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## Effects of a Randomized Controlled Trial to Increase Repeat Mammography Screening in Iranian Women

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### Abstract

**Background**—Although mammography use has increased in developed countries, regular screening in developing countries including Iran remains low. Multiple frameworks, including the Health Belief Model (HBM) and the Theory of Planned Behavior (TPB), have been used to understand screening practices among Iranians. The HBM includes intrapersonal constructs such as perceptions of breast cancer and mammography. The TPB includes interpersonal and environmental constructs, such as perceived control and subjective norms.

**Objectives**—The current study had 2 objectives: (1) to examine changes in the HBM and TPB constructs and repeat mammography screening in women receiving either intervention and women in the control group and (2) to compare changes in the HBM and TPB constructs and repeat mammography screening across the 2 interventions.

**Methods**—One hundred eight-four women from 3 randomly selected health centers in Sanandaj, Iran, participated. Eligibility criteria were being 50 years or older, having received a mammogram in the past 2 to 3 years, and no intention to obtain a mammogram within the next year.

**Results**—The TPB and HBM participants exhibited greater changes in the HBM and TPB constructs and were more likely to have a mammogram relative to control participants. The TPB and HBM participants exhibited comparable changes in constructs and repeat mammography.

**Conclusion**—Findings suggest both interventions equally improved mammography screening. Additional studies are furthermore warranted to address nonadherent Iranian women's needs in line with these conceptual models.

**Implications for Practice**—Use of the HBM and TPB constructs in clinical practice may be helpful to promote continued screening among this population.

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## Keywords

Health belief model; Iran; Mammogram repeat; Theory of planned behavior

Early detection is thought to be a key factor in reducing mortality from breast cancer: increased use of mammography has been shown to reduce as much as 65% of breast cancer deaths.<sup>1</sup> Although mammography use has increased in developed countries, the mammography utilization rates of Iranian women remain low. Simultaneously, there are a significant number of Iranian women who have obtained a mammogram and are not adherent.<sup>2,3</sup> One study showed that, among women 40 years or older in Sanandaj, 75% of 689 women had never obtained a mammogram, and 5.7% had never received a second mammogram.<sup>2</sup> Interventions maintaining repeat mammography are warranted, given that morbidity and mortality of breast cancer are likely to depend on continued, regular screening practices.<sup>4</sup>

Several factors contribute to the alarming underutilization of mammography by Iranian women. Most research on Iranian women has used the Health Belief Model (HBM) as a guiding conceptual framework to understand decisions regarding mammography and other early detection behaviors for breast cancer.<sup>5-7</sup> The HBM assumes that individuals act to prevent or control a disease when they believe (1) there is a substantial negative impact of the disease (perceived severity); (2) they are at risk of developing a disease (perceived susceptibility); (3) there are effective behaviors for preventing or managing the disease (perceived benefits); (4) the benefits outweigh the barriers to the recommended behavior; and (5) in their ability to accomplish the behavior (self-efficacy).<sup>2,7</sup> According to the HBM, perceived severity and susceptibility of breast cancer may contribute to elevated breast cancer worry, which in turn may prevent or encourage mammography screening, depending on perceptions of screening (ie, benefits, barriers) and self-efficacy.<sup>8</sup> These constructs have been used to understand mammography and breast self-examination practices among Iranian women in descriptive<sup>3,9</sup> and intervention studies.<sup>10,11</sup> Research characterizing mammography screening among Iranian women has often focused on the low levels of breast cancer knowledge (ie, severity, susceptibility),<sup>12-14</sup> higher number of perceived intrapersonal barriers to obtain a mammogram,<sup>7,15</sup> and low levels of self-efficacy.<sup>16</sup> Findings have shown that increased perceived breast cancer knowledge does not necessarily lead to the promotion of preventive behaviors.<sup>11,17,18</sup> Furthermore, in some cases, perceived severity and susceptibility may lead to resistance or fatalism in the face of disease.<sup>19</sup>

