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Review Article

Health Belief Model in Predicting Screening Behavior among Population at Risk of Colorectal Cancer: A Systematic Review

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Abstract

Background: We aimed to review systematically the role of Health Belief Model (HBM) in predicting the health behaviors of patients at risk of colorectal cancer (CRC) and to evaluate the effectiveness of HBM-based educational program on the knowledge and intention of individuals for preventive actions.

Methods: A systematic literature search was performed in PubMed, Scopus, Ovid, Science Direct, Embase, and Google Scholar from1980 up to June 2023 using CRC and HBM as the search words with all their similar terms. All available data were then extracted and described qualitatively.

Results: Overall, 37 articles with 24286 study populations were collected for data extraction. Findings showed that perceived benefit was the most important component of HBM and community-based education can play an important role in improving the awareness and intention of individuals for preventive actions such as screening behaviors. In addition, culture is an important factor in health belief of individuals, so culture-based modified HBM may help to enhance the efficiency of HBM in predicting the knowledge and intention rate among the population.

Conclusion: Preventive actions can minimize the risk of developing cancer, and consequent quality of life. HBM provides a valuable framework for understanding health behaviors by considering the perceptions of individuals about the disease.

Keywords: Colorectal cancer; Health belief model; Screening behavior; Educational program; Systematic review

Introduction

Colorectal cancer (CRC) is a significant public health concern, with a substantial global burden. It is the third most commonly diagnosed cancer and the second leading cause of cancer-related deaths worldwide (1). The prevalence of CRC varies across different populations and regions. Developed countries, such as the United States, Western Europe, and Australia, have higher incidence rates compared to developing nations. However, the incidence in developing countries

is quickly rising due to changes in lifestyle and dietary patterns leading to increased obesity rates, sedentary behavior, and consumption of processed foods (2). Multiple risk factors have been identified for CRC. Age, genetic mutations, family history of the disease, and certain lifestyle such as food consumption are significant factor, which may affect the incidence rate (3, 4). Many novel technologies have been developed for treatment of various cancer including CRC; however, preventive measures are essential in reducing the burden of cancer (5, 6).

For this purpose, health behaviors such as nutrition and screening are crucial for early detection and prevention (7). With the implementation of effective screening programs, lifestyle modifications, and awareness campaigns, it is possible to reduce the incidence, burden of this cancer, and promote early detection and better treatment outcomes (8). For this purpose, several frameworks have been developed to increase the awareness of people and predict the preventive actions.

Health Belief Model (HBM) is a widely accepted theoretical framework that aims to explain and predict individuals' health behaviors. HBM is grounded in the concept that individuals' perceptions of their susceptibility to and severity of a health condition, as well as their knowledge and beliefs about the benefits and barriers of taking action, influence their health-related decisions (9). According to the HBM, individuals are more likely to engage in preventive health behaviors if they perceive themselves to be at risk of an illness. Accordingly, the HBM emphasizes the role of beliefs about the susceptibility, severity, benefits, barriers, cues to action, and self-efficacy (10). People are more likely to engage in health-promoting behaviors if they believe that these behaviors will provide significant benefits in terms of preventing or managing a health condition. Conversely, perceived barriers, such as time, cost, or inconvenience, can reduce motivation to adopt healthy behaviors (11). Several factors can influence an individual's health beliefs, including personal experiences, social support, and cultural norms (12). On the other hand, individual beliefs and attitudes are not fixed and can be modified through effective communication and education strategies (13). In addition, Culture-based modified HBM interventions demonstrate the importance of integrating cultural factors into health behavior models to enhance their effectiveness. By understanding and addressing the unique cultural contexts of target populations, health interventions can be more successful in promoting positive health outcomes. For example, in some cultures; there may be a strong emphasis on family decision-making regarding health, which can affect individual health choices. Incorporating traditional health practices and beliefs into interventions (14).

A culturally adapted intervention aimed at increasing mammography rates among Asian American women. The program included educational materials in multiple languages and addressed cultural beliefs about modesty and gender roles that may hinder screening (15). A culturally tailored HIV prevention program was developed that included community leaders and used culturally relevant messaging. The program emphasized the importance of family and community support, framing HIV prevention as a community responsibility rather than just an individual one. Increased awareness and reduced stigma associated with HIV testing within the community (16).

