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# Approval Sheet

Barriers to Colorectal Cancer Screening in the Eastern Mediterranean Region: A Scoping Review Using the Theoretical Domains Framework

By

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# Barriers to Colorectal Cancer Screening in the Eastern Mediterranean Region: A Scoping Review Using the Theoretical Domains Framework

By

Caleb Dean Hartley

B.A., Asbury University, 2019

Thesis Committee Chair: Ghada N Farhat, PhD, MPH

Thesis Committee Member: Yousef Khader, ScD, MSPH, MHPE, MSc

An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of Master of Public Health in

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2021

# Abstract

Barriers to Colorectal Cancer Screening in the Eastern Mediterranean Region: A Scoping Review Using the Theoretical Domains Framework

By Caleb Dean Hartley

Background: Colorectal cancer screening plays a key role in mitigating morbidity and mortality associated with the disease. Areas such as the Eastern Mediterranean Region experience a particularly large burden of colorectal cancer. While trends have been described at the country level within the region, it is important to understand what barriers exist to colorectal cancer screening, so that more effective interventions can be conceptualized and implemented.
Objectives: The aims of this paper are two-fold: first, to identify barriers related to colorectal cancer screening at the individual/at-risk population, provider, and system levels; second, to provide a proof-of-concept for the utility of the Theoretical Domains Framework in characterizing barriers.
Methods: A scoping review was conducted applying the TDF. The search strategy was conceptualized and implemented by searching three online databases that identified papers related to colorectal cancer screening in the Eastern Mediterranean Region. Duplicates were removed both automatically by EndNote and manually for those that remained by two members of the research team. Two data collection matrices, constructed according to the TDF, were used to extract data from papers relevant to the study topic. The first is a matrix that identified barriers to colorectal cancer screening at the individual, provider, and health system levels, as oriented from the perspective of the at-risk population. The second is a matrix that identified barriers related to recommending colorectal cancer screening and conducting screening at the individual/public, provider, and health system levels, oriented from the perspective of the provider.
Results: Barriers related to colorectal cancer screening are evident at the individual/public, provider, and health system levels. The most noted barriers among both matrices pertained to the domains of knowledge, emotion, environmental context and resources, and beliefs about consequences.
Conclusion: In understanding barriers at the individual, provider, and health system levels, more effective interventions can be developed to promote screening and early detection for colorectal cancer.

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## Acknowledgements

I am grateful to the Eastern Mediterranean Public Health Network for their guidance and assistance throughout this process. I would like to thank Dr. Yousef Khader of the Jordan University of Science and Technology for his unwavering support and wisdom, and Nupur Chhaachhi for helping make this work possible.

I would also like to thank my advisor, Dr. Ghada Farhat, for her flexibility, encouragement, and commitment in seeing this project through, as well as for challenging me throughout this work to strive for excellence. To Drs. Steven Yeh and Jessica Shantha, who have helped grow my interest in global health, thank you for all that you have done in helping me get to where I am today.

I would like to thank my family for how they have been consistent in supporting me throughout this process. Finally, to my fiancé Angie. Thank you for being by my side through it all.

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# Chapter 1: Introduction

## Background

Worldwide as of 2020, colorectal cancer (CRC) was the third most common cancer with 1.93 million cases diagnosed that year. Additionally, the World Health Organization (WHO) reported CRC to be the second most common cause of cancer death in 2020 with 935,000 total deaths (1). Despite advances in CRC care, the burden of CRC is predicted to steadily increase, with 2.2 million new cases and 1.1 million deaths projected by the year 2030 (2). This burden is predicted to continually increase, with over 3.09 million cases in the year 2040 (3).

While the burden of CRC is experienced throughout the world in various countries, certain regions experience a particularly sizable impact from the disease. An example is the Eastern Mediterranean Region (EMR), one of six World Health Organization (WHO) regions, that is comprised of 21 Member States, along with Palestine (Gaza Strip and West Bank) (4). Trends of CRC have been described at both regional and country-by-country levels within the EMR, and these studies demonstrate both the burden of CRC, as well as challenges to controlling the impact it has. Current CRC screening programs in the EMR that focus on early detection of disease have shed light on disease detection and the age of the individual at time of diagnosis. In the United Arab Emirates (UAE), an eight-year observational study revealed that 46% of cases of cancer among the 7540 colonoscopies included in the study were in individuals under the age of 50, with 14% being in individuals under the age of 40 (5). Regarding cancer stage at diagnosis, 63% of cases had advanced stages of disease, and the program was found to help with the early diagnosis of approximately 37% of cases in the study (5).

With the impact that colorectal cancer has, a robust, culturally appropriate, and empowering model for screening is necessary to mitigate its effect in the region. By leveraging current

knowledge on barriers to screening ascertained through an exhaustive scoping review, effective colorectal cancer screening programs can be developed and implemented in conjunction with stakeholders, as well as regional and country leaders.

## Statement of the Problem

With the burden CRC constitutes in the EMR, it should be of high priority to conceptualize and implement secondary prevention programs within the region to detect the disease at early stages and curtail its impact. Secondary prevention programs are noted in the literature to drastically reduce CRC's burden through a bifurcated approach: timely detection of the disease and appropriate treatment according to best clinical practices (1). Expert consensus is that CRC is among the most preventable cancers, largely through secondary prevention measures which can make significant advances in combatting CRC, even without significant lifestyle changes (3,6).

Many countries throughout the EMR have established national screening programs for CRC, such as the United Arab Emirates (UAE), Bahrain, Lebanon, Qatar, the Islamic Republic of Iran, Saudi Arabia, and Kuwait (Table 1) (3). Most countries, however, do not have a national screening program for CRC despite its significant burden. This is particularly concerning, especially in light of data from the WHO that indicate a high prevalence of CRC risk factors among adults in countries such as Jordan. These risk factors include physical inactivity (12.1%), obesity (28.1%), and smoking tobacco (26.2%), among other risk factors for adults (7).

Considering the aforementioned influences on CRC's burden in the EMR, a great deal of research has been done within the region. Specifically, the etiology of CRC, risk factors, barriers, and provider knowledge, awareness, and practices relating to CRC screening have all been

explored. However, much still needs to be ascertained regarding factors that influence CRC screening behavior across the EMR.

## Study Purpose

The goal of this project is to prepare the groundwork for a robust, culturally appropriate, and empowering model for secondary prevention, beginning with an assessment of barriers to CRC screening and early detection from the perspectives of healthcare providers and the general public. Identifying barriers and behavioral influences related to screening will inform interventions and guide capacity building efforts needed to launch screening programs at the national level. These barriers and behavioral influences will be examined in a tripartite manner at the individual, provider, and health system levels (Tables 2 and 3). The Theoretical Domains Framework (TDF) will be utilized to extract behavioral influences at each of these levels, from the point of view of the population at risk and that of healthcare providers.

## Significance

This project helps consolidate and expand the current knowledge base through a variety of mechanisms. In terms of evidence pertaining to CRC screening, numerous studies have been conducted throughout the EMR to understand factors that influence screening behavior in the population, whether they fall at the individual, provider, or contextual levels (15-52). To our knowledge a comprehensive synthesis of the literature that integrates these various levels of influence has not been done. This scoping review aims to apply a methodical approach, the Theoretical Domains Framework, to elucidate barriers for CRC at the individual, provider, and health-system levels, from the perspectives of the population at risk and providers. This evidence synthesis will inform the design and implementation of locally relevant and culturally

appropriate models for secondary prevention. On a methodological level, this review will further demonstrate the utility of the TDF to thoroughly characterize multi-level determinants of behavior. To our knowledge, this is the first time the TDF is used in the context of a scoping review to identify influences from existing studies.

# Chapter 2: Literature Review

## Burden of Colorectal Cancer

According to 2018 data from the Global Cancer Observatory, the EMR has an age-standardized rate (ASR) for colorectal cancer incidence of 8.3 per 100,000 population, and a corresponding mortality rate of 4.9 per 100,000 population. At the country level, Lebanon, Palestine (Gaza Strip and West Bank), and Jordan have the highest ASR incidence at 20.0, 19.1, and 17.0 per 100,000 population, respectively. In terms of ASR mortality, these countries have rates of 10.9, 11.9, and 9.3 per 100,000. Sudan, Pakistan, and Afghanistan have the lowest ASR incidence rates of 5.4, 4.2, and 4.0 per 100,000, respectively, with some of the lowest mortality rates of 3.9, 3.3, and 3.7 per 100,000 (Figure 1) (8).

According to data from the Lebanon National Cancer Registry and reported by the World Health Organization's Global Cancer Observatory, colorectal cancer made up 8.5% of new cases of cancer in 2018 among both sexes (9). The same data indicate that colorectal cancer was the fourth most common cancer among males and second most common among females. Further evidence from the Lebanese cancer registry indicate that CRC ranks third among the top causes of cancer mortality and morbidity (9,10). In comparison to other contexts in the EMR, Palestine (Gaza Strip and West Bank) had high ASR mortality and incidence rates at 19.1 and 11.9 per 100,000, respectively (8).

The Jordan National Cancer Registry reported that CRC was the third most common cancer (4.9%) in terms of the number of new cases in 2018 among both sexes. Among males, new cases of CRC made up 9.2% of new cases for the year, and for females, 10.9% (11). A November 2016 mortality report from Jordan similarly indicated neoplasms of the colon, rectum, and anus as one

of the leading causes of death in the country among deaths reported to the non-communicable disease directorate for the year 2013 (12).

While EMR countries such as Sudan have not experienced as large of a CRC burden compared to other countries in the region, they still face a considerable disease impact. Data from the Khartoum Cancer Registry of Sudan and reported by the WHO's Global Cancer Observatory identified CRC as the fourth leading cause of new cancer cases in 2018 among both sexes. Further, CRC was the fourth most common cancer among males and fifth most common among females in 2018 (13). This is corroborated by a 2016 study that found colorectal carcinoma tumors to be among the most identified tumors among the study population in Sudan (14).

Other countries like Pakistan and Afghanistan reported lower national burdens. 2018 data from the Punjab Cancer Registry in Pakistan found CRC to not be among the most common new cases of cancer in the country among males and females. Instead, colon cancer was identified as the sixteenth most common type of cancer, with rectum cancer being the eighteenth most common (15). According to 2018 data reported by the Global Cancer Observatory for the country of Afghanistan, rectum cancer was the twelfth most common type of cancer among both sexes and colon cancer the nineteenth (16).

In terms of age and cancer stage at diagnosis, limited data has been published from the UAE Iran, Saudi Arabia, and Jordan. An eight-year observational study published in 2019 from the UAE highlighted both age and cancer stage at time of cancer detection (5). Of the 7540 colonoscopies observed in the study, 46% of cases of cancer were detected in individuals under the age of 50 and 14% below the age of 40 years old. Fifty-three years was the average age of an individual diagnosed with colon cancer. In terms of cancer stage at diagnosis, data from the

Emirate of Abu Dhabi's Health Authority of Abu Dhabi (HAAD) revealed that 63% of cases were detected at advanced stages and that the screening program assisted with the early diagnosis of nearly 37% of CRC cases. Of these cases, 6.7% were in situ or at Stage 0 at time of diagnosis, 21.3% were at Stage I, while 8.9% were at Stage II (5).

A 2006 study from Iran revealed that 17% of CRC patients were under the age of 40 years. and 64.5% were at least 40 years-old (age was not determined in 8.5% of cases) (17). In Saudi Arabia, a 2015 study determined that the median age for presentation of CRC over a study period from 1994 to 2010 was 55 years for women and 60 years for men. As of 2010, 28.4% of patients in the study had CRC with distant metastasis, an indicator of an advanced stage of cancer (18). 2010 data from Jordan's National Cancer Registry indicated the median age at diagnosis of colon cancer for Jordanian females to be 64 years and 60 years for Jordanian males. For rectal cancer, these median ages at diagnosis were 56 years for Jordanian females and 59 years for Jordanian males (7).

## Etiology of Colorectal Cancer

Etiologic evidence from the EMR regarding CRC is very limited, being described in only a smattering of countries. Three primary studies are to note regarding etiologic evidence for CRC in the EMR. A 2017 paper from Lebanon noted risk factors such as dietary factors, air pollution, smoking, body mass, index (BMI), and a lack of physical activity as relating to various forms of cancer, including CRC (19). An 11-year epidemiological study, published in 2020, further identified risk factors related to CRC in Lebanon. Of note, use/consumption of alcohol and tobacco, as well as being overweight or obese, were identified as risk factors for CRC (20). Lastly, an eight-year observational study in the UAE identified both modifiable and non-

modifiable risk factors for CRC. An example non-modifiable risk factor that was identified was being of at least 40 years in age, and an example modifiable risk factor included the use of tobacco products such as shisha, medwakh, and cigarettes (5).

