Original Article

Health Belief Model-based Intervention on Women's Knowledge and Perceived Beliefs about Warning Signs of Cancer

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ABSTRACT

Objective: Early detection of cancers essentially depends on knowledge of the warning signs. This study, therefore, aimed at investigating the effect of Health Belief Model (HBM)-based educational intervention on the knowledge and perceived beliefs of women about the warning signs of cancer. **Methods:** This experimental study with intervention ($n = 80$) and control ($n = 80$) groups was performed at four urban health centers affiliated to the university. Data collection was done in two phases, before and one month after the educational intervention, using three instruments, a demographic-clinical information questionnaire, the awareness questionnaire on cancer warning signs, and the cancer warning signs-HBM questionnaire. **Results:** The results of the multivariate repeated-measures analyses of variance indicated that the hypothesis of this study was confirmed. It means that "women's knowledge and their perceived beliefs of cancer warning signs" improved after HBM-based educational intervention in the intervention group, compared to the controls over time. Thus, the "level of knowledge" and perceived beliefs of the women in the intervention group compared to the controls increased, in terms of perceived "sensitivity," "severity," "benefits," "barriers," "cue to action," and "self-efficacy" over time ($P < 0.001$). **Conclusions:** It could be hoped that this intervention would be effective for improving the performance of women in health-promoting behaviors of cancer prevention. It is recommended that health-care providers plan for HBM-based educational interventions, based on educational needs of the target groups at different community levels.

Key words: Education, health belief model, intervention, warning signs of cancer, women

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Introduction

Despite the implementation of multiple cancer control strategies, the disease prevalence is still rising worldwide and has not been significantly reduced.[1] Cancer is one of the leading causes of death worldwide. It is the second and third most common cause of death in developed and developing countries, after cardiovascular diseases.[2] It is estimated that more than one-third of cancers can be prevented, and one-third of them can be cured if diagnosed early.[3] In Iran, cancer deaths account for the highest number of deaths after cardiovascular diseases and accidents.[4] A total of 112,131 new cases were registered in the Iranian National Population-based Cancer Registry for 2014. Of these cases, 53.9% were men and 46.1% were women. The age-standardized incidence rates per 100,000 of all cancers were 177.44 and 141.18 in men and women, respectively. The three most prominent places of cancers in men were stomach, prostate, and colorectum and in women were breast, colorectum, and stomach.[5]

The World Health Organization (WHO) emphasizes the prevention of cancer and the promotion of people's quality of life. WHO predicts that between 30%-50% of cancers can be prevented by avoiding risk factors, and early detection and management of patients. There is a high chance of cure for many cancers, if they timely diagnosed and treated.[6] In many cancers, survival and longevity are more pronounced if diagnosed early. Success in early detection is mainly dependent on an individuals' knowledge of cancer warning signs.[7] Most researchers agree on ten cancer warning signs. These include changes in bowel and urinary habits, wounds that do not heal for ≥ 3 weeks, unusual bleeding or secretion, presence of thickening and formation of lump or mass in the breast or other organs of the body, difficulty in swallowing, digestion problems (indigestion), significant changes in moles and warts, nagging cough or hoarseness, sudden weight loss, and severe and resistant pain.[8-10]

Assessing the level of general knowledge about cancer warning signs, identifying effective factors, and avoiding exposure to predisposing factors can play an important role in controlling and preventing disease at the community level.[11] The Health Belief Model (HBM)-based education is an efficient way to raise people's knowledge and subsequent behavioral change.[12] The HBM is a model mostly used in the prevention programs and relatively short-term interventions to change behavior.[13] Using this model, based on six constituent constructs, one can lead the individuals to the point of reaching the belief that they are vulnerable to the disease, and hence, they should apply risk-reducing behaviors.[14] To take preventive measures based on this model, individuals should first feel threatened by cancer (perceived sensitivity) and then perceive the depth of this risk and the seriousness of its different complications on physical, mental, social, and economic aspects (perceived severity). They should see the positive signs that they receive from their surroundings (cue to action), believe in the usefulness and applicability of the cancer prevention program (perceived benefits), and also find the preventive factors of cue to action less costly than its benefits (perceived barriers) to ultimately adopt cancer prevention measures.[15]

A literature review shows that numerous studies have been conducted on the proportion of total cancer deaths attributable to the risk factors at the international level, but there are few studies on the level of knowledge and beliefs of the general public toward cancer warning signs.[16] The results of an international study show that the general public's knowledge of cancer warning signs has been low in countries, such as India, Britain, Scotland, Ireland, and France.[17] A review of previous studies in Iran also shows that there are a few studies on the general public's knowledge and beliefs about the warning signs of cancers.[4,18] Therefore, investigating the level of perceived knowledge and beliefs of the people about cancer warning signs can play an important role in disease prevention at the community level. Since women's health is considered a basis for the health of the population, families, and society, as well as a development indicator in countries,[19] HBM-based educational intervention was designed for a group of women at urban health centers. Considering the important role of nurses and other health-care team members at the first level of prevention, this study aimed to "determine the effect of HBM-based educational intervention on knowledge and perceived beliefs of women about cancer warning signs." Therefore, this hypothesis was formulated in this study as "HBM-based educational intervention has an influence on women's knowledge and their perceived beliefs about cancer warning signs."

