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Evaluation of health belief model-based educational intervention on colorectal cancer screening behavior at South Khorasan, Iran

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Abstract:

BACKGROUND: Colorectal cancer is the most common cancer of the gastrointestinal tract. Health beliefs play an important role in the development of health behaviors. In this study, the effect of educational intervention based on Health Belief Model on colorectal cancer screening behavior was investigated.

MATERIALS AND METHODS: This study was performed as a randomized controlled intervention. The study population was 50–70-years old in Khosf city. Initially, 120 eligible populations were randomly divided into intervention and control groups (60 people in each group). The data collection tool was a standard colorectal cancer screening questionnaire that was completed before, immediately, and 3 months after the intervention. The intervention consisted of eight 60-min training sessions. The collected data were analyzed using SPSS19 software and statistical tests.

RESULTS: The mean age of the intervention and control groups was 63.53 ± 5.67 and 57.73 ± 5.77 years. In terms of mean scores of knowledge, perceived susceptibility, perceived severity, and perceived barriers were homogeneous before intervention. After the intervention, the mean score of the model constructs showed significant changes, which was statistically significant ($P < 0.05$). The rate of occult blood test in stool 3 months after training reached 90% in the intervention group and 15% in the control group.

CONCLUSIONS: The results of this study showed that by taking measures to reduce perceived barriers as well as increase knowledge, perceived susceptibility, severity, benefits and self-efficacy, the rate of participation in occult blood testing in feces can be significantly increased.

Keywords:

Cancer screening, colorectal cancer, fecal occult blood test, health belief model

Introduction

Colorectal cancer is the most common cancer of the gastrointestinal tract, accounting for 38% of gastrointestinal cancers.[1] Colorectal cancer is the second most common cause of cancer death in the United States. According to the American Cancer Society in 2020, approximately 147,750 people had colorectal cancer and 53,200 died from the disease.[2] Colorectal cancer is the third most common cancer in Iran and the second most common cancer in women. The standardized age incidence in men and women is 16.57 and 11.86/100,000 population, respectively.[3] Many health and care problems are preventable, and factors such as increasing the frequency of cancer screening, regular follow-up of abnormal screening test results, and advances in cancer treatment are effective in reducing mortality.[4]

A study in the United States found that people who were screened regularly and

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annually were 33% less likely to die from colorectal cancer than those who were not screened.[4]

Among colorectal cancer screening tests, fecal occult blood test (FOBT) is preferred over other methods due to its ease of performance and low cost.[5] Despite the effectiveness of screening programs in diagnosing early and treatable cancers, unfortunately, a large number of people at risk do not participate in screening programs.[6] According to the study of Salimzadeh *et al*. in Tehran, 11% of the respondents reported prior screening by either FOBT (6.5%) or colonoscopy (4.5%).[7] Furthermore, the study by Ramazani *et al*. in South Khorasan showed that 8.3% of participants performed screening tests for early detection of colorectal cancer, and 15% intended to do so.[8] Various studies around the world have shown that people are less likely to participate in colorectal cancer screening programs.[9,10] This reluctance is due to various obstacles such as low level of knowledge and poor communication of health-care providers with people, poor communication skills, low self-efficacy, and low perceived sensitivity, lack of information, fear of cancer diagnosis, lack of time for this test, lack of doctors' advice, and perceived insensitivity.[6,11,12] There is ample evidence that public awareness of colorectal cancer in Asia is generally low, but it is believed that educating the general public, improving access to resources, health care, and removing barriers to screening can increase outcomes.[13]

The effectiveness of health education programs depends to a large extent on the correct use of models and theories, so today, the use of theories is essential for health education professionals and health promotion.[14] Screening behaviors are influenced by individual beliefs and it is necessary to use models in this field that are based on individual beliefs. One of the models that is widely used to evaluate health beliefs is the Health Belief Model (HBM).[15] The basic constructs of the HBM include:

a. Perceived susceptibility: A person's opinion about the chance of getting sick
b. Perceived severity: A person's opinion about the severity of the disease
c. Perceived benefits: A person's perception of the effectiveness of preventive behaviors
d. Perceived barriers: A person's perception of problematic factors in preventive behaviors
e. Self-efficacy: A person's perceived ability to accept the behavior, and cues to action are a set of effective factors in adopting disease prevention behavior [Figure1].[16]