## Colorectal Cancer Secondary Prevention Programs

Colorectal cancer screening initiatives are found in a plethora of contexts, both under-resourced and well-resourced. Over the past two decades, a large number of CRC screening programs were established, especially in the EMR (Table 1). These programs have largely been categorized as having a population-based organization or a structured opportunistic organization. Of the programs in the EMR, the vast majority have a population-based organization. The UAE has a population-based organization for CRC screening whereas Bahrain, Kuwait, Lebanon, and Qatar have population-based pilot screening for CRC. The Islamic Republic of Iran, meanwhile, has a structured opportunistic approach to CRC screening (3).

While the organization of screening programs may differ, they have the same goal of decreasing mortality of colorectal cancer by detecting disease at earlier stages. For the population-based approach to CRC screening, the screening test varies. Whereas the majority of countries across the globe with the population-based approach use 2-step screening, the actual modalities of testing differ. It is noted that a lack of evidence from randomized, controlled trials (RCTs) about the efficacy of colonoscopies for screening, as well as a lack of equity in access, have impacted their uptake. For structured opportunistic screening, such as in the Islamic Republic of Iran, colonoscopies have been the preferential choice for screening measures (33).

Despite the increasing number of nationwide colorectal cancer screening programs throughout the EMR, the majority of countries in the region have not yet adopted or implemented such programs. At the World Health Organization's Fifty Eighth World Health

Assembly (16-25 May 2005), a resolution was passed for all countries to conceptualize and implement a national cancer control program (34, 35).

## Colorectal Cancer Screening Rates

While data on region-wide colorectal cancer screening rates for the Eastern Mediterranean Region are not available, some country-specific data exist. Palestine, Iran, Saudi Arabia, and Kuwait have identified national screening rates for colorectal cancer. A 2014 study of barriers to CRC screening in Palestine, in which all Palestinians over the age of 50 who resided in the West Bank were able to participate, found that only 14% (193 of 1352) of participants had undergone either colonoscopy or stool testing for CRC (36). The rate of CRC screening was 13% among women and 15% among men, a difference that was not statistically significant ($p = 0.38$). Further, women had a slightly lower rate of CRC screening by FOBT as compared to men (10.2% vs. 11%, $p = 0.72$). Similarly, women also had a lower rate of colonoscopy compared to men (5.7% vs. 8.4%, $p = 0.07$) (36).

According to a 2019 study in Kuwait, the screening rate for CRC was between 5 and 17% (37). A 2009 review focusing on colorectal cancer in Iran on both molecular genetics and epidemiological levels noted the country's rate of CRC screening as 'negligible' (33). As of a 2014 study, no CRC screening rate had been reported in Saudi Arabia (38). Similarly, as of a 2016 study, no data or statistics pertaining to CRC screening in Oman had been reported (39). To our knowledge, data on screening rates do not exist for any other EMR country.

# Chapter 3: Manuscript

## Barriers to Colorectal Cancer Screening in the Eastern Mediterranean Region: A Scoping Review Using the Theoretical Domains Framework

### Contribution of the Student

The student was responsible for project conceptualization, data collection, coordination of the scoping review process, synthesis of data, and manuscript preparation.

### Abstract

Background: Colorectal cancer screening plays a key role in mitigating morbidity and mortality associated with the disease. Areas such as the Eastern Mediterranean Region experience a particularly large burden of colorectal cancer. While trends have been described at the country level within the region, it is important to understand what barriers exist to colorectal cancer screening, so that more effective interventions can be conceptualized and implemented.
Objectives: The aims of this paper are two-fold: first, to identify barriers related to colorectal cancer screening at the individual/at-risk population, provider, and system levels; second, to provide a proof-of-concept for the utility of the Theoretical Domains Framework in characterizing barriers.
Methods: A scoping review was conducted applying the TDF. The search strategy was conceptualized and implemented by searching three online databases that identified papers related to colorectal cancer screening in the Eastern Mediterranean Region. Duplicates were removed both automatically by EndNote and manually for those that remained by two members of the research team. Two data collection matrices, constructed according to the TDF, were used to extract data from papers relevant to the study topic. The first is a matrix that identified barriers to colorectal cancer screening at the individual, provider, and health system levels, as oriented from the perspective of the at-risk population. The second is a matrix that identified barriers related to recommending colorectal cancer screening and conducting screening at the individual/public, provider, and health system levels, oriented from the perspective of the provider.
Results: Barriers related to colorectal cancer screening are evident at the individual/public, provider, and health system levels. The most noted barriers among both matrices pertained to the domains of knowledge, emotion, environmental context and resources, and beliefs about consequences.
Conclusion: In understanding barriers at the individual, provider, and health system levels, more effective interventions can be developed to promote screening and early detection for colorectal cancer.

# Background

Colorectal cancer (CRC) is a noncommunicable disease (NCD) that often starts as a polyp on the inner lining of the rectum or colon (1). While not all polyps turn into cancer, those that do can create a large burden for the infected individual. The burden of CRC is variable on the global scale, some regions experience a sizable impact from the disease. One example is the Eastern Mediterranean Region (EMR), one of six World Health Organization (WHO) regions that includes 21 Member States, along with Palestine (Gaza Strip and West Bank) (2). Trends of CRC have been described at both regional and country-by-country levels within the EMR. As of a 2019 article from the Eastern Mediterranean Health Journal, CRC was the second most common cancer in the EMR (3,4). Similarly, a 2016 policy statement released by the World Health Organization (WHO) highlighted a rising incidence of CRC in various countries in the region (5).

In cancerous polyps, disease severity and outcomes can often be mitigated when polyps are detected at earlier stages of development. In these early stages of disease progression, treatments are likely to be more effective and less costly compared to more advanced stages (5). Screening for polyps in the colon and rectum, subsequently, is an effective means to detect CRC and reduce its morbidity, mortality, and cost. Several modalities for screening for CRC exist, including colonoscopy, flexible sigmoidoscopy, stool tests, and CT colonography (6,7).

The growing burden of CRC in the EMR requires a multipronged reponse that necessarily includes seconday prevention. To be effective, screening and early detection interventions need to be culturtally tailored, evidence based, and informed by theories of behavior and behavior change (8-11). While crucial for successful implementation, changing behavior at the individual level is not an easy task and is often predicated on a series of behaviors and contexts that occupy

multiple levels, e.g., the patient, provider, and health system (12). For a behavior such as undergoing screening for colorectal cancer, its multi-level determinants need to be elucidated before interventions aimed at promoting screening are designed.

A novel framework to identify multi-tiered factors that influence behavior is the Theoretical Domains Framework (TDF), a consolidative approach to integrating theories of behavior change that is being used more widely and across a multitude of disciplines (12). The TDF is organized around 14 theoretical domains that serve as foci for assessing problems and barriers relating to implementation. While the TDF, a consolidation of 33 behavioral change theories, has now been used in a multitude of ways, it was originally created for implementation science, specifically for the means of identifying influences on behavior among health professionals (13, 14). This original intention for the development of the TDF informs the aims of this paper, which are to: (1) identify barriers to recommending and undergoing colorectal cancer screening among health professionals and the public, respectively, and (2) provide a proof of concept for the utility of the TDF in conjunction with a scoping review to thoroughly identify such barriers from existing studies.

## Methods

*Study Selection*

No restrictions were placed on the research approach (mixed methods, quantitative, qualitative) nor the study design (cross-sectional, cohort, etc.), so long as the paper met the following eligibility criteria: (1) the study setting was one of the countries part of the EMR, (2) the study timeframe was between 2000 – 2021, (3) the paper focused on CRC screening, and (4) the paper focused on barriers or determinants of CRC screening. The identified articles were

divided among two reviewers who independently determined eligibility. First, the title and abstract of each work was examined to decide if it was eligible or not. In cases where eligibility was questionable, the full paper was read to reach a determination. Such instances were also brought to the attention of the research supervisor to ensure proper designation of papers in question.

*Search Strategy*

A search strategy was built to identify literature pertaining to CRC screening in the EMR. The overarching search strategy, which was established a priori to data collection, was conducted through two outlets, PubMed and Scopus. While terms such as 'colorectal cancer' and 'screening' were used, related terms (as informed by the literature) were similarly included in the search strategy. Examples of terms related to 'colorectal cancer' included 'intestinal neoplasms', 'bowel cancer', 'rectal cancer', 'rectum cancer', and 'colon cancer'. Additionally, terms related to 'screening' included 'prevention and control', 'early detection', 'early detection of cancer', 'campaign', 'outreach', and 'guideline(s)'. Geographically, the search was limited to the EMR, so the name of each country was included in the search strategy, along with 'EMRO' (WHO Regional Office for the Eastern Mediterranean) and 'eastern Mediterranean'. In terms of temporality, literature from 2000 – 2021 was included, and as applicable, this time parameter was included in the text of the search equation (Scopus). In the case of PubMed, a built-in function was used to restrict the time parameters to the 2000-2021 timeframe.

*Extraction of Data*

Informed by the TDF, two data extraction matrices were designed and used to collect and organize data from eligible studies. The first matrix captured the individual/ at-risk population perspective towards barriers and influences to 'undergoing screening', categorized according to the 14 domains of the TDF, and aggregated across the individual (self), healthcare provider, and health system levels. The second matrix was oriented towards the provider's perspective and targeted barriers for two separate behaviors, 'recommending screening' and 'conducting screening'. The term 'provider' was used to refer to physicians, nurses, pharmacists, and other healthcare workers/providers. Similar to the first matrix, barriers identified by providers were organized around the 14 TDF domains and aggregated across the individual (patient), healthcare provider (self), and health system levels. The TDF classifies influencing factors according to 14 domains: knowledge, skills, social/professional role and identity, beliefs about capabilities, optimism, beliefs about consequences, reinforcement, intentions, goals, memory, attention and decision processes, environmental context and resources, social influences, emotion, and behavioral regulation. While each domain is complex, they can be defined simply while articulating associated constructs. For this work, the original definitions and constructs of each domain were used, as defined in the seminal work that validated the TDF's utility in implementation research (12).

Knowledge was defined as awareness regarding the existence of something, and associated constructs include knowledge of task environment and procedural knowledge. Skills were defined as proficiency or ability that is acquired through practice. Associated constructs included competence, ability, practice, and skill assessment, among others. Social/professional role and identity was defined as a cogent set of personal qualities and behaviors of an individual that are

displayed in a work or social setting. Related constructs included leadership, identity, organizational commitment, professional boundaries and confidence, and group identity. The beliefs about capabilities domain was defined as the acceptance of the reality, truth, or validity of a talent, ability, or facility that a person can put to use in a constructive way. Professional confidence, self-esteem, perceived behavioral control, and self-confidence were some of the constructs associated with this domain (12).

The optimism domain was defined as confidence that desired goals will be attained or that things will happen for the best, and constructs for this domain included identity, pessimism, and optimism. The beliefs about consequences domain was defined as the acceptance of the reality, truth, or validity about outcomes of a behavior in a given situation. Constructs associated with this domain were outcome expectancies, consequents, anticipated regret, and beliefs. Reinforcement was defined in the seminal work as the resulting increased probability of a response, due to the coordinating of a contingency or dependent relationship between the response and stimulus. Constructs for this domain included rewards, contingencies, sanctions, punishment, and incentives. Intentions were defined as the conscious decision to resolve to act in a particular way or to perform a certain behavior. Stability of intentions, stages of change model, and the transtheoretical model for stages of change were constructs associated with this domain (12).

The domain of goals was defined as mental representations of end states of outcomes that an individual desires to achieve. Constructs related to this domain include goals, target setting, implementation intention, and action planning. The memory, attention, and decision processes domain was defined as the ability to retain information, selectively focus on certain aspects of the environment, and choose between alternatives. Related constructs included tiredness,

cognitive overload, attention, attention control, memory, and decision making. Environmental context and resources was defined as any circumstance of an individual's environment or situation that modifies social competence, independence, adaptive behavior, and skills and abilities. Related constructs include environmental stressors, salient events and critical incidents, barriers and facilitators, organizational climate/culture, and resources. Social influences were defined as interpersonal processes that cause a change in thought, feeling, or behavior for an individual. Constructs such as modelling, group identity, social norms and social pressure, power, and intergroup conflict, among others, were associated with this domain (12).

The domain of emotion was defined as a complex pattern of reaction that involve behavioral, physiological, and experiential elements, in which an individual tries to with an event or matter that is personally significant. Fear, anxiety, affect (positive or negative), stress, and burn-out were all associated with emotion. Behavioral regulation, defined as anything seeking to manage or objectively change observed or measured actions, has several constructs associated with it, including action planning, breaking habit, and self-monitoring (12).

Data were extracted from the literature according to the 2 matrices. Data extraction was highly granular and included quotes and verbatim descriptions of identified barriers (Tables 1 and 2).

*Data Validation*

Through the whole process form study selection to data extraction and synthesis, several mechanisms were in place to promote validity and consistency. As noted above, two reviewers worked independently to determine eligibility of papers that were yielded from the application of the search strategy and to extract data according the TDF matrices. Each was in charge of a

subset of the articles. Uncertainty about eligibility or categorization of extracted data was brought to the rest of the research team for discussion, with the research supervisor making a final determination. Additionally, the independent researchers cross-checked the data extraction of one another. Any discrepancies in applying the TDF matrix were brought for discussion by the full research team.

