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Original Article

Predicting Mammography Screening Behavior Among Women Employed at University: A Theory of Planned Behavior Approach

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Abstract

Background: The prevalence of breast cancer (BC) has notably increased in Iran, making it the most frequently diagnosed cancer among women and the primary cause of new cases. Moreover, studies have indicated a low level of awareness among Iranian women regarding BC screening. Recognizing the impact of knowledge on behavioral intention, researchers proposed incorporating a knowledge-based structure into the theory of planned behavior (TPB) model. This conceptual model was subsequently tested to assess its effectiveness and predict mammography screening behavior.

Methods: A cross-sectional survey was conducted among 320 women employed at Mashhad University of Medical Sciences in Iran. The applied instruments were the TPB scale and knowledge questionnaire. In this investigation, SPSS 22.0 and Amos 22.0 were employed for all analyses. A structural equation model (SEM) was also used to evaluate the relations between variables.

Results: Individuals' behavioral intention was significantly associated with higher levels of knowledge (β=0.29), perceived behavioral control (β=0.36), and subjective norms (β=0.32). The model demonstrated that perceived behavioral control was the strongest predictor of intention for mammography screening. Additionally, behavioral intention had a significant effect on mammography screening behavior (β=0.56). Furthermore, knowledge could directly influence behavioral intention, attitude, perceived behavioral control, and subjective norms.

Conclusion: Our findings revealed that interventions aimed at increasing women's sense of control over BC screening circumstances could have a significant impact on screening intention and behavior. By targeting these factors, healthcare providers and public health professionals can create specific interventions to enhance mammography screening rates among women.

Keywords: Breast cancer, Structural equation model, Mammography, Theory of planned behavior, Knowledge

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Introduction

Breast cancer (BC) is one of the public health challenges worldwide (1). In 2022, 2.3 million women were diagnosed with BC and 670 000 deaths occurred globally. The anticipated future impact of BC is expected to rise to more than 3 million new cases and 1 million deaths by 2040 (2). In Iran, the prevalence of BC has considerably increased, making it the most frequently diagnosed cancer among women and the primary cause of new cases (3). The latest GLOBOCAN 2020 report indicates that BC is the most prevalent cancer in Iran, accounting for 12.9% of all new cancer cases, and ranks as the fifth leading cause of cancer-related deaths, accounting for 6.1% of such fatalities. The age-standardized incidence rate is 35.8, while the age-standardized mortality rate is 10.8 per 100 000 individuals. These figures represent an increase compared to the 2014 reports, and projections suggest that the rate could exceed 70 per 100 000 by the end of 2030 (4). BC can cause a variety of complications, including metastasis (spreading to other parts of the body), hypercalcemia (high calcium levels in the blood), kidney stones, kidney failure, irregular heartbeat, and neurological problems such as confusion, dementia, or coma. It can also lead to blood clots, pain, and wasting syndrome (5). Early diagnosis is essential for successful treatment and reduced burden of the disease, but in Iran, delays in seeking evaluation are a major factor in mortality and negative outcomes. Mammography is a crucial tool for early BC detection, leading to a 20% reduction in the rate of mortality (6). Despite increased use in developed countries, mammography rates among

Iranian women remain low (7).

Leveraging behavioral change theories can improve the efficacy of health promotion initiatives by taking into account environmental elements and individual traits that impact health-related behaviors (8,9). The theory of planned behavior (TPB) focuses on social influences, including motivation to comply with influential individuals and social norms, making it a crucial factor in promoting positive behaviors such as mammography (10). Previous research indicates that cultural values and beliefs impact mammography behavior (11). Therefore, this model offers a cultural perspective on behavior, potentially leading to the greater promotion of mammography compared to the health belief model (12,13). The TPB suggests that an individual's actions are influenced by their behavioral intention, thus forecasting their real behaviors. This intention of behavior is shaped by perceived behavioral control, subjective norms, and attitude. Perceived behavioral control encompasses people's perception of his/her ability to manage their behaviors, considering past factors that have either facilitated or hindered the behaviors. Subjective norms pertain to the perceived influence or pressure from significant individuals in people's lives regarding whether to engage in specific behaviors. Attitude is shaped by people's belief in the outcomes of behaviors and their assessments of consequences (10).

However, multiple studies have indicated a low level of awareness among Iranian women regarding BC screening (9). Ahmadian et al have noted that women who undergo mammograms typically possess sufficient information from various sources (14). Recognizing the impact of knowledge on behavioral intention, researchers have recommended to incorporating a knowledge-based structure into the traditional TPB model. This conceptual model has subsequently been tested to evaluate its effectiveness. Therefore, this study aims to apply TPB to predict mammography screening behavior.