The HBM provides important information concerning intra-personal factors associated with health behavior, including perceptions of disease as well as self-efficacy. Given this focus, the HBM provides less information concerning the contributions of other factors, including significant social, interpersonal, and contextual topics.<sup>20</sup> Addressing interpersonal, contextual, and social factors may be particularly important toward efforts to improve early detection of breast cancer among Iranian populations. Major barriers influence the ability to obtain a mammogram in Iran, including convenient location and transportation,<sup>14,21</sup> no national breast cancer screening program,<sup>22</sup> and lack of routine physician recommendations, which are often required to obtain a mam-mogram.<sup>21-23</sup> Simultaneously, interpersonal

barriers exist in Iran, including a lack of conversations with healthcare providers about early detection efforts as well as conflicting messages concerning breast cancer screening among family members.<sup>14,21</sup> These factors may underlie the limited effectiveness of HBM-oriented interventions on mammography screening in Iranian populations.<sup>11</sup> Whereas the HBM does not address these important factors, the Theory of Planned Behavior (TPB) may serve as a helpful framework to address important contextual and interpersonal factors related to mammography screening decisions through incorporation of cultural factors (subjective norms)<sup>24,25</sup> and the perception of external factors (perceived behavioral control).<sup>26</sup>

The TPB incorporates the influence of systemic factors on health behaviors as a function of an individual's perceived control in the context of these barriers. The construct of perceived control is similar to self-efficacy, in that it defines an individual's perceived ability to perform a health behavior. Self-efficacy may be defined as one's degree of confidence in one's own ability to perform the behavior in the face of various obstacles or challenges, including intrapersonal, interpersonal, and environmental barriers.<sup>27</sup> Regarding Iranian women, self-efficacy may include the ability to obtain a mammogram despite elevated levels of breast cancer worry, social norms, and environmental factors. This overall perceived ability is important to measure; simultaneously, use of specific constructs may inform which factors should be addressed to increase overall perceived self-efficacy and subsequent screening practices. The construct of perceived control focuses on women's perceptions about their actions in the specific context of environmental and systemic factors. For example, perceived control among Iranian women may pertain to women's ability to obtain information concerning resources available to obtain a mammogram, given the lack of a national program. There are community screening services that can be used as resources to obtain a mammogram in Iran<sup>13,15</sup>; women's knowledge that these services exist and how to access them are important components of perceived control. Furthermore, given the importance of physician recommendations for mammography use in Iran,<sup>7,15,21</sup> women may need to learn how to advocate for themselves within medical settings to obtain a mammogram. Measuring perceived control can thus be considered measurement of women's ability to act on specific environmental and systemic barriers to obtain a mammogram.

The TPB additionally focuses on interpersonal factors and the role of interpersonal action on health practices. The construct of subjective norms is defined as a woman's perceptions of approval and/or disapproval about behaviors such as mammography by their larger society as well as important people within their network, including family, friends, and healthcare professionals. Perceived subjective norms may be shaped by a number of sociocultural mechanisms, including conversations about behaviors such as mammography. For example, conversations with healthcare professionals,<sup>28</sup> family, and friends have been shown to be cues to action toward mammography plans and practices.<sup>7,15,21</sup> The influence of subjective norms may be particularly important for countries such as Iran, given the cultural importance placed on interdependence and interconnectedness among persons and groups.<sup>28</sup> For example, a recent qualitative study in Iran showed that the majority of women mentioned family opinions, especially husbands' encouragement or discouragement, as an important contributing factor in their decisions to obtain breast and cervix cancer screening

tests.<sup>28</sup> Interventions that increase positive subjective norms regarding mammography may thus improve screening practices among Iranian women.

Little research has focused on the needs of Iranian women who have a history of mammography but have not maintained regular, continued mammography. Furthermore, few studies comparing the influence of multiple frameworks on mammography use exist. Such research is warranted to understand which framework may be most compatible with the experiences and needs of Iranian women. The HBM is the most commonly used framework for this population, but little is known about its effectiveness in capturing comprehensively factors associated with women's decisions to obtain a mammogram relative to other frameworks, including the TPB. Comparison of multiple frameworks may elucidate which frameworks should be used to develop future observational studies and interventions among Iranian women. The aim of this article was to address these gaps in extant literature through conducting comparative research on two 6-month interventions among Iranian women. The first intervention was based on the HBM (HBM group). The second intervention included components from the HBM intervention as well as integrated 2 constructs (subjective norms, perceived behavioral norms) from the TPB (TPB group). Given the HBM and the TPB both note the importance of intrapersonal factors, both interventions included educational components regarding the perceived threat of breast cancer (severity, susceptibility), perceptions concerning screening mammography (benefits, barriers), and one's general ability to obtain a mammogram (self-efficacy). In addition, the TPB intervention incorporated exposure to positive subjective norms concerning mammography use through facilitating peer support among participants as well as trained women as to ways in which they can address systemic barriers to mammography use (eg, ways to obtain a physician recommendation). Such additional information might result in increased screening in this group relative to the control group (CON group) and the HBM group. The usefulness of this additional information was thus assessed through comparison of women in the 2 intervention groups with regard to the TPB constructs as well as repeat mammography screening.

