ORIGINAL ARTICLE

The Effect of Health Belief Model-Based Education on Knowledge and Prostate Cancer Screening Behaviors: A Randomized Controlled Trial

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Abstract

Background: Prostate cancer has been reported as the second leading cause of cancer death among men in 2013. Prevention and early detection of cancer are considered as critical factors in controlling the disease and increasing the survival of patients. Therefore, we aimed to investigate the effect of Health Belief Model (HBM)-based education on knowledge and prostate cancer screening behaviors in a randomized controlled trial.

Methods: This study was a non-blinded randomized controlled trial. We enrolled 210 men aged 50-70. Balanced block randomization method was used to randomize the final participants who had inclusion criteria into intervention (n=93) and control (n=87) groups. The participants of the intervention group attended training workshops based on HBM. Data were collected using three questionnaires, i.e. demographic questionnaire, Prostate Cancer Screening-Health Belief Model Scale (PCS-HBMS), and the Knowledge about Prostate Cancer Screening questionnaire, all given before and immediately one month after the intervention.

Results: The mean scores of the perceived susceptibility, severity, barriers and benefits increased significantly after the intervention (P>0.05) in the intervention group. In the control group, such a difference was reported only for perceived susceptibility (P>0.05). The rate of participation in prostate cancer screening in the intervention group increased from 7.5% to 24% and 43.3% one month and three months after the intervention, respectively.

Conclusion: Our findings showed that the health education programs designed based on HBM could positively affect prostate cancer preventive behaviors of individuals by improving their knowledge level and leaving positive effects on perceived susceptibility and severity as well as considering the perceived barriers, benefits and health motivations.

Trial Registration Number: IRCT2013090911691N3

Keywords: Beliefs; Early detection of cancer; Knowledge; Prostatic neoplasm; Retirement

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Introduction

Studies have reported that men are more prone to diseases and have a higher mortality rate than women.[1] Previous investigations have shown that men adopt more inappropriate lifestyle choices, are less concerned about their health, ignore the warning signs of the disease, and also have late referral to medical centers compared with women.[1]

According to the official census published by American Cancer Society, prostate cancer was reported as the second leading cause of cancer death among American men after lung cancer and its incidence ranked the first among all cancers in 2013.[2] However, in Iran, the rate of deaths from prostate cancer is found relatively higher than other types of cancers. Remarkably, with 1309 deaths in 2013, its mortality rate was estimated as 3.85 per 100.000 men in the same year. According to statistical surveys, this was higher than that of esophageal and laryngeal cancer but lower than that of gastric, lung and bronchial cancer.[3]

Based on the published statistics, its age-standardized incidence rate in Iran during 2003 to 2008 was reported as 4.69, 7.16, 14.04, 16.65, and 16.02 per 100,000 men, respectively, indicating an increasing trend of the disease in Iran during the mentioned years.[4] About 97% of all prostate cancers occur in men aged 50 and older.[2]

Prostate cancer is fully and definitely treatable if diagnosed and detected early before the metastasis of the disease. Since such a cancer is often asymptomatic, it is diagnosed after its progress to the later stage that is incurable. At this stage, it has no definite treatment, so the mortality rate increases.[5] In 2013, the American Cancer Society recommended that men aged older than 50 should be aware about screening for early prostate cancer detection and those who are at risk of developing the disease should receive information about such screening at earlier ages. Ethnicity, a family history of the disease, age and obesity are known as the risk factors of this cancer.[2]

Despite being asymptomatic, prostate cancer can be detected early using various diagnostic methods. Digital Rectal Examination (DRE) and Prostatic-Specific Antigen (PSA) are routine testing techniques for early prostate cancer diagnosis. Transrectal Ultrasound (TRUS- guided prostate biopsy is also another most commonly used method of diagnosing the disease.[6]

Furthermore, prevention and early detection of cancer are considered as critical factors in controlling the disease and increasing the survival of patients. Therefore, the importance of public health education should be emphasized in developing countries where people have inadequate information about screening methods.[7]

Various studies have shown that men with higher levels of knowledge show higher tendency towards such screening .[3]When counseling and education is done based on a specific protocol, it could lead to a change in people's behavior.[8]

Health Belief Model (HBM) has been widely used to measure the health beliefs and behaviors about cancer screening. HBM is a cognitive model that tries to identify patterns of healthy behavior. The *perceived susceptibility*, severity, benefits, and barriers are four main components of the HBM. Behavior was explained by the HBM as ensuing from the combination of attitudes associated with four concepts.