*Synthesis of Data*

Extracted data, in granular verbatim form, were placed in the respective level (individual, provider, health system) and TDF domain of the applicable matrix. Domains not covered in the literature were designated as gaps in the literature and foundations for future work. In addition to granular data extraction, we further synthesized the data by collapsing identified factors that bear a similar meaning under common themes (Figures 1-3).

## Results

***Descriptive results***

From 1049 pieces of literature, 119 papers were eligible for data extraction (Figure 4). Overall, the papers varied in their study location throughout the EMR. Additionally, they varied in study type, and focused to different degrees on barriers to CRC screening as a primary aim (Table 3). For the patient oriented TDF (Table 1), factors related to 12 of the 14 TDF domains were identified, and the domain with the richest data was ‘Knowledge.’ For the provider oriented TDF, factors that influenced barriers to recommending and conducting CRC screening were identified in 7 of 14 domains. The ‘Knowledge’ domain, too, was the domain with the most results (Tables 1 and 2).

### *Barriers to CRC screening*

#### *Knowledge*

Knowledge was the most identified domain in the literature in both the individual and provider matrices. From the public/individual perspective, barriers to undergo screening for CRC have knowledge-related factors at the public, provider, and health system levels. Regarding individual-level factors, poor knowledge/lack of awareness of CRC symptoms, risk factors, and screening modalities were the most commonly cited factors (15-29). Other factors such as being unaware of the potential severity of CRC, having low functional health literacy skills (FHLS) and literacy rates, and education level were also factors that contributed to screening barriers at the individual level (30-34). Regarding provider-level factors, the public noted low awareness and knowledge of symptoms and risk factors for CRC among medical students, in addition to provider education level impacting screening (26, 35). Health system-level factors included a lack of government awareness campaigns (36).

With the provider-oriented TDF, knowledge-related factors were noted at all levels: patient, provider, and health system. Providers noted a low level of public awareness of CRC, signs, symptoms, and screening tests, (23 27, 37-38). Among providers, it was noted that some believed that only those who are high-risk for CRC should be screened, along with a broader unfamiliarity with CRC screening modes, frequency, symptoms, and risk factors (15,26-27,39-41). Factors at the health system and contextual levels were not directly identified in the literature outside of a few factors. These factors include inadequate training for laboratory technicians and providers, a lack of hospital policy/procedures for screening, healthcare provider (HCP) shortages, long wait times, and acute availability of screening services (38-39).

*Skills*

Low literacy rates were the only noted barriers from the public perspective (34). Meanwhile, providers noted a low inability for providers to identify the correct screening test for a patient (42). Additionally, inadequate training for laboratory technicians and providers was also noted (39). No other skill-related factors were identified in the literature.

*Social/Professional Role and Identity*

From the public perspective, barriers to undergoing CRC screening, as they pertain to social/professional role and identity, included findings that women were more likely to undergo FOBT as compared to men, and that those who have a higher level of education are more likely to undergo screening for CRC (28). In terms of provider-level factors, findings that male primary care physicians are less likely to recommend CRC screening were noted in the literature (35). No factors were indicated in the literature for provider barriers to recommending and conducting CRC screening in relation to social/professional role and identity.

*Beliefs about Capabilities*

For the public, two studies found that more participation in CRC screening was influenced by higher perceived self-efficacy (28,43). For providers, they noted a lack of confidence to be able to perform and interpret screening tests in an appropriate manner (39).

*Beliefs about Consequences*

The public/individual noted several individual-level factors related to beliefs about consequences. Many studies noted a poor estimation (often underestimation) of risk for CRC,

often stemming from a lack of family history of CRC, having no clinical symptoms, being of young age, or perceived self-immunity (28, 31, 33, 34, 40, 44-48). No factors were noted among providers or at the provider or health system levels from the view of the public/individual.

*Optimism*

One study indicated that a positive perception (in terms of self-efficacy) of FOBT uptake strongly predicts undergoing screening (28). No factors were noted among providers or at the provider or health system levels from the view of the public/individual.

*Reinforcement*

Several reinforcement-related factors were noted at the individual and provider levels from the view of the public. The first of these is a non-acceptability of having a colonoscopy performed without some form of sedation, as well as a lack of physician recommendation for screening (31, 49). From this same view, but at the provider level, a lack of physician recommendation for screening and an absence of screening reminders by healthcare workers were factors noted in the literature (20, 34, 44, 48, 50). For providers, the only factor cited at any level was a lack of emphasis on prevention for providers (39).

*Intentions*

The public noted a low priority for personal health and seeking health care. In turn, low priority for health and health care contributed to a low or overall lack of intention to seek health care services and valued personal health (21). The public also noted a distrust of Western

medicine (31). Only a lack of emphasis on prevention among providers was extracted from the literature and from the provider perspective (39).

*Goals*

No factors were extracted for 'Goals' for either TDF.

*Memory, Attention, and Decision Processes*

The only factor extracted for the memory, attention, and decision processes domain was a lack of reminders by healthcare workers (44).

*Environmental Context and Resources*

A plethora of factors at each level were extracted for both TDFs. Time restraints, religious objection, religious protection, urban residents being more likely to undergo screening, and a distrust of Western medicine were all extracted from the literature review at the individual level for the public (17,31,33,44,51). For provider-related factors, distrust of physicians and poor physician-patient relationships were noted as barriers to undergoing CRC screening (21). At the health system level, cost, a lack of screening facilities, difficulty in arranging transport to and from testing facilities, and low socioeconomic status were all found to be barriers to CRC screening (17, 21, 24, 34, 36, 41, 46, 52).

When it comes to the provider perspective, providers noted socioeconomic status among some patients as an individual-level factor that is a barrier to recommending screening (39). For providers, they noted inadequate training a barrier to recommending CRC screening (39). At the health system level, inadequate training for laboratory technicians was a barrier to

recommending screening, and a lack of specialists, absence of hospital policy and protocols for cancer screenings, shortage of healthcare workers, acute availability of screening services, and long wait times were all indicated in the literature as barriers to conducting CRC screening (37-39).

*Social Influences*

In the Social Influences domain in the public TDF, individual level factors included low social support while no factors were listed at any level for providers (51).

*Emotion*

The Emotion domain was well-defined among the public at the individual level. Fear, as it relates to test results, undergoing screening, endoscopic procedures, and potential pain from screening are all factors were commonly identified at this level (15, 17-18, 20-21. 23, 25, 31, 34, 36, 40, 45-46, 51). Additionally, anxiety, shyness, embarrassment/shame, weariness of screening being conducted by a provider of the opposite sex, and a 'bad feeling' were also described in the literature (15, 17-18, 21, 23, 25, 31, 51). Among providers, the only factor in the Emotion domain was that which related to recommending screening was the patients' fear of painful procedures (23).

*Behavioral Regulation*

No factors were extracted for 'Behavioral Regulation' for either TDF. An example of behavioral regulation includes using the Head-Toes-Knees-Shoulders (HTKS) to measure a child's ability to integrate memory, attention, and inhibitory control tasks (53).

# Discussion

The goal of this paper was two-fold, the first being to identify influences on behavior among health professionals and the public as they relate to barriers to CRC screening. The second is to provide a proof of concept for the utility of the TDF in conjunction with a scoping review. Upon interpretation of the matrices developed from this work, it can be concluded that the major barriers to CRC-related decision making pertain to the domains of knowledge, environmental context and resources, and emotion. Collectively, these domains were the most cited in the literature that was examined for this work. Each of these domains offer a starting point to improve and refine current interventions, in addition to guiding current and future planning of interventions.

This scoping review applied a methodical approach, the Theoretical Domains Framework, to answer two questions related to colorectal cancer screening in the EMR: 1) what are the barriers to undergoing screening from the perspective of the general public/ population at risk? And 2) what are the barriers to recommending and conducting screening, regarded as two independent behaviors, from the perspective of healthcare providers? The work used an ecological approach to generate for each of the two perspectives a comprehensive assessment of factors that influence screening aggregated according to the individual, provider, and health system levels. It also demonstrated the utility of the TDF in conjunction with a scoping review to thoroughly identify barriers to a certain behavior from existing studies.

Understanding behavioral influences at the individual, provider, and health system levels is crucial to successful and effective interventions. Data synthesized in this review provides a rich foundation for conceptualizing and implementing locally relevant and culturally appropriate screening programs throughout the EMR.

Multiple influences on behavior, coalescing with various TDF domains, were identified. For example, ‘Knowledge’ emerged as the richest domain and the most commonly reported influence on CRC screening-related behaviors across studies (15-41). Interestingly, both the individual and provider perspectives highlighted the multi-faceted impact of knowledge on CRC-related decision making. From the individual perspective, both personal knowledge about CRC (risk factors, symptoms, screening modalities, etc.) and perceived provider knowledge of the disease emerged as factors that influence screening (15-30). This was nicely complemented by the provider’s perspective, which identified limited knowledge of CRC-associated concepts (risk factors, screening modalities and frequencies, symptoms, etc.) at the provider level, as well as perceived patient knowledge, as barriers to recommending or conducting screening (15, 23, 26-27, 38-41). The convergence of both perspectives around shortcomings in knowledge, among patients and providers alike, warrants prioritizing this domain in future interventions to promote screening.

Aside from knowledge, various TDF domains were linked to screening, including environmental context and resources, emotion, and beliefs about consequences (Tables 1 and 2). On the other hand, no data was identified for the domains of behavioral regulation, goals, and memory, attention, and decision processes. Investigating barriers that belong under these domains is warranted for a thorough accounting of influences on the decision-making process related to screening. Of note, some factors identified in the literature were cross-listed across multiple domains (i.e., lack of government awareness campaigns). This contributes to the factual basis of the complexity of factors that influence screening.

In general, only a small amount of data pertaining to health system level factors were identified through the scoping review. This is an indicator of the scarcity in research oriented

towards assessing the capacity of the health system for cancer prevention and control. In comparing the amount of data in the two matrices, little data were extracted that was oriented from the perspective of the provider. This signals a need for additional research targeting providers.

The strength of this work is multifaceted. First, the utilization of the 14 domains of the well validated TDF lends itself to a comprehensive assessment of barriers, as the TDF has been validated in various aspects. Subsequently, the use of the TDF in this work provides methodical strength. Third, the ecological component of the work, that is, exploring barriers at the public/at-risk population, provider, and health system levels, provides a multitude of levels to collect and further explore data. Finally, the dual perspective of patients and providers provides a means of validation of barriers that were identified. Synergistically, these strengths help enable target interventions at a number of domains and levels, even among varying audiences.

In spite of the rigor of this work, several weaknesses should be taken into account. First, only papers in English were included in the search strategy. This may have, subsequently, excluded papers that are valuable to this topic. Second, the 2000 – 2021 timeframe specified in the search strategy may not have been a wide enough timeframe to gather important works. Finally, the list of terms related to ‘colorectal cancer’ and ‘screening’, while comprehensive, was not exhaustive. As such, the papers that used related terms that were not included in the search strategy were likely missed.

## Conclusion

This study aimed to identify barriers related to CRC screening in the EMR by means of utilizing the TDF framework in synchrony with a scoping review to help generate a comprehensiveness assessment. This novel approach of using the TDF to perform a methodical

scoping review yielded two matrices that were used for data extraction: one oriented from the individual/public/patient level, and the other from the provider level. These matrices highlight behavioral influences across 14 domains that impact barriers to undergoing, as well as recommending and conducting, CRC screening. The matrices can be used as a foundation in which CRC screening programs are shaped, ideally yielding more effective, culturally tailored advances to CRC prevention and control.

