

Theoretically designed interventions for colorectal cancer prevention: A Case of the Health Belief Model

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Abstract

Background

According to the WHO, most chronic diseases, including cancer, can be prevented by identifying their risk factors such as unhealthy diet, smoking and physical inactivity. This study examined the effectiveness of educational interventions on colorectal cancer prevention-nutritional behaviors by employing a health belief model among the personnel of Shahid Beheshti University of Medical Sciences.

Methods

In this experimental study, 110 employees of Shahid Beheshti University of Medical Sciences were randomly divided into two groups (intervention and control) with cluster sampling. The data gathering tool was a researcher-made questionnaire containing two parts of 10-dimensional information and health belief model constructs. Educational intervention was conducted for one month and in four sessions in the form of classroom lecture, pamphlet, educational text messages via mobile phones and educational pamphlets through the office automation system. Two groups were evaluated in two stages, pre-test and post-test. Data were analyzed using SPSS-18 software, paired t-test and independent t-test (intergroup comparisons).

Results

Two groups were evaluated for variables such as age, sex, education level and family history of colorectal cancer, and there was no significant differences between the two groups ($P < 0.05$). After the two months since intervention, except for the mean score of perceived barriers, which was not significant after intervention, the mean scores of knowledge, perceived susceptibility, perceived severity, perceived benefits, perceived self-efficacy, behavioral intention, and preventive behaviors were significantly increased after the intervention in the intervention group compared to the control group ($P > 0.05$).

Conclusion

Implementation of educational intervention based on health belief model was effective for the personnel, and can enhance the preventative nutritional behaviors related to colorectal cancer.

Background

Colorectal cancer (CRC) is the second leading cause of cancer deaths in the United States and is the third most common cancer in men and women in the world after lung cancer and stomach cancer [1]. Nearly 1.4 million new cases of colorectal cancer are diagnosed every year worldwide, with nearly half of the affected patients losing their lives due to the disease [2]. Approximately 4.6% of men (1 in 22) and 4.2% of women (1 in 24) are diagnosed with CRC during their life time [3].

The incidence of colorectal cancer in Iran ranges from 6 to 9.7 per 100,000 annually, with a death rate of about 1.198 per hundred thousand, and it accounts for approximately 13% of all gastrointestinal cancer-related deaths [4]. According to the latest cancer record in Iran, colon and rectum cancer ranked third in female cancers and fifth in male cancers. The global incidence of CRC is estimated to increase by 60%, to more than 2.2 million new cases leading to 1.1 million cancer deaths by 2030 [2]. The risk of colon cancer increases with age and is higher in men than in women [5]. Various factors are involved in the development of various types of cancer, including colorectal cancer, which can be attributed to genetic, environmental and dietary factors [6]. Among the risk factors of colorectal cancer, nutritional factors are considered to be the most important and preventable ones, so that 30 to 50% of cases can be prevented by proper nutrition [7]. Colorectal cancer is also more common in Iran than in other Asian countries [8, 9]. Therefore, the need to educate people about the nutritional behaviors associated with colorectal cancer is becoming more and more evident.

Health behavior theories / models

The value of health education and health promotion programs depends on the effectiveness of them and the effectiveness of these programs depends on the correct use of theories and available models in health education and promotion. As the adequate theoretical support along with basic hygiene needs are available for people, the effectiveness of these programs are increased. To have an effective and useful intervention in the field of colorectal cancer prevention, having a good model to change the behavior has a specific priority. Several studies have shown that, the most effective training programs are based on the theory-driven approaches, which are rooted in behavior-changing models; also selecting appropriate model or theory is the first step in the process of planning a training program [10].

"Health Belief Model" as theoretical framework of intervention

The Health Belief Model (HBM) has been used to explain the health behavior in the prevention and screening of colorectal cancer [11–13]. The HBM states that the perception of a health behavior threat is influenced by general health values and beliefs about the vulnerability toward health problems. Once an individual perceives a threat to his/her health that has been cue to actions (internally or externally), his/her perceived benefits starts to outweigh his/her perceived barriers and then, the person most likely will take the recommended preventative health-promoting actions. Demographic variables, perceived threats, and cues to action (family history, screening test results or discussions with a health professional) act as modifying factors [14] (Fig. 1).

