Investigating the effect of training based on the Protection Motivation Theory on the intention to perform mammography among teachers

Abstract

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

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 using SPSS version 26 and chi-square, paired t-tests, and covariance.

Findings: The results indicated that 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 ($P \geq 0.05$).

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. Therefore, utilizing the constructs of Protection Motivation Theory in designing educational interventions appears to be essential.

Keywords: Breast cancer, Mammography, Intervention

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 last 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 the 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 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]. Bashiriyan 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 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 on human behavior are addressed. One such educational model is the 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]. The 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. suggested that healthcare providers develop PMT-based programs for 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 of 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 the protective motivation theory on the intention to undergo mammography in female teachers in Tehran.

Materials and Methods

Trial Design and Participants

this interventional study was conducted in 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 for this study 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 criteria for the study included the willingness of individuals to participate, physical and mental health, no history of cancer, and being employed as teachers in middle schools. **Exclusion criteria** included individuals aged over 40 with breast cancer, non-participation in educational sessions, 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: 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 the motivational one (intent), were designed 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].

Intervention

The educational program was conducted over four sessions of 60 minutes each at two-week intervals (see Table 1). The content of the educational program included primary prevention methods, secondary prevention methods, and factors predisposing 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 again

Table 1. Schedule and Content of the Educational Sessions Provided

Session	Outline	Strategy	Teaching aids	Time
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	60 minutes
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, 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' sharing of their experiences, family, and friends regarding concerns and problems of breast cancer, the role of women in maintaining health and their responsibility towards 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 in participants. (Sensitivity and severity)			
	Review of the second session's content, review of the third session's content, discussion about the obstacles and problems raised for performing mammography, benefits of screening and early detection of breast cancer using mammography and using 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 prepare a list of obstacles and problems, as well as beliefs that might change people's decision to perform mammography for the next session to discuss them. (Reward, response cost)	"	"	"
	Providing solutions to strengthen individuals' will and self-efficacy to perform mammography, facilitating factors of behavior, providing incentives, reducing and removing perceived obstacles (Self-efficacy and response efficacy), Finally, summarizing the content of previous sessions and encouraging and motivating individuals to take action to perform mammography	"	"	"

Statistical Analysis:

The data analysis of this study 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 for the tests was set at 0.05.

Findings

In the present study, 125 individuals were assigned to the intervention group and 125 to the control group.

Table 2. Summary of Participants' Demographic Information According to Study Groups

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

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).

Table 3. Comparison of Mean Scores of Protection Motivation Theory Constructs in Intervention and Control Groups Before and After Intervention

Variables*	Group	Before Intervention Mean ± SD	After Intervention Mean ± SD	Paired-t statistic	p-value
Perceived Susceptibility	Intervention	20.80 ± 4.01	30.48 ± 5.73	-4.172	0.000
	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	0.000
	Control	13.96 ± 5.84	11.41 ± 3.85	3.978	0.000
Perceived Self-Efficacy	Intervention	11.92 ± 2.26	11.92 ± 2.26	-14.920	0.000
	Control	12.24 ± 2.68	12.24 ± 2.68	-3.060	0.000
Rewards	Intervention	7.11 ± 2.77	10.00 ± 3.96	-14.189	0.000
	Control	6.55 ± 3.55	6.75 ± 3.75	5.000	0.000
Response Cost	Intervention	36.16 ± 10.47	45.30 ± 13.61	-6.319	0.000
	Control	38.41 ± 9.12	54.92 ± 11.60	-14.000	0.000
Fear	Intervention	14.63 ± 4.14	18.40 ± 6.63	-5.378	0.000
	Control	14.68 ± 4.33	14.46 ± 4.14	-10.009	0.000
Intention	Intervention	2.50 ± 0.47	3.36 ± 0.71	-8.53	0.000
	Control	2.48 ± 0.48	2.50 ± 0.47	-0.214	0.831

Based on Table 3 and the results of the independent t-test, the mean scores of Protection Motivation Theory constructs for both the intervention and control groups did not differ significantly before training (P > 0.05).

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, the results of which are given in Table 4.