Methods

This is a randomized experimental study with two groups (intervention and control groups) by pretest–posttest design. The study was conducted at four urban health centers affiliated with the Bushehr University of Medical Sciences in Bushehr, Iran, from 2015 to 2016.

Ethical approval

The research project was approved by the Research Ethics Committee of the two universities, Shahid Beheshti and Bushehr Universities of Medical Sciences, Iran (Approval No. IR.SBMU.PHNM.1299.339). Besides, the research project was registered in the Iranian Registry of Clinical Trials (IRCT2015090723937N1). The purpose of the study was explained to all participants, and informed written consent was taken. All participants were informed about

the anonymity and confidentiality of the questionnaires and of voluntary participation in the study. The participants were free to withdraw from the study at any time without consequences.

Sampling and data collection procedures

This experimental study was performed on 160 women, who came to four university health centers in two groups as intervention (n = 80) and control (n = 80). The inclusion criteria included women having family health records in those centers, having the ability to answer the Persian version of the questionnaires, and being cancer-free during the study. The absence of ≥1 educational session was considered an exclusion criterion. To determine the sample size, according to the sampling formula, around 64 samples were selected per each group (effect size 0.4, power 90%, and Type I error of 0.05). Expecting a 30% dropout rate, a sample size of 83 women was calculated for each group (n = 166).

$$n = \frac{2\sigma^2 \left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}\right)^2}{d^2} \approx 64$$

For selection of the health centers, at first, all 11 urban health centers affiliated with the Bushehr University of Medical Sciences were divided into four clusters. Three clusters included three health centers from the northern, eastern, and western parts of Bushehr city, and one cluster included two health centers from the suburbs. Then, one health center was randomly selected from each of the clusters, meaning that a total of four urban health centers were used in the study. To select the samples for the intervention and control groups, two health centers were randomly assigned to each of them. Inside the centers, the samples were randomly selected from women who came to the centers, based on the inclusion criteria (41–42 women for each health center). Sampling began at these health centers after obtaining the ethics permission from two universities of medical sciences and urban health centers, as well as obtaining oral and written consent from the participants and coordination with the authorities. The data were collected in two stages: before the intervention (pretest) and 1 month after the intervention (posttest) using three questionnaires. In the first phase, 166 questionnaires were distributed among the participants and 162 questionnaires were collected. In the second phase, 162 questionnaires were distributed among the participants, but only 160 questionnaires were collected. Two incomplete questionnaires were removed from the control group in this phase.

Designing health belief model-based educational intervention

Based on the pretest phase, a need assessment process was conducted in the intervention group. After that, the content of the educational intervention by focus on ten warning signs of cancers, high ranked cancers in the Iranian population, risk factors, and healthy lifestyle behaviors was developed in the form of an educational package. This educational package was prepared by studying new textbooks and articles, searching in reliable databases, and concentrating on the HBM model constructs. For assessment of the validity of the educational package, it was reviewed by an expert panel, consisting of two specialists in medical-surgical and community health nursing and one specialist in health education, all of them with doctoral degrees. After this review and applying the necessary changes by the research team, this package was again returned to the expert panel, and the qualitative content validity of it was confirmed. In this package, the main aims and objectives of each session together with the necessary media were explained (pamphlet, booklet, and cancer pictures gallery. Pictures were shown in PowerPoint slides by a projector and computer). The educational intervention was planned for five sessions of 30–45 min for 5 weeks (one session per week). Educational intervention sessions were held with lectures, questions and answers, and group discussion. Educational materials, including a booklet and a summary which was delivered in the form of a pamphlet (according to the HBM constructs as a cue to action), were provided to the participants at the end of each session. It is worth noting that the educational materials were fully provided to the participants in the control group after posttest and the completion of the study, to meet the research ethics and to protect the rights of participants in the control group.

The first session was an orientation and introduction phase. A lecture about the research and its objectives was given, and then, a pretest was done. Afterward, a lecture and discussion were held about cancers, statistics in the world and Iran, and warning sign of cancers (perceived sensitivity and severity). The importance of having a healthy lifestyle was also discussed (perceived benefits).

Sessions 2–5 focused on ten cancer warning signs and symptoms and their relationships with specific cancers, according to the highest incidence ranking of cancers in Iran. These sessions had two important objectives: improving cancer prevention knowledge (perceived sensitivity, severity, and benefits) and improving cancer preventive behaviors (perceived benefits, barriers, and self-efficacy) based on the HBM constructs.

