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Effect of Protection Motivation Theory-Based Training on Intention to Perform Mammography among Teachers

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ABSTRACT

Aims Early detection of breast cancer through mammography is effective in reducing mortality associated with this cancer. This study aimed to determine the effect of Protection Motivation Theory-based education on the intention to undergo mammography among teachers in District 4 of Tehran.

Materials & Methods This interventional study was conducted on 250 teachers in Tehran, who were randomly divided into an intervention group (125 participants) and a control group (125 participants) in 2024. The data collection tool was a questionnaire on women's participation in breast cancer screening based on protection motivation theory, which included 56 items and 8 dimensions. The educational intervention based on protection motivation theory was conducted in four sessions, held bi-weekly, for the intervention group. Data were analyzed by SPSS 26 using chi-square tests, paired t-tests, and covariance analysis.

Findings After the educational intervention, the mean scores of the constructs of protection motivation theory and the intention to undergo mammography showed a significant difference between the intervention and control groups ($p<0.05$).

Conclusion The educational intervention using protection motivation theory is effective in increasing women's intention to participate in breast cancer screening programs and undergo mammography.

Keywords Breast Cancer; Mammography; Motivation

CITATION LINKS

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Introduction

Breast cancer, as one of the significant challenges in women's health worldwide, accounts for millions of deaths each year, representing nearly 1 in every 6 deaths [1]. Global estimates show substantial inequalities in the burden of breast cancer in relation to human development. For instance, in countries with a very high human development index, 1 in 12 women will be diagnosed with breast cancer in their lifetime, and 1 in 71 women will die from it. In contrast, in countries with a low human development index, 1 in 27 women will be diagnosed with breast cancer in their lifetime, and 1 in 48 women will die from it [2]. In Iran, breast cancer constitutes 12.9% of all common cancers and was the fifth leading cause of cancer-related deaths in 2020. The most recent age-standardized incidence rate of breast cancer in Iran was 35.8, and it is expected to rise to over 70 cases per 100,000 people by the end of 2030. The highest incidence of breast cancer in Iran was found in central provinces, while the lowest rates were reported in southeastern provinces. The peak incidence occurs in the age group of 40 to 49 years. A rapid increase in incidence among young women from various regions of the country has also been reported. Understanding the timeline from breast cancer diagnosis to recovery requires precise analysis and diagnosis [3]. Early detection and timely medical intervention can significantly improve prognosis and increase survival rates while playing a crucial role in cancer management and treatment [4].

Among the methods for breast cancer screening, breast self-examination by women is a simple, effective, and beneficial way to screen for breast cancer, suitable for all women, and it increases self-awareness [5]. However, mammography is the most effective screening method, as it aids in early diagnosis and treatment at the asymptomatic stage [6]. Despite extensive evidence regarding the importance of regular mammography [6-8], participation rates in screening are low [9] and vary greatly depending on age, region, and insurance status [10, 11]. Breast cancer screening in routine health care settings leads to a significant reduction in breast cancer mortality [12]. Psychological and practical issues, ethnic factors, the impact of socio-economic status, and issues related to screening programs are all influential factors in participation in mammography screening. Lack of awareness and ignorance about the necessity of screening present major barriers to widespread involvement in mammography [9]. Other factors affecting screening uptake include education level, occupation, personal history of breast disease, financial and time constraints, fear, and embarrassment [13, 14]. Barriers to mammography among Asian women include knowledge, demographic factors, costs and insurance, cultural factors, beliefs, attitudes, emotions, fear, pain and embarrassment, self-efficacy, religious factors, psychological issues, time constraints, fatalism, professional recommendations, communication, social support, and access to services. Awareness, attitude and belief, perceived risk, and facilitating professional and social factors are important for promoting mammography [13]. Bashirian *et al.* reported that using health education models and theory-based behavioral interventions affects breast cancer screening behaviors among women [15].

