Development and Validation of the Psychometric Properties of the Perceived Barriers of Mammography Scale

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Abstract

Background To improve women's participation in early detection of breast cancer we need to understand women's perceived barriers to Mammography. Due to lack of women participation in referrals to mammography centers, this study aims to develop and test the psychometric properties of the Perceived Barriers of Mammography Scale (PBMS-23) for Iranian women.

Methods A mixed method design was performed to develop the PBMS-23 during 2016–2017. The item pool was mainly generated through qualitative data and literature review. Next, the developed questionnaire was answered by 500 women ages 40 to 69 years. The internal consistency, test-retest reliability, content and face validity and construct validity (both exploratory and confirmatory) were assessed.

Results Twenty eight items were initially extracted and next, based on content validity assessment, twenty three items (PBMS-23) were remained. The exploratory factor analysis revealed eight factors of believe in fate and destiny, breast conflict, defense avoidance, inconveniences/difficulties of mammography screening, contrasting/competing priorities, fear, distrust of mammography, and lack of knowledge in the PBMS-23 that accounted for 59.20 of the total variance. The confirmatory factor analysis also showed a model with appropriate fitness for the data. The Cronbach's alpha coefficient and the intra-class correlation coefficient were 0.68, 0.90 respectively.

Conclusion The findings showed that the developed PBMS-23 instrument was a valid and reliable instrument for assessing perceived barriers of mammography screening that can be used both in practice and in future studies especially in the Middle East.

Introduction

Early detection of breast cancer is recommended by the World Health Organization and the Center for Disease Control and Prevention (1, 2) which are known as a fact and scientific based cornerstone of providing real information, which could help individuals to make informed decision about their health and thus better rate of survival (3). While there are numerous evidences that indicated many of women do not adhere to mammography and early detection of breast cancer, which lead to investigate breast cancer when it has metastases to the other tissues(4, 5). In other words, the consequences of delayed in early detection of breast cancer leads to detecting cancer in the advanced stages resulting in higher cost of care, preventable deaths, and disability from cancer (6).

Compliance with mammography is influenced by multiple cognitive, behavioral, and environmental factors(7). In fact, inadequate knowledge on breast cancer and benefits of mammogram, and environmental factors such as unavailability of screening units and the higher costs of screening, might affect women's perception, which consequently might be the cause of low participation rate among women for mammography referrals to the mammography centers. Additionally, low rate of participation among women to go for a mammography test because of cultural beliefs is a great concern(8).

Research targeting early detection of breast cancer, had mainly utilized theories that do not emphasize the disparities, which are rooted in the social and cultural contexts of communities(9). In fact, developing cultural- specific scales might be a precise measurement tool especially for cognitive factors. In this regard, the majority of studies that have examined the perceived barriers of mammography adoption among Iranian women, has used the Champion's Health Belief Model (HBM) Scale that is designed in the United States, where cultural and traditional views are quite different from a traditional community such as Iran and the view of Iranian women on the issue. Although the validation of the scale is previously translated into Persian(10) and have been administered, there are still some particular context-based considerations like the cultural and religious beliefs that should be taken into account. Additionally, the HBM accounts for a wide range of important psychosocial predictors of behavior, however, critics of the application of this model claim that there is a lack of consistent predictive power mainly because of its' focus on a limited number of factors.

In mammography adherence research, the applied tools for measuring perceived barriers of mammography has failure in addressing the contextual factors like availability, affordability and convenience of the service, women's insurance status as well as the emphasis of the model on individual responsibility for behavior(11).Thus, the main aim of the current study was to develop and to examine the psychometric properties of the developed scale for measuring perceived barriers of mammography among Persian speaking women as first or second language.