By understanding individuals' beliefs and addressing their concerns, healthcare professionals can enhance the effectiveness of health promotion interventions. In the present study, we aimed to review systematically the evidences about the role of HBM in predicting and promoting the health behaviors of people at risk of CRC.

Materials and Methods

Study search and inclusion criteria

The present study investigated the role of HBM for the prediction of preventive behaviors of individuals at risk of CRC as well as knowledge assessment. Studies were included if they used the HBM to predict the knowledge and intention of

participants in performing self-protection behaviors of CRC. For this purpose, a systematic search was performed from1980 up to July 2023 in electronic databases including PubMed, Scopus, Ovid, Science Direct, and Embase. Google Scholar was also searched to find additional references. The key terms used for this purpose include "Health Belief Model" and "Colorectal Cancer" with all their equivalents terms in the keyword search. For this purpose, following search strategy was used in the PubMed: (health belief model OR HBM OR health belief theory OR health belief) AND (Colorectal cancer OR Colon cancer OR CRC OR bowel cancer OR rectal cancer). First, the search was limited to English articles. Next, review articles, case reports and conference papers were excluded.

The search was performed independently by two authors, and possible disagreement between the authors was resolved by double-checking in each step. All the procedures including study design and article selection were performed according to the PRISMA checklist 2020 as a recommended protocol for reporting systematic reviews (17).

Data extraction and the measured variables

For data extraction, all informative data including the demographic data, bibliographic information, study type, number of participants and their age were extracted. Next, the main outcomes, knowledge or intention rate or score of participants and the main contributing components of HBM in each study in addition to possible barriers or effective factors were extracted. Type of intervention in the interventional studies was also extracted and used for qualitative data analysis.

Quality assessment of included studies

Because different types of studies were included in this literature review, quality assessment was performed according to an appropriate quality scale of each type of study. Accordingly, Newcastle-Ottawa scoring tool was used for quality assessment of included controlled trials and cohort studies, and the National Institutes of Health (NIH) quality assessment scale, specialized for observational and cross-sectional studies, was used to evaluate the quality of observational studies. The questions of NIH checklist include 14 items and describes the quality of individual studies as a number of up to 14. While, Newcastle-Ottawa quality assessment scale has three different parts including "selection", "comparability", and "outcome" with overall 8 questions, and every study can obtain maximum 9 stars. The questions of Newcastle-Ottawa and NIH quality assessment were provided as supplementary data (Not published).

Results

Total of 2488 articles were found through database search, of which 2135 articles were in the PubMed and 271 articles were in Scopus. Moreover, 14 articles were found through search in the Google Scholar. Additional 23 non-repeated articles were also found in other databases. In addition, 8 articles were found through manual reference list screening of the previously included articles. Systematically procedure of article selection is presented in Fig. 1. The Quality of the included articles was also evaluated using relevant quality assessment scales and Table 1 presented the quality of included articles according to the types of studies. After exclusion of irrelevant papers in several steps, 37 related articles were collected for qualitative data description, of which 11 articles were interventional studies, and 26 articles were evaluation and observational studies. Therefore, the results were described in two sections of interventional and observational studies.