The second session was about "thickening or lump in the breast or other parts of the body" as one of the warning signs of cancer in the breast or other parts of the body (testicle, lymph nodes, or glands). The focus was on increasing the knowledge about "breast cancer" (perceived sensitivity, severity, and benefits) and improving self-efficacy.

The third session was focused on "changes in bowel habits and bladder function." Long-term constipation, diarrhea, or a change in the stool size may be a sign of colorectum cancer. Pain during urination, blood in the urine, or a change in the bladder function habits could be related to cancer in the bladder or prostate. "Indigestion" and "trouble swallowing" are also two warning signs of cancers. Indigestion or trouble swallowing over a long time can be signs of cancer in the stomach, esophagus, or pharynx. The focus was on increasing the knowledge about "colorectum, stomach, and prostate cancer" (perceived sensitivity, severity, and benefits) and improving self-efficacy.

The fourth session was focused on "unusual bleeding or discharge." Coughing with blood may be a sign of cancer in lung; blood in stool which can look very dark or black stool could be a sign of colorectum cancer. Blood in the urine may be a sign of cancer in the bladder or kidney. A bloody discharge from the nipple may be a sign of breast cancer. Abnormal vaginal bleeding can be related to uterus cancer. Furthermore, a warning sign of "nagging cough or hoarseness" or a cough that does not go away may be a sign of lung cancer. Hoarseness can be a sign of larynx or thyroid gland. The focus was on increasing the knowledge about "lung and bladder cancer" (perceived sensitivity, severity, and benefits) and improving self-efficacy.

The fifth session was focused on four cancer warning signs of "severe and resistant pain," "unexplained weight loss," "recent change in a wart or mole or any new skin change," and "sores that do not heal for more than 3 weeks." Pain can be an early symptom of cancer in bones or testicular. A headache that does not disappear or get better with treatment may be a symptom of tumor in the brain. Back pain can be a symptom of cancer in the colorectum or ovary. Mostly, pain related to cancer means it has spread (metastasis). An unexplained weight loss of 10 pounds or more may be a sign of cancer in the pancreas, stomach, esophagus, or lung. Any wart, mole, or freckle that shows a change in color, size, or shape or losing sharp borders may be related to cancer in the skin. Skin cancers may bleed and appear like sores that do not heal, especially in individuals who smoke, chew tobacco, or drink alcohol. A long-lasting sore in the mouth could be related to oral cancer. Sores on the penis or vagina may be a sign of early cancer. The focus was on increasing the knowledge about "healthy lifestyle" (perceived sensitivity, severity, and benefits) and improving self-efficacy.

One month later, posttest was done in both, intervention and control groups.

Measurements

The data collection was performed using three researcher-made questionnaires, including demographic-clinical information questionnaire, awareness questionnaire on cancer warning signs, and cancer warning signs-HBM questionnaire.

Demographic-clinical information questionnaire

This questionnaire included 13 questions about the demographic information of women participating in the study, including age, marital status, educational level, and employment status, previous information about cancer warning signs, cancer history among family relations, having a chronic disease, present health status, and observance of a healthy lifestyle.

Awareness questionnaire on cancer warning signs

This questionnaire included ten questions about the knowledge of cancer warning signs with three options: yes, no, and I do not know. Options yes, no, and I don't know were assigned scores 2, 1, and 0, respectively (score range of 0–20). The questions in this section were prepared based on ten cancer warning signs. The total score was obtained by the mean calculation. The validity of this researcher-made questionnaire was verified through determining the content validity, i.e. the qualitative content validity, the content validity ratio (CVR), and the content validity index (CVI) by ten experts from the School of Nursing and Midwifery and the School of Health. The results showed that the CVR and the CVI values were at least 80% and 96%, respectively, for the questionnaire. The face validity was also confirmed by a sample independent of the original sample (n = 10), but similar to its characteristics. The reliability of the questionnaire was confirmed using a split-half method and calculating the Spearman–Brown correlation coefficient (r = 0.76). Consistency of the questionnaire was also calculated using the test–retest method and calculating intraclass correlation coefficient (ICC = 0.99).

Cancer warning signs-health belief model questionnaire

This questionnaire comprised 34 questions based on six HBM constructs, i.e. "perceived sensitivity" (five questions with a score range of 5–25), "perceived severity" (five questions with a score range of 5–25), "perceived benefits" (six questions with score range of 6–30), "perceived barriers" (seven questions with score range of 7–35), "cue to action" (four questions with a score range of 4–20), and "self-efficacy" (five questions with a score range of 5–25). Appropriate questions in this section were designed by studying textbooks, articles, and available guides for each of the HBM constructs using a 5-point Likert scale, ranging from "completely agree" to "completely disagree" (score range of 1–5). For example, one of the "perceived sensitivity" items is "attention to cancer warning signs reduces the chance of developing cancer in the future." Examples of other model constructs include the "perceived severity" construct: "many people