Due to the high prevalence of this cancer and the low number of cases diagnosed in the early stages due to lack of timely screening, despite the availability of FOBT and the heavy burden of treatment of this disease, preventive measures are necessary. According to the influential factors in the incidence of disease, education can play an important role in increasing the level of screening and reducing the burden of this disease. Therefore, the aim of this study was to determine the effect of education on colorectal cancer screening by FOBT based on the HBM.

Materials and Methods

Study design and setting

This study was a randomized controlled field trial that was performed on 120 people aged 50–70 years in Khosf, a city located in the east of Iran in 2019.

Study participants and sampling

Sampling was done by clustering method, so that initially 4 centers were selected from the comprehensive health service centers of Khosf city based on geographical conditions and homogeneity of customs. Then, 2 centers in the control group and 2 centers in the experimental group were randomly selected. In each center, based on the household number in the Sib system, 30 people from 50 to 70-years old who were eligible for the study were selected. Inclusion criteria were age 50–70 years, no history of occult blood test in the stool, no self-reported person or first-degree relatives diagnosed with colorectal cancer, ability to answer questions physically and mentally, and informed consent for participation in the study. Exclusion criteria included an incomplete response to the questionnaire and irregular and ineffective attendance at training sessions (absence of more than one session).

Data collection tool and technique

The data collection tool was the standard colorectal cancer screening questionnaire from Tahmasebi *et al*. whose validity and reliability were confirmed.[17] Cronbach's alpha coefficients in the present study for susceptibility, severity, barriers, benefits, and perceived self-efficacy were 0.69, 0.92, 0.92, 0.90, 0.74, 0.83, and a total of 0.67, respectively. This questionnaire includes demographic information and constructs of HBM (including perceived susceptibility, severity, benefits, barriers, self-efficacy,

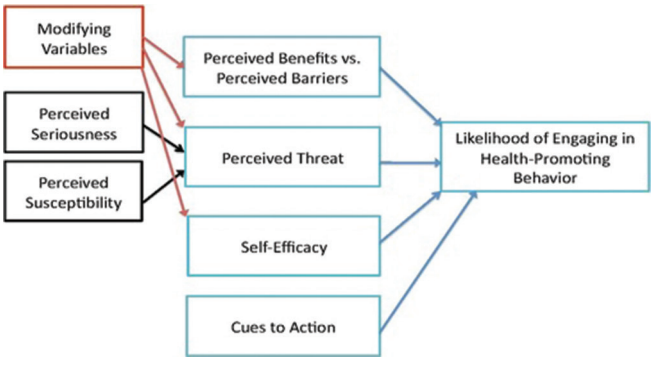

Figure 1: Conceptual framework of the health belief model[16]

and cues to action). Knowledge questions were 15 multiple-choice questions that were assigned to the correct option of Score 1 and the incorrect options of score zero, which range from 0 to 15. Questions related to perceived susceptibility include 4 questions, perceived severity 14 questions, perceived barriers 16 questions, and perceived benefits 8 questions, the answers to which are in the form of a 5-point Likert scale (strongly agree, agree, have no opinion, disagree, and strongly disagree). Perceived self-efficacy questions consist of 6 questions in a 5-point Likert scale (not at all, little, no comment, most of the time, and always) reported on a scale of 1–5. The cues to action consist of 2 multiple-choice questions.

Prior to the intervention, a meeting was held for the staff of the laboratory unit of the health center, staff, and health workers about the purpose of the project, a sufficient number of fitness tests in health centers, storage conditions, and how to perform a fitness test was discussed. The members of the intervention group were divided into 4 training classes (15 people), and 8 training sessions of 60 min were held for each group. For the first session, the purpose of the plan and the time and place of the training sessions were informed by phone. At the beginning of the first session, the first questionnaire was completed for all participants (2 training sessions per week for each group). Educational content based on the HBM was presented in the form of PowerPoints in simple language with photos to attract attention and motivate, along with educational clips and pamphlets [Table 1]. Immediately and 3 months after the educational intervention, a requestionnaire was completed for the intervention and control groups. It should be noted that due to the epidemic of Covid-19 and the observance of social distance, for 15 people, it was completed by telephone interview.