Our study had several hypotheses. First, we hypothesized there would be a greater difference in both interventions, relative to the CON group, concerning the HBM constructs, including perceived susceptibility, severity, benefits, barriers, and self-efficacy. We further hypothesized there would be increased screening in the intervention groups relative to the CON group. Second, we hypothesized the TPB intervention would be more effective regarding changes in the TPB constructs (perceived control, subjective norms) and repeat mammography screening rates.

## Methods

### Procedures

**RECRUITMENT**—The study site was Sanandaj, Iran. Using a table of random numbers, 3 of 19 healthcare centers were randomly selected as recruitment sites. A list of women older than 50 years from each clinic was selected and then contacted by phone or through a home visit, if their phone number was not available. Approximately 244 women were screened for the following eligibility criteria: no history of breast cancer, a history of a mammogram

within the past 2 to 3 years, no intention to obtain a mammogram within the next year, and an ability to read and write. Fifty-five women did not participate in the study; 18 women refused to participate, and the remaining women were ineligible because they had never obtained a mammogram (n = 22) or were planning to obtain a mammogram (n = 15). Prior to participation, investigators sent a written information sheet and consent form for the women to sign. After consenting to participate in the study, 190 individuals were randomly assigned to 1 of 3 conditions: a tailored intervention based on the HBM that included constructs from the TPB (n = 60), an intervention based on the HBM (n = 63), and a control (CON) group (n = 61). Follow-up data were received from 184 participants as 6 participants were lost to follow-up. All survey questionnaires described below were administered to the 3 groups prior to and 6 months following the intervention. During the study, 6 women decided to cease their participation in the project. The Ethical Committee of Kurdistan University of Medical Sciences approved the study.

**INTERVENTION**—The timeline and components of the interventions and educational methods used are outlined in Table 1. The interventions occurred within the selected healthcare centers and were conducted by research staff, who received 5 hours of training prior to the start of the interventions. Two professors trained in health education and promotion provided training to research staff. One professor, who was an expert in the HBM, provided training to staff implementing the HBM intervention. The other professor, who was an expert in the HBM as well as the TPB, provided training to staff implementing the TPB intervention.

**CONTROL GROUP**—Women in the CON group interacted twice with research staff to complete surveys at 3 months prior to and 6 months following the intervention. Furthermore, the CON group received pamphlets after they completed the follow-up questionnaire. Pamphlets included the following information: risk factors for breast cancer, benefits of early detection breast cancer by mammography, the recommended guidelines for mammography screening according to the American Cancer Society, the importance of regular doctor visits, and some strategies to overcome common barriers (eg, lack of government resources).

**THE HBM CONSTRUCT SESSIONS**—There were 8 sessions for the HBM and TPB interventions that focused on perceived threat (ie, perceived susceptibility/seriousness of breast cancer), benefits, and barriers of mammography and self-efficacy (Table 1). Session formats included multimodal lectures with educational resources (films, slides pamphlets). Individual components of sessions were tailored to women's specific needs, which were identified through the baseline surveys. Each participant received eight 45- to 60-minute group sessions at weeks 1 to 6, 8 to 9, and 10 to 13. During these sessions, participants were divided into groups based on their reported common woman's requirements obtained, and intervention education sessions took place in groups of 5 to 12 women. Group sessions allowed for active learning through small group discussions and exposure modeling (eg, role modeling with breast cancer survivors).

**THE TPB CONSTRUCT SESSIONS**—The TPB group additionally received 4 sessions focused on subjective norms and perceived behavioral control. During sessions regarding subjective norms, small groups of women were formed to promote peer support and increase exposure to positive interpersonal norms concerning mammography use. They also received education about the importance of developing social networks that helped to share commitment and plans related to mammography. In individual counseling sessions, participants were asked identify and provide contact information for 5 important relatives they thought might help remind them about scheduling a mammogram. Research staff contacted relatives and invited them to participate in a 60-minute public session that included different ways to talk to family members about mammography use, including short phone messages as well as reminders about the need to obtain a mammogram when giving birthday, wedding anniversary, and mother/woman’s day gifts. Regarding perceived control, women were trained as to several ways to resolve environmental challenges, including medical advocacy to obtain a physician recommendation for a mammogram. Finally, during the 18th week of the intervention, the TPB participants received signed reminder messages by a gynecologist physician from research staff regarding scheduling mammography appointments and had telephone conversations regarding subjective norms.