Table4. Comparison of the mean scores of the constructs of the protection motivation theory in the intervention and control groups through covariance

Variables*	Source	Sum of squares	df	Mean squares	F	Sig.	Partial Eta Squared
Perceived Susceptibility	Pre-test	360.175	2	180.088	8.625	0.000	0.065
	group	321.645	1	321.645	15.405	0.000	
	Error	5157.269	247	20.880			
Perceived Severity	Pre-test	868.430	2	443.215	7.862	0.000	0.060
	group	869.571	1	869.571	15.426	0.000	
	Error	13923.746	247	56.371			
Perceived Response Efficacy	Pre-test	7108.788	2	3554.394	108.907	0.000	0.469
	group	6927.726	1	6927.726	212.267	0.000	
	Error	8061.312	247	32.637			
Perceived Self-Efficacy	Pre-test	1495.544	2	747.772	59.812	0.000	0.326
	group	1479.565	1	1479.565	118.346	0.000	
	Error	3088.012	247	12.502			
Rewards	Pre-test	2695.116	2	1347.558	259.866	0.000	0.678
	group	529.964	1	529.964	102.2	0.000	
	Error	1280.840	247	5.186			
Response Cost	Pre-test	5559.055	2	2779.527	17.377	0.000	0.123
	group	5092.263	1	5092.263	31.835	0.000	
	Error	39509.345	247	159.957			
Fear	Pre-test	2227.901	2	1113.950	43.677	0.000	0.261
	group	2210.497	1	2210.497	861.67	0.000	
	Error	6299.575	247	25.504			

The results of the covariance test show that training based on the theory of protective motivation has caused changes in the theoretical constructs and intention to undergo mammography.

Table5. Comparison of Intention to Undergo Mammography in the Intervention and Control Groups after Intervention

Variable	Control Group	Intervention Group	p-value*
Intention to undergo mammography in the next month	N (%)	N (%)	
I don't think so	(15.2) 19	0	0.000
I think so	(36) 45	(12.8) 16	
I probably will go	(32) 40	(37.6) 47	
I will definitely go	(16.8) 21	(62.6) 62	

*Chi-Square Test

Discussion:

The present study investigated the effect of an educational intervention based on the 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 Mohammadi et al. reported, after the intervention, there was a significant difference in perceived susceptibility between the intervention and control groups [27, 28]. However, Levin et al. reported in 2015 that perceived susceptibility has a minor effect on the motivation to screen for breast cancer [29]. Pirzadeh et al. (2021) and Nazari et al. also reported that the perceived susceptibility after the educational intervention did not show a significant difference between the intervention and control groups [29, 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, based on the Protection Motivation Theory constructs, data on breast cancer incidence and mortality among Iranian women in recent years were employed 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 culture/language while focusing on enhancing support for women [31].

In this study, 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 the PMT led to increased perceived severity in the intervention group for breast self-examination [27]. Additionally, in the study by Ghafari et al., perceived severity related to self-examination and mammography in the intervention group increased [32]. However, in the study by Pirzadeh et al. (2021) and Nazari et al. [23], perceived severity after the educational intervention did 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 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]. Ghafari et al. [32] and Pirzadeh et al. [30] also reported 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 Chan et al. (2019) showed that women receiving messages containing high efficacy had the highest intention of breast self-examination [34].

In this study, 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, Ghafari et al. (2019) reported that theory-based education in health volunteers reduced barriers to breast self-examination and mammography in the intervention group [32]. Contrary to our findings, in the study by Pirzadeh et al. (2021), participants' perceived barriers for undergoing mammography did not decrease post-intervention [30]. This discrepancy may stem from differences in study participants regarding demographic variables 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 strategy 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.

In this study, the educational intervention significantly improved perceived reward among participants in the intervention group. Supporting this finding, in the several studies there was 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]. In this study, improved the fear construct among participants in the intervention group. Also, in the study by Ghafouri Pour et al. (2020), women who reported higher levels of fear were 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 affect women’s attitudes and behavioral intentions, but not on the early detection of breast cancer [37]. In the study by Emami et al. (2021), fear of breast cancer did not have a significant effect on women’s mammography screening [38]. Differences in the demographic characteristics of the study population may be the reason for this discrepancy.

An educational intervention based on the protective motivation theory significantly increased the intention to undergo mammography in female teachers. This finding is

consistent with the study by Li et al. [39] and Ghaffari et al. [32]. Therefore, it can be said that interventions based on the educational model promote self-care and create a foundation for improving breast cancer screening behavior in women and increase the awareness and efforts of policymakers to improve breast cancer screening behavior.

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

Study limitations: Given that self-reported information is not an objective measure for measuring individuals' beliefs, convictions, and abilities and is not available to the researcher, some individuals may have refused to provide a true answer and given an unrealistic answer. The inability to measure behavior (doing mammography) due to the limited follow-up time is another limitation of this study.

Conclusion:

The results of this study proved the pivotal role of the protective motivation theory constructs in explaining the intention to do mammography in 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 improved general health and quality of life for this target group.

Educational intervention based on this theory is proposed for screening other diseases in different communities.