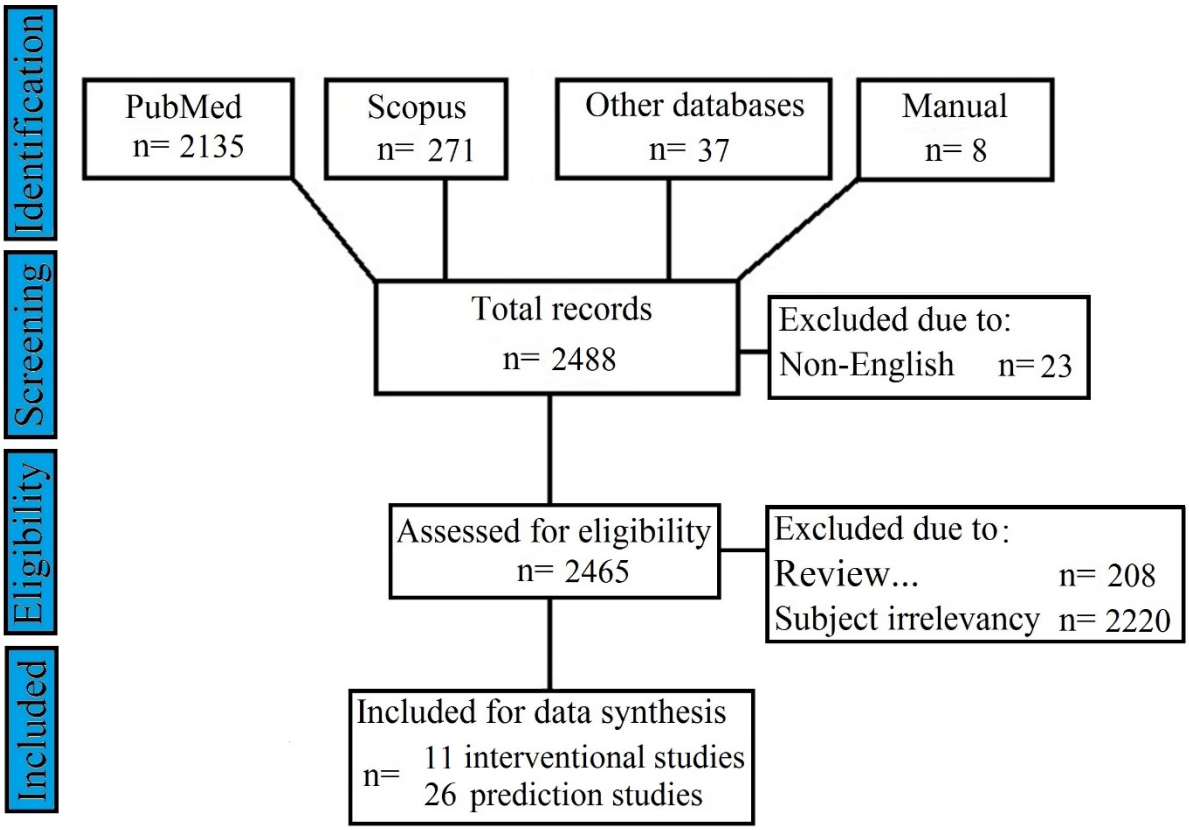

Fig. 1: Selection flowchart of included articles

Table 1: Quality assessment of included articles

No	Reference	Study type	Checklist	Score
1	Gu J, 2023 (18)	CSS	NIH	11/14
2	Du Q, 2022 (19)	CSS	NIH	10/14
3	Minutolo G, 2022(20)	CSS	NIH	10/14
4	Khazaei S, 2022 (21)	RCT	NOS	7/9
5	Torosian T, 2021 (22)	OS	NIH	9/14
6	Rakhshanderou S, 2020(23)	PCS	NOS	7/9
7	O'Reilly SM, 2020 (24)	CSS	NIH	12/14
8	He L, 2020 (25)	OS	NIH	10/14
9	Lee SY, 2020 (26)	CSS	NIH	11/14
10	Lin IP, 2020 (27)	CSS	NIH	12/14
11	Bai Y, 2020(28)	CSS	NIH	9/14
12	Almadi MA, 2019 (29)	CSS	NIH	11/14
13	Taş F, 2019 (30)	OS	NIH	10/14
14	Wagner CV, 2019	PCS	NOS	7/9

Table 1: Continued …

	(31)			
15	Lee SY, 2018 (32)	CSS	NIH	10/14
16	Williams RM, 2018 (33)	PCS	NOS	6/9
17	Hatami T, 2018 (34)	RCT	NOS	7/9
18	Gholampour Y, 2018(35)	OS	NIH	10/14
19	Jeihooni AK, 2017(36)	CSS	NIH	11/14
20	Sohler NL, 2015(37)	OS	NIH	12/14
21	Almadi MA, 2015 (38)	CSS	NIH	12/14
22	Koc S, 2014 (39)	CSS	NIH	11/14
23	Le TD, 2014 (40)	OS	NIH	11/14
24	Tavassoli E, 2014(41)	PCS	NOS	6/9
25	Wong RK, 2013 (42)	PCS	NOS	7/9
26	Javadzade SH, 2012(43)	CSS	NIH	11/14
27	Holt CL, 2012(44)	RCT	NOS	5/9
28	Rawl SM, 2012(45)	RCT	NOS	6/9
29	Causey C, 2011(46)	PCS	NOS	6/9
30	Cyr A, 2010 (47)	OS	NIH	10/14
31	Salz T, 2009 (48)	PCS	NOS	6/9
32	Sung JJY, 2008 (49)	OS	NIH	11/14
33	Greenwald B, 2006(50)	RCT	NOS	7/9
34	James AS, 2002 (51)	CSS	NIH	10/14
35	Jacobs LA, 2002 (52)	CSS	NIH	10/14
36	Harewood GC, 2002(53)	OS	NIH	11/14
37	Macrae FA, 1984(54)	OS	NIH	11/14