Perceived susceptibility refers to beliefs about the probability of obtaining a disease or condition.

Perceived Severity: Feelings concerning the seriousness of acquiring a sickness or of leaving it untreated embody evaluations of each medical and clinical consequence (for example, death, disability, and pain) and potential social consequences (such as effects of the work, domestic life, and social relations).

Perceived Benefits focus on the effectiveness of healthy behavior in reducing the threat of the condition.[9,10]

Perceived Barriers is the potential negative

aspects of a particular health behavior, a kind of unconscious, cost-benefit analysis occurring when the individuals know the perceived barriers are more costly than the perceived benefits; then, they take action to do screening. For example, these barriers can be expensive, time consuming, unpleasant, painful or upsetting. These barriers may lead a person away from performing the healthy action.

In addition to the four original concepts, *health motivation* has also been used as part of the HBM in predicting health related behavior. Health motivation refers to a generalized state of intent that results in behaviors to maintain or improve health. This concept was first introduced for inclusion in the HBM by Becker. The concept of health motivation used in combination with the original four HBM concepts has evidence of significant predictive ability.[10]

Therefore, in this study we used HBM focusing on prevention as a reference framework. Currently, there is a lack of consideration towards men's health, especially the middle-aged and elderly ones. Due to the increasing number of cases with prostate cancer reported by clinical specialists, which are caused by the late referral of the patients, we aimed to investigate the effect of HBM-based education with the purpose of increasing knowledge and the health belief about prostate cancer and prostate cancer screening behaviors**.**

Materials and Methods

This study was approved by the Ethics Committee of Shiraz University of Medical Sciences (Ethics Committee Approval Number: CT-92-6721). In this non-blinded randomized controlled trial, 210 men aged 50-70 were enrolled during April to October 2013. We selected our participants from the population of men who were retired from Shiraz Department of Education, using a simple random sampling method. The researcher referred to the list of the males retired from Shiraz Education Department, using table of random numbers. Their positive and broader insights towards research projects could facilitate easy accessibility to them for further follow-ups and evaluation of the results. Shiraz General Department of Retirement Affairs was chosen as research setting due to the large number of referrals for welfare and administrative affairs.

The sample size was calculated as 105 in each group based on the data of similar studies and using Power SSC statistical software (power: 80%, α: 0.05, mean difference: 1.6, loss rate=20% and SD: 3.2). A simple random sampling method was used to select 210 participants. Quadri- Balanced block randomization method was used to randomize the participants into intervention and control groups. In this study, we had two groups of control and intervention. Therefore, we used two variables, A and B, for them, respectively. By taking two variables A and B in quaternary blocks, six modes of movement were possible. According to the sample size (210), 53 blocks were needed. Then, the blocks were randomly written on paper and the researcher referred to the list of men and placed them in the blocks. Afterwards, 30 men were excluded due to their withdrawal from participation in the study, so the number of final participants was 93 and 87 in the intervention and control groups, respectively (Figure 1).

Inclusion criteria were willingness to participate in the study, giving written informed consent, no history of prostate cancer and prostatic hyperplasia with obvious clinical symptoms, age of 50 to 70 years, and lack of severe vision and hearing impairment. However, exclusion criteria were absence in training sessions and participation in similar training courses.

After explaining the aims of the study, written informed consent was obtained from all the participants and their anonymity and confidentiality were guaranteed. Data were collected by the researcher and a trained research assistant through face to face interview by using three different questionnaires including demographic questionnaire, Prostate Cancer Screening- Health Belief

