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Effects of an Educational Health Belief Model Program on Promoting Preventive Behaviors for Breast Cancer Among Women in Iran

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Abstract

Breast cancer is regarded as a healthcare issue for women worldwide and affects women of all races, ethnicities, and social classes. The study aimed to examine the effects of the health belief model (HBM)-based educational program on knowledge, practices, and how to prevent breast cancer in women who go to health centers in Iran, which is in the province of Alborz in Iran. A quasi-experimental study was carried out based on a pretest-posttest design with the control group in 2022. A study targeted 128 women in 2 interventions ($n = 64$) and control ($n = 64$) groups. The data were collected from participants using a researcher-made questionnaire developed based on key constructs of the HBM, before and 2 months after the educational intervention. Educational intervention was held for 6 sessions of 60 min duration each. The health belief model evaluates 7 components of individuals, including perceived susceptibility, perceived severity, perceived barriers, perceived benefits, self-efficacy, cues to action, and practice. The Mann-Whitney test was utilized to compare the levels of quantitative variables between the 2 groups. A chi-squared test was utilized for the categorical variables. A robust analysis of covariance (ANCOVA) was employed to evaluate the effect of the intervention on all 7 HBM components. The results showed that using the health belief model can increase awareness, perceived benefits, perceived susceptibility, perceived severity, and self-efficacy of women for the prevention of breast cancer.

Keywords

education, health belief model, breast cancer, women, prevention, behaviors, self-efficacy

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Introduction

Even though breakthroughs in technology and medical science worldwide have fostered humans' ability to confound most cancers (eg, breast cancer [BC]), they are still perceived as dreadful conditions threatening human life. Being diagnosed with cancer frequently fundamentally changes the patient's life and results in numerous physical and psychological burdens from the date of diagnosis.[1,2] BC is the most commonly diagnosed cancer among women.[3] Among women, BC accounted for approximately 24.5% of all cancer cases and 15.5% of cancer deaths, ranking first for incidence and mortality in the majority of the world countries in 2020.[4] The American Cancer Society (ACS) estimates 297,790 new cases of invasive breast carcinoma in the United States in 2023, of which 43,700 may die. This spotlights BC as the most diagnosed cancer and the second-leading cause of death among American women.[4,5] In Iran, as reported, 1 out of every 10 to 15 women might be diagnosed with BC. However, the mean age at diagnosis among Iranian women has decreased at least a decade earlier than that in developed nations. The mean age at diagnosis among women in Western countries and Iran is 56 and 45 years, respectively.[5] In Iran, 16,967 new cases of BC and 4810 related deaths were estimated in 2020.[6] Another study conducted utilizing Iranian cancer registration data from 2008 to 2016 prognosticated that by 2025, the incidence of BC in women may increase and the number may reach about 25,000. In 2017, the highest age-standardized incidence rate (ASR) reported per 100,000 women was in the provinces of Tehran (57.4), Isfahan (51.9), Yazd (48.7), Gilan (48), and Alborz (47.6).[7]

BC is regarded as a healthcare issue for women worldwide.[8] It affects women of all races, ethnicities, and social classes.[9] The incidence and prevalence of BC differ worldwide. Such a difference is partly due to variable genetic structure and exposure to environmental carcinogens, but largely emanates from different lifestyle behaviors.[7] Research has revealed a significant and direct association between people's lifestyles and the rate of BC incidence.[10] Research has shown that breast self-examination by a person is the most important step in determining the tumor in the early stages. So, the patient himself discovers the presence of a mass in the breast in over 65% of the cases.[11] However, research findings show that, despite the high efficiency of breast self-examination in reducing mortality, the rate of adoption of this preventive behavior by women in different populations is low.[12] The results of other studies have shown that using the health belief model can promote BC prevention behaviors.[12,13] Regarding the role of health education and learning good habits that lessen BC incidence among young females, the ACC advises educating women aged 20 and older on the advantages of monthly breast self-examination (BSE), the capability of identifying symptoms, and adopting risk-lowering strategies.[14] One educational strategy is to use the health belief model (HBM) to promote awareness among women about BC. The health belief model is widely used to explain and predict intrapersonal cognitive factors that influence BC screening behaviors and the planning and execution of BC screening plans among various populations.[8] The key constructs of the HBM include perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, and cues to action.[15] In this model, the person must first feel that he or she is at risk of acquiring an illness or disease (perceived susceptibility) and then understand the depth of the risk and its impact on his or her life as well as the lives of others (perceived severity). Again, he or she must believe in the usefulness and applicability of preventive behaviors (perceived benefits) and find the deterrents to such behaviors less costly than the benefits (perceived barriers) to take preventive action.[16] Because theoretical interventions are crucial in encouraging preventive actions against BC. This study examines the impact of HBM-based education on promoting BC prevention behaviors among women attending health centers in Iran, located in the province of Alborz, Iran. Thus, given the growing trend of BC in Iran and since many patients with BC are referred to in the advanced stages of the disease, it is crucial to address the problem through an educational intervention based on appropriate patterns of behavior promotion to reduce mortality caused by it.