who have cancer neglected cancer warning signs;" "perceived benefit" construct: "paying attention to cancer warning signs reduces treatment costs;" "perceived barriers" construct: "conducting diagnostic tests and diagnosis of cancer are costly;" "cue to action" construct: "physicians and other staff at the health-care center can help me identify and diagnose cancer warning signs;" and "self-efficacy" construct: "I can overcome my fear and embarrassment to perform tests for cancer warning signs." The score of these constructs was estimated by the mean calculation. The validity of this questionnaire was confirmed by determining the qualitative content validity, the CVR, and the CVI. The results showed that the range of the CVR and the CVI for all parts of the questionnaire was equal to at least 80% and about 96%, respectively. The face validity of this questionnaire was confirmed by a sample, independent of the original sample (n = 10). The reliability of this questionnaire was confirmed by determining Cronbach's alpha coefficient (Cronbach's alpha range of 0.78–0.80 for the constructs of the model) and the ICC (range: ≥0.92).

Statistical analysis

All statistical analyses were conducted using the SPSS version 20 (IBM Corporation, Armonk, NY, USA). For data analysis, the descriptive and inferential statistics were used in this study. Differences between two groups based on the six main variables of age, education, marital status, job status, previous knowledge of cancer warning signs, and family history of cancer in first-degree relatives were examined by a primary analysis with Chi-square and Fisher's exact tests. The outcome variables containing knowledge and the HBM constructs were evaluated by the Kolmogorov–Smirnov test, and the normality assumption of the variables revealed a violation. To evaluate the changes in the knowledge and the HBM constructs before and after the intervention and answer to the study hypothesis, due to nonnormality data, the nonparametric tests including the Wilcoxon signed-rank test for within-group comparisons and the Mann–Whitney U-test for between-group comparisons were used. Multivariate repeated-measures analysis of variance (ANOVA) was applied to show changes in the groups over time and interaction effects between time and group from pretest to posttest phase. The significance level was set at $P < 0.05$. Missing data in this study were <5%.

Results

The results of Chi-square and Fisher's exact tests showed that there was no difference between the two intervention and control groups, based on six variables of age (P = 0.656), education (P = 0.130), marital status (P = 0.100), employment status (P = 0.396), previous knowledge of cancer warning signs (P = 0.751), and a family history of cancer in first-degree relatives (P = 0.329). The mean age of women in this study was 29.9 ± 7.1 years. Other demographic and clinical characteristic of the women are shown in Table 1.

Wilcoxon signed-rank tests for within-group comparison of mean changes in outcome variables of the study are presented in Table 2. The figures in Table 2 show that there were significant changes in the mean scores obtained by the participants in the intervention group for knowledge and all the HBM constructs from the pretest to posttest

Table 1: Demographic and clinical characteristics of women in the control (n=80) and intervention groups (n=80)

Variable*	Group	Control, *n* (%)	Intervention, *n* (%)
Age (years)	<20	4 (5.0)	8 (10.0)
	20-29	35 (43.7)	34 (42.4)
	30-39	32 (40.0)	31 (38.8)
	≥40	9 (11.3)	7 (8.8)
Marital status	Single	6 (7.5)	14 (17.3)
	Divorced	5 (6.2)	4 (5.0)
	Widowed	1 (1.3)	1 (1.4)
	Married	68 (85.0)	61 (76.3)
Education	Primary school	2 (2.5)	5 (6.2)
	Secondary school	6 (7.5)	15 (18.8)
	High school	6 (7.5)	2 (2.5)
	College	27 (33.7)	20 (25.0)
	University	39 (48.8)	38 (47.5)
Employment status	Employed	28 (35.0)	23 (28.7)
	Housewife	52 (65.0)	57 (71.3)
Sufficient monthly family income	Yes	24 (30.0)	28 (35.0)
	No	56 (70.0)	52 (65.0)
Family history of cancer	Yes	19 (23.8)	14 (17.5)
	No	61 (76.2)	66 (82.5)
Previous knowledge about cancer warning signs	Yes	38 (47.5)	36 (45.0)
	No	42 (52.5)	44 (55.0)
Adherence to nutritional advice	Yes	75 (93.8)	70 (87.5)
	No	5 (6.2)	10 (12.5)
Smoking	Yes	8 (10.0)	17 (21.2)
	No	72 (90.0)	63 (78.8)
Daily exercise	Yes	53 (66.2)	53 (66.2)
	No	27 (33.8)	27 (33.8)
Alcohol consumption	Yes	6 (7.5)	12 (15.0)
	No	74 (92.5)	68 (85.0)
Health status	Bad	1 (1.3)	0 (0.0)
	Average	6 (7.5)	8 (10.0)
	Good	31 (38.8)	33 (41.3)
	Very good	27 (38.8)	25 (31.3)
	Excellent	15 (18.8)	14 (17.5)
Chronic disease	Yes	7 (8.7)	5 (6.3)
	No	73 (91.3)	75 (93.7)

*Differences between two groups based on the six main variables of age, education, marital status, employment status, family history of cancer in first-degree relatives, and previous knowledge of cancer warning signs were examined and showed there are no differences (P>0.05)

phases ($P = 0.001$). Table 2 also shows a significant increase in mean scores obtained in the control group from the pretest to posttest phases in five constructs of the HBM, including perceived susceptibility ($P = 0.001$), perceived severity ($P = 0.012$), perceived barriers ($P = 0.006$), cue to action ($P = 0.003$), and self-efficacy ($P = 0.001$).