The purpose of this study was to determine the effect of theory-based educational intervention on colorectal cancer preventative behaviors of the personnel of Shahid Beheshti University of Medical Sciences. If successful, the results of this study will be used as the basis for the design of colorectal

cancer prevention interventions and a suitable model for healthcare officials to plan for prevention of this disease and provide interventions for people at risk of colorectal cancer. They can also be used by health authorities to solve related problems and ultimately, promote the health of society.

Material And Method

Study design and sampling

This experimental-interventional study was conducted on two groups of intervention and control at Shahid Beheshti University of Medical Sciences (Tehran, Iran) from October 2015 to June 2016. The sample size was calculated by a formula, and with considering a 10% drop out, the sample size was determined to be 110 individuals, 55 of whom were assigned to the intervention group and 55 to the control group. The random sampling method (clustering and simple random sampling) was used in this study. In order to choose from four faculties (schools) of Shahid Beheshti University of Medical Sciences, four faculties were randomly selected and from these four faculties, two were randomly assigned as intervention group and 2 were considered as control group.

Inclusion & Exclusion Criteria

Being under 50 years of age, having satisfaction to participate in the study, and not having serious diseases, including gastrointestinal diseases were the inclusion criteria. Also, not willing to continue with the study, not completing the questionnaire in full, and not attending in more than two educational sessions were the exclusion criteria.

Measures

The data collection tool was a researcher-made questionnaire, which consisted of following parts:

Part one

Demographic questions about age, gender, educational level, and economic status.

Part two

Constructs of the health belief model, which includes knowledge, perceived susceptibility, perceived severity, perceived benefits, perceived barriers, perceived self-efficacy, behavioral intent, and behavior (Table 1).

Table 1
Description of study instrument

Construct	No. of Items (Format)	Scoring (Range)
1) Knowledge; refers to a theoretical or practical understanding of a subject	11 items (true-false- don't know)	'Correct' response = 2, 'don't know' response = 1, 'incorrect' response = 0 (0–22)
2) Perceived Susceptibility; refers to subjective assessment of risk of developing a health problem	4 items/ 5- point Likert Scale (strongly disagree to strongly agree)	Strongly disagree = 1, disagree = 2, no idea = 3, agree = 4, strongly agree = 5 (4–20)
3) Perceived severity: Perceived severity refers to the subjective assessment of severity of a health problem and its potential consequences.	6 items/5- point Likert Scale (strongly disagree to strongly agree)	Strongly disagree = 1, disagree = 2, no idea = 3, agree = 4, strongly agree = 5 (6–30)
4) Perceived benefits: Health-related behaviors are also influenced by the perceived benefits of taking an action.	7 items/5- point Likert Scale (strongly disagree to strongly agree)	Strongly disagree = 1, disagree = 2, no idea = 3, agree = 4, strongly agree = 5 (7–35)
5) Perceived barriers: Health-related behaviors are also a function of perceived barriers to taking action.	9 items/5 point Likert Scale (strongly disagree- strongly agree)	Strongly disagree = 1, disagree = 2, no idea = 3, agree = 4, strongly agree = 5 (9–45)
6) Behavioral intention; refers to a person's perceived probability or "subjective probability" that he or she will engage in a given behavior.	5 items/5- point Likert Scale (strongly disagree to strongly agree)	Strongly disagree = 1, disagree = 2, no idea = 3, agree = 4, strongly agree = 5 (5–25)
7) Behavior; refers preventative behaviors associated with colorectal cancer.	5 items/5- point Likert Scale (Always to never)	Always = 5, often = 4, sometimes = 3, rarely = 2, never = 1

Validity and Reliability

The validity of the tool was ensured by face / content validity and its reliability was tested by test-retest and internal consistency (Cronbach's alpha). For face validity, a survey was done on 4–5 employees about the difficulty in understanding the words and phrases, the probability of misunderstanding the phrases, and lack of clarity in the meaning of the words. Some modifications were made to the tool's questions. To determine the face and content validity of the questionnaire, two gastroenterologists, five health education and health promotion specialists, and one related expert were asked to complete the questionnaire. The initial questionnaire had 52 questions. The constructs of knowledge had eleven questions, perceived susceptibility constructs had four questions, perceived severity constructs had six questions, perceived benefits constructs had seven questions, perceived barriers structure had nine questions, perceived self-efficacy constructs had five questions, and the constructs of intention and behavior had five questions each. After collecting expert opinions and calculating content validity ratio (CVR) and content validity index (CVI), one question about perceived barriers with CVR = 0.5 was removed from the sample questions. Cronbach's alpha coefficient was used to obtain the reliability of the internal consistency. The questionnaire was completed by 30 employees and its Cronbach's alpha coefficient was 0.72, which was acceptable. To ensure the stability, test re-test method was used. The questionnaire was completed by fifteen employees in two weeks intervals ($R = 0.77$).