CSS: Cross-Sectional Study, RCT: Randomized controlled trial, PCS: Prospective cohort study, OS: Observational study, NIH: National Institutes of Health, NOS: Newcastle-Ottawa Scale

Interventional studies

The efficiency of HBM-based education on the knowledge and intention were evaluated among different population in 11 studies. Overall, 3451 participants of different ethnic groups, with different religious belief, age, and culture were evaluated in the included studies. Self-efficacy was associated with CRC screening, but knowledge and barriers were not significantly associated with screening, wherein the education only increased knowledge rate by 7% (37). Another study showed that classroom lecture, pamphlet, and educational messages can lead to a significant increase in the mean scores of knowledge, perceived susceptibility, severity, benefits, self-efficacy, behavioral intention, and preventive behaviors; however, the intervention did not influence the mean score of perceived barriers (23). Findings also demonstrated that computer-based education improves colon cancer screening knowledge and health beliefs of African-Americans by significantly increasing CRC knowledge scores, perceived CRC risk scores, barriers scores and benefit scores with perceived benefits as the major contributing factor (45). Other studies also showed that education ses-

sions were effective in improving participants' knowledge with more than 80% increasing in knowledge and intention (46, 50). In addition, perceived benefits was the major effective component of HBM, which would significantly predict screening behavior (33, 34, 41). Spiritually based educational intervention resulted in significant pre/post increases in knowledge, perceived benefits of screening, and decreases in perceived barriers to screening (44). Training can result in 3- to 6-fold increase in the knowledge, perceived susceptibility, perceived severity, perceived benefits, Self-efficacy, cues to action, and social support (21).

As mentioned by the participants, the most important information sources for the knowledge were health care staff, family and friends, radio and television, and internet (35). Findings of intervention of the level of awareness and intention for health behaviors are summarized in Table 2.

Table 2: Effects of education on knowledge or intention of participants about CRC, according to HBM

No	Patients, age	Follow-up time	Assessed behavior	Intervention	Main components of HBM influencing outcome	Knowledge or intention score or rate (baseline)	Knowledge or intention score or rate (post-test)	Barriers/ effective factor	Reference
1	120, 56.63 year	3 months	FOBT	Eight videos educational session	Perceived susceptibility	15%	90%	No recommendation, lack of symptoms	Khazaei S, 2022 (21)
2	110, 25-49 year	2 months	Nutritional behaviors	Classroom lecture, pamphlet, educational messages	Perceived susceptibility, severity, benefits, self-efficacy	Control: 19.57 ± 4.56 Test: 20.86 ± 4.49	18.64 ± 4.70 26.23 ± 2.28	-	Rakhshanderou S, 2020 (23)
3	762 church members	12 months	FOBT, colonoscopy	Workshop	Perceived benefit	Score: 1.7	Score: 2.5 (+68%)	Embarrassment	Williams RM, 2018 (33)
4	98	3 months	Nutritional behavior	Audiovisual CD information about nutritional behavior	Perceived severity, perceived self-efficacy, perceived benefits	Test: 0.59 Control: 0.52	0.85 (+26%) 0.56 (+4%)	Cost and difficulty of healthy eating	Hatami T, 2018 (34)
5	200 men	3 months	FOBT	Face-to-face training	Perceived susceptibility	Test: 20.17% Control: 22.1%	75.25% 23.85%	time, lack of symptoms	Gholampour Y, 2018 (35)
6	1101, 57 year	12 months	CRC screening	Multimedia program	self-efficacy, readiness	22.7%	+7.7%	-	Sohler NL, 2015(37)
7	130 students	2 months	Consumption of fruits and vegetables	Educational classes	Perceived severity, perceived benefits	Test: 41.39% Control: 40.29%	82.35% 47.31%	-	Tavassoli E, 2014 (41)
8	316, 60 years	1 month	CRC screening	Spiritually-based education	Perceived benefits	Score: 9.23	Score: 12.16	-	Holt CL, 2012 (44)
9	556, 57.3 year	36 months	FOBT, colonoscopy	Online education and brochure	Perceived barriers, benefits	53.48	80.95	Physician recommendation	Rawl SM, 2012(45)
10	38, 50-60 year	-	Healthy lifestyle	PowerPoint presentation	Perceived benefit	60.5%	84.2%	Cost	Causey C, 2011 (46)
11	20 female employees of an accounting firm	12 months	Prevention and screening	Community education	Perceived benefit	80%, Score: 3.84	Score: 4.89	Costs	Greenwald B, 2006 (50)