Mann–Whitney U-tests for between-group comparison of mean changes in outcome variables of the study are presented in Table 3. The figures in Table 3 show that there were significant changes in the mean scores obtained by the participants in the intervention group compared with the control group for knowledge and all the HBM constructs 1 month after the educational intervention ($P = 0.001$).

Table 2: Changes of the mean in the knowledge and the HBM constructs within the intervention ($n=80$) and control groups ($n=80$) of women before and after the educational intervention

Variable	Group	Mean±SD		*P*
		Before education	One-month after education	
Knowledge	Control	7.99±3.71	7.64± 2.76	0.134
	Intervention	7.50±4.18	16.68±1.98	0.001
Perceived sensitivity	Control	16.68±1.99	15.96±1.87	0.001
	Intervention	16.75±2.51	20.86±1.46	0.001
Perceived severity	Control	16.49±1.87	16.18±1.88	0.012
	Intervention	16.22±1.91	21.16±1.71	0.001
Perceived benefits	Control	20.83±2.30	20.86±2.30	0.128
	Intervention	21.85±1.79	26.50±2.14	0.001
Perceived barriers	Control	22.36±2.34	21.94±2.54	0.006
	Intervention	21.40±2.68	30.26±2.13	0.001
Cue to action	Control	11.99±2.04	21.94±2.54	0.003
	Intervention	12.10±1.67	17.46±1.60	0.001
Perceived self-efficacy	Control	15.56±5.00	16.00±2.38	0.001
	Intervention	15.80±5.89	22.01±1.91	0.001

Table 3: Changes of the mean in the knowledge and the HBM constructs between the intervention ($n=80$) and control ($n=80$) groups of women before and after educational intervention

Variable	Time of the test	Mean±SD		*P*
		Control group	Intervention group	
Knowledge	Before	7.99±3.71	7.50±4.18	0.490
	After	7.64±2.76	16.68±1.98	0.001
Perceived sensitivity	Before	16.68±1.99	16.75±2.51	0.155
	After	15.96±1.87	20.86±1.46	0.001
Perceived severity	Before	16.49±1.87	16.22±1.91	0.155
	After	16.18±1.88	21.16±1.71	0.001
Perceived benefits	Before	20.83±2.30	21.85±1.79	0.003
	After	20.86±2.30	26.50±2.14	0.001
Perceived barriers	Before	22.36±2.34	21.40±2.68	0.003
	After	21.94±2.54	30.26±2.13	0.001
Cue to action	Before	11.99±2.04	12.10±1.67	0.015
	After	12.10±1.67	17.46±1.60	0.001
Perceived self-efficacy	Before	15.56±5.00	15.80±5.89	0.671
	After	16.00±2.38	22.01±1.91	0.001

Table 3 also shows significant differences in mean scores obtained by the intervention group compared with the control group concerning three HBM constructs, including perceived benefits ($P = 0.003$), perceived barriers ($P = 0.003$), and cue to action ($P = 0.015$), before the educational intervention in the pretest phase.

The results of multivariate repeated-measures ANOVA showed that there was an interactive effect between time and group in all the outcome variables. Moreover, changes concerning the knowledge and the HBM constructs in the intervention group, compared to the control group, are significant over time ($P < 0.001$) [Table 4].

Discussion

This experimental study was conducted based on the pretest–posttest design with intervention and control group to determine the effect of the HBM-based educational intervention on knowledge and perceived beliefs of women about cancer warning signs at the health centers affiliated to the university. The results showed that the study hypothesis was confirmed. It means that women's knowledge and their perceived beliefs about warning signs of cancer improved after HBM-based educational intervention in the intervention group compared to the controls.

The comparison of the intragroup means shows that the mean scores in the intervention group increased seven scores in knowledge and all of the HBM constructs, 1 month after the educational intervention, except for the "perceived barriers," which increased only three scores. These results are in line with previous studies.[17,18] However, in our study, there was a significant increase in the mean scores obtained by the participants in the control group, 1 month after the pretest in five HBM constructs, including "perceived susceptibility," "perceived severity," "perceived barriers," "cue to action," and "perceived self-efficacy." It can be said that although the control group had not gone through any education program, this slight increase might have been due to the retention of some information after completing the questionnaires, gathering of information from the media, and also women's tendency to obtain information about cancer warning signs after participation in the study.

