors have read and agreed to the published version of the manuscript.

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If any scientific Body approved it/ if it is part of an approved student thesis

This study was given Ethical approval by the Ethical Committee at Alexandria University Faculty of Medicine (Approval No. 00012098). All candidates have signed a consent, before participating in the study.

How the ethical issue was handled (name the ethical committee that approved the research)

This study was given Ethical approval by the Ethical Committee at Alexandria University Faculty of Medicine (Approval No. 00012098). All candidates have signed a consent form before participating in the study.

Availability of data (if applicable to your research)

The interview records and data used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Any conflict of interest

All authors have declared no competing interests.

Abbreviations

AI: Artificial Intelligence
AMUH: Alexandria Main University Hospital
AUHs: Alexandria University Hospitals
CDC: Centers for Disease Control and Prevention
CHW: Community Health Worker
CME: Continuing Medical Education
CRC: Colorectal Cancer
FQHC: Federally Qualified Health Center
FIT: Fecal Immunochemical Test
FOBT: Fecal Occult Blood Test
IRB: Institutional Review Board
LLM: Large Language Model
SDOH: Social Determinants of Health
UAB: University of Alabama at Birmingham
USPSTF: United States Preventive Services Task Force

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