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# Figures and Tables

Figure 1. **Barriers to Colorectal Cancer Screening in the Eastern Mediterranean Region: Individual Level**

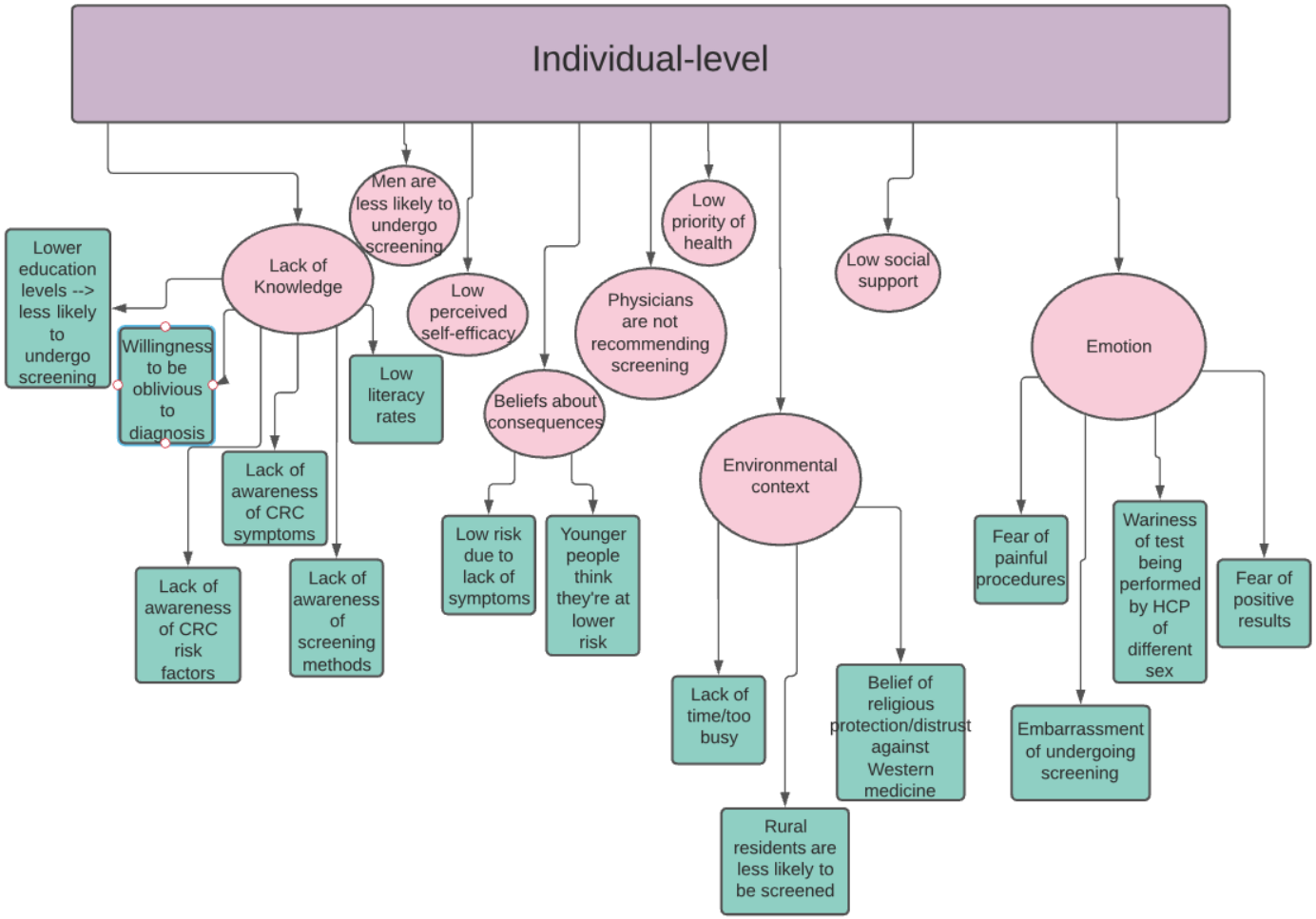

Figure 2**. Barriers to Colorectal Cancer Screening in the Eastern Mediterranean Region: Provider Level**

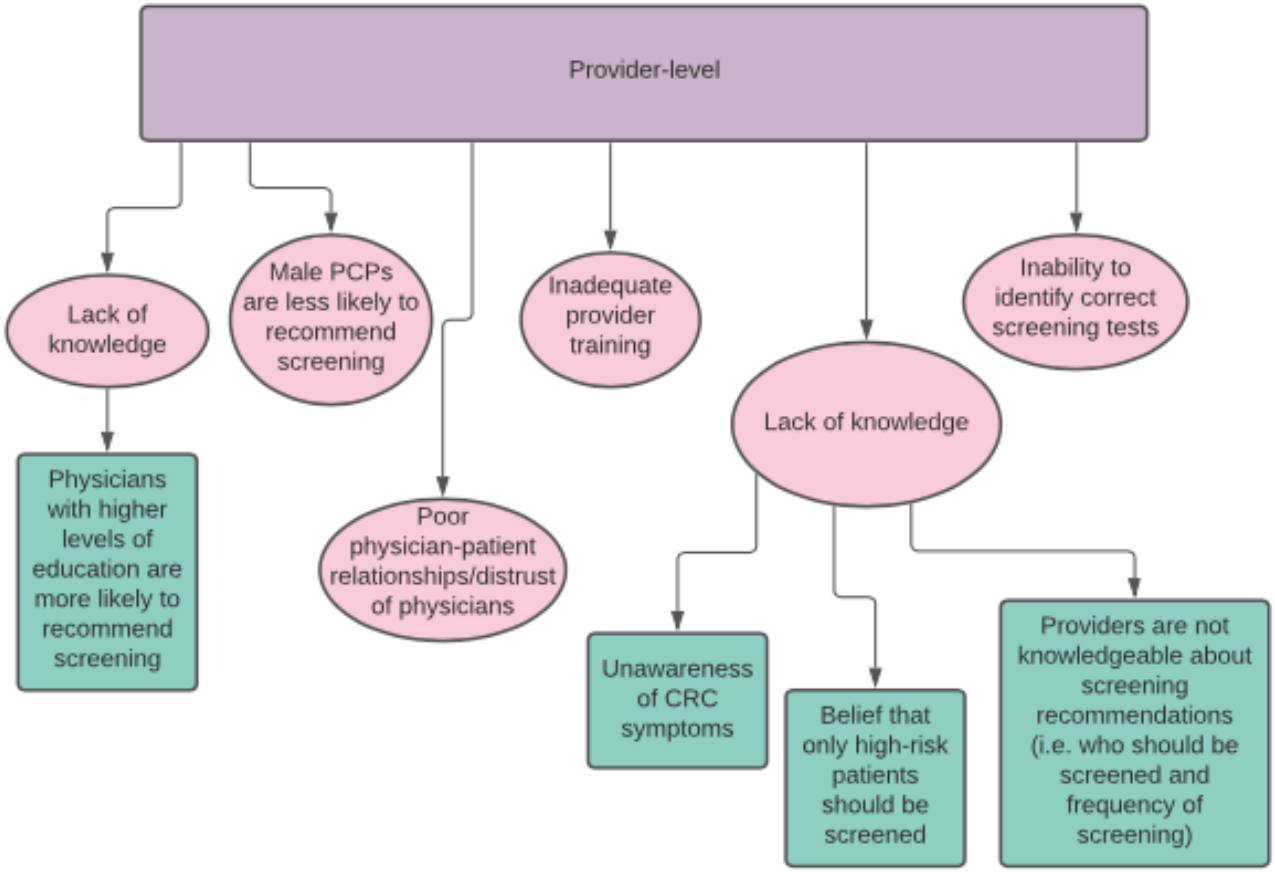

Figure 3. **Barriers to Colorectal Cancer Screening in the Eastern Mediterranean Region: Health System Level**

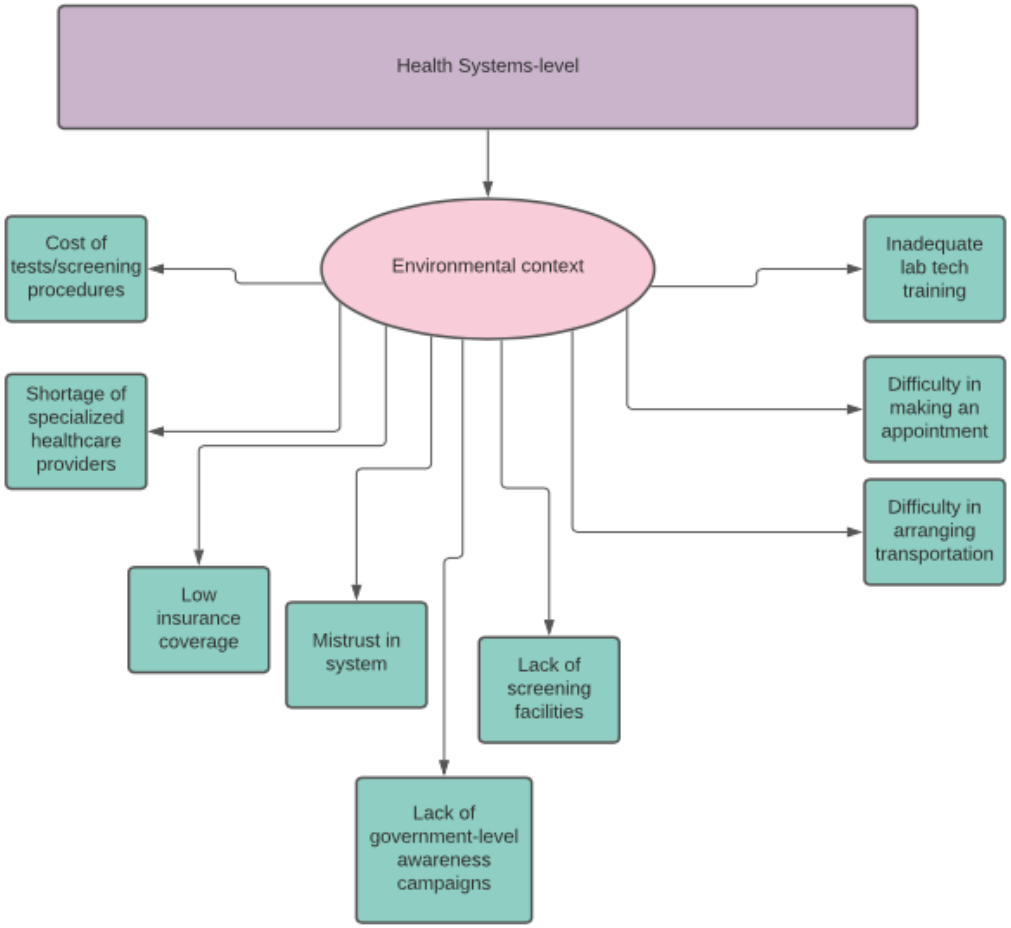

Figure 4. **Flow Chart of Studies Used in the Scoping Review**

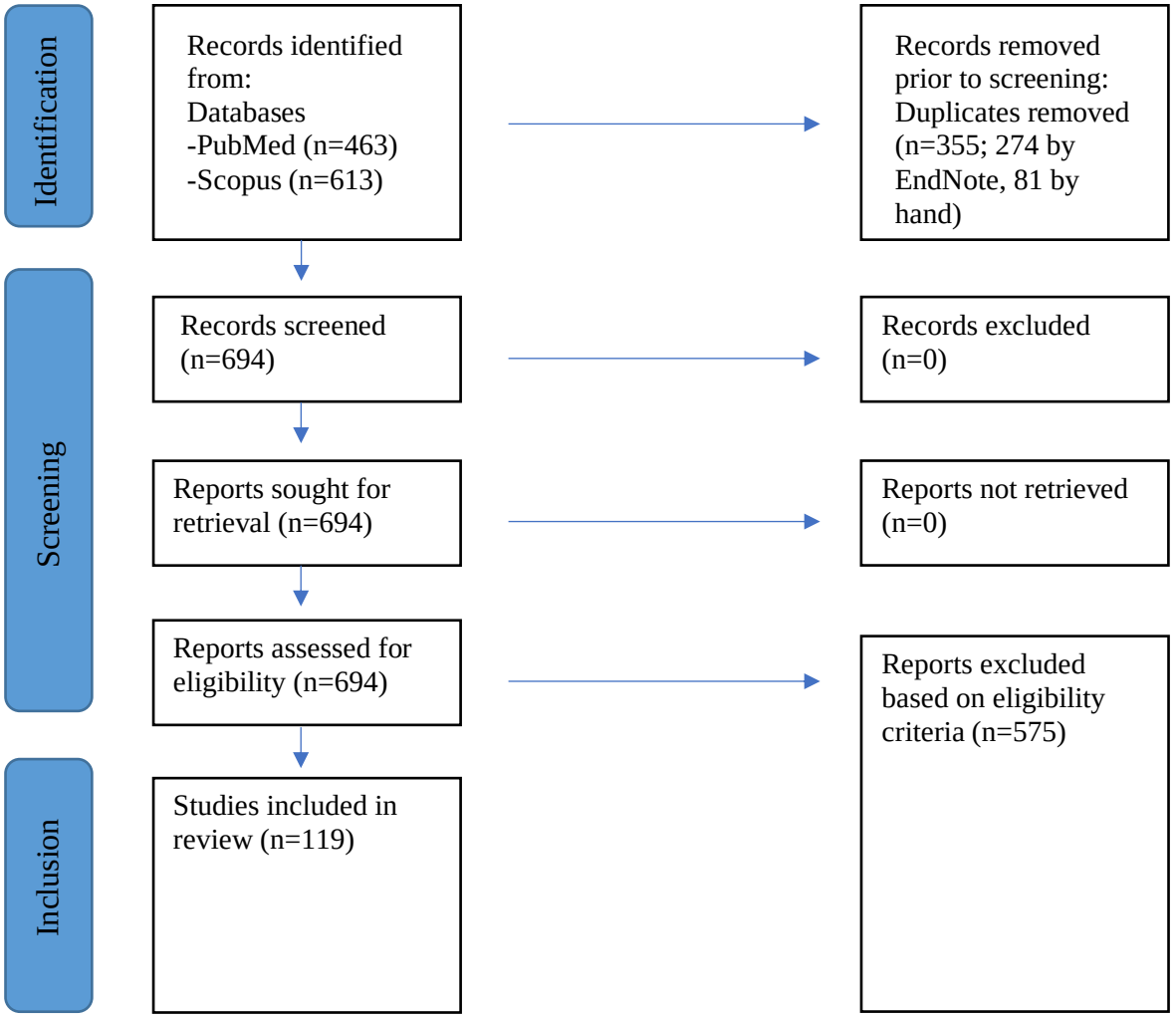

Table 1. Barriers to colorectal cancer screening in the Eastern Mediterranean Region according to domains of the Theoretical Domains Framework and ecological level (individual, provider, and health system): patient perspective