An intergroup comparison of the means shows an increase of 4–9 scores, 1 month after the educational intervention in knowledge and all the HBM constructs in the intervention group, compared to the control group. These findings are similar to previous studies in populations.[17,18] However, in our study, before the educational intervention, there was a significant difference between the mean scores of the participants in the intervention group compared to the control group in the three constructs of the HBM – "perceived benefits," "perceived barriers," and

Table 4: The results of multivariate repeated measures analysis of variance in the control ($n=80$) and intervention ($n=80$) groups based on the knowledge and the health belief model constructs over time from the preintervention to postintervention phase

Variable	Sum of squares	Interactional effect	*F*	*P*
Knowledge	Intercept	31,680.80	2068.29	0.000
	Time × group	1814.51	295.93	0.000
Perceived sensitivity	Intercept	567.11	196.20	0.000
	Time × group	10,011.25	196,119.00	0.000
Perceived severity	Intercept	551.25	267.22	0.000
	Time × group	98,140.05	20,553.23	0.000
Perceived benefits	Intercept	422.01	188.51	0.000
	Time × group	161,085.86	22,960.46	0.000
Perceived barriers	Intercept	1725.15	409.67	0.000
	Time × group	184,176.03	22,073.01	0.000
Cue to action	Intercept	482.65	283.34	0.000
	Time × group	58,293.00	10,878.92	0.000
Perceived self-efficacy	Intercept	96,257.81	5351.54	0.000
	Time × group	667.01	40.14	0.000

"cue to action." Since the results of primary analyses in the beginning of the study showed that the intervention and control groups did not differ in terms of educational levels and previous knowledge of cancer warning signs, this difference could be attributed to individual personality or environmental factors, such as access to resources. Therefore, in this study, multivariate repeated-measures ANOVAs were used to investigate the genuine effectiveness of educational intervention. The results showed an interaction effect between time and group so that the mean scores for "knowledge," "perceived susceptibility," "severity," "benefits," "barriers," "self-efficacy," and "cue to action" in the control group were slightly greater than or equal to the intervention group in the pretest phase. However, these findings confirmed our previous results and indicated that although there was a significant difference between the two groups before educational intervention, the mean scores of women for "knowledge," "perceived susceptibility," "severity," "benefits," "barriers," "self-efficacy," and "cue to action" in the intervention group, compared to the control group, increased significantly over time.

A discussion in detail on the changes in the level of knowledge and the HBM constructs during intergroup comparisons shows that although the average knowledge of cancer warning signs in the two groups was approximately the same in the preintervention phase, it increased as much as nine scores in the intervention group 1 month after the educational intervention. In addition, in the preintervention phase, none of the groups had a good knowledge of cancer warning signs, and their average score was around 3 scores less than the average score of the questionnaire. Perhaps, one of the reasons for this can be attributed to an inadequate focus of the country's current health system on cancer prevention programs at the first level of prevention, though an increasing public knowledge of cancer and education about cancer-risk factors is of great importance in controlling the disease. Studies in developing countries show that individuals' level of knowledge varies from low to moderate, whereas it was assessed to be high in most developed countries.[20] The findings of this study are similar to those of previous studies on various cancers.[21,22] In these studies, most of the participants reported a low or moderate level of knowledge before the education, but their level of knowledge increased in the postintervention phase.

Our findings on "perceived susceptibility" of women participating in the study of cancer warning signs show that although the average "perceived susceptibility" of cancer warning signs in the two groups was approximately the same in the preintervention phase, it increased as much as four scores in the intervention group 1 month after the educational intervention. This finding is similar to that of Gammage *et al.*'s study.[23] However, in our study, the preintervention "perceived sensitivity" mean score was higher than the mean score of the questionnaire, which could be due to the type of the disease and its importance in the public's mind. Findings on "perceived severity" of cancer warning signs in women participating in the study indicate that although the average "perceived severity" of cancer warning signs in the two groups was approximately the same in the preintervention phase, it increased as much as five scores in the intervention group 1 month after the educational intervention. In our study, preintervention "perceived sensitivity" mean score of cancer warning signs was higher than the mean score of the questionnaire, which could indicate the severity of the disease and the subsequent consequences of the disease in the public mind. Muthoni and Miller[24] in their study showed an improvement in all attitudinal components, including "perceived severity" after the educational intervention. Findings on "perceived benefits" of cancer warning signs in women participating in this study indicate that although the average score of "perceived benefits" of cancer warning signs in the intervention group was slightly higher than in the control group, it increased as much as six scores in the intervention group 1 month after the educational intervention. In our study, preintervention "perceived benefits" mean score was approximately equal to the mean score of the questionnaire. It should be noted that one's perception of the benefits paves the way for the adoption of effective measures, and there is a strong correlation between "perceived benefits" and the adoption of "preventive behaviors."[25] Gammage *et al.* also showed in their study that the average score of "perceived benefits" in the intervention group had increased compared to the controls after the educational intervention.[23] The