Ethical consideration

After explaining the objectives of the project to the subjects and ensuring the confidentiality of information, the consent form was completed. It should be noted that no training class was held for the control group during the study. To comply with ethical principles, an educational session was held at the end of the study with an educational pamphlet. Furthermore, the study was approved by the Birjand University of Medical Sciences (BUMSs) at Research Review Board (Research Code: 455879) and also at the ethics committee board (IR.bums.REC.1398.39).

Statistical analysis

The data were analyzed using IBM SPSS Statistics for Windows, version 19 (IBM Corp., Armonk, N.Y., USA). Qualitative variables were described based on number and percentage and quantitative variables were described using mean and standard deviation. Chi-square test was used to evaluate the homogeneity of qualitative variables in the studied groups and an independent *t*-test was used for quantitative variables. Kolmogorov–Smirnov test was used to test the normality hypothesis. Repeated measurement methods were used to examine changes in susceptibility, severity, barriers, benefits, and perceived self-efficacy over time. Paired *t*-test was also used to compare changes in variables whose initial scores were significant. The McNemar test was used to examine participants' performance changes for the screening test. Statistical tests were considered at a significant level of 0.05.

Table 1: Schedule of training sessions

Meeting number	Session title	Target variables	Presentation method	Learning assist tools
First and second sessions	Introducing the objectives of the study Defining colorectal cancer, the importance of disease providing statistics on the prevalence and disability of colorectal cancer	Increasing awareness and arousal of perceived susceptibility and severity	Lectures with questions and answers and group discussions	PowerPoint, video projector, whiteboard, magic marker
Third and fourth sessions	Introduction of colorectal cancer preventive behaviors, colorectal cancer risk factors, colorectal cancer screening behavior by concealed blood test in stool	Aiming to increase and promote perceived benefits	Group discussion and lecture with questions and answers and identification of interests	PowerPoint, video projector, whiteboard, magic marker
Fifth and sixth sessions	Principles of colorectal cancer prevention and ways to overcome perceived barriers to screening for cancer by secretory blood test	Increase awareness on how to screen colorectal cancer and increase awareness to overcome barriers and increase self-efficacy	Group discussion lecture with questions and answers	PowerPoint, video projector, whiteboard, magic marker
Seventh session	Fixed issues related to the educational content of the previous session	To overcome obstacles and increase self-efficacy	Group discussion lecture with questions and answers	View photos and videos and interview a person with colorectal cancer
Eighth session	Provide summaries of educational content and answer participants' questions	Browse content	Lecture with questions and answers	PowerPoint, video projector, whiteboard, magic marker

Table 2: Comparison of demographic characteristics in the intervention and control groups