| Domain | Target Behavior | Individual-level Factors | Provider-level Factors | Health System-level Factors |
|---|---|---|---|---|
| **Knowledge** | *Barriers to undergoing CRC screening* | Little knowledge of CRC symptoms (15)<br><br>Lack of knowledge about CRC risk factors, the benefits of undergoing screening, and the overall importance of screening (16)<br><br>Unaware of CRC symptoms (17)<br><br>Had not heard of CRC screening, unaware of different screening methods (18)<br><br>Inadequate knowledge of CRC risk factors (19)<br><br>Lack of knowledge regarding availability of fecal occult blood test (FOBT) (20)<br><br>Little understanding of the causes, symptoms, and screening methods for CRC (21)<br><br>Poor awareness of cancer symptoms and signs (22) | Low awareness and knowledge of CRC, risk factors, symptoms, and associated screening modalities among medical students (26)<br><br>Physicians with higher levels of education and qualifications are more likely to recommend CRC screening (35) | Lack of government awareness campaign (36) |

| | | |
|---|---|---|
| | Lacking knowledge of CRC and providers (23) | |
| | Lack of knowledge regarding screening procedures (24) | |
| | Little knowledge of screening procedures (25) | |
| | Low awareness and knowledge of CRC, risk factors, symptoms, and associated screening modalities (26) | |
| | Lack of sufficient knowledge (27) | |
| | Low participant knowledge about colorectal cancer & 80.6% (377/468) of the participants stated that the most important reason for which they did not uptake FOBT (fecal occult blood test) was lack of knowledge (28) | |
| | Lack of awareness that CRC is a major cause of mortality (29) | |
| | Inadequate awareness of functional health literacy skills (FHLS), limited awareness regarding CRC testing and screening (30) | |

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|---|---|---|---|---|
| | | Lack of education beyond elementary school is a barrier to screening (31, 32)<br><br>Higher knowledge associated with higher educational level, older age, and having family history of CRC (33)<br><br>Low literacy rates (34) | | |
| **Skills** | *Barriers to undergoing CRC screening* | Low literacy rates (34) | - | - |
| **Social/professional role and identity** | *Barriers to undergoing CRC screening* | Women were more likely to uptake FOBT; individuals with higher levels of education are also more likely to undergo screening (28) | Male primary healthcare physicians (PHPs) are less likely to recommend screening (35) | - |
| **Beliefs about capabilities** | *Barriers to undergoing CRC screening* | Higher perceived self-efficacy leads to greater participation in CRC screening (28,43) | - | - |
| **Beliefs about consequences** | *Barriers to undergoing CRC screening* | Oblivious to diagnosis is associated with a better quality of life which could lead to a lower likelihood of undergoing screening (31)<br><br>Not at risk due to lack of symptoms, lack of family history of CRC, and having a healthy lifestyle (44)<br><br>Absence of clinical symptoms (45) | - | - |

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| | | Patient did not have clinical symptoms or think screening was not needed (34)<br><br>Younger people are less likely to undergo screening, potentially due to the fact that they think they are at lower risk (28)<br><br>Absence of clinical symptoms (46)<br><br>Patient self-perception as immune to developing CRC (47)<br><br>Patient underestimation of CRC risk (33, 40)<br><br>Are not feeling sick, so less reason to get screened (48) | | |
| **Optimism** | *Barriers to undergoing CRC screening* | Positive attitude towards FOBT uptake is a strong predictor towards screening (28) | - | - |
| **Reinforcement** | *Barriers to undergoing CRC screening* | Lack of physician's recommendation to undergo screening (31)<br><br>Non-acceptability of colonoscopy without sedation (49) | Lack of reminders by healthcare workers (44)<br><br>Lack of physician recommendation (20)<br><br>Lack of physician recommendation (34) | - |

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|---|---|---|---|---|
| | | | Not being recommended by their (patients') doctor to get screening (48,50) | |
| **Intentions** | *Barriers to undergoing CRC screening* | Low priority of health (21)<br><br>Distrust of Western medicine (31) | - | - |
| **Goals** | *Barriers to undergoing CRC screening* | - | - | - |
| **Memory, attention, and decision processes** | *Barriers to undergoing CRC screening* | - | Lack of reminders by healthcare workers (44) | - |
| **Environmental context and resources** | *Barriers to undergoing CRC screening* | Too busy to go to the doctor (17)<br><br>Lack of time (44)<br><br>Time (51)<br><br>Urban residents are more likely to be screened for CRC; distrust of Western medicine and religious objection (31)<br><br>Belief of religious protection against CRC (God's control of fate and destiny) (33) | Poor physician-patient relationships and overall distrust of physicians (21) | Difficult to make an appointment, difficulty in arranging transport (17)<br><br>Cost of tests, inadequate insurance coverage, and medical tariffs; mistrust in health care system (21)<br><br>Low socio-economic status, especially in rural areas; cost of test (34) |

| | | | | |
|---|---|---|---|---|
| | | | | Low socio-economic status (52)<br><br>Screening procedures are too expensive, lack of screening facilities (24)<br><br>Cost (41, 46)<br><br>Lack of government-level CRC screening programs and awareness campaigns (36) |
| **Social influences** | *Barriers to undergoing CRC screening* | Low social support (51) | - | - |
| **Emotion** | *Barriers to undergoing CRC screening* | Fear of endoscopic procedures; weary of test being performed by a HCP that is not the same sex as the patient (15)<br><br>Scared and embarrassed to undergo screening (17)<br><br>Embarrassed by the idea of a colonoscopy, fear of positive diagnosis of CRC (18)<br><br>Fear of undergoing screening and results (45) | - | - |

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| | | Fear of painful colonoscopy procedures (20)<br><br>High degree of anxiety associated with cancer detection, as well as anticipated embarrassment from undergoing screening (21)<br><br>Fear of advanced CRC and the screening test (34)<br><br>Shyness and fear of screening results (23)<br><br>Fear of finding CRC, anxiety of screening procedures (25)<br><br>Bad feeling (51)<br><br>Fear of positive results and shame (46)<br><br>Patient fear of finding out they have cancer (40)<br><br>Finding the test to be embarrassing (31)<br><br>Fear of results (36) | | | |
| **Behavioral regulation** | *Barriers to undergoing* | - | - | - | |

*CRC screening*

Table 2. Barriers to colorectal cancer screening in the Eastern Mediterranean Region according to domains of the Theoretical Domains Framework and ecological level (individual, provider, and health system): healthcare provider perspective

| Domain | Target | Patient-level Factors | Provider-level Factors | Health System-level Factors |
|---|---|---|---|---|
| **Knowledge** | *Barriers to recommending CRC screening* | Lack of CRC awareness and related screening modalities (37)<br><br>Lack of public awareness, signs, and symptoms (23) | Unawareness of symptoms of CRC (15)<br><br>Belief that only high-risk patients should be screened (39)<br><br>Low awareness and knowledge of CRC, risk factors, symptoms, and associated screening modalities (26) | Inadequate training for laboratory technicians and providers (39) |
| | *Barriers to conducting CRC screening* | Lack of sufficient knowledge (27)<br><br>Lack of awareness of CRC tests (38) | Lack of sufficient knowledge (27)<br><br>HCPs (Health Care Providers) are not knowledgeable about CRC screening recommendations (40) | Lack of hospital policy or protocols for cancer screening, shortage of trained HCPs (Health Care Providers) to conduct CRC screening or to follow up with invasive procedures, limited availability of screening services, and long waiting time for screening appointments (38) |

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|---|---|---|---|---|
| | | | Poor knowledge of who should receive CRC screening and the frequency of screening (41) | |
| **Skills** | *Barriers to recommending CRC screening* | - | Inability to identify correct screening tests (42) | Inadequate training for laboratory technicians and providers (39) |
| | *Barriers to conducting CRC screening* | - | - | - |
| **Social/professional role and identity** | *Barriers to recommending CRC screening* | - | - | - |
| | *Barriers to conducting CRC screening* | - | - | - |
| **Beliefs about capabilities** | *Barriers to recommending CRC screening* | - | Lack of confidence in providers to perform and interpret screening test appropriately (39) | - |
| | *Barriers to conducting CRC screening* | - | - | - |

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| **Beliefs about consequences** | *Barriers to recommending CRC screening* | - | - | - |
| | *Barriers to conducting CRC screening* | - | - | - |
| **Optimism** | *Barriers to recommending CRC screening* | - | - | - |
| | *Barriers to conducting CRC screening* | - | - | - |
| **Reinforcement** | *Barriers to recommending CRC screening* | - | Lack of emphasis on prevention (39) | - |
| | *Barriers to conducting CRC screening* | - | - | - |
| **Intentions** | *Barriers to recommending CRC screening* | - | Lack of emphasis on prevention (39) | - |
| | *Barriers to conducting CRC screening* | - | - | - |

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|---|---|---|---|---|
| **Goals** | *Barriers to recommending CRC screening* | - | - | - |
| | *Barriers to conducting CRC screening* | - | - | - |
| **Memory, attention, and decision processes** | *Barriers to recommending CRC screening* | - | - | - |
| | *Barriers to conducting CRC screening* | - | - | - |
| **Environmental context and resources** | *Barriers to recommending CRC screening* | Socioeconomic status (39) | Inadequate training for providers (39) | Inadequate training for laboratory technicians, cost (39) |
| | *Barriers to conducting CRC screening* | - | - | Shortage of specialized healthcare providers (37)<br><br>Lack of hospital policy or protocols for cancer screening, shortage of trained HCPs (Health Care Providers) to conduct CRC screening or to follow up with invasive procedures, limited availability of screening |

| | | | | |
|---|---|---|---|---|
| | | | | services, and long waiting time for screening appointments (38) |
| **Social influences** | *Barriers to recommending CRC screening* | - | - | - |
| | *Barriers to conducting CRC screening* | - | - | - |
| **Emotion** | *Barriers to recommending CRC screening* | Fear of painful procedures (23) | Fear (38) | - |
| | *Barriers to conducting CRC screening* | - | - | - |
| **Behavioral regulation** | *Barriers to recommending CRC screening* | - | - | - |
| | *Barriers to conducting CRC screening* | - | - | - |

Table 3. Summary of Studies by Country and Author(s)

| Country | Authors |
|---|---|
| United Arab Emirates | Al Abdouli, Al-Sharbatti |
| Iran | Baghianimoghadam, Besharati, Bidouei, Boogar, Chouhdari, Ghobadi Dashdebi, Gholampour, Jeihooni, Khani Jeihooni, Kharameh, Khashij, Mahdi, Maheri, Majidi, Mansour-Ghanaei, Maserat, Mirzaei, Mirzaei-Alavijeh, Montazeri, Movahedi, Mozafar Saadati, Nikbakht, Niya, Nopour, Pourhoseingholi, Qandian, Rahmati-Najarkolaei, Ramazani, Ramezani, Roshani, Sadeghei, Safaee, Safdari, Salimzadeh, Shiri, Sohrabi, Soodejani, Taghavi, Taheri-Kharameh, Tahmasebi, Valukalaie, Zali |
| Saudi Arabia | Al-Doghether, Al-Hajeili, Al-Thafar, Al-Zalabani, Aldiab, Alduraywish, Aljumah, Almadi, Almutairi, Althobaiti, Alyabsi, Galal, Gosadi, Imran, Khayyat, Mosli, Shah, Zubaidi |
| Lebanon | Telvizian, Tfaily |
| Palestine/Gaza Strip | Elshami, Qumseya |
| Jordan | Abuadas, Ahmad, Al-Jaberi, Alqudah, Mhaidat, Obeidat, Omran, Rababah, Shihab, Taha |
| Oman | Al-Azri, Muliira |
| Qatar | Al-Dahshan, Mahmoud |
| Bahrain | Nasaif |

| | |
|---|---|
| Kuwait | Saeed |
| Pakistan | Ahmed, Bhurgri, Hasan, Hussain, Khalid, Muhammad, Yousaf |
| Iraq | Muhammed |
| Egypt | Brand Bateman, Zaher |
| Morocco | Imad |
| Tunisia | Rejaibi, Rym |

# Chapter 4: Discussion and Recommendations

## Discussion

The goal of this paper was two-fold, the first being to identify influences on behavior among health professionals and the public as they relate to barriers to CRC screening. The second is to provide a proof of concept for the utility of the TDF in conjunction with a scoping review. Upon interpretation of the matrices developed from this work, it can be concluded that the major barriers to CRC-related decision making pertain to the domains of knowledge, environmental context and resources, and emotion. Collectively, these domains were the most cited in the literature that was examined for this work. Each of these domains offer a starting point to improve and refine current interventions, in addition to guiding current and future planning of interventions.