Materials and Methods

Study Population

This cross-sectional study investigated factors affecting mammography screening adherence in women employed at Mashhad University of Medical Sciences in Iran. The required sample size was determined to be 320 individuals based on preliminary studies regarding the use of health belief models and planned behavior in similar studies (15,16) and considering a 95% confidence level and a margin of error of less than 0.04.

$$n = \frac{Z_{1-\frac{\sigma}{2}}^{2}}{d^{2}} p(1-p)$$

The inclusion criteria included informed consent to participate in the study and no history of BC.

Tools

The initial questionnaire was used to collect demographic information such as marital status, age, and level of education.

In addition, the TPB scale, validated by Hatefnia et al (16), was utilized to measure the influencing factors related to mammography behavior across four subscales, namely, perceived behavioral control (3 items, score range: 3–15), subjective norms (n = 5, score range: 5–25), attitude (n = 3, score range: 3–15), and behavioral intention (n = 1, score range: 1–5). Responses were recorded on a 5-point Likert-type scale, ranging from strongly disagree (1 point) to strongly agree (5 points). The reliability coefficient range of Cronbach's alpha was from 0.80 to 0.88 for different subscales used in the TPB analysis of our data. Mammography performance was assessed through a self-report question, asking participants whether they had routinely undergone mammography screening, with responses recorded as yes or no.

The third tool, developed by Hatefnia et al, was employed to assess women's understanding and knowledge of BC and mammography through 15 items. Responses were categorized as false, or I do not know = 0, and true = 1 for analysis (score range: 0–15). The validity of this questionnaire was confirmed (15), and the reliability coefficient (Cronbach's alpha) was 0.78.

Statistical Analysis

In this investigation, SPSS 22.0 and Amos 22.0 were utilized for all statistical analyses. The average scores of the TPB subscales and the total knowledge score were calculated for analysis. In addition, a structural equation model (SEM) was used to evaluate the relationships between variables. The model fit is found acceptable when the root mean square error of approximation is < 0.10, the goodness of fit index, Tucker-Lewis index, and comparative fit index are > 0.90, and the chi-squared/degrees of freedom is < 2–5 (17). The statistical significance level was set at $P < 0.05$.

Results

In this study, the mean age ± standard deviation of the investigated women was 40.67 ± 2.98 years. In general, 281 (87.8%) of them were married, while 39 (12.2%) were single. In terms of education, 19 (5.9%), 189 (59.1%), 91 (28.4%), and 21 (6.6%) had associate, BSc, MSc, and PhD degrees, respectively.

Table 1 presents the mean ± standard deviation of

Table 1. Mean and Standard Deviation of Knowledge and Subscales of Theory of Planned Behavior

Variables	Mean	Standard Deviation	Range
knowledge	8.26	2.02	0-15
Attitude	9.99	2.15	3-15
Perceived behavioral control	13.02	4.96	3-15
Subjective norms	14.55	4.86	5-25
Behavioral intention	4.95	2.01	1-5

the variables under study. Regarding mammography screening behavior, the majority of participants had never undergone mammography (n = 232, 72.5%), and only 27% of them (n = 88) had performed mammography.

The findings revealed several significant predictors, as indicated by standardized beta (Figure 1). Individuals' behavioral intention was significantly associated with high levels of knowledge, perceived behavioral control, and subjective norms (Table 2). The model of this research showed that perceived behavioral control was the strongest predictor of intention to mammography screening. In addition, behavioral intention significantly affected mammography screening behavior. Further, knowledge could directly influence behavioral intention, subjective norms, perceived behavioral control, and attitude. Moreover, knowledge had an indirect effect on behavioral intention through the mediating variables of subjective norms and perceived behavioral control. The model of this investigation demonstrated an acceptable fit with the examined data (Table 3).

Discussion

This study applied the SEM method to predict mammography screening behavior based on TPB. The results revealed that only 27.5% of the sample had ever undergone mammography.

The model of this investigation displayed acceptable fit with the examined data. Overall, the researchers believe that the TPB constructs are important and predictive factors for screening behaviors such as BC screening (16,18). Women's intention to engage in behaviors of screening is likely to increase when they possess adequate and accurate knowledge, maintain a positive attitude of timely diagnosis of BC, and feel capable of performing health-related behaviors (18).