Materials and Methods

Study Design and Setting

A quasi-experimental study was conducted in 2022 using a pretest-posttest design with a control group. The study focused on women visiting health centers in Alborz Province, Iran. Data collection began after the project was approved by the university research council. The researcher visited comprehensive health service centers, reviewed referrals, and selected eligible participants from the Parsa electronic system based on predefined inclusion criteria. A total of 128 women were chosen and, after providing informed consent, were evenly divided into an intervention group ($n = 64$) and a control group ($n = 64$).

Inclusion criteria required participants to have no history of benign or malignant breast diseases and to consent to the study. Exclusion criteria included unwillingness to continue, missing more than one training session, or developing a specific illness during the study. For ethical approval, the university's ethics committee granted permission, and participants received clear explanations about the study's objectives. Their informed consent was obtained, and confidentiality was ensured by assigning numeric codes to questionnaires.

Data was collected using a researcher-designed questionnaire with 3 sections: demographic characteristics (5 items), knowledge (7 items), and HBM constructs, including perceived susceptibility (4 items), perceived severity (4 items), perceived barriers (6 items), perceived benefits (5 items), self-efficacy (4 items), cues to action (3 items), and practice

(6 items). Questions on perceived susceptibility, severity, benefits, barriers, and self-efficacy used a 5-point Likert scale ("completely agree" to "completely disagree"). Practice questions were based on a 3-point scale ("always," "rarely," and "sometimes"), cues-to-action questions were "yes" or "no," and knowledge questions were "true" or "false." Examples of practice questions included: "Do you control your weight to prevent breast cancer?" "Are you cutting back on fats?" "Do you perform breast self-examination or mammography to prevent breast cancer?" and "Do you eat high-fiber foods like fruits and vegetables?"

The questionnaire's validity was confirmed through content validity, assessed by experts in health education, health promotion, oncology, and epidemiology, whose feedback refined the questions. Reliability was established with a Cronbach's alpha of 0.7. Before the intervention, both groups completed the questionnaire. The intervention group then participated in 6 training sessions based on pretest results, educational needs, and HBM constructs. These sessions used lectures, videos, Q&A, group discussions, and SMS reminders.

The first session introduced BC, its prevention, and the individual's role in prevention, using lectures and group discussions. The second and third sessions highlighted the consequences of unhygienic behaviors to raise perceived susceptibility and severity, sharing stories of BC deaths and showing images of affected individuals, delivered via film screenings and lectures. The fourth and fifth sessions emphasized the benefits of preventive behaviors and minimized perceived barriers (eg, breast self-examination takes only 15 min), using examples of successful cases to dispel misconceptions. Cues to action, like disease symptoms, were discussed at the end of the fifth session to encourage preventive actions. The sixth session broke breast self-examination into manageable steps to boost self-efficacy, using moulage for hands-on training. Each session lasted 60 min. Two months after the intervention, both groups completed the questionnaire again. The control group received no training during the study but was given educational pamphlets on BC prevention afterward to ensure ethical standards.