Collectively among both TDFs, the 'Knowledge' domain was the most-cited domain as influencing undergoing CRC screening among the public, as well as conducting and recommending screening among providers. In the public-oriented TDF, individual-level factors related to knowledge in 20 different papers, while factors at the provider level were cited in three different papers, with no factors noted at the health system level (Table 2). Deficits in knowledge often pertained to CRC symptoms, risk factors, and screening mechanisms at the individual level. This is harmonized in the provider oriented TDF, in which providers noted a lack of knowledge and awareness related to signs, symptoms, and CRC testing modalities among the public. Another point of interface between the 'Knowledge' domain of the two TDFs is at the provider level. From the public perspective, lack of adequate knowledge of CRC symptoms, risk factors, and ways to be screened among providers was a barrier to undergoing CRC screening.

At the provider level in the provider TDF, the ‘Knowledge’ domain is the most populated of the entire provider TDF. Providers noted an unawareness of CRC symptoms, beliefs about who should and should not be screened for CRC, providers not being knowledgeable about CRC screening recommendations, and unfamiliarity with screening intervals at this level. This perhaps stems from the health system level, with inadequate emphasis being placed on CRC screening modalities and intervals, risk factors, symptoms, etc.

The ‘Environmental Context and Resources’ domain provided a wide catchment of factors at each level in the public TDF. At the individual level, factors associated with barriers often included time, the role of geography in screening priority (urban residents being more likely to undergo screening for CRC), religious objection and distrust of Western medicine, and the role of God being in control of fate and destiny. With providers, a poor physician-patient relationship, along with a larger distrust of physicians, was noted in one paper. At the health system level, low socio-economic status (SES), procedure cost, and a lack of access to transportation, government-level screening programs for CRC, screening facilities, and awareness campaigns were noted. From the provider perspective, patient SES, as well as shortcomings in provider and technician training, provider shortages, and lacking hospital protocols and policies for cancer screening are all factors that impact recommending and conducting CRC screening.

A shortage of screening facilities and lacking hospital policies/procedures may be a downstream impact of the minority of countries in the EMR not having national screening programs for CRC (3). Additionally, the factor of one living in a rural vs. urban area, which may be synchronous with the transportation issue, is important to note, given the percent of the population living in urban vs. rural areas in the EMR. While countries such as Qatar, Kuwait, and Lebanon have a large percent of the population living in urban areas (99.5%, 98.4%, and

88.4%, respectively) according to 2018 projections, some countries have a population that is more so located in rural areas. The populations of Afghanistan, Egypt, Pakistan, Somalia, Sudan, and Yemen, meanwhile, are largely rural, in terms of the percent of the population that lives in rural areas (71.1%, 43.8%, 41.2%, 42%, 35%, and 37.5%, respectively) (40). These countries, subsequently, may have a more difficulty time in reaching all individuals, due to most of them living in rural areas.

Emotion at the individual level among patients is also a point to note. Fear and embarrassment/shame were the two most-noted factors at this level (cited 10 and 5 times, respectively). Other emotion-related factors include anxiety, shyness, and an overall 'bad feeling'. While emotion may be a harder concept to identify as compared to provider shortages or gaps in knowledge, it should not be underplayed in the role of screening-seeking behaviors. Emotion may relate to knowledge, in that misguided or altogether false information may be disseminated, stoking fear, anxiety, or potential embarrassment and shame to the public. That being said, appropriate, factual knowledge and information being spread may, in part, also lessen the impact that emotion has on screening-related behaviors.

When leveraged for existing and future work, the data from this paper can help support overall program effectiveness. However, starting points for future work should not merely include the domains that are comparatively well-defined in comparison to the others. Domains such as behavioral regulation, goals, and memory, attention, and decision processes, while having no data extracted from the literature, should similarly serve as launch points for future understanding of influences on behavior as they relate to CRC screening. This work should be used within the framework of existing literature. With the volume of literature published related to CRC screening in the EMR, this paper can serve as a point of content distillation for

policymakers, providers, and other stakeholders that are seeking to invoke greater program effectiveness and impact.

Several strengths and limitations are present with this work. In terms of strengths, several measures were taken to ensure validity throughout the data collection and extraction processes. Additionally, the utility of the TDF is further validated through this work. Weaknesses primarily deal with the search strategy. As mentioned previously, the search strategy included several terms related to ‘colorectal cancer’ and ‘screening’. However, because an exhaustive list of related terms was not used, some papers that used related terms not included in the search strategy were likely not included in the results from the searches across the databases. Another weakness is that the 2000 – 2021 timeframe may not have been a wide enough window to include all of the papers that are meaningful to informing the TDFs used in this work. Finally, only papers in English were included in this work. In turn, some papers in other languages that are spoken at national and/or regional levels in the EMR were similarly not included.

## Recommendations

This work is important on two fronts. The first is that this work identifies barriers to CRC screening at a multitude of levels. These identified barriers can, in turn, be used as formative work to inform CRC screening initiatives throughout the EMR. The second matter of importance of these is that it provides a proof of concept for the use of the TDF to not only identify barriers related to CRC screening, but also to demonstrate that the TDF can be used in synchrony with a scoping review as a means of informing the framework.

To address gaps and barriers in existing secondary prevention programs for CRC and to inform future programs, several recommendations are pertinent. For both existing and future efforts relating to CRC screening, local evidence is foundational to successful programming. Screening guidelines informed by local evidence and adapted to the cultural context, rather than the mere adoption of Western standards and approaches, will improve the impact of secondary prevention programs in national contexts. Additionally, educational initiatives that run in parallel with screening campaigns must take place on two fronts. First, further education must take place at the provider level. In countries such as Oman and Saudi Arabia, primary care physicians play a crucial role in CRC screening (39,31). Expanding their roles in the CRC screening process, whether that be through providing referrals, education, or support, can prove to be advantageous to the populations that are at-risk (26). Second, education must be emphasized at the individual level. The Kuwait Ministry of Health conducted a nationwide campaign that involved both screening and education (42). Through this campaign, over 40,000 people were reached through the education arm of the campaign, and over 450 individuals had colon polyps or cancer detected upon screening (42). Such multi-component campaigns will ideally bolster patient awareness of

CRC risk factors, modalities of screening, and testing locations for CRC screening (41). Further, such educational initiatives will address knowledge gaps that are evidenced in both TDFs.

Outside of the need for more education interventions to address knowledge gaps, further research should focus on addressing gaps indicated in the TDFs. Resulting from the scoping review, it was found that several domains of the TDF need to be the focus of future work. The public-level TDF highlights a lack of published literature in the following domains: intentions, goals, behavioral regulation, and memory, attention, and decision processes. The provider-level TDF underlines a similar lack of published literature in the domains of behavioral regulation, and memory, attention, and decision processes. Additionally, the domains of social/professional role and identity, beliefs about consequences, optimism, reinforcement, social influences, and goals lack published literature within the framework of the scoping review that was conducted. As such, these domains should be the target of future work to help bolster effective planning, conceptualization, and implementation of CRC screening interventions in the EMR.

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# Appendices

## Search Strategy Terms

PubMed

("Intestinal Neoplasms"[Mesh] or ((colorectal[tw] or colon[tw] or rectum[tw] or rectal[tw] or intestines[tw] or intestinal[tw] or bowel[tw]) and (cancer[tw] or cancers[tw] or "Neoplasms"[Mesh]))) AND (Afghanistan[tw] or Bahrain[tw] or Djibouti[tw] or Egypt[tw] or iran[tw] or Iraq[tw] or Jordan[tw] or Kuwait[tw] or Lebanon[tw] or Libya[tw] or morocco[tw] or Palestine[tw] or Palestinian[tw] or oman[tw] or Pakistan[tw] or Qatar[tw] or Saudi arabia[tw] or arabian[tw] or Somalia[tw] or sudan[tw] or Tunisia[tw] or united arab emirates[tw] or yemen[tw] or emro[tw] or eastern Mediterranean[tw]) AND ("prevention and control" [Subheading] or screening[tw] or guideline[tw] or guidelines[tw] or campaign[tw] or outreach[tw] or education[tw] or early detection[tw] OR "Early Detection of Cancer"[Mesh])

Scopus

( INDEXTERMS ( "Intestinal Neoplasms" ) OR ( ( TITLE-ABS-KEY ( "colorectal" ) OR TITLE-ABS-KEY ( "colon" ) OR TITLE-ABS-KEY ( "rectum" ) OR TITLE-ABS-KEY ( "rectal" ) OR TITLE-ABS-KEY ( "intestines" ) OR TITLE-ABS-KEY ( "intestinal" ) OR TITLE-ABS-KEY ( "bowel" ) ) AND ( TITLE-ABS-KEY ( "cancer" ) OR TITLE-ABS-KEY ( "cancers" ) OR INDEXTERMS ( "Neoplasms" ) ) ) ) AND ( TITLE-ABS-KEY ( "Afghanistan" ) OR TITLE-ABS-KEY ( "Bahrain" ) OR TITLE-ABS-KEY ( "Djibouti" ) OR TITLE-ABS-KEY ( "Egypt" ) OR TITLE-ABS-KEY ( "iran" ) OR TITLE-ABS-KEY ( "Iraq" ) OR TITLE-ABS-KEY ( "Jordan" ) OR TITLE-ABS-KEY ( "Kuwait" ) OR TITLE-ABS-KEY ( "Lebanon" ) OR TITLE-ABS-KEY ( "Libya" ) OR TITLE-ABS-KEY ( "morocco" ) OR TITLE-ABS-KEY ( "Palestine" ) OR TITLE-ABS-KEY ( "Palestinian" ) OR TITLE-ABS-KEY ( "oman" ) OR TITLE-ABS-KEY ( "Pakistan" ) OR TITLE-ABS-KEY ( "Qatar" ) OR TITLE-ABS-KEY ( "Saudi arabia" ) OR TITLE-ABS-KEY ( "arabian" ) OR TITLE-ABS-KEY ( "Somalia" ) OR TITLE-ABS-KEY ( "sudan" ) OR TITLE-ABS-KEY ( "Tunisia" ) OR TITLE-ABS-KEY ( "united arab emirates" ) OR TITLE-ABS-KEY ( "yemen" ) OR TITLE-ABS-KEY ( "emro" ) OR TITLE-ABS-KEY ( "eastern Mediterranean" ) ) AND ( "prevention and control [Subheading]" OR TITLE-ABS-KEY ( "screening" ) OR TITLE-ABS-KEY ( "guideline" ) OR TITLE-ABS-KEY ( "guidelines" ) OR TITLE-ABS-KEY ( "campaign" ) OR TITLE-ABS-KEY ( "outreach" ) OR TITLE-ABS-KEY ( "education" ) OR TITLE-ABS-KEY ( "early detection" ) OR INDEXTERMS ( "Early Detection of Cancer" ) ) AND ( LIMIT-TO ( PUBYEAR , 2021 ) OR LIMIT-TO ( PUBYEAR , 2020 ) OR LIMIT-TO ( PUBYEAR , 2019 ) OR LIMIT-TO ( PUBYEAR , 2018 ) OR LIMIT-TO ( PUBYEAR , 2017 ) OR LIMIT-TO ( PUBYEAR , 2016 ) OR LIMIT-TO ( PUBYEAR , 2015 ) OR LIMIT-TO ( PUBYEAR , 2014 ) OR LIMIT-TO ( PUBYEAR , 2013 ) OR LIMIT-TO ( PUBYEAR , 2012 ) OR LIMIT-TO ( PUBYEAR , 2011 ) OR LIMIT-TO ( PUBYEAR , 2010 ) OR LIMIT-TO ( PUBYEAR , 2009 ) OR LIMIT-TO ( PUBYEAR , 2008 ) OR LIMIT-TO ( PUBYEAR , 2007 ) OR LIMIT-TO ( PUBYEAR , 2006 ) OR LIMIT-TO ( PUBYEAR , 2005 ) OR LIMIT-TO ( PUBYEAR , 2004 ) OR LIMIT-TO ( PUBYEAR , 2003 ) OR LIMIT-TO ( PUBYEAR , 2002 ) OR LIMIT-TO ( PUBYEAR , 2001 ) )

## Figures and Tables

Figure 1**. Estimated age-standardized incidence and mortality rates for colorectal cancer in the Eastern Mediterranean Region in 2020, both sexes, all ages** (1)