### Measures

All measures were translated into Farsi using a standard forward-backward translation technique. After translation, a panel of Iranian experts, which included 3 gynecologists, 2 health education professors, a psychologist, and 2 public nursing professors, reviewed the instrument to determine the cultural appropriateness and validity of the translated tool. All items of original questionnaires were included in the baseline questionnaire. Nine items were modified, based on expert feedback. The 2 items “I am able to find a breast lump which is the size of a quarter” and “I am able to find a breast lump which is the size of a dime” were changed to “filbert,” because there are no Iranian coins similar to quarters and dimes. Most of the experts suggested the use of “filbert” and “rather greater than filbert” instead of dime and quarter, respectively. Given that the Islamic religion limits relationships between women and men to marriage and existing Iranian norms concerning romantic relationships, the terms “partner” and “boyfriend” were deleted from several items concerning relationship status. The final questionnaire used included 37 items, including 3 items pertaining to perceived susceptibility, 7 items for perceived severity, 6 items for perceived benefits of mammography, 9 items for perceived barriers, 10 items for perceived self-efficacy, 1 item for subjective norms, and 1 item for perceived control.

Sociodemographic and clinical questions. The sociodemographic items included in the survey were age, education (0 = <high school, 1 = high school degree, 2 = college/university degree), employment (0 = unemployed, 1 = employed), perceived income (1 = poor/very poor, 2 = middle income, 3 = high income), marital status (0 = single, 1 = married), health insurance (0 = uninsured, 1 = insured), presence of breast problems (0 = no, 1 = yes), and family history of breast cancer (0 = no, 1 = yes).

**THE HBM CONSTRUCTS**—The questionnaire used in the current study was based on Champion’s<sup>29</sup> revised Health Belief Model Scale. We provide sample items as well as the



Cronbach's  $\alpha$  for this study's participants. Perceived susceptibility was assessed with a 3-item scale (eg, "It is likely that I will get breast cancer"; Cronbach's  $\alpha = .84$ ). Participants answered a 7-item scale concerning perceived severity (eg, "The thought of breast cancer scares me"; Cronbach's  $\alpha = .82$ ). A sample item and Cronbach's  $\alpha$  for this sample for the 6-item perceived benefits of mammography scale are "Having a mammogram will help me find breast lumps early" and .72. Regarding the 9-item barrier instrument, a sample item was "Having a mammogram takes too much time" and Cronbach's  $\alpha$  was .73. The HBM constructs were rated on a 4-point scale from 1 (strongly disagree) to 4 (strongly agree) and scored by calculating the means of all item scores.<sup>30</sup> Perceived self-efficacy was adapted from an existing mammography self-efficacy scale.<sup>31</sup> This scale included 10 items (eg, "I can arrange transportation to get a mammogram"). Respondents could choose an answer from a 4-point Likert scale ranging from 1 (not at all confident) to 4 (very confident). Cronbach's  $\alpha$  was .90.

**THE TPB CONSTRUCTS**—We provide sample items as well as the test-reliability coefficient for this study's participants. Subjective norms were defined through 1 item ("Most people who are significant to you expect you must get a mammogram when you are due"). Respondents answered using a 4-point scale ranging from 1 (never) through 4 (often). The test-retest reliability coefficient over a 2-week period was 0.84. Perceived behavioral control was assessed using the item "How much control do you have over whether you get a mammogram when you are due?" rated on a 4-point scale ranging from 1 (never) through 4 (often). The test-retest reliability coefficient over a 2-week period was 0.87.

**REPEAT MAMMOGRAPHY**—We ascertained whether women obtained a mammogram 6 months after the intervention through self-report as well as medical records. Women who received a mammogram were designated as adherent. Women who did not receive a mammogram were designated as nonadherent.