effect of education on the creation of positive motivation depends on its efficiency and an elevated understanding of individuals on its benefits. Findings on "perceived barriers" to cancer warning signs in women participating in the study show that although the average score of "perceived barriers" to cancer warning signs in the control group was slightly higher than the intervention group in the preintervention phase, it increased as much as nine scores in the intervention group 1 month after the educational intervention. In our study, the preintervention mean score for "perceived barriers" was higher than the mean score of the questionnaire. This finding is similar to a study carried out to investigate the effects of an education program on women's knowledge and beliefs about breast cancer in Spain.[26] In our study, the preintervention mean score for the "cue to action" was approximately equal to the mean score of the questionnaire. In the present study, the most important source of information for cancer warning signs in the intervention and control groups included media (books, newspapers, magazines, Internet, radio, television, and satellite). However, the participants stated that physicians and health-care personnel played a less significant role in this regard. This seems to be a serious warning to the health-care system, underscoring the need for planning to provide the ground for a more active role of this group and their greater participation in cancer prevention educational programs. In addition, findings on the "cue to action" on cancer warning signs in women participating in the study show that although the average score of "cue to action" to cancer warning signs in the intervention group was slightly higher than the control group in the preintervention phase, it increased as much as five scores in the intervention group 1 month after the intervention. This finding is similar to the previous studies.[27] Although the "self-efficacy" mean score is not a direct indicator of individual performance, it can be a reflection of how women will perform in the future. Although the average score of women's "perceived self-efficacy" of cancer warning signs was the same in the two groups in the preintervention phase, it increased as much as six scores in the intervention group 1 month after the educational intervention. This means there was an increase in women's understanding of how they could detect and prevent cancer with the help of warning signs and make others aware of the reasons of common cancers. This finding is consistent with the studies of other researchers.[26,28,29] In our study, "perceived self-efficacy" mean scores in both groups were somewhat higher than the mean score of the questionnaire in the preintervention phase.

In summary, a comparison of average scores between the groups showed that average scores in the knowledge and all the HBM constructs in the intervention group were significantly higher than the control group, 1 month after the educational intervention. Therefore, HBM-based education showed an effective influence on knowledge and perceived beliefs of women about cancer warning signs over time.

Limitations

The use of self-reported questionnaires and the impossibility of direct monitoring of women's performance about cancer warning signs and prevention methods after HBM-based education in the home environment, may limit the external validity of the study. The educational package was prepared for participants in the study, according to the pretest results. Thus, it cannot be used directly in other studies. However, it can be a good guide for other researchers in parallel studies.

Conclusion

The results showed that the hypothesis of the study was confirmed. It means that HBM-based educational intervention caused an increase in the level of women's knowledge and their perceived beliefs of cancer warning signs in the intervention group, compared to the controls over time. The education affected "knowledge" and perceived beliefs of women referred to the health centers in terms of perceived "sensitivity," "severity," "benefits," "barriers," "cue to action," and "self-efficacy." It could be hoped that it would be effective for improving women's health-promoting behaviors in cancer prevention. Moreover, the low mean score of women's knowledge about cancer warning signs in the preintervention phase of our study could be an alarm for health-care providers and health-care policymakers in the community. It is recommended that health-care providers plan for HBM-based educational interventions based on educational needs of the target groups at different community levels.

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Conflicts of interest

There are no conflicts of interest.