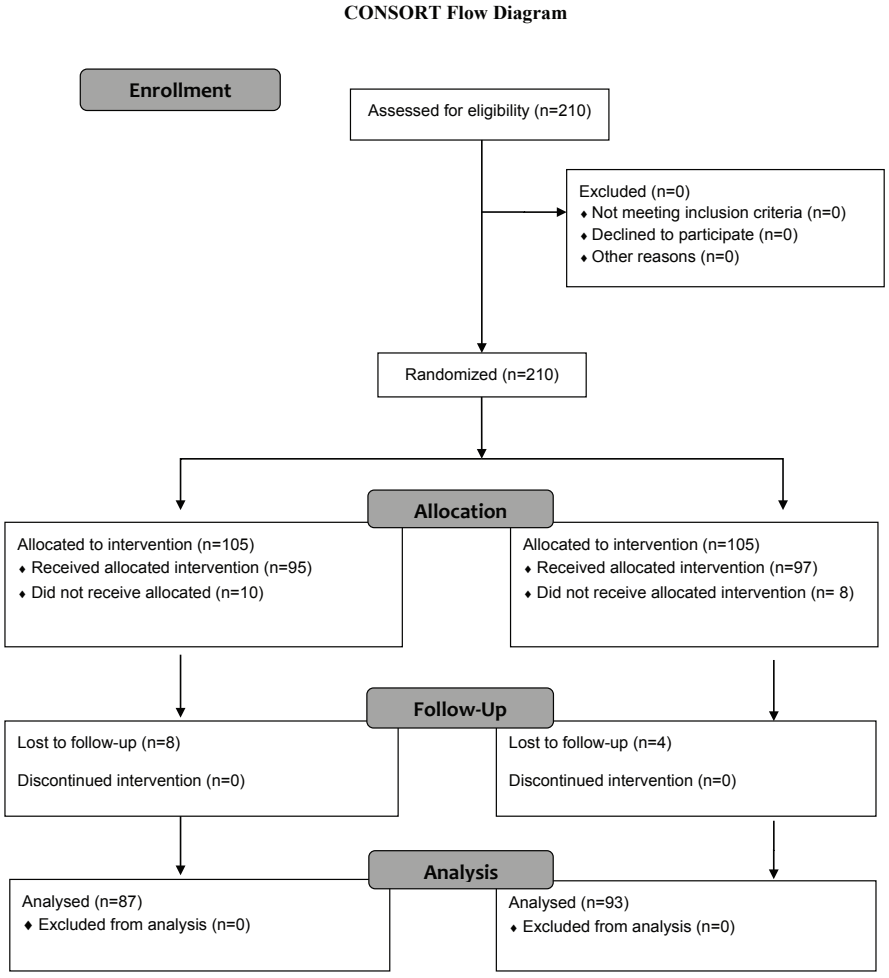

Figure 1: CONSORT Flow diagram of participants

Model Scale (PCS-HBM) and the Knowledge Prostate Cancer Screening questionnaire.

The demographic questionnaire was developed by the researcher; it included 13 questions about demographic characteristics of the participants. The questionnaire provided information about age, marital status, educational level and monthly income, history of prostate cancer and prostatic hyperplasia with obvious clinical symptoms, history of undergoing prostate cancer screening using DRE and PSA testing, a family history of the mentioned cancer, knowledge about the disease as well as the methods of acquiring knowledge about it for researcher.

The Prostate Cancer Screening Knowledge questionnaire was developed by Weinrich et al. (2004) and contained 12 questions. Each question had three options "true", "false" and "I don't know". The correct responses were scored 1 and the wrong ones and those answered "I don't know" were scored 0. Scores ranged from 0 to 12 with higher scores reflecting a higher level of knowledge. Scores lower than 7, 7-9 and 10-12 were considered as low, intermediate, and good, respectively.[11]

Prostate Cancer Screening-Health Belief Model Scale (PCS-HBM)which was designed by Capik and Gozum (2011) included 41 items with a 5 point Likert scale anchored at 1=completely disagree and 5=completely agree. The scale consisted of 41 questions and 5 sub-scales including perceived susceptibility (5 items), perceived severity (5 items), health motivations (10 items), perceived barriers (15 items), and perceived benefits (7 items). An increase in the scores for the sub-scales of susceptibility, severity, motivation and benefit and a decrease in the score for the sub-scale of barriers reflected the positive effect of the

intervention.[12]

PCS-HBM and Prostate Cancer Screening Knowledge questionnaire were translated in Persian using back translation technique, which includes the use of a panel of experts and interpreters to translate the items from the source language to the target language and then they were back-translated to the source language. Then, some changes were made to adapt this instrument to Iranian culture.

After performing a pilot study on 30 men retired from Shiraz Department of Education, the reliability coefficient for PCS-HBM and Prostate Cancer Screening Knowledge questionnaires was calculated, using Cronbach alpha and Kuder Richardson 20technique. After analyzing the data, Kuder Richardson 20 coefficient was calculated as 0.98 for the Knowledge Prostate Cancer Screening Questionnaire and Cronbach's alpha was calculated as 0.83 for PCS-HBM questionnaire.

To assess the prostate cancer screening behaviors of men in the intervention group, they were given referral forms for free consultation with a urologist and prostate cancer screening. Subsequently, the participation rate of men, who had not been screened within the last year, was examined one and three months after the intervention.