Intervention

Both intervention and control groups were pre-tested using the questionnaire. The analysis of educational needs determined the educational methods (educational package), and the number of educational sessions was obtained by the pre-test results. The content of each session was determined according to the samples' learning power, the use of credible scientific sources, and the field experts' comments. Assurance about the matching of content materials with the samples' learning power was obtained by pre-testing (pamphlets, SMS, etc) 10 employees who were not part of the study.

Educational intervention based on educational text messages

Over the course of ten days, ten text messages were sent to the employees in the intervention group at 8am, most of which had been prepared according to the educational objectives of the constructs of knowledge, perceived susceptibility, perceived benefits, perceived barriers and perceived self-efficacy.

Educational pamphlets

Two pamphlets were given to the employees during two separate sessions, along with simultaneous provision of individual counseling. There was a possibility of questioning and answering any ambiguity regarding the content of pamphlets. The first pamphlet contained sections on the signs and symptoms of colorectal cancer and the risk factors of this cancer, and the second pamphlet contained sections on methods of preventing this cancer.

Educational packages in the office automation system

Educational packages were uploaded on the staff automation system for ten days and the employees were asked to study it during the working hours.

The intervention was conducted one month and follow-up two months after the intervention. The educational contents were taken from the trusted sources of the Ministry of Health, complemented by what the staff needed to know about promoting nutritional behaviors related to the prevention of colorectal cancer. The education varied in form across the model constructs. For perceived susceptibility, the facts and figures of the incident rate of colorectal cancer were presented in the class, and for perceived severity, images of colorectal cancer problems were used. Also, for perceived barriers, educational materials were used to somehow incite the individuals to analyze the cost of optimal behavior against the costs of risks, time, etc involved in unhealthy behavior. The educational content used for perceived benefits intended to raise awareness on the usefulness of health promoting behaviors to reduce the risk of illness or to understand the benefits of healthy behaviors. In Fig. 2, the research process is presented in general.

Ethical Considerations

At first, a permission was obtained from the university to conduct the study and attend the healthcare center. The samples were assured about the confidentiality of their specifications and information. They were also told that, their information will only be used for the purpose of this study and the data collection. The participants were allowed to enter and leave the study at any time. Suitable conditions were provided for a proper understanding of questions and responses for the subjects. After the end of the intervention period, the control group was also trained using the slides that were used to train the intervention group. An informed consent was obtained from the participants.

Data Analysis

Data were analyzed by SPSS software. Kolmogorov Smirnov test was used to check the normality of the data. To assess the effectiveness of intervention on variables of knowledge, perceived susceptibility, perceived severity, perceived benefits, perceived barriers, perceived self-efficacy, behavioral intention and behavior in the intervention and control groups, paired t-test and Wilcoxon tests were used for intra-group comparisons, and independent t-test and Mann-Whitney test were used for intergroup comparisons. In this study, the confidence level of 95% and the significance level of 0.05 were considered.

Findings

The findings of this study showed no drop out until the end of study. The questionnaire was completed in both groups in a complete and precise manner. Homogenization was done in the two groups by controlling variables such as age, sex, level of education, and related family history. The results showed no significant relationship within these variables ($P < 0.05$), (Table 2).