Statistical Analysis

The results were reported as medians (Q_1–Q^3, interquartile range) or percentages for quantitative and categorical variables, respectively. Given that the data exhibited a nonnormal distribution (as confirmed by the rejection of the Shapiro-Wilk normality test), the nonparametric Mann-Whitney test was applied to compare the levels of quantitative variables between 2 groups. For categorical variables, a chi-squared test was utilized. To examine differences in component means across groups while adjusting for baseline component effects, an analysis of covariance (ANCOVA) was employed. The validity of ANCOVA results depends on 2 key assumptions: (i) the relationship between component levels at the study's conclusion and baseline remains consistent across groups (homogeneity of regression slopes) and (ii) baseline scores are independent of the study groups. The first assumption can be assessed using the Mann-Whitney test, while the second requires that the interaction between baseline scores and group allocation (baseline × group effect) be nonsignificant. A significant interaction effect indicates a violation of this assumption. In cases where ANCOVA assumptions were violated, a robust ANCOVA approach was adopted. All statistical analyses were conducted using the R statistical software, with the WRS2 package employed for implementation.[17]

Results

The characteristics of participants stratified by study groups are given in Table 1. The study population was 128 women, mostly in the 35 to 45 age group (60.9% of cases and 56.3% of controls), who previously hadn't been diagnosed with cancer (over 95% in both groups), and who also mostly were from families without a history of cancer in their family members (over 92% in both groups). Moreover, 18.8%of participants in the case group had a high school degree, and the remaining 82.2% had an academic degree. In the control group, these percentages were 12.5% and 88.5%, respectively. The comparison of participants' characteristics between the 2 groups revealed no statistically significant difference in their ages (chi-squared test, $P = .846$), cancer histories (Fisher exact test, $P = 1.0$), family histories of cancer (Fisher exact test, $P = .717$), or education levels (chi-squared test, $P = .572$) between the cases and controls.

Table 2 represents the median (Q_1–Q_3) of the HBM components stratified by groups before and after the educational intervention. Cronbach's alpha was also reported at both baseline and study conclusion for each component, serving

Table 1. Demographic Characteristics of Case and Control Groups.

Available	Cases (n, %)	Controls (n, %)	P-value
Age (years)			
< 35	11 (17.2)	11 (17.1)	.846
35–40	21 (32.8)	22 (34.4)	
41–45	18 (28.1)	14 (21.9)	
> 45	14 (21.9)	17 (26.6)	
Cancer history			
Yes	2 (3.1)	3 (4.7)	> .99
No	62 (96.9)	61 (95.3)	
Family history of cancer			
Yes	5 (7.8)	3 (4.7)	.717
No	59 (92.2)	61 (95.3)	
Education			
High school degree	12 (18.8)	8 (12.5)	.572
Undergraduate degree	29 (45.3)	29 (45.3)	
Postgraduate degree	23 (35.9)	27 (42.2)	

Table 2. The Comparison of HBM Components/Constructs Between 2 Groups Pre- and 2-Months Post-Educational Intervention Using the Mann-Whitney Test.

	Baseline				End of study (month 3)			
Component	Case	Control	*P*-value	α-Cronbach	Case	Control	*P*-value	α-Cronbach
Knowledge	4 (0-6)	4 (0.75-6)	.368	0.90	6 (3-7)	4.5 (0-7)	.014	0.90
Perceived susceptibility	11.5 (10-16)	11 (10-14)	.685	0.62	13 (12-14)	11.5 (10-13.2)	< .001	0.63
Perceived severity	13.5 (11-15)	14 (10.7-15)	.975	0.67	15 (14-16)	13.5 (11.7-15)	< .001	0.64
Perceived barriers	19 (17.7-22)	19 (17-21)	.608	0.50	17 (15-18)	19.5 (18-21)	< .001	0.60
Perceived benefits	16 (14-18)	17 (15-18)	.464	0.48	18 (17-19)	17 (15-18)	< .001	0.58
Cues to action	2 (1-3)	3 (1-3)	.834	0.84	2.5 (1-3)	2 (1-3)	.649	0.79
Self-efficacy	13 (12-14)	13.5 (12-15)	.279	0.65	14 (14-15)	13 (12-15)	.002	0.49
Practice	9 (8-11)	9 (8-11)	.83.1	0.68	9 (8-11)	13 (12-13)	< .001	0.80

Marked differences were observed following the intervention. For each component, Cronbach's alpha was also reported at the baseline and the end of the study.
Abbreviation: HBM, health belief model.

as a reliability coefficient and a measure of the questionnaire's internal consistency. The results indicate that the questionnaire measurements are acceptable for most components. Due to the non-normality distribution of data, comparisons between the 2 groups were made using the Mann-Whitney test. The results showed that the 2 groups were comparable at the baseline for all HBM components, an indication of the homogeneity of cases and controls, but following the intervention, the 2 groups became markedly different in all components ($P < .05$) except for the "cues to action" component ($P = .649$).