Afterwards, the participants of the intervention group attended training workshops consisting of two four-hour sessions for two days, in groups of 15 participants. The educational program was designed based on pre-test results and structures of health belief model. Educational intervention was performed in the intervention group through lecture, group discussion with questions and answers, and brain storming. The learning process was facilitated by teaching aids, such as videos, photos and booklets.

In the first session, first lecture method was employed due to little information in most of the subjects to make them familiar with prostate cancer, its anatomy, physiology, functions of prostate gland, pathology, and effective risk factors. Then, we used perceived susceptibility structure, talked about the incidence and prevalence rate of prostate cancer in Iran and the world, signs and symptom of prostate cancer, and the current treatment modalities of prostate cancer. Then, with regard to adults' education theory which considered free discussion as a necessary part of education, the subjects held group discussion. Then, by considering the perceived severity, those whose parents, relatives or a close friend had died as a result of prostate cancer were invited to talk about the severity of the complications of prostate cancer as someone who had experienced it. Next, group members freely discussed about their experiences about complications of prostate cancer. Finally, the complications of the lack of health, especially low levels of primary and secondary prevention, were discussed by the participants.

In the second session, first lecture method was employed due to low level of information in most of the subjects to make them familiar with methods of prostate cancer screening. The subjects had group discussion on benefits and advantages of prostate cancer screening in prevention of prostate cancer, treatability of prostate cancer in the early stage, and cost efficacy of prostate cancer prevention.

In order to help the subjects to brain storm in education, all the inhibiting obstacles in unimportant subjects' complications of diagnosis of prostate cancer and positive predictive value(PPV) and negative predictive value (NPV) of PSA test were indicated and related strategies were mentioned. Then, the clients discussed about the ear of prostate cancer screening. CDs and slides were shown. Finally, the referral center for prostate cancer screening was introduced to the clients.

All the participants filled out the questionnaires at baseline and after one month. The men participating in the control group received no planned educational program, but the intervention sessions were offered to this group after the study was completed. The collected data were analyzed using SPSS software, version 18. Statistical qualitative tests, Analysis of Covariance (ANCOVA),

Chi-square, independent and paired t-test were used as appropriate. The significance level was set at <0/05.

Results

The age range of the participants was 50-70 years and their mean±SD age was 58.1±4.8 and 56.8±5.3 in the intervention and control groups, respectively. Independent t-test showed no significant difference between the two groups with respect to their age P=0.08. 95% of the participants were married. There was a significant difference between the groups in terms of educational level and monthly income; those in the intervention group had a higher educational level and income compared of the participants in the control group (P>0.05).

Regarding the randomized allocation of the participants, the results of ANCOVA showed that the significant difference found between the groups in terms of income and educational level had no compounding effect on the study. The rate of the participants who had no family history of prostate cancer and no experience of undergoing DRE and PSA testing for prostate cancer screening was reported 87.2%, 95.6% and 85.6%, respectively. 86.1% of the men had no knowledge about such screening; however, the other respondents knew about it and reported television (48%), magazines and newspapers (20%), a family member with the same disease (12%), radio (8%), physicians (8%), and friends (4%) as their source of knowledge.

According to Table 1 which compares the knowledge level between the intervention and control groups before and after the intervention, 95.7% of the men in the intervention group were at low and intermediate levels before the intervention, while their levels improved to intermediate and good after the intervention. Nevertheless, we observed no significant changes in the control group in this regard (Table 1).

Paired t-test showed a statistically significant difference in the mean score of HBM components in the intervention group after being compared with that before the intervention (P>0.05). In the control group, such difference was reported only for perceived susceptibility (P>0.05), while there was no statistically significant difference in the mean scores of perceived severity, barriers, benefits, and motivation (P>0.05).

Independent t-test revealed a statistically significant difference between the intervention and control groups with respect to the mean scores of the perceived susceptibility, severity, barriers and benefits after the intervention (P>0.05) compared with before it (P>0.05) . The results of the data analysis showed a statistically significant difference between the intervention and control groups regarding the mean scores of knowledge and motivation before the intervention (P>0.05).

To reach a more accurate result (to control the significance effect of the mean scores of knowledge and HBM components in the intervention and control groups before the intervention), the mean difference scores were compared after the intervention. According to the result of independent t-test, a statistically significant difference was observed between the groups with respect to the mean scores of all HBM components after the intervention (P<0.001) (Table 2).