The results indicated significant positive relationships between knowledge and mammography intention, perceived behavioral control, attitude, and subjective norms, highlighting the importance of awareness in engaging in health-related behaviors. Having adequate awareness of the risk factors of BC serves as the foundation for primary prevention of this disease (19). Knowledge is crucial for making rational decisions about any health behavior, even though it may not be sufficient on its own (20). Abamecha et al found that knowledge has a significant impact on attitude, influencing an intention for screening. Similar findings were reported in related studies conducted in China (10). In the study performed by Akpinar et al, awareness of BC and its related screening methods was associated with the behavior of breast self-examination among women in Turkey (21). The findings of the study by Keshavarzi et al also confirmed the

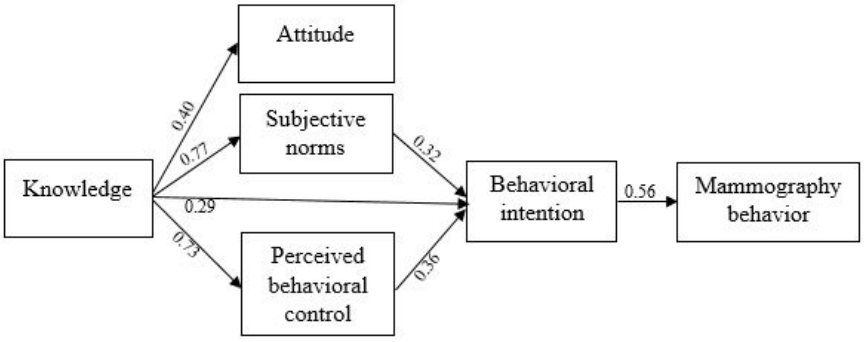

Figure 1. Final Structural Equation Model of the Study

Table 2. Path Analysis of Knowledge, Mammography Behavior, and Subscales of Theory of Planned Behavior

Path Analysis			Standardized β	SE	CR	*P* Value
Perceived behavioral control	←	Knowledge	0.73	0.09	18.98	0.0001
Subjective norms	←	Knowledge	0.77	0.07	21.57	0.0001
Behavioral intention	←	Subjective norms	0.32	0.02	6.53	0.0001
Behavioral intention	←	Perceived behavioral control	0.36	0.02	7.91	0.0001
Behavioral intention	←	Knowledge	0.29	0.04	7.64	0.0001
Behavior	←	Behavioral intention	0.56	0.01	12.15	0.0001
Attitude	←	Knowledge	0.40	0.05	7.69	0.0001

Note. CR: Critical ratio (when the CR is > 1.96 for a regression weight, that path is significant at the 0.05 level); SE: Standard error.

Table 3. Goodness of Fit Indices

	χ^2/df	RMSEA	TLI	CFI	GFI	*P* Value
Mammography behavior	3.90 (19.49/5)	0.09	0.97	0.99	0.99	0.002

Note. X^2/df: Chi squared/degree of freedom; RMSEA: Root mean square error of approximation; TLI: Tucker-Lewis index; CFI: Comparative fit index; GFI: Goodness of fit index.

significant association between knowledge and variables of attitude, intention, perceived behavioral control, and subjective norms among women (22).

Knowledge influences BC screening intention through attitude as well. Previous research has indicated that a lack of adequate awareness can prevent individuals from identifying the principal symptoms of cancer, leading to neglect and potential delays in detection (23). Understanding causal factors and prevention methods is essential in the prevention of BC, as it can influence decision-making and help individuals avoid or overcome these factors to prevent the disease (24). Understanding the potential outcomes of a behavior, finding support from relevant groups, and addressing obstacles to performing the behavior can all have a positive impact. While awareness is necessary, it is not always sufficient to protect against illness and other health issues. Apart from awareness, individuals' beliefs about preventive actions and health-related issues are crucial in either hindering or facilitating health-promoting behaviors (8).

Our findings revealed that perceived behavioral control had a positive impact on the screening intention and was the strongest predictor of this intention. The significance of perceived behavioral control, which highlights the obstacles and enabling factors for performing a behavior, becomes increasingly evident (25). In Iran, various factors have been demonstrated for low levels of the behavior of BC screening, such as a lack of interest in health, fear of radiation during mammography, fatalism, and a lack of adequate awareness. The other factors include a lack of subjective norms and unavailability of mammography equipment, lack of confidence in health instructions, pain, and transportation problems to mammography centers (14,26). Individuals are motivated to perform different behaviors when they believe they have control over them, even in difficult circumstances (27). Hatefnia et al discovered that perceived behavioral control was a significant factor in predicting mammography performance among Iranian women (16). Likewise, Steele and Porche focused on women aged 40-74 in Louisiana and concluded that perceived behavioral control was the most influential predictor of the intention of mammography (28). In the TPB model and other behavior change models, it is suggested that increased perceived behavioral control diminishes perceived barriers and enhances the positive attitudes of recommended healthy behaviors. When this aligns with facilitators of behaviors, it leads to an increase in intention and the likelihood of performing the behavior (29).