Variables	Control		Intervention		Test statistics	*P*
	n	%	*n*	%		
Sex						
Male	29	48.3	33	55	0.34	0.46
Female	31	51.7	27	45		
Job						
Free	30	50	35	58.3	3.20	0.41
Employee	1	1.7	1	1.7		
Jobless	0	0	2	3.3		
Housewife	29	48.3	22	36.7		
Marital status						
Single	1	1.7	0	0	1.02	1
Married	56	93.3	57	95		
Absolute	3	5	3	5		
Economic situation						
Good	3	5	7	11.7	1.75	0.46
The average	43	71.7	41	68.3		
Poor	14	23.3	12	20		
Going to the doctor						
Yes	38	63.3	36	60	0.14	0.85
No	22	36.7	24	40		
Family history of cancer						
Yes	1	1.7	6	10	3.79	0.11
No	59	98.3	54	90		
Family cancer ratio						
Does not have a Familial history	59	98.3	54	90	3.88	0.22
Sister/brother	0	0	2	3.3		
Father/mother	0	0	2	3.3		
Aunt/Uncle/Dei/Grandpa/Grandma	1	1.7	2	3.3		
Insurance						
Not inssurance	0	0	2	3.3	8.04	0.02
Social security	13	21.7	13	21.7		
Health service	1	1.7	8	13.3		
Other	46	56.7	37	61.7		
Intention to take a test						
Yes	3	5	6	10	1.08	0.49
No	57	95	54	90		
Sport and walks per week						
Dont exercise	10	16.7	11	18.3	0.17	0.94
<150 min	32	53.3	30	50		
>150 min	18	30	19	31.7		
Fruit/Vegetable						
≤3 Servingsa week	24	40	21	35	0.32	0.70
>3 Servingsa week	36	60	39	65		
Smoking						
Yes	3	5	2	3.3	0.20	1
No	57	95	58	96.7		
Hookah						
Yes	1	1.7	0	0	1.00	1
No	59	98.3	60	100		
	Mean	**SD**	**Mean**	**SD**		
Age	57.73	5.77	56.63	5.67	1.05	0.29
Body Mass Index (BMI)	24.60	3.51	26.33	4.96	2.20	0.02
Number of children	3.90	1.43	3.71	1.83	0.61	0.54
Literacy (class)	2.40	2.29	3.28	2.55	1.99	0.04
Number of cigarettes	0.05	0.21	0.05	0.28	0	1

Table 3: Comparison of mean scores of knowledge and constructs of HBM before, immediately and three months after the intervention in the intervention and control groups

Variables	Control (*n*=60)					Intervention					$P^{\ddagger}$	$P^{\S}$	P^{*}
	Before	Immediately	3 months After	$P^{\dagger}$	Effect size	Before	Immediately	3 months After	$P^{\dagger}$	Effect size			
Knowledge	3.58±16.38	3.70±17.93	3.02±20.03	<0.001	0.48	3.56±16.88	2.6±26.60	1.91±27.78	<0.001	0.89	0.44	<0.001	<0.001
Perceived susceptibility	1.66±11.03	1.52±11.81	1.41±12.38	<0.001	0.32	1.92±10.66	2.13±16.28	1.90±17.28	<0.001	0.83	0.26	<0.001	<0.001
Perceived severity	2.85±48.11	3.00±49.15	3.48±50.26	<0.001	0.31	4.55±48.51	4.75±60.40	4.29±63.00	<0.001	0.88	0.56	<0.001	<0.001
Perceived barriers	2.51±53.31	2.45±51.75	2.76±50.53	<0.001	0.40	4.44±52.86	5.75±31.41	6.09±28.5	<0.001	0.91	0.49	<0.001	<0.001
Perceived benefits	1.84±23.35	2.00±24.21	2.45±25.30	<0.001	0.42	4.99±25	4.01±34.60	3.73±36.23	<0.001	0.83	0.02	<0.001	<0.001
Perceived self-efficacy	1.88±18.08	1.89±18.90	2.18±19.40	<0.001	0.25	2.46±18.96	2.75±25.05	2.91±26.13	<0.001	0.83	0.03	<0.001	<0.001

†repeated Measure ANOVA, ‡Between-group comparisons of baseline values between the two groups. §Between-group comparisons of change values (Immediately -before) between the two groups. *Between-group comparisons of change values (After -before) between the two groups

Results

According to the results, the mean age of the subjects was 56.63 ± 5.67 years; 51.7% were male (62); 48.3% (58) were female; 94.2% (113) were married; and 96.7% (117 people) were insured. Other demographic results are presented in Table 2.

The results of Table 3 show that the two groups at the beginning of the study were not significantly different in terms of mean scores of awareness ($P = 0.44$), perceived susceptibility ($P = 0.26$), perceived severity ($P = 0.56$), and perceived barriers ($P = 0.49$). However, the perceived benefits ($P = 0.01$) and self-efficacy ($P = 0.03$) were significantly higher in the intervention group. Due to the fact that the interaction of time and group was significant in the analysis of repeated measurements, the analysis was performed separately in different groups over time and the groups were compared at different times. To adjust the effect of the initial score, the analysis of changes in scores in groups was performed.