Paired t-test indicated a significant difference in the mean score of knowledge in

Table 1: Comparison of knowledge level between the intervention and control groups before and after the intervention

Knowledge Level Number (%)	Groups Number (%)	Time	
		Before intervention	1 month after intervention
Low	Intervention	45 (48.4%)	6 (6.5%)
	Control	26 (29.9%)	23 (26.4%)
Intermediate	Intervention	44 (47.3%)	55 (59.1%)
	Control	47 (54%)	49 (56.3%)
Good	Intervention	2 (2.2%)	32 (34.4%)
	Control	6 (6.9%)	8 (9.2%)

Table 2: Comparison of the mean score (±SD) of HBM components and knowledge between the intervention and control groups

Sub-Scales	Intervention (n=93) Mean±SD	Control (n=87) Mean±SD	P value*
Before Intervention			
Perceived Susceptibility	14.66±4	13.52±3.99	0.059
Perceived Severity	3.21±3.85	12.44±2.89	0.133
Health Motivation	40.84±6.21	38.45±6.47	0.012
Perceived Barriers	45.37±7.06	45.57±7.91	0.859
Perceived Benefits	29.98±3.2	29.48±3.99	0.348
Knowledge	7.37±1.7	8.33±1.43	<0.001
After Intervention			P value**
Perceived Susceptibility	-2.84±3.2	0.52±2.38	<0.001
Perceived Severity	-4.32±2.95	-0.16±1.72	<0.001
Health Motivation	-5.37±5.35	0.47±5.35	<0.001
Perceived Barriers	18.08±8.37	-0.49±3.41	<0.001
Perceived Benefits	-3.5±3.23	-0.49±3.41	<0.001
Knowledge	-2.54±1.34	-0.39±1.39	<0.001

*Independent t-test; **Paired t-test

the intervention group after the intervention compared with before it (P<0.001), while no significant differences (despite a slight change) were observed in the control group (P=0.808).

The participation rate of men in screening before the intervention, one month and three months after the intervention is shown in Table 3.

Discussion

The primary objective of this study was to increase participation in the screening and for this aim education based on the health belief model was implemented; then, we investigated the levels of knowledge, scores of the health belief components about prostate cancer, and the rate of participating retired men in prostate cancer screening.

86.1% of the retired men in this study had no knowledge about prostate cancer screening. Similarly, in a study which was conducted in North Florida, 0.83% African American men had some knowledge about prostate cancer screening and 17% did not have any knowledge about it.[13] Another study also indicated that 58% of male New Yorkers were aware of prostate cancer screening in 2000.[14]

In our study and another study in Iran, the history of prostate cancer screening was 8.6% and 14.4%, respectively.[15] This rate in the studies by Kris et al. (2007) was 67%; Allen et al.'s study (2010) reported 44%; and in Sheridan (2012) it was reported 59%.[16-18]

Comparison of the results of these studies with those of our study indicates a low level of awareness about prostate cancer screening and low participation rate in prostate cancer screening among Iranian men.

Our findings were consistent with other studies indicating the significant increase of individuals' knowledge level about prostate cancer after the intervention.[17,19-22]

A study which was done in Turkey with this tool did not find a significant difference in the level of knowledge in men after an educational intervention by the web.[23] Therefore, it can be concluded that for 50 to 70 year old men, face to face training and the group training could

Table 3: The men participating in the intervention group in the screening

Time	Before intervention	One months after intervention	Three months after intervention
Number (%)	7 (8%)	21 (24%)	36 (41.3%)

be more effective.

In another study, it was confirmed that print arm is more effective than web arm and usual care to improve knowledge and reduce decisional conflicts about prostate cancer screening.[24]

All the aforementioned studies confirmed the importance of education and its effects on promoting the level of the individuals' knowledge. We also observed a significant increase in the mean score of perceived susceptibility in the intervention group following the educational intervention and such result was similar to other studies on prostate cancer screening, diabetes mellitus and breast self-examination.[23,25-27]

Moreover, most of our participants believed that they might be at risk of prostate cancer. Carmel had a critical review on 46 HBM-related investigations and concluded that "perceived susceptibility" could be the most powerful factor in predicting the behaviors.[28]

As to the perceived susceptibility, the belief that the disease can occur without any symptoms leads to initiation of screening behaviors.[29] In our study, the mean score of such a component increased in the control group. Bakhtariaghdam et al. also reached a similar result and suggested it could be due to the fact that taking the pre-test had made the respondents sensitive to the subject.[30] However, Ghaffari et al. believed that it resulted from the curiosity of the participants in the control group to evaluate and complete the questionnaire at the pre-test stage.[31] Similarly, we can conclude that such increase lies in the curiosity of the participants to find out more about the disease and increase their knowledge about it during the interval between pre-test and post-test phases which makes them sensitive to the subjects discussed in the questionnaire.