Another useful comparison is to compare each group over time to see if intervention has improved individual scores. Figure 1 displays the boxplot of each component before and after the intervention classified by each studied group. A paired t-test with Bonferroni adjustment for controlling type I error was used to compare the pairwise groups. As can be seen, except for the cues to action component, the score of all components has been improved significantly following the intervention.

Although the Mann-Whitney test (or t-test) and the paired t-test confirmed the effectiveness of the educational intervention, these statistical tests failed to adjust for the level of construct scores at the baseline. Since the individual's score at the baseline may affect the component's score of an individual at the end of the study, this source of bias has to be removed by the statistical analysis. Thus, the analysis of variance (ANCOVA) was used to properly address this issue. The homogeneity of regression slopes and the independence of baseline scores were 2 ANCOVA assumptions that were tested using Mann-Whitney and interaction effects, respectively. For perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and the self-efficacy construct, at least one of these assumptions were violated therefore the robust ANCOVA was used.[7,11] Cues-to-action was the only HBM construct that was analyzed using parametric ANCOVA. Results showed that the educational intervention increased the cues to action in the case group as compared to the control group ($F\ (1125) = 5.83$, $P = .017$).

In robust ANCOVA, the trimmed means (20%) were compared between 2 groups at some design points (usually 5 points) where the relationship between pre-and posttest values was the same in both groups. Comparisons between the trimmed means of the case and control groups were made by constructing 95% confidence intervals using the bootstrapping method. In multiple comparisons, confidence intervals were adjusted for inflation type I error. Figure 2 presents the scatterplot of knowledge, perceived susceptibility, perceived severity, perceived barriers, perceived benefits, self-efficacy, and practice scores at baseline and at the end of the study (month 3), as analyzed using robust ANCOVA. It appears that the educational intervention raised the knowledge score (panel A) of participants regardless of their initial knowledge score. Participants with lower initial perceived susceptibility (7-11, panel B) and initial perceived severity (<15, panel C) benefited from the intervention as well. In other words, the intervention was useful mainly for those participants who had low scores of perceived susceptibility and severity at the beginning of the study.

Panel D of Figure 2 shows the scatter plot comparing perceived barrier scores at baseline with those at the end of the study. The differences between the 2 groups remained significant, indicating a lower score for subjects in the intervention group. The educational intervention was also quite effective in promoting the perceived benefits (panel E, Figure 1), the self-efficacy score (panel F, Figure 1), and the practice score (panel G, Figure 1) of individuals in the case group compared to the control group (scores were significantly higher in the case group at all design points).

Discussion

The present study scrutinized the effects of HBM-based education on elevating BC prevention behaviors in women referring to health centers in Iran. The result of this study revealed that the score of all structures of the health belief model except cues to action increased significantly after educational intervention. The results revealed a significant difference in the mean score of knowledge in the intervention group