### Analysis Plan

To identify potential covariates, we assessed group differences in baseline demographics, breast problems, health insurance, and family history of breast cancer using  $\chi^2$  analyses and analyses of variance. We next completed a repeated-measures multivariate analysis of variance to assess changes in the HBM and TPB constructs, including covariates identified through previous analyses. If significant, we reported univariate and post hoc analyses to assess group differences across time. Finally, a mixed-effects logistic regression analysis was conducted to compare mammography repeat of the 2 intervention arms with control arm as the reference group. The mixed-effects logistic regression analysis was run with random intercepts to account for differences in protocol and access to mammography among the 3 participating health-care centers. To assess differences between the intervention groups, a second mixed-effects logistic regression analysis was conducted; similar random intercepts were used, but the CON group was excluded, and the HBM group was used as the referent group.

## Results

Table 2 provides demographic information across groups. At baseline, the average age of participants was 55.93 (SD, 7.80) years. Approximately 47% had less than a high school education, and 52% were not currently employed; nonetheless, more than two-thirds of the sample reported a good/very good income status. The majority of women were married. Most had health insurance (85%); only 7% reported any breast problems in the past 5 years, and only 11% had family history of breast cancer. The majority of sociodemographic and clinical variables did not vary across groups (data not shown); nevertheless, there were significant differences in marital status,  $\chi^2_2 = 17.69, P < .001$ . Consequently, all subsequent analyses included marital status as a covariate.

### The HBM and TPB Constructs

Table 3 depicts reliability estimates and descriptive statistics before and after intervention for the multiple groups. Our multivariate analysis revealed significant group differences in longitudinal changes in the HBM and TPB scores, after adjusting for marital status, Wilks  $\lambda = 0.66, F_{14,348} = 5.82, P < .001$ . Subsequent univariate analysis revealed significant group differences in all HBM and TPB variables across time. Regarding the HBM constructs, intervention groups tended to have increased perceived susceptibility and severity regarding breast cancer as well as increased perceived benefits and self-efficacy related to mammography. Conversely, intervention groups perceived lower levels of barriers to mammography use. With regard to the TPB constructs, intervention groups appeared to have higher levels of positive subjective norms and greater perceived control regarding mammography. Planned contrasts revealed that all differences between the CON and HBM groups were significant ( $P < .05$ ), whereas there were no significant differences between perceived benefits ( $P = .71$ ), susceptibility ( $P = .33$ ), and seriousness ( $P = .13$ ) between the CON and TPB participants. No significant differences emerged in the TPB constructs among the HBM and TPB groups ( $P$ 's = .29–.35).

### Changes in Mammography Use

Table 3 depicts the percentage of women who obtained a mammogram 6 months after the intervention across the different study arms. After adjusting for healthcare centers and marital status, we found significant increased mammography screening rates among the HBM (adjusted odds ratio [aOR], 5.11; 95% confidence interval [CI], 2.26–11.52;  $P < .001$ ) and the TPB groups relative to the CON group (aOR, 6.58; 95% CI, 2.80–15.47;  $P < .001$ ). The TPB and HBM participants were more than 6- and 5-fold likely to report they had obtained a mammogram relative to the CON participants. A second model assessing only the 2 interventions with the HBM as the referent group revealed comparable rates of screening mammography (aOR, 1.24; 95% CI, 0.58–2.6;  $P = .58$ ).

## Discussion

The current intervention study compared the effectiveness of interventions tailored in terms of different conceptual frameworks (HBM, TPB) on repeat mammography in Iranian women. Our work provides significant contributions with regard to repeat mammography, as



most research concerning Iranian populations has largely focused on women with and without a mammography history.<sup>3,7,10</sup> Furthermore, our study serves to compare 2 frameworks that have been used to understand the role of psychosocial and interpersonal variables (HBM, TPB<sup>3,32</sup>) on Iranian women's mammography decisions. Our study had 2 objectives: (1) to assess changes in the HBM and TPB constructs as well as mammography screening across 3 groups of women (CON, HBM, TPB) and (2) to assess differences between interventions with regard to the TPB constructs and mammography screening. We hypothesized that women undergoing both interventions would have increased changes regarding the HBM constructs as well as would be more likely to have obtained a mammogram relative to women in the CON group. Second, we hypothesized those women receiving the TPB intervention would have a greater change in the TPB constructs as well as would be more likely to have obtained a mammogram relative to women in the HBM intervention and CON groups.