Observational studies

Based on the defined inclusion criteria, overall, 26 observational studies with 20835-study population were included in this part of literature review. These studies evaluated the rate of knowledge about CRC and intention of the individuals for screening and preventive behaviors. Findings showed that the knowledge and awareness about CRC, the benefits of screening tests, and preventive measures was low among the population (26). In addition, there was a gap between knowledge and undergoing CRC screening (29, 30). Moreover, perceived benefits, barriers, cues to action, and self-efficacy are the most important contributor for screening and preventive behaviors (20, 28). However, seriousness in health belief and perceived susceptibility can also contribute to screening and preventive behaviors of individuals, particularly in first-degree relatives of patients with CRC (19, 27, 54). Perceived severity could also be considered as the most influencing factors in high-risk population (25). In addition, findings showed that willingness to undergo a CRC screening test increased if there was a family history of CRC (38, 52). Embarrassment, pain, perceived access barriers to CRC testing, cost of healthy behaviors, no recommendation from a physician and not having health insurance were the most important barriers (31, 47, 49). Table 3 shows the efficiency of HBM in predicting the knowledge or intention of patients about CRC.

Table 3: Efficiency of HBM in predicting the knowledge or intention of patients about CRC.

No	Patient, age	Data collection tools	Assessed behavior	Main components of HBM influencing outcome	Barriers/ effective factor	Knowledge score or rate (%)	Intention rate (%)	Reference
1	265 FDR, 35.89 year	Knowledge questionnaire	CRC screening	Perceived benefits, self-efficacy	-	83.4%	23.0%	Gu J, 2023 (18)
2	201 FDR	Knowledge questionnaire	CRC screening	Perceived susceptibility	-	-	18.9%	Du Q, 2022 (19)
3	175 Patients with a positive FOBT, 50-69 year	Telephone interview	Colonoscopy	Perceived benefits	Recommendation of general practitioner	-	25.7%	Minutolo G, 2022 (20)
4	368, 55 year	Knowledge questionnaire	CRC screening	Perceived benefits	Cost	84%	22%	Torosian T, 2021 (22)
5	1127, >60 year	Knowledge questionnaire	FOBT, colonoscopy	Perceived susceptibility, perceived seriousness	Stress	78.9%	25%	O'Reilly SM, 2020(24)
6	2568 high-risk population, 63.43 year	In-person interview	Colonoscopy	Perceived severity	Prior recommendation or knowing someone with CRC	-	20.68%	He L, 2020 (25)
7	728 Koreans, 60.29 year	Face-to-face interview	FOBT	Perceived barriers	Private freedom	-	28.87%	Lee SY, 2020 (26)
8	125, 62.38 year	Knowledge questionnaire	Screening intention, health protective behavior	Seriousness in health belief	Inconvenience	64.9%	26.4%	Lin IP, 2020 (27)
9	186 relatives of CRC patients, 49.62 year	Online surveys	Colonoscopy	Perceived benefits	Painful procedure, time	-	15.6%	Bai Y, 2020 (28)
10	5720, 43.28 year	Survey delivery method	Colonoscopy	Perceived benefits	-	73%	15.24%	Almadi MA, 2019(29)
11	235, 59.37 year	Data collection form	CRC screening	Perceived benefits	Lack of knowledge	77.9%	11.5%	Taş F, 2019 (30)
12	1578, 54 year	Knowledge questionnaire	Sigmoidoscopy	Perceived benefits	embarrassment and pain	91%	65.2%	Wagner CV, 2019 (31)