Education is recognized as the most fundamental and significant way to promote self-care behaviors [16]. Considering that human behavior is influenced by various factors, health researchers need to understand behavior and the factors influencing it in order to create a healthy lifestyle and design effective interventions that either change or modify existing behaviors or replace them with new ones. This emphasizes the role of models and theories in behavioral studies [17]. Utilizing theories increases the efficiency, effectiveness, and likelihood of achieving results [18]. Various motivational programs have been developed to raise public awareness regarding protective behaviors. The most successful health behavior promotion programs emerge when effective factors influencing human behavior are addressed. One such educational model is protection motivation theory (PMT) [19].

PMT is one of the most useful frameworks for predicting protective behaviors in health behavior change studies when adopting preventive behaviors [20]. Protection Motivation Theory posits that fear can enhance positive protective motivations through six constructs: self-efficacy, response efficacy, response cost, perceived susceptibility, perceived severity, and perceived rewards. This model, which contains the essential component of motivation, can be employed to change attitudes and behaviors [21]. This protective motivation ultimately stimulates health behavior [22]. Healthcare providers can utilize PMT as a framework for developing educational interventions aimed at improving breast cancer screening behaviors among women [23]. In this regard, Hakim *et al.* suggest that healthcare providers develop PMT-based programs for the early detection of breast cancer among women in various community settings [24].

Considering that PMT has been extensively used as one of the best theories in behavioral sciences in various studies to explain behavior and identify the most significant influencing factors, and that its validity has been empirically confirmed in many health-related studies, this theory is utilized as the conceptual framework for this research. Conducting a theory-based educational intervention and selecting teachers according to their social and cultural status, who can play an increasing role in promoting community health, are innovations of the present study. This study aimed to determine the effect of an educational intervention based on

protection motivation theory on the intention to undergo mammography in female teachers in Tehran.

Materials and Methods

Research design and participants

This interventional study was conducted on 250 teachers in District 4 of Tehran in 2024. The sample size was determined based on previous studies [25], with α=0.05, β=80%, a design effect of 10%, and considering a 10% incomplete questionnaire completion rate within each group, totaling 250 participants (125 individuals in each group). Sampling was carried out in multiple phases. According to the survey, there are 64 middle school girls' schools in District 4 of Tehran. Initially, 24 schools were randomly selected using even and odd numbers. Then, using random number tables, 125 women over 40 years old from 12 schools were chosen as the intervention group, and 125 women over 40 from another 12 schools were chosen as the control group (10 women per school).

Inclusion and exclusion criteria

Inclusion criteria included the willingness of individuals to participate, physical and mental health, no history of cancer, and employment as teachers in middle schools. Exclusion criteria included individuals over 40 years of age with breast cancer, non-participation in educational sessions, a history of breast biopsy, and pregnancy during the study. After obtaining approval for the study design and receiving an ethics code, written consent was obtained from the study participants, assuring them of the confidentiality of their information. The implementation of this research took place from early December 2024 to the end of March 2025.

Data collection tools

Data were collected using a two-part questionnaire completed through interviews and self-reporting. The first part of the questionnaire contained demographic information, while the second part consisted of the Protective Motivation Questionnaire for Iranian Women's Participation in Preventive Breast Cancer Behaviors, developed by Khodayarian *et al.* [26]. The questionnaire includes 56 items across 8 dimensions, including perceived susceptibility (8 items, e.g., "Because there is no history of breast cancer in my family, my chances of developing breast cancer are lower"), perceived severity (11 items, e.g., "If I develop breast cancer and my body does not respond to chemotherapy, the likelihood of death is high"), rewards (3 items, e.g., "I do not go for diagnosis and treatment of breast cancer because I will lose my beauty"), response efficacy (7 items, e.g., "If a mass in my breast is detected early through a doctor's examination or mammography, I can be treated sooner"), self-efficacy (5 items, e.g., "I can schedule a mammogram"), response costs (16 items, e.g., "The mammography center is too far from my residence"), fear (5 items, e.g., "I don't want to think about breast cancer because it reminds me of death"), and protective motivation (1 item, e.g., "What is your decision regarding undergoing a mammogram in the next month?"). All items, except for the motivational one (intent), are scored on a 5-point Likert scale ranging from strongly agree to strongly disagree. In the study by Kavosi *et al.*, the reliability and validity of the questionnaire were confirmed [26].