According to Table 3, after the intervention, exception of perceived barriers, the mean score of knowledge, perceived susceptibility, perceived severity, perceived benefits, and perceived self-efficacy increased significantly in the intervention group and also showed an increase in the control group. This may be due to the implementation of a national colorectal cancer screening program with a secret blood test in the stool. The results of Table 3 show a significant increase in the effect size of knowledge and other constructs of the HBM in the intervention group compared to the control group.

The results of McNemar test showed that there is a significant difference between the intervention and control groups in performing secret blood tests in feces ($P < 0.05$). Hidden fecal blood tests in the intervention group immediately and 3 months after the intervention were 35 (58.3%) and 54 (90%), respectively. In the control group, they were zero and 9 (15%), respectively.

Discussion

According to the World Health Organization, all people over the age of 50 are at risk for colon cancer.[18] The purpose of this study was to determine the effect of educational interventions based on HBM on colorectal cancer screening behavior in people aged 50–70 years. The results of the present study showed that the educational intervention has significantly increased the mean score of knowledge of individuals compared to before the intervention. Most studies have emphasized the effectiveness of educational interventions in raising people's awareness of various health issues. Among

them, we can mention the results of the studies of Alavi Langroodi *et al*.,[19] Gholampour *et al*.,[18] Moattar *et al*.,[20] Cameron *et al*.,[21] Khani Jeihooni *et al*.,[22] and Rakhshanderou *et al*.[23] that it consistent with this study.

Awareness and knowledge are essential components of any behavior change. In fact, to accept any behavior change, one must first be aware of what is about to change it.[24] The results of this study showed that educational intervention can improve the knowledge and awareness of people in the field of colorectal cancer screening. One of the reasons that increased the awareness of people in this study is holding training sessions in the form of group discussions, questions and answers, and showing educational clips.

The results of the current study showed that the mean score of perceived susceptibility and perceived severity of individuals had a significant increase compared to before the intervention. Perceived susceptibility is a person's mental belief in the possibility of getting sick or harmed as a result of a certain behavior. Perceived severity is the belief in the extent of the damage caused by an illness or traumatic situation caused by a particular behavior.[25] The results of the present study in terms of perceived susceptibility and perceived severity are in line with the results of the study of Gholampour *et al*.,[14] Bae *et al*.,[26] and Moattar *et al*.[20] Contrary to the results of this study, the results of the study by Alavi Langroodi *et al*.[19] were not significant in the perceived susceptibility in the intervention group after the educational intervention. The results of the present study indicate the importance of performing effective educational interventions in the field of increasing perceived susceptibility and perceived severity of people toward awareness of the risk of colorectal cancer.

The results of the present study showed that the educational intervention based on the constructs of the HBM has caused a significant decrease in the mean score of perceived barriers compared to before the intervention. Obstacles that a person encounters in adopting a new behavior during his personal evaluation has the most important contribution in determining the rate of behavior change.[25] The findings of the study in the intervention group in the construct of perceived barriers are consistent with the results of the study of Moattr *et al*.,[20] Gholampour *et al*.,[18] and Khani Jeihooni *et al*.[22] Contrary to the results of the present study, the studies of Alavi Langroudi *et al*.[19] and Rakhshanderou *et al*.[23] were not significant in terms of perceived barriers in the intervention group after the educational intervention.