Table 2

Demographic and background variables in intervention and control groups before the intervention

Variable	Group	Intervention group (N = 55)	Control group (N = 55)	P – value*
		N (%)	N (%)	
Age	25–35	18(35.3)	18(36)	0.939
	36–49	32(62.7)	31(62)	
Sex	Woman	16(31.4)	19(38)	0.484
	Man	35(86.6)	31(62)	
Level of Education	Diploma	5(9.8)	11(22)	0.138
	Associate Degree.	10(9.6)	5(10)	
	Undergraduate degree and higher	36(70.6)	34(68)	
Special Diet	Yes	10(19.6)	9(18)	0.837
	No	40(78.4)	40(80)	
Family History Of Cancer	Yes	22(43.1)	21(42)	0.908
	No	29(56.9)	29(58)	
*Chi-square				

The results of paired t-test showed that, the mean scores of constructs of knowledge, perceived susceptibility, perceived severity, perceived benefits, perceived self-efficacy, behavioral intention, and behavior before and after the training in the intervention group were significantly different ($P > 0.05$). However, the scores of constructs of perceived barriers before and after the training in the intervention group did not differ as expected, and this difference was not statistically significant ($p = 0.186$), (Table 3).

Table 3

Comparison of intervention and control groups in terms of health belief model constructs before and after the intervention

Constructs	Groups	Before intervention	After intervention	P value*
		Mean \pm SD	Mean \pm SD	
Knowledge	Intervention	20.86 \pm 4.49	26.23 \pm 2.28	< 0.001
	Control	19.57 \pm 4.56	18.64 \pm 4.70	0.076
	T-test	0.052	< 0.001	
Perceived Susceptibility	Intervention	13.60 \pm 3.70	15.58 \pm 2.07	< 0.001
	Control	11.35 \pm 3.95	11.62 \pm 3.41	0.432
	T-test	0.005	< 0.001	-
Perceived Severity	Intervention	22.24 \pm 4.72	24.18 \pm 2.98	< 0.001
	Control	20.93 \pm 3.76	20.55 \pm 3.08	0.431
	T-test	0.133	< 0.001	
Perceived Benefit	Intervention	28.56 \pm 3.75	30.35 \pm 3.57	< 0.001
	Control	27.77 \pm 3.88	25.50 \pm 4.23	< 0.001
	T-test	0.208	< 0.001	
Perceived Barrier	Intervention	23.13 \pm 5.57	22.11 \pm 4.85	0.181
	Control	22.51 \pm 4.10	24.00 \pm 4.17	0.022
	T-test	0.576	0.041	
Perceived Self- Efficacy	Intervention	17.82 \pm 3.39	20.03 \pm 2.70	< 0.001
	Control	16.50 \pm 2.86	16.18 \pm 3.05	P = 0.386
	T-test	0.046	< 0.001	
Behavioral Intention	Intervention	19.20 \pm 3.06	20.26 \pm 2.76	0.011
	Control	18.93 \pm 2.63	17.91 \pm 2.99	0.015
	T-test	0.652	< 0.001	
Behavior	Intervention	15.60 \pm 1.68	16.64 \pm 2.02	< 0.001
	Control	15.66 \pm 1.89	15.50 \pm 1.73	0.552
	T-test	0.854	0.003	
* Paired Samples Test				

Discussion

The purpose of this study was to investigate the effects of educational interventions on the promotion of colorectal cancer prevention nutritional behaviors.

The results of this study showed a significant difference in the intervention group in terms of the mean score of knowledge before and after the educational intervention. These results are consistent with the findings of Roozitalab [15], HO et al [16], Gimeno et al [17], and Abood et al [11] studies. Also, there was no significant difference in the control group before and after the intervention. Knowledge is an important determinant of CRC prevention, and the findings of this study showed the positive impact of interventions and education on individuals' knowledge. People's readiness to act in the right way to avoid illness requires the formation of behavior and raising people's knowledge is a primary step in creating the right behavior. Therefore, training programs, including public information campaigns, workshops, videos, websites, exhibitions, etc should be used to inform people about CRC symptoms and risk factors.

In the present study, the mean score of perceived susceptibility construct showed a significant difference between the intervention and control group after the educational intervention. Alidoosti et al [12], and Grace et al [18] reported the results consistent with the present study. The real and successful prevention of a health-related problem depends on the provision of real-life information about the susceptibility of individuals and the risks associated with it. The findings of this study and the above mentioned studies confirmed that, education has been able to play an important role in increasing the susceptibility of individuals regarding the complications of CRC and consequently, the adaption of positive health behaviors (including preventative nutritional behaviors). It should be noted that, perceived susceptibility seems to be considered as one of the most effective factors in the adoption of preventative behaviors. Therefore, designing interventional programs in different environments and tailoring the materials for each group (in terms of age, education, etc) and using various information sharing methods, including mass media as a widespread promotional platform can increase the knowledge of public about the importance of health-related issues.