Table 1. Schedule and content of the educational sessions provided

Session	Content	Strategy	Teaching aids
1	Introduction and acquaintance, rules, study objectives, and number of sessions; definition of breast cancer; breast cancer screening; breast cancer symptoms; breast cancer diagnosis; individuals at risk of breast cancer	Lecture, group discussion	PowerPoint, training booklet, pamphlet, images
2	Review of the first session's content; epidemiology (cancer statistics); prevalence of cancer in Iran and the world; cancer mortality; details of breast cancer with colorful graphic images; factors making women more susceptible to breast cancer (stress and consumption of fatty foods and fast food); psychological and physical consequences of breast cancer; side effects of chemotherapy and radical mastectomy (e.g., interference with daily life and loss of physical and psychological comfort); and loss of women's sexual attractiveness. Participants share their experiences, concerns, and problems regarding breast cancer, as well as the role of women in maintaining health and their responsibilities toward their husbands and children, summarizing information at the end of the session. Discussion and exchange of ideas by the researcher, directed in a way to increase the perceived threat among participants (sensitivity and severity).	-	-
3	Review of the second session's content; review of the third session's content; discussion about the obstacles and problems associated with performing mammography; benefits of screening and early detection of breast cancer using mammography, along with participant experiences; advantages of performing mammography and early detection of breast cancer. At the end of the session, to prepare for the next session, participants were asked to create a list of obstacles and problems, as well as beliefs that might influence people's decisions to perform mammography, for discussion in the next session (reward, response cost).	-	-
4	Providing solutions to strengthen individuals' will and self-efficacy to perform mammography; facilitating factors for behavior; providing incentives; reducing and removing perceived obstacles (self-efficacy and response efficacy) Summarizing the content of previous sessions and encouraging and motivating individuals to take action to perform mammography	-	-

Intervention

The educational program was conducted over four sessions of 60 minutes each at two-week intervals (Table 1). The content of the educational program included primary prevention methods, secondary prevention methods, and factors predisposing individuals to breast cancer. The training employed methods, such as lectures, question-and-answer sessions, group discussions, and feedback. Two months after the intervention, to assess the impact, a post-test was conducted for both the intervention and control groups, and participants in both groups completed the questionnaires once again. To maintain ethical considerations, the educational materials were provided to the control group after they had completed the questionnaires.

Statistical analysis

The data analysis was conducted using SPSS version 26, employing descriptive statistics (mean, standard deviation, frequency) and independent t-tests, paired t-tests, chi-square tests, or Fisher's exact test. The significance level was set at 0.05.

Findings

A total of 125 individuals were assigned to the intervention group and 125 to the control group (Table 2).

In terms of education, spouse's education, spouse's occupation, age, marital status, having children, and having supplementary insurance, both study groups were homogeneous (p>0.05).

Based on the independent t-test results, the mean scores of the protection motivation theory constructs for both the intervention and control groups did not differ significantly before training (p>0.05; Table 3).