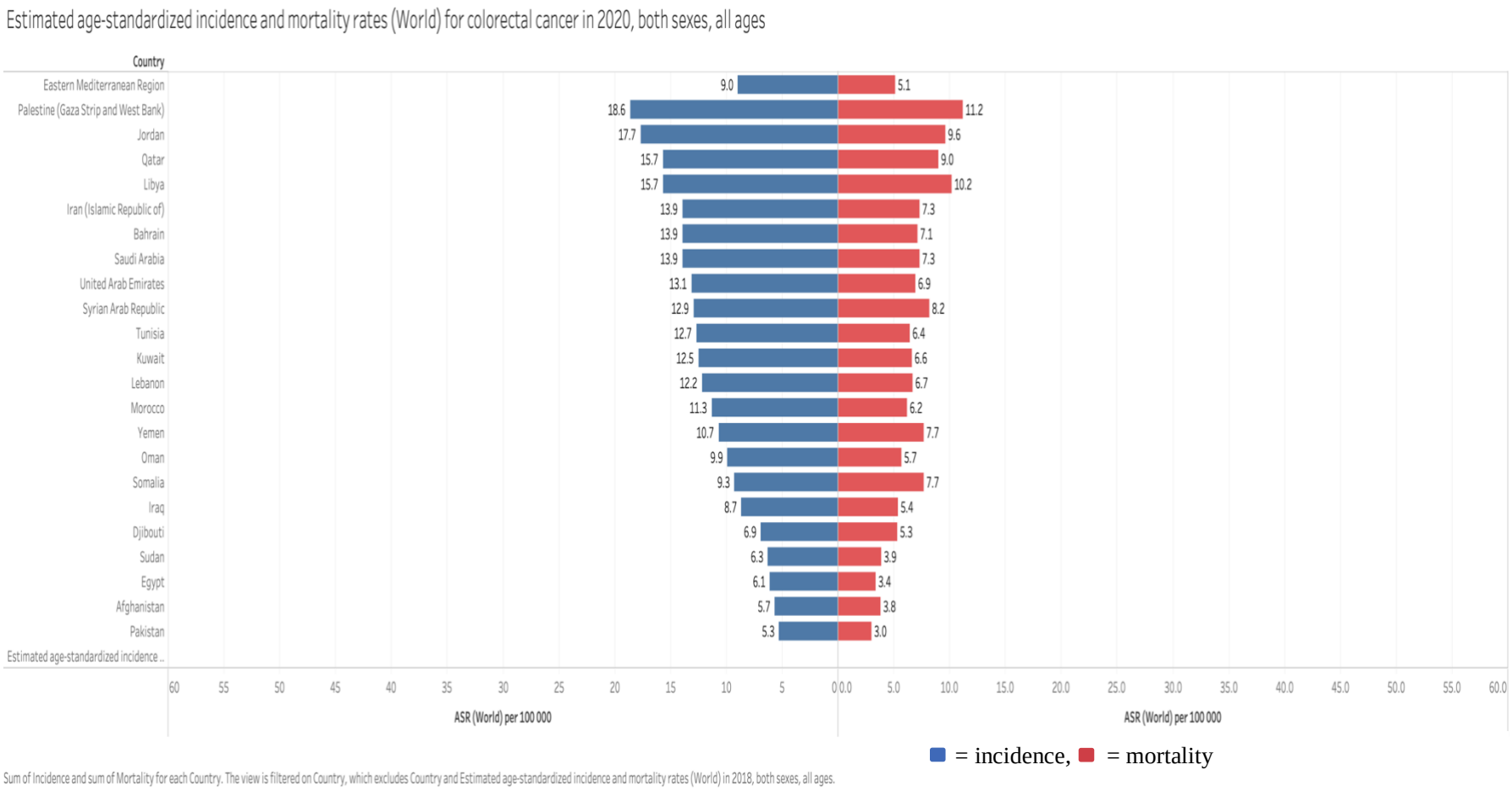

Figure 2**. Barriers to Colorectal Cancer Screening in the Eastern Mediterranean Region: Individual Level**

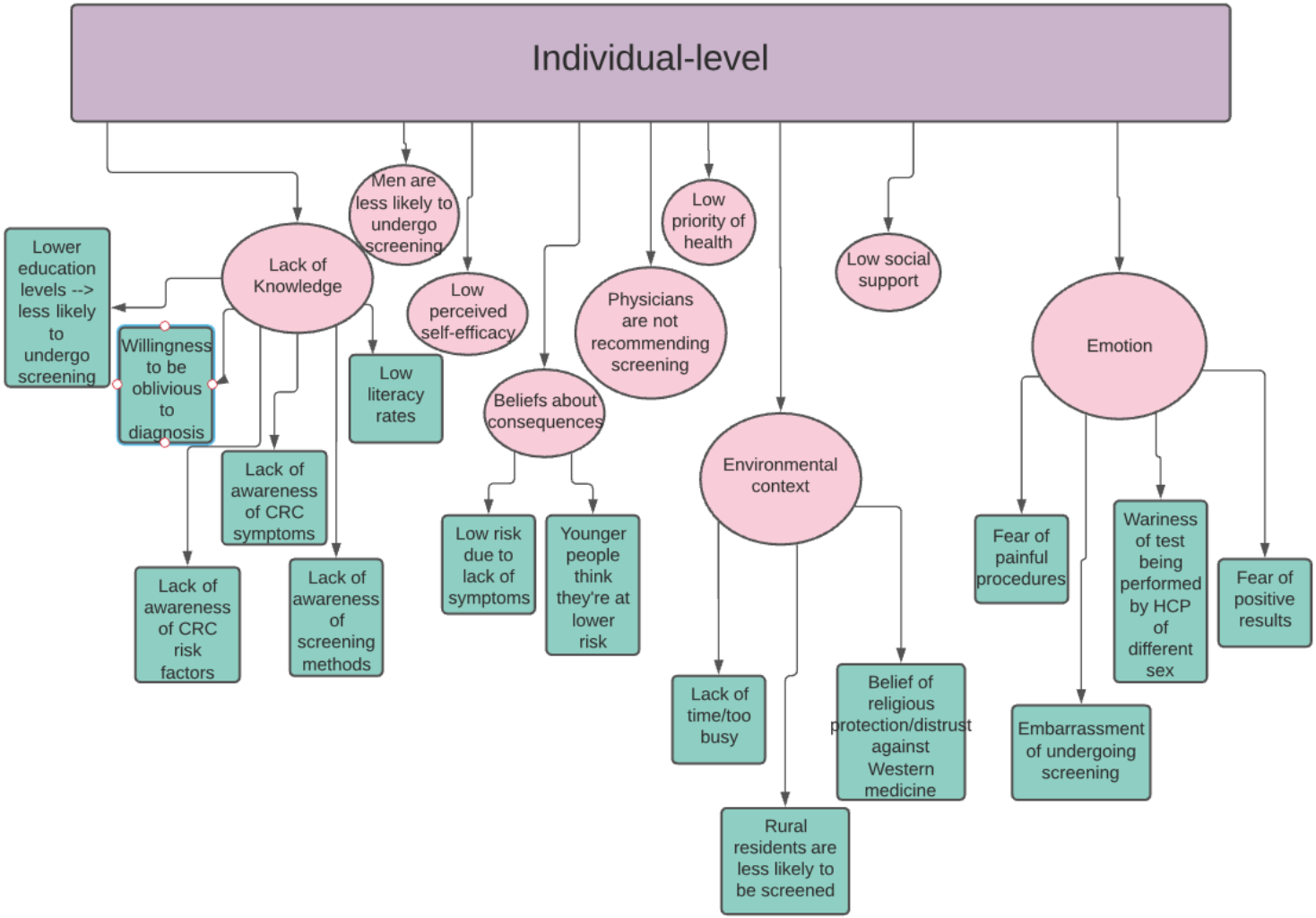

Figure 3**. Barriers to Colorectal Cancer Screening in the Eastern Mediterranean Region: Provider Level**

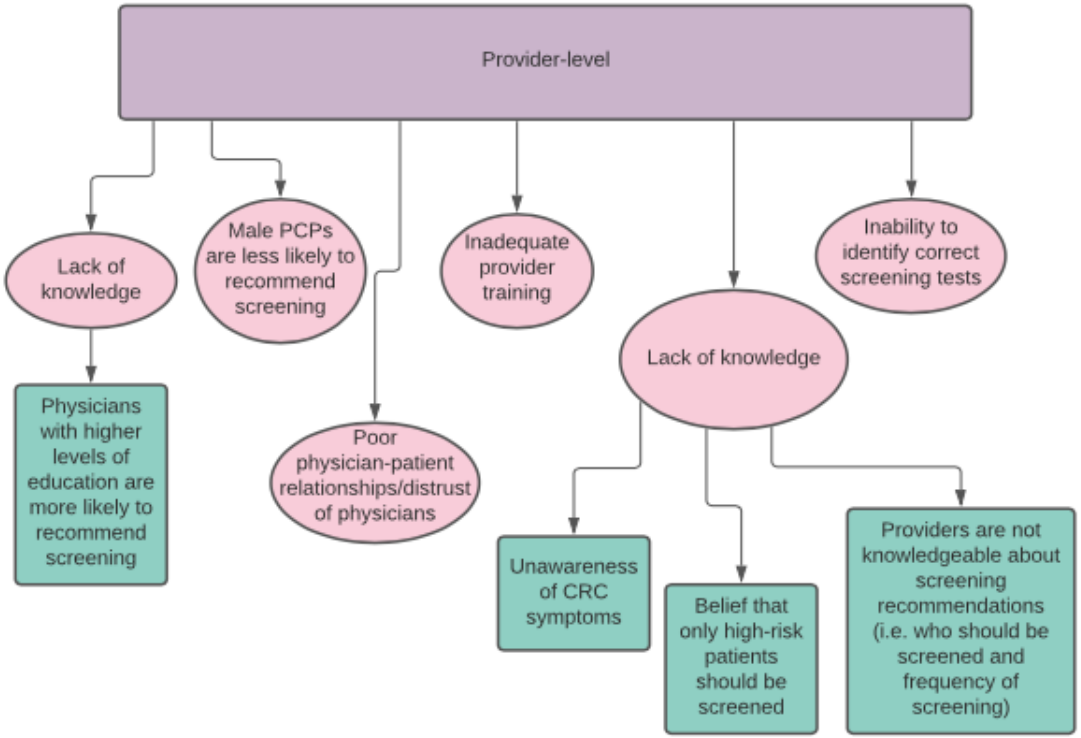

Figure 4**. Barriers to Colorectal Cancer Screening in the Eastern Mediterranean Region: Health System Level**

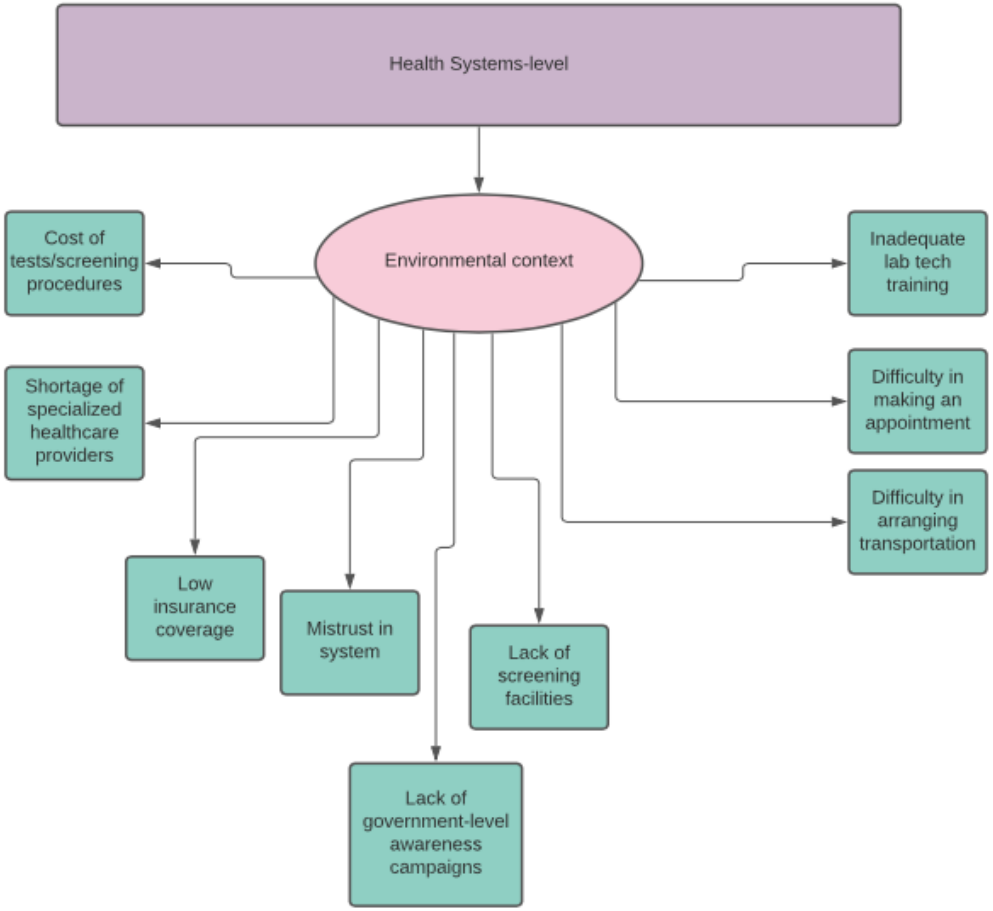

Table 1. **Secondary prevention programs for colorectal cancer in the Eastern Mediterranean Region**

| Country | Launch Year | Program Type | Organization | Screening Recommendations | Screening Modality |
|---|---|---|---|---|---|
| United Arab Emirates | 2013 (21) | Population-based (3) | Public/Government-run (21) | Colonoscopy every 10 years or annual stool test beginning at age 40 (22) | 1) Colonoscopy<br>2) Stool test (22) |
| Bahrain | 2019 (23) | Population-based pilot (3) | Mixed (23) | Colonoscopy every five years after the age of 50 (24) | 1) Colonoscopy<br>2) Fecal immunochemical/fecal occult blood test (24) |
| Lebanon | Not reported | Population-based pilot (3) | Not reported | Begins at age 50 and until 70 years of age (25) | 1) Screening exam/colonoscopy/sigmoidoscopy<br>2) Fecal immunochemical/fecal occult blood test (26) |
| Qatar | 2016 (25) | Population-based (3,25) | Not reported | Annual fecal immunochemical test starting at age 50 until age 74 (25,27) | 1) Faecal immunochemical test (25,28) |
| Iran (Islamic Republic of) | Not reported | Structured opportunistic initially, now population-based pilot (3) | Not reported | Annual occult blood test or colonoscopy every 10 years (29) | 1) Colonoscopy<br>2) Fecal occult blood test (29) |
| Saudi Arabia | 2017 (25) | Population-based (25) | Not reported | Annual fecal occult blood test, radiographic test, or colonoscopy every 10 years from age 45-75 (25,30,31) | 1) Colonoscopy<br>2) Stool blood test<br>3) Radiographic test (25,30,31) |
| Kuwait | 2014 (25) | Population-based pilot (3) | Not reported | Biennial FIT (25) | 1) Sigmoidoscopy<br>2) Colonoscopy<br>3) Barium enema with X-ray (32) |