The results of this study showed the difference between the mean scores of perceived severity construct before and after the training in the intervention group. These results are consistent with the findings of Alidoosti et al [12, 19], but they are not consistent with the study of Grace et al [18]. Studies by Kolutek et al [20], Wang et al [21], Cengiz et al [22] and Donadiki et al [23] reported the role of beliefs regarding public health threats, perceived susceptibility and perceived severity in the health promotion behaviors. Becker et al believed that, one's intention to self-care is influenced by his or her perception of vulnerability and the severity of disease outcomes [24]. Therefore, the need for interventions to increase the perception of society about the irreparable complications of diseases caused by unhealthy behaviors (malnourished eating habits) seems necessary.

In this study, there was a significant difference between the two groups in terms of the constructs of perceived benefits after the educational intervention. This result is consistent with the findings of Grace et al [18], Alidoosti et al [12], and Abood et al [11] studies.

Therefore, informing and educating people about nutritional behaviors such as; food purchasing behaviors, food preparation and cooking, eating frequency and nutritional habits, and hygiene and food maintenance can prevent the irreparable detriment caused by CRC, which can be imposed on both the individual and the government.

In the present study, the mean score of perceived barrier construct decreased after the intervention. This was a good result, but it was not statistically significant. In the present study, the mean score of perceived barrier construct decreased after the intervention, which is not consistent with the results of studies by Moatari et al [25], Grace et al [18] and Gimeno et al [17]. The study of Rajabi et al (2000) identified some of the most important causes of barriers to nutrition in prevention of cancer [26], such as the difficulty of preventative measures, inappropriate economic status, and fear of cancer information. Therefore, strategies that overcome the individual and environmental barriers that affect nutritional behaviors should be addressed by planners and policymakers.

In the present study, the mean score of perceived self-efficacy construct significantly increased after the training in the intervention group. The results of the study by Braun [27], Alidoosti et al (12), and Hart et al [28] are consistent with this finding. Perceived self-efficacy is considered as a strong motivational source and, in fact, is an indicator of the ability of individuals to organize themselves in pursuit of certain goals[29]. Studies show that individuals with a high level of perceived self-efficacy have a greater commitment to engage in activities at a time of challenges and difficulties, and spent more time and effort on such activities [30]. Such individuals are more likely to contribute to maintaining healthy behaviors and retrieve them, even after failure, and they have stronger intention and motivation. This not only improves the target adjustment, but also ensures achievement and sustainability in pursuit of the goals [31]. Since self-efficacy is a prerequisite for behavioral change, it seems that the beliefs of employees regarding their ability to properly handle the health-related behaviors associated with the prevention of colorectal cancer, can be effective in preventing CRC. The more they believe in their efficiency and ability to take colorectal cancer prevention behaviors, the more they do the intended behaviors.

In this study, the mean score of behavioral intention construct was increased in the intervention group after the intervention. In the study of Braun [27] and Gimeno et al [17], similar to the results of present study, the mean score of behavioral intention construct was increased in the intervention group after the intervention. Also, in the present study, the mean score of behavioral construct increased after the intervention in the intervention group, and there was no significant difference between the two groups after the intervention in this regard. The results of this study are consistent with the findings of Abood et al [11], Hart et al [28], Roozitalabi et al [15], Alidoosti et al [12], and Davoodi et al [32] studies. Behavioral intention is the thought of doing a behavior, and is considered as the immediate determinant of that behavior. Although increasing knowledge is an important step in changing attitudes and behaviors, it is not a major contributor to CRC prevention. Achieving the intention to behave is influenced by individual and environmental factors, so in addition to enhancing individual aspects, overcoming the structural and

environmental barriers of the health system regarding the use of cancer prevention nutritional behaviors is also vital.

Limitations

The limitations of this study, which could have had a relative effect on its findings, include the short duration of intervention, the sample size, the inability to follow the long term effect of the intervention, and the self-reporting of the subjects in responding to questions. However, the use of this method in such studies is inevitable and may lead to a bias of the "researcher-desired report". In this study, anonymous questionnaire was used to minimize this bias.