Table 2. Frequency of participants' demographic information according to study groups

Parameter	Intervention group (n=125)	Control group (n=125)	p-Value
Marital status			
Married	109(87.2)	111(88.8)	0.697
Single	16(12.8)	14(11.2)	
Age (year)			
30-40	30 (24)	31(24.8)	0.504
40-50	(56.8) 71	75(60)	
50-60	22 (17.6)	19(15.2)	
60-70	2(1.6)	0(0)	
Having children			
Yes	105(84)	105(84)	1.000
No	20(16)	20(16)	
Education level			
Associate degree	23(18.4)	23(18.4)	0.939
Bachelor's degree	63(50.4)	66(52.8)	
Master's degree	30(24)	26(20.8)	
PhD	9(7.2)	10(8)	
Spouse's education level			
Diploma	28(22.4)	31(24.8)	0.944
Associate degree	18(14.4)	14(11.2)	
Bachelor's degree	54(43.2)	55(44)	
Master's degree	18(14.4)	17(13.6)	
PhD	7(5.6)	8(6.4)	
Spouse's occupation			
Unemployed	3(2.4)	9(7.2)	0.130
Employee	83(66.4)	72(57.6)	
Self-employed	39(31.2)	44(36.2)	
Supplemental insurance			
Yes	116(92.8)	118(94.4)	0.605
No	9(7.2)	7(5.6)	

Table 3. Mean scores of protection motivation theory constructs in the intervention and control groups before and after the intervention

Parameter	Group	Before intervention	After intervention	Paired-t test	p-Value
Perceived susceptibility	Intervention	20.80±4.01	30.48±5.73	-4.172	0.0001
	Control	21.28±3.91	21.17±2.98	0.226	0.822
Perceived severity	Intervention	38.04±6.64	39.33±7.75	-1.445	0.151
	Control	37.64±6.92	35.59±7.22	2.293	0.024
Perceived response efficacy	Intervention	12.78±5.46	22.26±6.09	-11.256	0.0001
	Control	13.96±5.84	11.41±3.85	3.978	0.0001
Perceived self-efficacy	Intervention	11.92±2.26	11.92±2.26	-14.920	0.0001
	Control	12.24±2.68	12.24±2.68	-3.060	0.0001
Rewards	Intervention	7.11±2.77	10.00±3.96	-14.189	0.0001
	Control	6.55±3.55	6.75±3.75	5.000	0.0001
Response cost	Intervention	36.16±10.47	45.30±13.61	-6.319	0.0001
	Control	38.41±9.12	54.92±11.60	-14.000	0.0001
Fear	Intervention	14.63±4.14	18.40±6.63	-5.378	0.0001
	Control	14.68±4.33	14.46±4.14	-10.009	0.0001
Intention	Intervention	2.50±0.47	3.36±0.71	-8.53	0.0001
	Control	2.48±0.48	2.50±0.47	-0.214	0.831

Table 4. Comparison of the mean scores of the protection motivation theory constructs in the intervention and control groups using analysis of covariance

Parameter	Source	Sum of squares	df	Mean squares	F	p-value	Partial Eta squared
Perceived susceptibility	Pre-test	360.175	2	180.088	8.625	0.0001	0.065
	Group	321.645	1	321.645	15.405	0.0001	
	Error	5157.269	247	20.880	-	-	
Perceived severity	Pre-test	868.430	2	443.215	7.862	0.0001	0.060
	Group	869.571	1	869.571	15.426	0.0001	
	Error	13923.746	247	56.371	-	-	
Perceived response efficacy	Pre-test	7108.788	2	3554.394	108.907	0.0001	0.469
	Group	6927.726	1	6927.726	212.267	0.0001	
	Error	8061.312	247	32.637	-	-	
Perceived self-efficacy	Pre-test	1495.544	2	747.772	59.812	0.0001	0.326
	Group	1479.565	1	1479.565	118.346	0.0001	
	Error	3088.012	247	12.502	-	-	
Rewards	Pre-test	2695.116	2	1347.558	259.866	0.0001	0.678
	Group	529.964	1	529.964	102.2	0.0001	
	Error	1280.840	247	5.186	-	-	
Response cost	Pre-test	5559.055	2	2779.527	17.377	0.0001	0.123
	Group	5092.263	1	5092.263	31.835	0.0001	
	Error	39509.345	247	159.957	-	-	
Fear	Pre-test	2227.901	2	1113.950	43.677	0.0001	0.261
	Group	2210.497	1	2210.497	861.67	0.0001	
	Error	6299.575	247	25.504	-	-	