Our findings confirmed a significant positive relationship between the variable of subjective norms and intention to undergo mammography. Subjective norms represent an individual's perception of whether others believe they should or should not engage in a particular behavior. They can gauge social pressure from important references to either perform or abstain from certain behaviors. Subjective norms are influenced by normative beliefs, where significant references believe a person should or should not engage in a behavior, motivating them to meet expectations (27). Women with higher subjective norms are more likely to intend to undergo BC screening, as they are repeatedly encouraged by important people in their lives (13). For instance, it was revealed that women with high perceived barriers could be influenced by advice from other women, indicating that relatives and friends can play a positive role in encouraging susceptible women to undergo screening (30). The TPB examines the influence of social and motivational factors on following influential individuals. Several studies have highlighted the importance of subjective norms in encouraging BC screening (18). Family and friends can provide psychological support to help overcome barriers to screening, while healthcare professionals can educate women about the significance of screening (31). In one study, suggestions from loved ones led to an increase in women's intention to undergo mammography in America (32). Health center officials and physicians were identified as the most significant sources of information regarding BC and its related screening methods (33). Additionally, a strong subjective norm was positively associated with increased breast self-examination behavior, demonstrating a 4.13 times higher likelihood compared to a weak subjective norm (31). Another study reported that nearly half of the variance in students' intentions to undergo breast screening was significantly correlated with subjective norms (34). Educational interventions that create a supportive environment and share experiences can increase individuals' sense of responsibility for their health and well-being. Therefore, interventions targeting normative influences could impact screening behavior.

The research findings confirm the theory's assertion that intention is a key determinant of behavior, particularly in the context of women's intention to undergo mammography (35). This highlights the importance of intention as a precursor to behavior, with increased intention leading to greater success in performing the behavior (36). Other studies have also identified intention as a significant predictor of women's participation in mammography screening (37). However, qualitative research on Iranian women revealed that many lacked the intention to undergo breast and uterus cancer screening, suggesting a need for educational interventions to address barriers (38).

It is crucial to identify influential and predictive factors to support health educational intervention programs with structured theories and models. Healthcare providers can use these findings to develop and implement programs aimed at increasing awareness about early BC detection and promoting sustained behavioral changes on a systematic basis. This study has enhanced our understanding of predictors of mammography screening behavior among females.

Limitations of the Study

Similar to many other studies, our research had some

limitations. The investigation was cross-sectional, indicating that it solely examined the relations between variables while not establishing causation. Additionally, all the data relied on self-reports, which could introduce bias and recall-related problems. Nonetheless, this study highlights the importance of understanding the psychological factors that influence health behaviors and using this knowledge to design effective interventions. Utilizing both the TPB scale and a knowledge questionnaire allowed for a comprehensive assessment of factors influencing mammography behavior, capturing a range of influences from knowledge to social norms. The use of SEM in the analysis provides detailed insights into the relationships between the different variables, enabling an understanding of direct and indirect effects. The study emphasizes actionable insights for healthcare providers and public health professionals, pointing to specific areas for intervention (e.g., enhancing perceived control), which can lead to improved health outcomes for women. Moreover, the findings add to the existing body of knowledge regarding mammography screening motivations in specific populations, particularly in Iran, thereby contributing valuable data to regional public health discussions. By focusing specifically on women's intentions and behaviors related to BC screening, the study emphasizes an important aspect of women's health and the need for gender-specific health interventions. Further research is needed to explore the specific strategies that can effectively enhance women's sense of control, subjective norms, and knowledge related to mammography screening.

Conclusion

Overall, it was found that women's intention to use mammography screening is primarily influenced by their perceived control over the behavior, followed by subjective norms and knowledge. These findings suggest that interventions aimed at increasing women's sense of control over BC screening circumstances could have a significant impact on screening intention and behavior. Public health professionals and healthcare providers can design specific interventions to enhance the rate of mammography screening among women by targeting these factors.

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Competing Interests

The authors declare that they have no competing interests.

Ethical Approval

The study was approved by the Mashhad University of Medical Sciences ethics board (Number: IR.MUMS.FHMPM.REC.1402.147).

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