In the current study, the barriers to participating in the screening of secret blood tests in the feces from the perspective of participants before the study, respectively, not knowing how to do 98%, not a doctor's advice 93%, no symptoms and being healthy 85.8%, it is better not to know I have cancer, 81.7%, not knowing the place of the test, 72.5%, forgetting to perform the test, 70.8%, having the test have no effect on infection, 67.5% and 63.3% mentioned fear of the result as a barrier. In this study, the biggest obstacle mentioned at the beginning of the study in the screening programs of secret blood test in feces was not knowing how to perform secret blood test in feces, which was in line with the results of the study of Tastan *et al*.[10] In the study by Hughes Alejandro *et al*.,[27] rural participants perceived screening costs as a barrier and further reported that colorectal cancer could not be prevented (Hughes Alejandro). In the study of Gholampour *et al*.,[18] the most important obstacles in performing occult blood test in feces were feeling healthy and lack of symptoms, lack of doctors' prescription and advice, lack of interest in performing FOBT test, and lack of sufficient knowledge about the test.[18] In Moattar *et al*.'s study,[6] the most important barriers were lack of time and feeling of health and lack of symptoms. In a study conducted by Al-Dahshan *et al*., 5 main barriers were reported, which were lack of symptoms, lack of family history, lack of sense of danger due to a healthy lifestyle, lack of time, and lack of reminders by staff and health-care providers.[28]

The results of this study showed that by taking measures to reduce perceived barriers, colorectal cancer screening can be increased by FOBT. The results of the present study show a significant increase in the mean score of perceived benefits in the intervention group after the intervention. The perceived benefits of a person's beliefs about the value and benefits of adopting a new behavior in reducing the risk of disease.[25] The results of the present study in the intervention group after performing educational interventions are similar to the results of the studies of Rakhshandro *et al*., Moattar *et al*., and Alavi Langroudi *et al*.[19,20,23] The results of the present study show that by performing educational interventions and increasing the perceived benefits, screening behavior can be increased by FOBT.

The results of this study were significant after perceived self-efficacy in the intervention group at the beginning of the study and also after the educational intervention in both intervention and control groups, but the perceived self-efficacy score in the intervention group showed a greater increase than the control group. The reason for the increase in self-efficacy score in the control group could be due to the implementation of a national colorectal cancer screening program with a FOBT. This finding is consistent with the results of studies by Gholampour *et al*.,[18] Alavi Langroudi *et al*.,[19] Moattar *et al*.,[20] Rakhshandro *et al*.,[23] and Javadzadeh

et al.[6] Perceived self-efficacy is one of the most important predisposing factors for the onset and continuation of health behaviors and is directly related to behavior.[25] Therefore, to promote self-efficacy, reminding the benefits of adopting healthy behaviors against the costs that unhealthy behaviors have for a person through educational clips, discussion, questions and answers, and removing barriers of healthy health behavior can be effective.

The frequency distribution of individuals in the behavior of FOBT showed that in the intervention group, immediately after the intervention 35 subjects (58.3%) and 3 months after the intervention 54 individuals (90%). In the control group, immediately after the intervention zero and 3 months after the intervention, nine patients (15%) had referred for the FOBT. In Aroma *et al*.'s study, in the experimental group, the participation rate in conducting a FOBT in the first stage is 83.1%, in the second stage 80.8%, and in the third stage 69.2%. In the control group, it is 14.1%, 7.7%, and 3.8%, respectively.[20] These findings indicate that education based on the HBM is effective in the participation of the intervention group and highlights the need for training to increase people's participation in screening programs.

The results of this study showed the effect of HBM-based education in the constructs of perceived susceptibility, severity, benefits, barriers, and self-efficacy on colorectal cancer screening with FOBT. Therefore, designing and implementing educational interventions based on these constructs can increase screening behavior.

Limitation and recommendation

This study has a number of strengths and limitation including existence of control and intervention groups, random assignment of individuals, using of HBM for educational intervention, and existence of quarterly follow up period. Limitations consist of the use of self-report tools, and due to time limitation, follow-up was performed merely 3 months after the educational intervention; therefore, long-term follow-up was not performed to maintenance of behavior.

Conclusions

The results of this study showed the effectiveness of an educational intervention based on the HBM on the constructs of perceived susceptibility, severity, benefits, barriers, and self-efficacy on colorectal cancer screening with FOBT. Therefore, designing and implementing educational interventions based on these constructs can increase screening behavior and must be considered for targeting and programming of efficient interventions. The results of this study can widely use in the field of activities of care providers, including physicians and health care providers. The findings of this study can also be used to change the beliefs of people in the community to improve their health and provide a culture of timely screening and appropriate action.

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Conflicts of interest

There are no conflicts of interest.

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