Table 2. Barriers to colorectal cancer screening in the Eastern Mediterranean Region according to domains of the Theoretical Domains Framework and ecological level (individual, provider, and health system): patient perspective

| Domain | Target Behavior | Individual-level Factors | Provider-level Factors | Health System-level Factors |
|---|---|---|---|---|
| **Knowledge** | *Barriers to undergoing CRC screening* | Little knowledge of CRC symptoms<br><br>Lack of knowledge about CRC risk factors, the benefits of undergoing screening, and the overall importance of screening<br><br>Unaware of CRC symptoms<br><br>Had not heard of CRC screening, unaware of different screening methods<br><br>Inadequate knowledge of CRC risk factors<br><br>Lack of knowledge regarding availability of fecal occult blood test (FOBT)<br><br>Little understanding of the causes, symptoms, and screening methods for CRC<br><br>Poor awareness of cancer symptoms and signs | Low awareness and knowledge of CRC, risk factors, symptoms, and associated screening modalities among medical students<br><br>Physicians with higher levels of education and qualifications are more likely to recommend CRC screening | Lack of government awareness campaign |

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| | Lacking knowledge of CRC and providers | |
| | Lack of knowledge regarding screening procedures | |
| | Little knowledge of screening procedures | |
| | Low awareness and knowledge of CRC, risk factors, symptoms, and associated screening modalities | |
| | Lack of sufficient knowledge | |
| | Low participant knowledge about colorectal cancer & 80.6% (377/468) of the participants stated that the most important reason for which they did not uptake FOBT (fecal occult blood test) was lack of knowledge | |
| | Lack of awareness that CRC is a major cause of mortality | |
| | Inadequate awareness of functional health literacy skills (FHLS), limited awareness regarding CRC testing and screening | |

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| | | Lack of education beyond elementary school is a barrier to screening<br><br>Higher knowledge associated with higher educational level, older age, and having family history of CRC<br><br>Low literacy rates | | | |
| **Skills** | *Barriers to undergoing CRC screening* | Low literacy rates | - | - | |
| **Social/professional role and identity** | *Barriers to undergoing CRC screening* | Women were more likely to uptake FOBT; individuals with higher levels of education are also more likely to undergo screening | Male primary healthcare physicians (PHPs) are less likely to recommend screening | - | |
| **Beliefs about capabilities** | *Barriers to undergoing CRC screening* | Higher perceived self-efficacy leads to greater participation in CRC screening | - | - | |
| **Beliefs about consequences** | *Barriers to undergoing CRC screening* | Oblivious to diagnosis is associated with a better quality of life which could lead to a lower likelihood of undergoing screening<br><br>Not at risk due to lack of symptoms, lack of family history of CRC, and having a healthy lifestyle<br><br>Absence of clinical symptoms | - | - | |

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| | | Patient did not have clinical symptoms or think screening was not needed<br><br>Younger people are less likely to undergo screening, potentially due to the fact that they think they are at lower risk<br><br>Absence of clinical symptoms<br><br>Patient self-perception as immune to developing CRC<br><br>Patient underestimation of CRC risk<br><br>Are not feeling sick, so less reason to get screened | | |
| **Optimism** | *Barriers to undergoing CRC screening* | Positive attitude towards FOBT uptake is a strong predictor towards screening | - | - |
| **Reinforcement** | *Barriers to undergoing CRC screening* | Lack of physician's recommendation to undergo screening<br><br>Non-acceptability of colonoscopy without sedation | Lack of reminders by healthcare workers<br><br>Lack of physician recommendation<br><br>Lack of physician recommendation | - |

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| | | | Not being recommended by their (patients') doctor to get screening | |
| **Intentions** | *Barriers to undergoing CRC screening* | Low priority of health<br><br>Distrust of Western medicine | - | - |
| **Goals** | *Barriers to undergoing CRC screening* | - | - | - |
| **Memory, attention, and decision processes** | *Barriers to undergoing CRC screening* | - | Lack of reminders by healthcare workers | - |
| **Environmental context and resources** | *Barriers to undergoing CRC screening* | Too busy to go to the doctor<br><br>Lack of time<br><br>Time<br><br>Urban residents are more likely to be screened for CRC; distrust of Western medicine and religious objection<br><br>Belief of religious protection against CRC (God's control of fate and destiny) | Poor physician-patient relationships and overall distrust of physicians | Difficult to make an appointment, difficulty in arranging transport<br><br>Cost of tests, inadequate insurance coverage, and medical tariffs; mistrust in health care system<br><br>Low socio-economic status, especially in rural areas; cost of test |

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| | | | | Low socio-economic status<br><br>Screening procedures are too expensive, lack of screening facilities<br><br>Cost<br><br>Lack of government-level CRC screening programs and awareness campaigns |
| **Social influences** | *Barriers to undergoing CRC screening* | Low social support | - | - |
| **Emotion** | *Barriers to undergoing CRC screening* | Fear of endoscopic procedures; weary of test being performed by a HCP that is not the same sex as the patient<br><br>Scared and embarrassed to undergo screening<br><br>Embarrassed by the idea of a colonoscopy, fear of positive diagnosis of CRC<br><br>Fear of undergoing screening and results | - | - |

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| | | Fear of painful colonoscopy procedures<br><br>High degree of anxiety associated with cancer detection, as well as anticipated embarrassment from undergoing screening<br><br>Fear of advanced CRC and the screening test<br><br>Shyness and fear of screening results<br><br>Fear of finding CRC, anxiety of screening procedures<br><br>Bad feeling<br><br>Fear of positive results and shame<br><br>Patient fear of finding out they have cancer<br><br>Finding the test to be embarrassing<br><br>Fear of results | | | |
| **Behavioral regulation** | *Barriers to undergoing CRC screening* | - | - | - | |

Table 3. Barriers to colorectal cancer screening in the Eastern Mediterranean Region according to domains of the Theoretical Domains Framework and ecological level (individual, provider, and health system): healthcare provider perspective

| Domain | Target | Patient-level Factors | Provider-level Factors | Health System-level Factors |
|---|---|---|---|---|
| **Knowledge** | *Barriers to recommending CRC screening* | Lack of CRC awareness and related screening modalities<br><br>Lack of public awareness, signs, and symptoms | Unawareness of symptoms of CRC<br><br>Belief that only high-risk patients should be screened<br><br>Low awareness and knowledge of CRC, risk factors, symptoms, and associated screening modalities | Inadequate training for laboratory technicians and providers |
| | *Barriers to conducting CRC screening* | Lack of sufficient knowledge<br><br>Lack of awareness of CRC tests | Lack of sufficient knowledge<br><br>HCPs (Health Care Providers) are not knowledgeable about CRC screening recommendations | Lack of hospital policy or protocols for cancer screening, shortage of trained HCPs (Health Care Providers) to conduct CRC screening or to follow up with invasive procedures, limited availability of screening services, and long waiting time for screening appointments |

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| | | | Poor knowledge of who should receive CRC screening and the frequency of screening | |
| **Skills** | *Barriers to recommending CRC screening* | - | Inability to identify correct screening tests | Inadequate training for laboratory technicians and providers |
| | *Barriers to conducting CRC screening* | - | - | - |
| **Social/professional role and identity** | *Barriers to recommending CRC screening* | - | - | - |
| | *Barriers to conducting CRC screening* | - | - | - |
| **Beliefs about capabilities** | *Barriers to recommending CRC screening* | - | Lack of confidence in providers to perform and interpret screening test appropriately | - |
| | *Barriers to conducting CRC screening* | - | - | - |

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| **Beliefs about consequences** | *Barriers to recommending CRC screening* | - | - | - |
| | *Barriers to conducting CRC screening* | - | - | - |
| **Optimism** | *Barriers to recommending CRC screening* | - | - | - |
| | *Barriers to conducting CRC screening* | - | - | - |
| **Reinforcement** | *Barriers to recommending CRC screening* | - | Lack of emphasis on prevention | - |
| | *Barriers to conducting CRC screening* | - | - | - |
| **Intentions** | *Barriers to recommending CRC screening* | - | Lack of emphasis on prevention | - |
| | *Barriers to conducting CRC screening* | - | - | - |

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| **Goals** | *Barriers to recommending CRC screening* | - | - | - |
| | *Barriers to conducting CRC screening* | - | - | - |
| **Memory, attention, and decision processes** | *Barriers to recommending CRC screening* | - | - | - |
| | *Barriers to conducting CRC screening* | - | - | - |
| **Environmental context and resources** | *Barriers to recommending CRC screening* | Socioeconomic status | Inadequate training for providers | Inadequate training for laboratory technicians, cost |
| | *Barriers to conducting CRC screening* | - | - | Shortage of specialized healthcare providers<br><br>Lack of hospital policy or protocols for cancer screening, shortage of trained HCPs (Health Care Providers) to conduct CRC screening or to follow up with invasive procedures, limited availability of |

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| | | | | screening services, and long waiting time for screening appointments |
| **Social influences** | *Barriers to recommending CRC screening* | - | - | - |
| | *Barriers to conducting CRC screening* | - | - | - |
| **Emotion** | *Barriers to recommending CRC screening* | Fear of painful procedures | Fear | - |
| | *Barriers to conducting CRC screening* | - | - | - |
| **Behavioral regulation** | *Barriers to recommending CRC screening* | - | - | - |
| | *Barriers to conducting CRC screening* | - | - | - |

Table 4. **Summary of Studies by Country and Author(s)**

| Country | Authors |
|---|---|
| United Arab Emirates (UAE) | Al Abdouli, Al-Sharbatti |
| Iran | Baghianimoghadam, Besharati, Bidouei, Boogar, Chouhdari, Ghobadi Dashdebi, Gholampour, Jeihooni, Khani Jeihooni, Kharameh, Khashij, Mahdi, Maheri, Majidi, Mansour-Ghanaei, Maserat, Mirzaei, Mirzaei-Alavijeh, Montazeri, Movahedi, Mozafar Saadati, Nikbakht, Niya, Nopour, Pourhoseingholi, Qandian, Rahmati-Najarkolaei, Ramazani, Ramezani, Roshani, Sadeghei, Safaee, Safdari, Salimzadeh, Shiri, Sohrabi, Soodejani, Taghavi, Taheri-Kharameh, Tahmasebi, Valukalaie, Zali |
| Saudi Arabia | Al-Doghether, Al-Hajeili, Al-Thafar, Al-Zalabani, Aldiab, Alduraywish, Aljumah, Almadi, Almutairi, Althobaiti, Alyabsi, Galal, Gosadi, Imran, Khayyat, Mosli, Shah, Zubaidi |
| Lebanon | Telvizian, Tfaily |
| Palestine/Gaza Strip | Elshami, Qumseya |
| Jordan | Abuadas, Ahmad, Al-Jaberi, Alqudah, Mhaidat, Obeidat, Omran, Rababah, Shihab, Taha |
| Oman | Al-Azri, Muliira |
| Qatar | Al-Dahshan, Mahmoud |
| Bahrain | Nasaif |
| Kuwait | Saeed |
| Pakistan | Ahmed, Bhurgri, Hasan, Hussain, Khalid, Muhammad, Yousaf |

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|---|---|
| Iraq | Muhammed |
| Egypt | Brand Bateman, Zaher |
| Morocco | Imad |
| Tunisia | Rejaibi, Rym |