Our findings partially supported our hypotheses. Relative to women in the CON group, women who underwent either intervention reported greater perceived susceptibility and severity of breast cancer, more perceived benefits related to mammography screening, and greater levels of self-efficacy to obtain a mammogram. Simultaneously, women from intervention groups perceived fewer barriers to mammography use relative to women in the CON group. Women in intervention groups also perceived greater positive subjective norms and more perceived control regarding mammography screening. Such changes in the HBM and TPB groups may have contributed to the higher rates of screening found within these groups at 6 months following completion of the study relative to women in the CON group (23%–25%).

Importantly, subsequent analyses revealed that the HBM intervention, and not the TPB intervention, was particularly impactful with regard to the HBM and TPB constructs. This is unexpected, given the HBM and TPB groups were given identical material with regard to the HBM constructs. Furthermore, our preliminary findings suggest no added benefit of the TPB sessions women in the TPB group received in terms of the TPB constructs or screening.

One potential explanation concerning our findings is that there may be relationships among the HBM and TPB constructs as well as potential interactive effects on screening practices. Although we included all outcome variables in a multivariate model, we did not assess the potential influence of some outcomes on each other. Such associations may have influenced the impact of our interventions. For example, we did not assess the interactions between self-efficacy, perceived threat, and perceived control, which have been shown to influence screening practices.<sup>33</sup> The HBM and TPB constructs may further influence each other; for example, few perceived benefits of regular mammography have been shown to influence women's perceived ability obtain a mammogram.<sup>34</sup> These interactions are important to consider in the future research, given that women in the HBM group reported relatively higher levels of self-efficacy and benefits to mammography than women in the TPB group. These elevated levels may have impacted subsequent perceptions concerning perceived control, for example. Further work is necessary to understand the reciprocal effects of these factors and their interactions on subsequent screening practices. Another explanation may

concern the relationships between perceived control, social norms, and barriers to get mammography. The lower barriers and the higher social norms to being on scheduled breast cancer screening may result in the greater perceived control.<sup>35</sup> Women in both experimental arms did not report more overall barriers compared with together. Further research is needed to examine specific barriers (eg, forgetting, embarrassing, being painful, and taking much) in order to provide clearer information, which were tested in other studies.<sup>36–38</sup> Moreover, for having definite interpretation, it is suggested to discover relationships between control, social norms, and barriers concepts to mammography repeat. Another potential explanation for our findings concerns effect modification by other variables, including sociodemographic factors. Although groups appear to be relatively similar in this regard, our sample size does not allow us to conduct further moderation analysis to see if differences across these characteristics may have interacted with receipt of intervention materials in relation to the HBM/TPB constructs and mammography screening.

## Limitations

There were several limitations of the current study. First, the sample size did not allow further analysis across different sociodemographic subgroups (eg, insurance status, age). Another limitation is the lack of detailed data regarding mammography history (eg, exact dates, number of mammograms across previous 5 years) to assess previous behavior effect on current practice and future plans. Future studies should provide more detailed information concerning mammography history at baseline. Second, this study did not provide longitudinal measures of the HBM or TPB constructs, which may be important to understand and correlate with repeat mammography across longer periods (eg, adherence across 10 years). Longitudinal studies of greater duration are warranted to assess the impact of interventions such as these on long-term screening plans and decisions. Third, women who decided to participate in this intervention may have been more motivated to obtain a mammogram than other nonadherent women in general and women who were contacted but decided not to participate. Finally, while previous interventions have found statistically significant improvements in repeat mammography behavior following shorter interventions,<sup>37,39</sup> neither these studies nor the current work have controlled for systemic factors impacting mammography utilization. For Iranian women, this includes the lack of national program to screening breast cancer, routine interactions with and recommendations to obtain a mammogram from physicians, access to mammogram services (eg, transportation, time restraints), and insurance coverage. Additional work addressing these factors is essential to improve mammography practices and subsequent early-stage detection of breast cancer in Iran. Finally, instruments used to assess the TPB constructs are single items and may not capture the full complexity and distinctiveness of these concepts. Indeed, our work adds to existing literature concerning the need for further psychometric work to address the advantages and limitations of specific instruments for perceived control and positive subjective norms. The majority of literature, including the current study, has administered only a direct measure of perceived control.<sup>27</sup> Indirect measures may, however, demonstrate different associations and need to be studied.<sup>40</sup> Furthermore, it is worthwhile to note that there is an overlap between perceived control and self-efficacy constructs; future psychometric work will serve to provide measures of perceived control that capture the