Conclusion

The findings of this study confirmed the effectiveness of health belief model-based education in the adoption of colorectal cancer prevention nutritional behaviors. Therefore, the importance of proper education is emphasized in order to optimize the nutritional behaviors of people, since education is a key to changing the patterns of nutrition. Therefore, it is suggested to use mass media such as radio and television, as well as educational leaflets and brochures, public information campaigns, workshops, videos, websites, and nutrition awareness-raising exhibitions to increase the knowledge of public about correct nutrition. On the other hand, it is imperative that, the authorities should provide leadership training on cancer prevention at the top of their responsibilities. In this regard, community health nurses can play an important role in educating people. It can be said that, in the field of cancer prevention, it is necessary for the state officials and governmental and non-governmental organizations to work closely with the medical staff. Since in this study various educational technologies such as text message and automation system were used to deliver the educational materials, and the effectiveness of these techniques was fully confirmed, it is recommended to conduct different interventional studies in populations such as employees of organization using the methods of this study. Also, given the time-consuming nature of individual counseling, it is better to use group discussions or workshops in future studies.

Abbreviations

CRC:Colorectal cancer; HBM:Health Belief Model

Declarations

The study on which these data analyses are based was approved by the Ethical Board Committee of Shahid Beheshti University of Medical Sciences. Participants were provided information about the study and consented by proceeding to take the survey; this implied consent was approved by the Ethical Board Committee of Shahid Beheshti University of Medical Sciences.

Consent for Publication

Not applicable.

Availability of data and material

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors have no conflicts of interest.

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Authors' contributions

MGH, SR, AS, and MM designed the study. MM and MGH wrote the first draft. SR and ASM conducted the analyses. All authors contributed to writing, revising, and approved the final manuscript.

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Figures

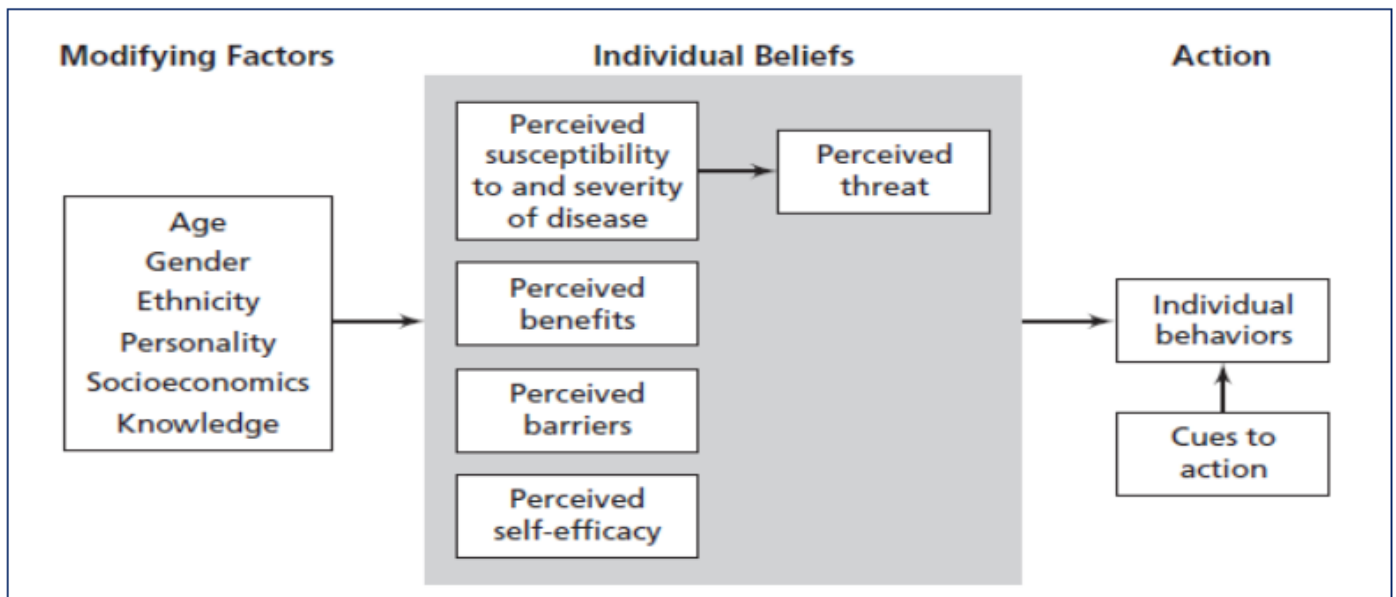


Figure 1

Health belief model's components and links [source: Ref [10]]