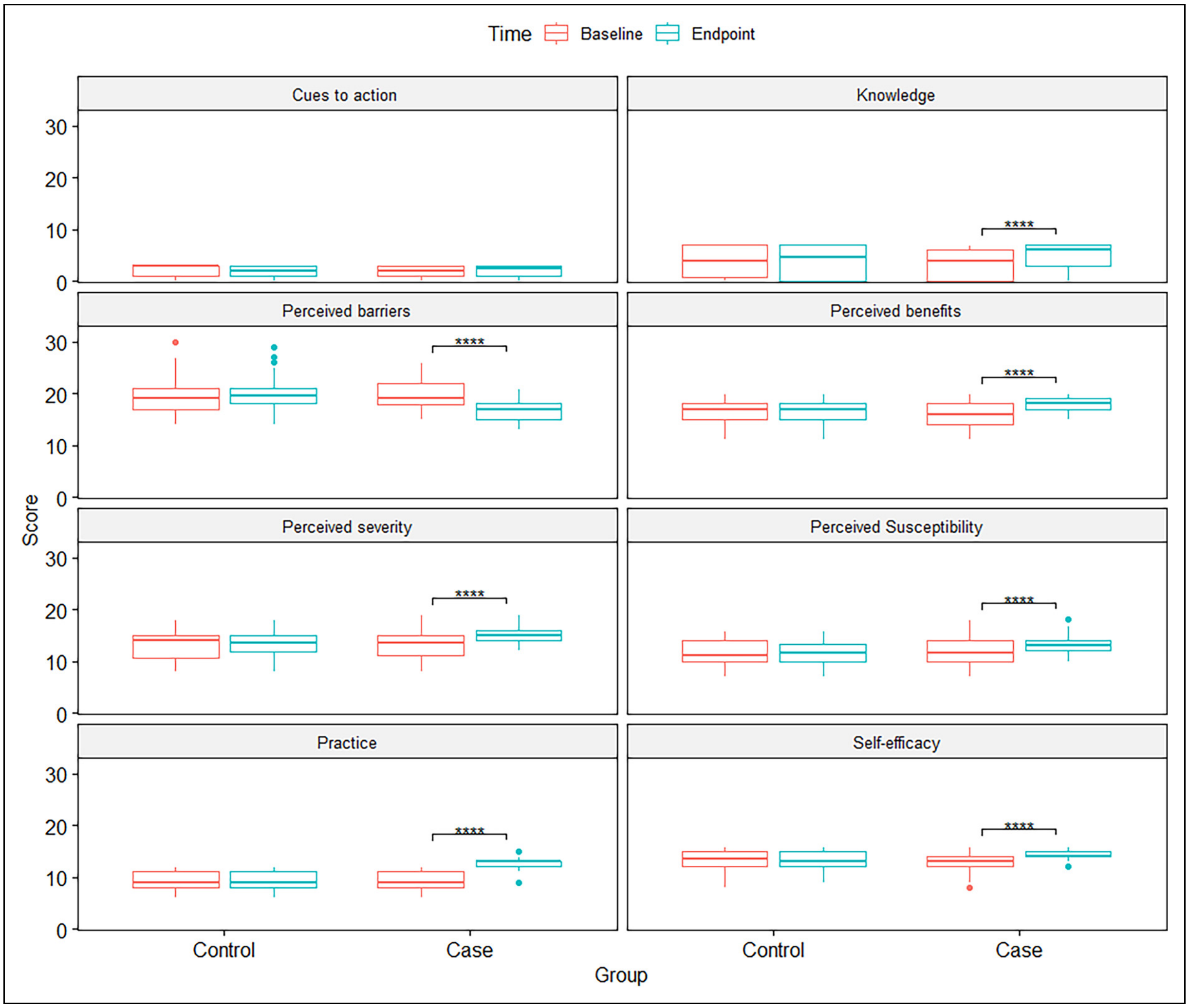

Figure 1. The box plot of knowledge, perceived susceptibility, perceived severity, perceived barriers, perceived benefits, self-efficacy, practice scores, and cues to action for women attending the health centers in Iran before and after the educational intervention was classified by each study group. A paired t-test with Bonferroni adjustment was used to make pairwise comparisons. * Significant at .05 level, ** significant at .01 level, *** significant at .001 level, and **** significant at .0001 level.

before and after training. By contrast, in the control group, there was no significant difference in the mean score of knowledge before and after the training intervention. This finding is in line with the study by Beydag et al[18] and Karimi et al.[19] Similar to our study, Hasani et al[20] reported a significant increase in BSE knowledge in the intervention group after the HBM-based training course. All these studies indicate the importance of education and its effect on promoting knowledge among women.

In this study, the mean scores of perceived susceptibility and perceived severity were significantly higher in the intervention group after training. This finding agrees with the result reported by Kalan-Farmanfarma et al.[21] Similarly, Hacihasanoglu and Gozum found a significant increase in perceived severity and threat after training.[22] However, in the study by Hasani et al,[20] the perceived severity in the intervention group did not significantly differ before and after the training course. Other studies have also pointed out a reduction in perceived susceptibility following the training course.[23,24] Generally, women who think more about their susceptibility to BC are more likely to adopt preventive behaviors. And, in turn, women who are more curious about this issue will perform preventive behaviors more enthusiastically.