Table 3: Continued …

13	202, 62.7 year	Survey package	FOBT	Self-efficacy, health temporal orientation	Fatalism	61.9%	4%	Lee SY, 2018 (32)
14	120, 64.21 year	Knowledge questionnaire	FOBT	Perceived Severity and Perceived Susceptibility	Bad feeling and shortage of time	42.2%	12.72%	Jeihooni AK, 2017 (36)
15	500, 41 year	Knowledge questionnaire	Colonoscopy	-	Cost, fear, access to physicians, embarrassment	70.7%	6.5%	Almadi MA, 2015(38)
16	400 FDR, 37.7 year	Knowledge questionnaire	Colonoscopy	Perceived confidence-benefits	Being female	38.25%	22.2%	Koc S, 2014 (39)
17	654, 62.3 year	Knowledge questionnaire	CRC screening	Perceived benefits	Anxiety and discomfort	Chinese: 46.6% Korean: 58% Vietnames: 34%	-	Le TD, 2014 (40)
18	1743, 61.3 year	Face-to-face interview	FOBT and colonoscopy	Perceived barriers	Worry about contracting CRC	88.5%	26.7%	Wong RK, 2013(42)
19	196	Home interview	FOBT	Perceived self-efficiency	Poor communication	Lab-referred: 48.5% Control: 36.5%	60.8% 13.3%	Javadzade SH, 2012 (43)
20	558	Mail-out survey	Genetic testing	Perceived benefits	Affordability and satisfying curiosity	58%	43%	Cyr A, 2010 (47)
21	277 CRC survivors	Telephone interviews	Colonoscopy	Perceived benefits	Cost	86%	48%	Salz T, 2009 (48)
22	1004, 30-65 year	Telephone survey	CRC screening	knowledge of CRC symptoms and risk factors	No access to CRC testing and not having health insurance	42.4 %	10%	Sung JJY, 2008 (49)
23	850 church members, 63 year	Telephone survey	FOBT Sigmoidoscopy Colonoscopy	Perceived benefits	Not recommended by doctor, painful, cost	-	23% 30% 20%	James AS, 2002 (51)
24	174 CRC patients and 90 FDR	Mail survey	Health maintenance visits	Perceived barriers and perceived seriousness	-	-	Patients: 83% FDR: 67%	Jacobs LA, 2002 (52)
25	300 patients (150 never-screened; 150 previously screened), 59.74 year	Knowledge questionnaire	Colonoscopy	Perceived benefits	Adequate analgesia, no recommendation from physician, embarrassment	60%	72%	Harewood GC, 2002 (53)
26	581	Knowledge questionnaire	FOBT	Perceived barriers and perceived susceptibility	-	51%	12%	Macrae FA, 1984 (54)

FDR: First-degree relatives

Discussion

CRC is one of the most common cancers and is the second leading cause of cancer death. Multiple risk factors such as age, inherited genetic mutations, family history of the disease, excessive alcohol consumption and smoking have been identified for CRC, which may significantly increase the risk of developing cancer. Despite advances in developing new anticancer agents, screening and preventive behaviors can be effective at detecting cancer at early and treatable stages, but a large proportion of people have few information about preventive measures (55). Find-

ings of population-based studies reveal that the disease can be treated by early diagnosis 90% (43). Lifestyle modifications and healthy diet can also play a role in prevention. Also, screening tests such as colonoscopy, and stool-based tests can help to identify pre-cancerous polyps or detect cancer at an early and treatable stage, and reduce mortality by over 30% (56). The HBM is one of the widely used psychosocial models developed to explain psychosocial constructs associated with preventive health behavior such as screening behaviors, and healthy lifestyle. The HBM may also be used to predict an individual's knowledge about a disease, action and intention for healthy behaviors. In the present study, the importance and reliability of HBM was reviewed in predicting the knowledge and intention of participants for preventive behaviors such as CRC screening.