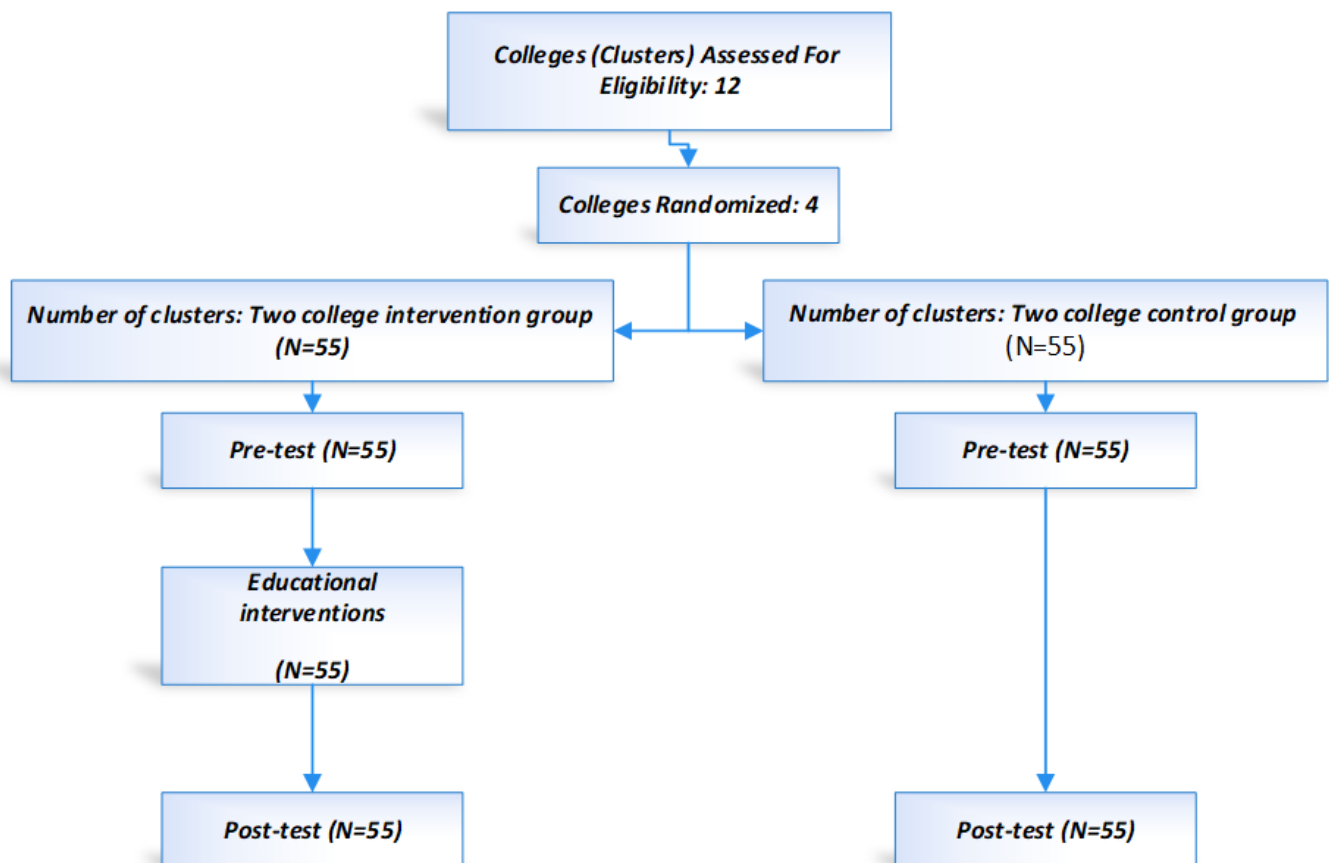


Figure 2

Schematic diagram of designed interventions for colorectal cancer prevention