The mean score of perceived benefits in the intervention group was significantly higher than that in the control group. This finding agrees with the result reported by Kalan-Farmanfarma et al[21] and Hacihasanoglu and Gozum.[25] In a study by Karimi et al, a positive and significant association was found between perceived benefits and BSE behavior.[19] In the present study, the mean posttraining score of the perceived barriers was significantly reduced in the intervention group compared to the control group, implying the effectiveness of HBM-based education in reducing the perceived barriers to adopting healthy behaviors. For the perceived barriers, the results agree with those reported by the

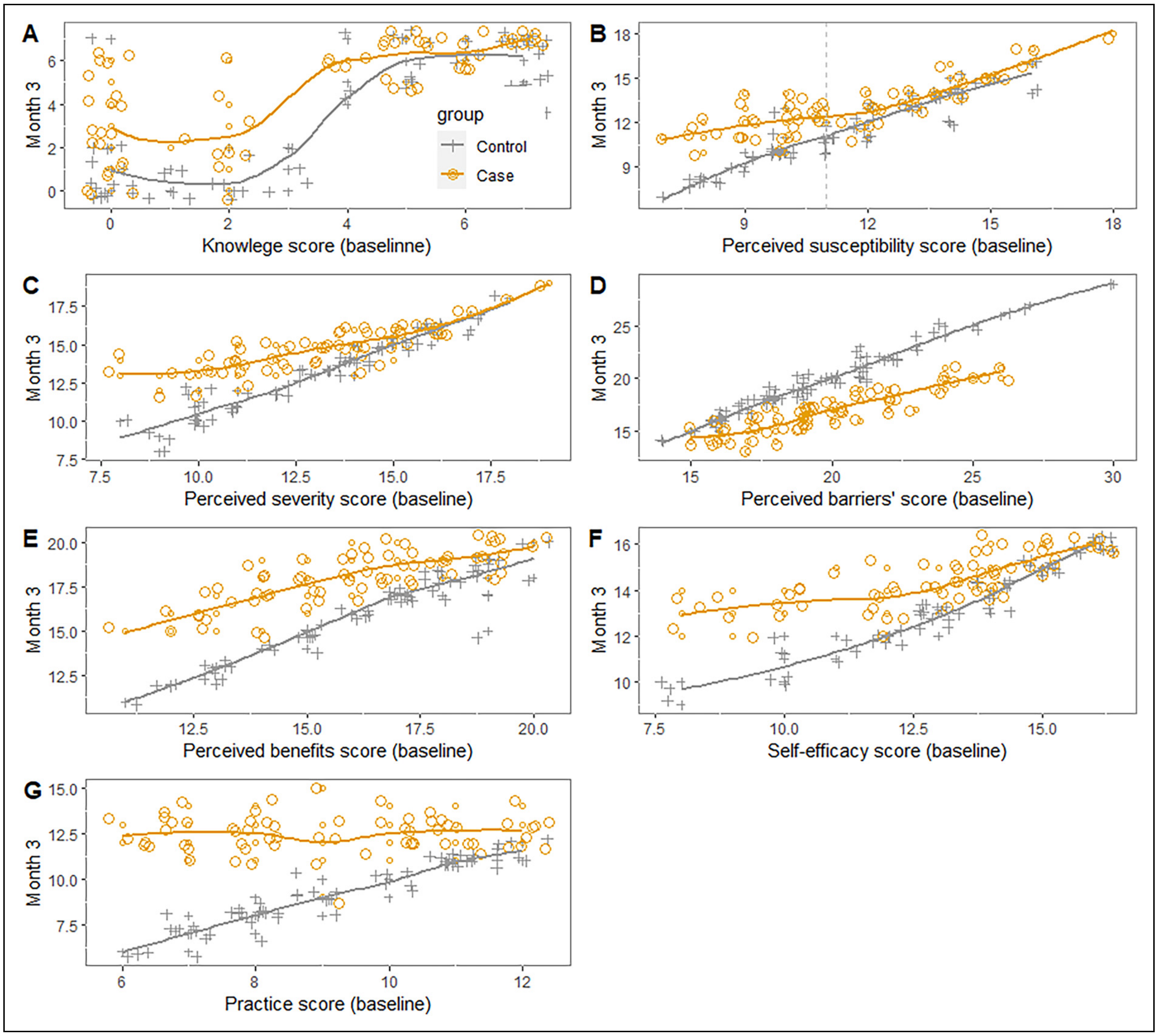

Figure 2. The plot of HBM component scores at the baseline (on the x-axis) against post-HBM component scores (on the y-axis) from robust ANCOVA. Two regression lines represent the intervention group (orange line, circle points) and the control group (gray line, plus symbols). Abbreviations: ANCOVA, analysis of covariance; HBM, health belief model.