Both knowledge and beliefs were found to be critical in promoting the cancer screening behavior of people. According to the findings of included studies, self-reported knowledge of CRC was high among the population, but intention of individuals for screening and healthy behaviors remains low (22, 32). Although intention for screening and health behaviors is almost same in both gender, the results showed that, "being female" was the strongest predictor of perceived barriers (39). On contrary, male participants were more likely to screen for cancer than female participants were, which may be due to public awareness of men about the risk of CRC or embarrassment, discomfort and fear of women from screening methods (18). Increased willingness to undergo screening was correlated with overall knowledge of screening tests, knowing friends who received CRC, family history and discussing screening tests with community members (40). On the other hand, CRC screening behavior was associated with having a regular visit for the physician, and there is a willingness to undergo screening if recommended by a health care professional; however, this willingness is cost-sensitive (22, 51). However, the results differ in different population, since the health beliefs of CRC survivors may not be the same as asymptomatic adults due to the experience of cancer. Finding indicated that a physician recommendation is an important determinant to influence intentions of patients for healthy behaviors (48). Training primary care providers is one of the operational strategies for 'physician recommendation ' in low-resource settings. This process ensures that providers can effectively communicate recommendations to patients, thereby improving adherence and health outcomes. Using this approach and the resources provided health systems in low-resource settings can work effectively by training primary care providers. This approach not only increases provider skills, but also ultimately improves patient engagement and health outcomes.

Regarding the role of awareness about the preventive actions, the results showed remarkable role of media, health staffs, and practitioners in improving the level of knowledge in people at risk of cancer (43). As mentioned by the participants, the most important information sources for the knowledge were health care staff, family and friends, radio and television, and internet, indicating the role of health care staff, media and family members (35, 36). Majority of findings demonstrated that the intention of participants has a positive association with worry about contracting CRC and a physician's recommendation. The information sources of 74.3% of the population about CRC is through reading or hearing in the print or broadcast media (42). Although involvement of healthcare professionals in disseminating information on the benefits of screening is an effective measure to increase the public awareness, colon cancer survivors were found to be the most effective person to advocate publicly the advantages and necessity of screening behaviors on TV (24, 53).

CRC screening and preventive actions increased significantly with educational level, but the level of knowledge and cues to action may be influenced by perceived barriers (42). According to the results of included studies, the level of awareness, and the rate of intention for preventive actions varied among different population. CRC screening remains poor even with high levels of

awareness in some population. Race, gender, and culture-specific psychological barriers were associated with behaviors, which highlights the need for culturally specific health interventions, and assessment methods (40). Accordingly, it is suggested that the strategies to increase public awareness should consider gender and culture specific approaches. On the other hand, cost was the major determinant of healthy behaviors such as screening test, even with high level of knowledge, so it is suggested to apply multi-level CRC screening programs in middle-income countries. Education of primary healthcare personnel to recommend preventive actions for the high-risk population is also recommended. Community based health education programs should also be designed aiming at inducing behavioral change by teaching the people about the benefits of prevention and early detection of CRC. According to the findings of this study, HBM as a valid and reliable instrument appears to be a useful construct for predicting and improving the knowledge and intention of individuals about CRC. However, it is suggested that future research explore the relative predictive power of HBM against TPB, SCT, or other behavior change theories to further refine intervention strategies

Conclusion

Preventive actions such as regular screening for CRC can minimize the risk of developing cancer, and consequent quality of life. HBM provides a valuable framework for understanding health behaviors by considering the perceptions of individuals about the disease. Incorporating these factors into health promotion interventional programs can improve the intention of individuals for health-promoting behaviors. Findings of this study showed that there is a need for health education programs to encourage people for preventive action such as screening test and lifestyle change. Given the strong association of preventive behaviors such as CRC screening and healthy diet with physician's recommendation, as well as the role of media and social activities, the influential role of the healthcare workers and community-based educational programs in promoting screening behaviors should be promoted. Social factors, traditional belief and culture are strong predictors of perceived benefits and intentions. Fatalistic beliefs and perception of individuals about the benefits and barriers of screening can be determinant in the intention of healthy behaviors. Therefore, it is suggested to include social and cultural factors in behavioral interventions to increase the efficiency of educational programs.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflicts of interest

The authors have stated that they have no conflicts of interest

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