distinct components of this concept. Regarding measures of subjective norms, the majority of literature, including this study, has often focused on normative beliefs and not on the motivation to comply with subjective norms.<sup>35,41</sup> Subjective norms are composed of 2 components: normative beliefs and motivation to comply. These 2 components can be measured in direct and indirect forms, only some studies have operationalized subjective norms in 2 components<sup>20,42</sup>; our study and other researchers have mostly used the direct measure of subjective norms.<sup>35,41</sup> Additional work is needed to explore the advantage or limitations using these different measures. Finally, while the TPB suggests the importance of social environmental and interpersonal factors, most existing instruments are not developed in the context of Iranian culture. The development of psychometric instruments directly pertaining to the experiences, values, and needs of Iranians (eg, limited government resources, family needs over one's own needs) is necessary to capture more accurately the influence of environmental and interpersonal factors on screening.

## Conclusion

The findings of this study moderately support hypotheses concerning the effectiveness of the HBM and TPB interventions for changing perceptions of breast cancer and mammography as well as increasing screening rates among Iranian women. Interventions resulted in increased understanding of the threat of breast cancer as a disease, perceived benefits of mammography use, and self-efficacy to obtain a mammogram. Simultaneously, interventions helped to decrease perceived barriers to mammography screening. Importantly, interventions had increased screening rates 6 months after completion of the project by 23% to 25% relative to CON group. Our study provides preliminary evidence that incorporation of subjective norms and perceived control within interventions may provide little benefit toward changing mammography perceptions and practices. These findings may have been influenced by interactions among closely related constructs, which were not tested in this current study. Future research assessing the relationship of the HBM and TPB variables is warranted to refine interventions and maximize success of mammography use. Our finding has several important implications for healthcare providers as well, including the need to explore intrapersonal and social factors influencing patients' screening decisions. These results offer several avenues for future breast cancer research and practice concerning Iranian populations and other groups who share similar cultural norms and values (eg, family, collectivism) as well as systemic constraints to health promotion.

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**Table 1**

Components of Interventions by Time, Targeted Constructs, and Methods

Time and Groups Receiving Session	Theory	Targeted Theoretical Constructs	Methods
Weeks 1–6: HBM, TPB	HBM	Perceived threat of breast cancer (BC)	<p><b>Group components</b></p> <p>Lecture about the development of BC, individual’s perception of the threat of BC focused on danger control</p> <p><b>Group components</b></p> <p>Lecture about benefits of mammography and importance of early detection of BC for outcomes</p> <p>Role modeling for early detection by mammogram</p>
Weeks 8–9: HBM, TPB	HBM	Perceived barriers of mammography	<p><b>Group components</b></p> <p>Lecture about personal and environmental barriers to obtain a mammogram</p> <p><b>Individual components</b></p> <p>Individual-tailored counseling about strategies to overcome barriers (eg, not knowing how to get a mammogram)</p>
Weeks 10–13: HBM, TPB	HBM	Self-efficacy	<p><b>Group components</b></p> <p>Lectures about their ability to schedule physician visits and logistics for mammography appointments (eg, transportation)</p> <p>Used physiological state strategies, eg, talk to providers about their mammogram concerns, getting a mammogram while being worried, and assist to identify risk factors for relapse to provide feedback that could be made to increase self-efficacy</p>
Weeks 14–17: TPB	TPB	Perceived control, subjective norms	<p><b>Group components</b></p> <p>Making small groups of women to provide and receive peer support, education related to importance of expanding social network to share plan of mammography; how to receive help from significant people to get reminded of mammography</p> <p>In groups, the participants’ family members were educated in the importance of expected family norms to having a mammogram.</p> <p>Arranging an exhibition to present types of remaindering massages</p> <p>Emphasizing on internal control health by modifying participants’ beliefs to accept responsibility for their health, ask for a mammogram from physicians when they did not, posting motivating messages received from their doctor/ family to being on schedule, training on control over the factors that can disrupt a plan of action, avoidance of controlling stimuli and other cases that support not having control for being on schedule</p> <p><b>Individually</b></p> <p>Consult to identify individual, experiences, and environmental factors that have influences on regular mammogram, how to perceive the challenges that could be solved, eg, physician appointment, not being alone when getting mammogram for adjusting more to that situation</p>
Week 18: HBM, TPB			<p>Reminder card sent to emphasize the importance of obtaining a mammogram</p>

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Time and Groups Receiving Session	Theory	Targeted Theoretical Constructs	Methods
Week 20: HBM, TPB			Individual phone calls to discuss if family members have encouraged them to get a mammogram (subjective norms) and to provide positive feedback about their ability to obtain a mammogram

Abbreviations: HBM, intervention based on the Health Belief Model; TPB, intervention based on the Health Belief and the Theory of Planned Belief models.