References

1. Anand P, Kunnumakkara AB, Sundaram C, Harikumar KB, Tharakan ST, Lai OS, *et al.* Cancer is a preventable disease that requires major lifestyle changes. Pharm Res 2008;25:2097-116.
2. Hirokawa K, Utsuyama M, Kikuchi Y, Kitagawa M. Scoring of immunological vigor: trial assessment of immunological status as a whole for elderly people and cancer patients. In: Immunosenescence. Medical Intelligence Unit. New York: Springer; 2007: 15-23.
3. Gibbs RS, Karlyn BY, Haney AF, Nygaard I. Danforth's Obstetrics and Gynecology. London: Wolters Kluwer Health Adis (ESP); 2012.
4. Montazeri A, Vahdaninia M, Harirchi I, Harirchi AM, Sajadian A, Khaleghi F, *et al.* Breast cancer in Iran: Need for greater women awareness of warning signs and effective screening methods. Asia Pac Fam Med 2008;7:6.
5. Roshandel G, Ghanbari-Motlagh A, Partovipour E, Salavati F, Hasanpour-Heidari S, Mohammadi G, *et al.* Cancer incidence in Iran in 2014: Results of the Iranian national population-based cancer registry. Cancer Epidemiol 2019;61:50-8.
6. World Health Organization. Cancer-Key facts. 12 September 2018. Available from: https://www.who.int/news-room/fact-sheets/detail/cancer. [Last accessed 2019 Jul 03].
7. Robb K, Stubbings S, Ramirez A, Macleod U, Austoker J, Waller J, *et al.* Public awareness of cancer in Britain: A population-based survey of adults. Br J Cancer 2009;101 Suppl 2:S18-23.
8. Ingebrigtsen SG, Scheel BI, Hart B, Thorsen T, Holtedahl K. Frequency of 'warning signs of cancer' in Norwegian general practice, with prospective recording of subsequent cancer. Fam Pract 2013;30:153-60.
9. American Cancer Society. Signs and Symptoms of Cancer-What are Signs and Symptoms; August 2014. Available from: https://www.cancer.org/cancer/cancer-basics/signs-and-symptoms-of-cancer. [Last accessed 2014 Aug 11].
10. Irish Cancer Society. 10 Early Warning Signs you Cannot Ignore. Irish Cancer Society; June, 2016. Available from: https://www.cancer.ie/reduce-your-risk/mens-health/early-warning-signs-you-cannot-ignore#sthash.MzjMykhv.dpbs. [Last accessed 2019 May 10].
11. San Turgay A, Sari D, Türkistanli EC. Knowledge, attitudes, risk factors, and early detection of cancer relevant to the schoolteachers in Izmir, Turkey. Prev Med 2005;40:636-41.
12. Rollins L, Sy A, Crowell N, Rivers D, Miller A, Cooper P, *et al.* Learning and action in community health: Using the Health Belief Model to assess and educate African American community residents about participation in clinical research. Int J Environ Res Public Health 2018;15:1862.
13. Jones CL, Jensen JD, Scherr CL, Brown NR, Christy K, Weaver J. The Health Belief Model as an explanatory framework in communication research: Exploring parallel, serial, and moderated mediation. Health Commun 2015;30:566-76.
14. Parsa P, Sharifi F, Shobeiri F, Karami M. Effects of group counseling based on health belief model on cervical cancer screening beliefs and performance of rural women in Kaboudrahang, Iran Asian Pac J Cancer Prev 2017;18:1525-30.
15. Skinner CS, Tiro J, Champion VL. The health belief model. In: Health Behavior: Theory, Research, and Practice. 5th ed. San Francisco (US): Jossey-Bass; 2015. pp. 75-94.
16. VanDyke SD, Shell MD. Health beliefs and breast cancer screening in rural Appalachia: An evaluation of the Health Belief Model. J Rural Health 2017;33:350-60.
17. Niksic M, Forbes LJ. Awareness of colorectal cancer: Recognition of symptoms and risk factors by socio-demographic characteristics. In: Timely Diagnosis of Colorectal Cancer. Olsson L. (eds), Cham: Springer; 2018. pp. 1-20.
18. Tan YY, Hesham R, Qodriyah HM. "Knowledge and attitude of university students in health sciences on the prevention of cervical cancer." Med J Malaysia 2010;65: 53-7.
19. Brown Speights JS, Nowakowski AC, De Leon J, Mitchell MM, Simpson I. Engaging African American women in research: An approach to eliminate health disparities in the African American community. Fam Pract 2017;34:322-9.
20. El Rhazi K, Bennani B, El Fakir S, Boly A, Bekkali R, Zidouh A, *et al.* Public awareness of cancer risk factors in the Moroccan population: A population-based cross-sectional study. BMC Cancer 2014;14:695.
21. Feizi A, Kazemnejad A, Hosseini M, Parsa-Yekta Z, Jamali J. Assessing awareness level about warning signs of cancer and its determinants in an Iranian general population. J Health Popul Nutr 2011;29:656-9.
22. Hajian S, Vakilian K, Najabadi KM, Hosseini J, Mirzaei HR. Effects of education based on the health belief model on screening behavior in high risk women for breast cancer, Tehran, Iran. Asian Pac J Cancer Prev 2011;12:49-54.
23. Gammage KL, Francoeur C, Mack DE, Klentrou P. Osteoporosis health beliefs and knowledge in college students: The role of dietary restraint. Eat Behav 2009;10:65-7.
24. Muthoni A, Miller AN. An exploration of rural and urban Kenyan women's knowledge and attitudes regarding breast cancer and breast cancer early detection measures. Health Care Women Int 2010;31:801-16.
25. Ueland AS, Hornung PA, Greenwald B. Colorectal cancer prevention and screening: A Health belief model-based research study to increase disease awareness. Gastroenterol Nurs 2006;29:357-63.
26. Hall CP, Hall JD, Pfriemer JT, Wimberley PD, Jones CH. Effects of a culturally sensitive education program on the breast cancer knowledge and beliefs of Hispanic women. Oncol Nurs Forum 2007;34:1195-202.
27. Gathirua-Mwangi WG, Monahan PO, Stump T, Rawl SM, Skinner CS, Champion VL. Mammography adherence in African-American women: Results of a randomized controlled trial. Ann Behav Med 2016;50:70-8.
28. Avci IA, Gozum S. Comparison of two different educational methods on teachers' knowledge, beliefs and behaviors regarding breast cancer screening. Eur J Oncol Nurs 2009;13:94-101.
29. Ceber E, Yücel U, Mermer G, Ozentürk G. Health beliefs and breast self-examination in a sample of Turkish women academicians in a university. Asian Pac J Cancer Prev 2009;10:213-8.