Reminding our participants of serious complications and the chronic nature of prostate cancer and considering loss of health and the problems caused by such disease as well as high costs of treatment have been important factors which led to improvement of their level of perceived severity. Several investigations showed that evaluation of clinical outcomes by the individuals could also affect this component.[29]

Moreover, we found a significant difference between the two groups after the intervention in terms of perceived severity. This finding was in agreement with other studies on the effect of HBM-based education on osteoporosis preventive behaviors and breast self-examination.[29,32]

Furthermore, independent t-test showed a statistically significant difference between the intervention and control groups with respect to the mean score of perceived benefits after the intervention. Other researchers found similar results in examining the effect of HBM-based educational program on urinary tract infection and Acquired Immune Deficiency Syndrome preventive behaviors.[33,34]

We believe that medical and health care staff should constantly consult with men about the risk of prostate cancer progression and benefits of screening. Men should also talk with the staff about their fears and obstacles which prevent them from participating in screening programs as it can increase their responsibility for their own health. There are two factors which can facilitate the men's participation in prostate cancer screening:

1- The belief that DRE and PSA tests help diagnose the disease before the appearance of symptoms.

2- The belief that early diagnosis and treatment can improve the prognosis of the disease.[35]

In the incidence of preventive behaviors, perceived barriers are directly associated with early diagnosis and participation in prostate cancer screening,[23] while education can remove such barriers and make men take action for early detection of the disease.[36]

According to both retrospective and prospective studies, "perceived barriers" is found to be the most powerful dimension of HBM in the expression and prediction of health protective behaviors.[29] We observed a significant difference between the groups

regarding the mean score of "perceived barriers". Likewise, other researchers found a significant decrease in the dimension of "perceived barriers" after HBM-based educational intervention in their studies on prostate cancer screening and nutritional behaviors associated with gastric cancer.[23,37]

Moreover, we tried to decrease the barriers significantly by increasing the participants' knowledge through education and providing free screening and consulting with a urologist. According to the results, the mean scores of health motivation appeared as significantly different between the groups. Our finding was similar to that of Capık and Gözüm who found an increase in the motivation mean score; however, such increase was not statistically significant.[23]

Insignificant increase of motivation could be attributed to the participants' low levels of knowledge and lack of sufficient information about prostate cancer and screening. Therefore, the significant increase of motivation in our study could be due to the proper knowledge level in the intervention group after training sessions and the efficiency of our educational intervention compared with internet and web-based education for men aged over 50.

Capık and Gözüm reported that the rate of participation in the screening increased after the educational intervention.[23] Furthermore, another study indicated that 48% of the participants who had not been screened within the last year were referred for screening again.[19] Similarly, Weinrich et al. observed that 71.8% of those in the intervention group participated in free screening due to educational intervention.[38]

We found out that the participation rate in such screening increased from 7.5% to 24% and 43.3% one month and three months after the intervention, respectively. Finally, we observed that 36 men, who had not been screened within the last year, participated in prostate cancer screening.

One limitation of the present study was the post-test one month after the intervention. Therefore, assessing information in several time intervals after the interventions is recommended in order to examine the long-term effects of interventions on prostate cancer screening behaviors and participation in decision-making regarding the subject. It is also recommended that the follow-up periods of screening should be increased to one year. Further investigations are also required to find out the most important potential barriers to prostate cancer screening in Iran.

Another limitation of this study was selecting the samples from among a particular group of people such as teachers. It appears that the level of education and knowledge is so much higher than the general population. It is recommended that in future studies samples should be chosen from various groups of people such as rural ones to obtain more generalizable results.

Conclusion

Our findings showed that the health education programs designed based on HBM could positively affect the prostate cancer preventive behaviors of our retired participants by improving their knowledge level and HBM components. Hence, we could confirm the efficacy of HBM in adopting the prostate cancer screening behaviors by the participants. Since this type of cancer is treatable in early stages, more attention should be paid to the educational design and planning based on educational theories and models so that we could increase the required knowledge about prostate cancer for early diagnosis and treatment of the disease.

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Conflict of Interest: None declared.

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