Table 5. Comparison of intention to undergo mammography in the intervention and control groups after the intervention

Intention to undergo mammography in the next month	Control group	Intervention group	p-value*
I don't think so	19(15.2)	0(0)	0.0001
I think so	45(36)	16(12.8)	
I probably will go	40(32)	47(37.6)	
I will definitely go	21(16.8)	62(62.6)	

* Chi-square test

To compare the averages of the protection motivation theory constructs in the studied groups, after examining the assumptions of the analysis of covariance, this analysis was used (Table 4).

Training based on the theory of protective motivation caused changes in the theoretical constructs and the intention to undergo mammography (Table 5).

Discussion

The present study investigated the effect of an educational intervention based on Protection Motivation Theory on the intention to perform mammography among female teachers in Tehran. In this study, the educational intervention improved the perceived susceptibility among participants in the intervention group. Correspondingly, Zahabi *et al.* and Mahboobighazaani *et al.* reported that after the intervention, there is a significant difference in perceived susceptibility between the intervention and control groups [27, 28]. However, Lwin reported that perceived susceptibility has a minor effect on the motivation to screen for breast cancer [29]. Pirzadeh *et al.* and Nazari *et al.* also reported that perceived susceptibility after the educational intervention does not show a significant difference between the intervention and control groups [23, 30]. The differences in findings from those studies may be due to varying intervention methods and educational content. Additionally, potential differences in participants' demographic characteristics (age, education, socioeconomic status) and cultural contexts across studies might result in discrepancies in findings. In this study, data on breast cancer incidence and mortality among Iranian women in recent years were employed, based on the constructs of Protection Motivation Theory, to enhance perceived susceptibility. Women who believe they are at risk for breast cancer are more likely to engage in breast cancer screening behaviors. Therefore, increasing beliefs about breast cancer as a motivation for undergoing mammography is promising, and it is necessary to adapt educational materials to the culture and language while focusing on enhancing support for women [31].

The educational intervention improved the perceived severity construct among participants in the intervention group. Supporting this finding, Zahabi *et al.* reported that group counseling based on PMT leads to increased perceived severity in the intervention group for breast self-examination [27]. Additionally, Ghaffari *et al.* reported that perceived severity related to self-examination and mammography increases in the intervention group [32]. However, in the studies by Pirzadeh *et al.* [30] and Nazari *et al.* [23], perceived severity after the educational intervention does not show significant differences between the intervention and control groups [30]. Perceived severity can act as a double-edged sword; in other words, when perceived severity is high, denial or non-acceptance of preventive behaviors may occur [28]. The results suggest that if individuals seriously understand the illness and its consequences, they will engage in preventive behaviors. In this study, the use of images

and videos of patients with advanced breast cancer increased the perceived severity in the intervention group.

The educational intervention also improved perceived self-efficacy among participants in the intervention group. There is a direct and significant relationship between breast cancer screening behaviors and perceived self-efficacy [23]. Ghaffari *et al.* [32] and Pirzadeh *et al.* [30] also report a significant increase in self-efficacy scores among participants in the intervention group.

Response efficacy is significantly related to breast cancer screening [33]. Consistent with the findings of this study regarding the improvement of perceived efficacy, the results of Chen & Yang showed that women receiving messages containing high efficacy have the highest intention to perform breast self-examination [34].