study investigating the effects of an educational program on the knowledge and opinions of Spanish women about BC.[26] In today's world, in which public knowledge has markedly expanded, perceived barriers seem to be the main restricting factor in adopting preventive behaviors. This is because a person may have adequate knowledge, perceived severity, perceived susceptibility, and perceived benefits, but he or she fails to conduct such behaviors due to the presence of obstacles. Cultural beliefs and attitudes toward BC represent a significant barrier to behavioral change. These beliefs can profoundly influence self-care actions and the factors that shape them. Culture is a pervasive, multifaceted force that molds beliefs, attitudes, behaviors, and health outcomes. Other obstacles to cancer prevention behaviors include fear of diagnosis, feelings of shame, and a lack of motivation to adopt preventive practices. Educating individuals about these behaviors can help mitigate these barriers. A common critique of the HBM is its failure to account for cultural, environmental, social, and economic factors that may impact health behaviors. Consequently, it is recommended to employ alternative models, such as the PRECEDE-PROCEED model, the Theory of Reasoned Action, or the PEN-3 model, which emphasize cultural considerations to promote BC prevention behaviors.

The mean posttraining score of self-efficacies was also increased in the intervention group, in line with the study by Kalan-Farmanfarma et al.[21] A similar study in Turkey showed higher self-efficacy scores in the group that performed the BSE procedure.[27] Likewise, the study by Avci et al[28] in Turkey reported self-efficacy and health motivation as 2 key constructs of the HBM, as they are more robust predictors of BSE in women than other constructs of the model.

In studying Indian women, Kessler et al[29] underlined self-efficacy approaches to promote BC screening behavior. Notably, self-efficacy refers to a person's ability to engage in preventive behaviors, which are critical in situations like BSE. Hence, educational programs should contain proper planning to improve self-efficacy in women to conduct anti-BC preventive behaviors. Some suggestions in educational interventions to increase self-efficacy: the desired behavior must be divided into small and doable steps so that individuals can learn the desired behavior step by step, see their success in each step, and believe in their abilities to perform this behavior. Indeed, exposing individuals to successful experiences by setting achievable goals increases the success of their performance. A reward or positive reinforcement should be considered for performing any learned behavior.

Regarding cues to action, no significant difference was observed in either group before and after the training. This result is in line with that reported by Mohammadi et al,[30] but conflicts with the study by Sadeghi et al.[31] Ultimately, the mean score of behavior (practice) improved after the educational training in the intervention group. This finding agrees with that reported by Yi and Luong,[32] who reported a 50.8% increase in the posttraining BSE practice in the intervention group. Overall, the present study showed that HBM-based training, which includes the attitudes and opinions of the participants, can efficiently promote appropriate preventive behaviors.

One of the limitations of this study is the recording of people's performance based on self-reporting. To solve this problem, it was tried to reduce the number of questions in the entire questionnaire during designing the questionnaire and in each model structure and to reduce the problem of inaccuracy in answering the questions to some extent. Since the health education program designed based on the health belief model is significantly effective in creating prevention behaviors and since BC is one of the most common cancers in women, educational programs using educational models are vital for BC prevention. For this purpose, it is recommended that educational programs be conducted using behavioral models.

Conclusion

The present study showed that HBM-based education can efficiently promote anti-BC preventive behaviors in women referring to health centers. So, it is possible to change the way women act by increasing their knowledge, perception of susceptibility, perception of severity, perception of benefits, and perception of their ability.

Acknowledgments

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Data Availability

The datasets generated and/or analyzed during the current study are not publicly available due to consent not being obtained from participants for this purpose but are available from the corresponding author on reasonable request.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethics Approval

This study was conducted as the preliminary phase of a study approved by the Ethics Committee of the Kermanshah University of Medical Science, Ethical Code IR.KUMS.REC.1400.745 (approval date: 2022.1.25); written informed consent was obtained from all the participants study was conducted in accordance with the ethical standards set by the university's ethics committee on human experimentation and adhered to the principles outlined in the Helsinki Declaration (revised in 1983).

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