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**Table 2**

Sociodemographic and Clinical Variables by Study Arm

Age, y	TPB (n = 60)		HBM (n = 63)		CON (n = 61)		Total (n = 184)		p <sup>a</sup>
	n (%)	Mean (SD)	n (%)	Mean (SD)	n (%)	Mean (SD)	n (%)	Mean (SD)	
<High school	33 (55.0)	56.38 (8.32)	25 (39.7)	55.68 (7.45)	29 (47.5)	55.73 (7.73)	87 (47.3)	55.93 (7.80)	.86
Good/very good income	23 (55.0)		41 (65.1)		40 (65.6)		114 (62.0)		.62
Employed	26 (43.3)		34 (54.0)		28 (45.9)		88 (47.8)		.46
Married	51 (85.0)		43 (68.3)		31 (50.8)		124 (67.4)		.03
Insured	48 (80.0)		53 (84.1)		55 (90.2)		156 (84.8)		.29
% Any breast problem	7 (11.5)		4 (6.7)		12 (19.0)		23 (12.5)		.11
Family history of breast cancer	1 (1.7)		6 (9.5)		4 (6.6)		11 (6.0)		.13

Abbreviations: CON, control group; HBM, intervention based on the Health Belief model; n (%), number and percent of women who reported obtaining a mammogram within 6 months following the intervention; TPB, intervention based on the Health Belief and Theory of Planned Belief models.

<sup>a</sup> P values based on  $\chi^2$  test and analysis of variance.

Outcomes of Interest, Adjusted for Marital Status

Table 3

	TPB (n = 60)		HBM (n = 63)		CON (n = 61)		P
	Pre Mean (SD)	Post Mean (SD)	Pre Mean (SD)	Post Mean (SD)	Pre Mean (SD)	Post Mean (SD)	
<b>HBM constructs</b>							
Perceived susceptibility ( $\alpha = .84$ )	3.28 (0.84)	3.66 (1.40)	3.44 (1.01)	4.25 (0.58)	3.04 (0.97)	3.16 (0.10)	.01
Perceived severity ( $\alpha = .82$ )	2.86 (0.77)	3.36 (1.31)	3.07 (0.96)	3.90 (0.74)	2.66 (0.10)	2.78 (0.77)	.009
Perceived benefits ( $\alpha = .72$ )	2.80 (0.08)	3.26 (0.08)	2.56 (0.08)	3.59 (0.08)	2.74 (0.08)	3.26 (0.08)	.001
Perceived barriers ( $\alpha = .73$ )	2.74 (0.07)	1.82 (0.07)	2.95 (0.07)	1.79 (0.07)	2.85 (0.07)	2.22 (0.07)	.001
Self-efficacy ( $\alpha = .90$ )	1.47 (0.06)	2.40 (0.09)	1.45 (0.06)	2.65 (0.09)	1.47 (0.06)	1.85 (0.09)	.001
<b>TPB constructs</b>							
Subjective norms (test-retest: 0.84)	2.83 (0.10)	3.66 (0.08)	2.76 (0.11)	3.39 (0.08)	2.93 (0.11)	3.05 (0.08)	.0001
Perceived behavioral control (test-retest: 0.87)	1.61 (0.05)	2.34 (0.06)	1.60 (0.06)	2.21 (0.06)	1.63 (0.05)	1.83 (0.06)	.0001
Obtained mammogram	n (%)	39 (65) <sup>d</sup>	n (%)	37 (59) <sup>d</sup>	n (%)	14 (23) [Reference]	

Abbreviations: TPB, intervention based on the Health Belief and Theory of Planned Belief models; HBM, intervention based on Health Belief model; CON, control; n (%), number of women who reported obtaining a mammogram within 6 months following the intervention.

<sup>a</sup>  $P < .001$ .