After the educational intervention, the response cost construct was reduced among participants in the intervention group. There is an inverse statistical relationship between breast cancer screening behaviors and perceived costs [23]. In line with these findings, Ghaffari *et al.* reported that theory-based education for health volunteers reduces barriers to breast self-examination and mammography in the intervention group [32]. Contrary to our findings, in the study by Pirzadeh *et al.*, participants' perceived barriers to undergoing mammography do not decrease post-intervention [30]. This discrepancy may stem from differences in study participants regarding demographic factors and their socioeconomic status. In this regard, Pirzadeh reported that the high cost of mammography, due to the lack of free services in the health system, is often considered a barrier for individuals, for which there is unfortunately no solution. Additionally, it can be said that in this study, the strategies used in the educational sessions (question-and-answer and brainstorming) led to the articulation of barriers by participants and provided suitable solutions to overcome them.

The educational intervention significantly improved perceived rewards among participants in the intervention group. Supporting this finding, several studies have reported an increase in perceived benefits from breast cancer screening following the educational intervention among women participating in the intervention group [27, 28, 32].

Women's fears and health beliefs impact their participation in early breast cancer detection approaches [35]. The fear construct was improved among participants in the intervention group. Additionally, according to Ghofranipour *et al.*, women who report higher levels of fear are more likely to regularly perform breast self-examination [33]. There is also a significant relationship between self-efficacy for undergoing mammography and fear of breast cancer [36]. Multiple factors affect the effectiveness of fear appeals, including individual personality, norms, fear strength, perceived threat, and perceived response efficacy. Fear appeals can influence women's attitudes and behavioral intentions, but not necessarily the early detection of breast cancer [37]. In the study by Emami *et al.*, fear of breast cancer does not have a significant effect on women's mammography screening [38]. Differences in the demographic characteristics of the study population may explain this discrepancy.

An educational intervention based on protective motivation theory significantly increased the intention to undergo mammography among female teachers.

This finding is consistent with the studies by Lee *et al.* [39] and Ghaffari *et al.* [32]. Therefore, it can be concluded that interventions based on educational models promote self-care, create a foundation for improving breast cancer screening behavior in women, and increase the awareness and efforts of policymakers to enhance breast cancer screening behaviors.

One of the strengths of this study is the focus on teachers, who, as role models for students, can play an important role in promoting community health by transferring the information learned in educational sessions to students and their parents. These findings can be utilized by other researchers, especially in developing countries with similar socioeconomic statuses.

Given that self-reported information is not an objective measure for assessing individuals' beliefs, convictions, and abilities, and is not available to the researcher, some individuals may have refused to provide truthful answers and instead given unrealistic responses. The inability to measure behavior (i.e., undergoing mammography) due to the limited follow-up time is another limitation of this study.

Our results demonstrated the pivotal role of the protective motivation theory constructs in explaining the intention to undergo mammography among female teachers. These findings, while confirming the effectiveness of this theory in health promotion research, provide a specific scientific basis for designing targeted interventions. Health planners and policymakers can use these insights to optimize breast cancer screening strategies and promote women's active participation by strengthening protective motivational factors. This, in turn, will lead to early detection, improved treatment outcomes, and enhanced general health and quality of life for this target group. An educational intervention based on this theory is proposed for screening other diseases in different communities.

Conclusion

The educational intervention using protection motivation theory is effective in increasing women's intention to participate in breast cancer screening programs and undergo mammography.

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Ethical Permissions: This article is part of a master's thesis in health education and promotion, approved by the Ethics Committee of Kurdistan University of Medical Sciences, Iran, under the ethics code IR.MUK.REC.1403.200. All methods were performed in accordance with the Declaration of Helsinki. After explaining the research objectives, written informed consent was obtained from all participants, who were also informed about the confidentiality of their data.

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Authors' Contribution: Hossainzadeh S (First Author), Introduction Writer/Methodologist/Main Researcher (35%); Bahmani A (Second Author), Methodologist/Assistant Researcher/Discussion Writer/Statistical Analyst (35%); Nili S (Third Author), Methodologist/Assistant Researcher/Discussion Writer/Statistical Analyst (20%); Fallahi A (Fourth Author), Methodologist/Assistant Researcher/Discussion Writer (10%)

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