Materials And Methods

This cross-sectional study was the second part of a large -scale study. The first part of this study was a mixed method study with exploratory sequential design in 2016. The results of qualitative part of this study was the main source of extracting item pool(12).The aim of the study was to develop and test the psychometric properties of the mammography screening barriers scale for Persian speaking women. The target population was Persian speaking women sampled from two cities of Tabriz and Hamadan, in Iran in autumn of 2017. Participants were 500 women ages 40 to 69 years and inclusion criteria were being at least 40 years of age and older, with no physical or mental disability and with no history of breast cancer.

Scale Development Procedure

Item generation

The initial item pool for the PBMS-23 extracted from the qualitative part (12),then comprehensive review of existing instruments, literature review, and content review by experts were conducted. The initial PBMS-23 for Iranian women was a 28-item instrument designed to investigate perceived barriers of

mammography among Persian speaking women.

Content And Face Validity

Based on the results of CVR, the estimated CVR for ten items were lower than 0.62 which CVR of two of them were 0.60. Next, according to opinion of the research team, two items with CVR = 0.60 were kept in the final scale. For the other eight items, according to opinion of the research team, five items were omitted and three other items was retained in the scale. It is noteworthy that almost nearly all items were revised based on the quantitative results and qualitative recommendations of the experts and finally, five items were dropped from further analysis. In the assessment of face validity using the impact score method, no score was lower than 1.5 per item and consequently all items were included in the scale (Table 2).

Table 1
Demographic and underlying characteristics of the women (N = 500).

Variables	n (%)
Age	
< = 50	235 (47.1)
51–60	187(37.5)
61+	77(15.4)
Literacy level	
Illiterate	29 (28.2)
Elementary and secondary school	198 (43.2)
Diploma	87 (19)
University	44 (9.6)
Marital Statues	
Married	415 (83.3)
Single/divorced/widowed	83 (16.7)
Employment	
Does not work outside the home	430 (86.7)
Employed outside home	66 (13.3)
Family Monthly Income	
Good	26 (5.3)
Moderate	242 (49.3)
Weak	223 (45.4)
Health Insurance	
Insured	67 (13.5)
Uninsured	.431(86.5)
Family history of breast cancer	
Yes	455 (93.4)
No	32 (6.6)
having problems related to breast	
Yes	116 (23.5)
No	378 (76.5)

Table 2
The scores of CVI, CVR and IS for items

Item	Item content	CVI	CVR	IS	Result
	I will not do mammogram because…….				
1	I am afraid to be diagnosed with cancerous tumor in my breasts by mammography.	0.97	0.88	4	corelate with qulitative recommendations of expert panel and confirmion of reaserch team
2	Procedure of doing of mammogram is painful.	0.90	0.81	4.2	Accept without change
3	To be exposed by mammography's radiation will hurt my body.	1	1	4.1	Accept without change
4	I do not want to think about breast cancer	0.93	0.80	3.7	corelate with qulitative recommendations of expert panel and confirm the reaserch team
5	Breast cancer happen only in older ages, I'm still young enough to do regular mammography.	0.90	0.80	4	Accept without change
6	For being more relaxed, I prefer to be unaware about my probable breast cancer.	1	1	4	corelate with qulitative recommendations of expert panel and confirm the reaserch team
7	I am healthy and don't have disease or problem in my breasts	0.90	1	4.3	corelate with qulitative recommendations of expert panel and confirm the reaserch team
8	I think breast self-examination is enough to diagnose breast cancer.	0.97	0.81	3.9	Accept without change
9	Mammography is not necessary unless my physician recommend it.	0.97	0.6	4	corelate with qulitative recommendations of expert panel and confirm the reaserch team
10	I don't know what to do for getting a mammogram.	0.93	0.81	4.1	Accept without change
11	I believe in divine destiny and mammography does not change my destiny.	0.97	0.60	4.2	corelate with qulitative recommendations of expert panel and confirm the reaserch team
12	Mammography will not save my life.	0.80	0.40	4	corelate with qulitative recommendations of expert panel and confirm the reaserch team
13	My spouse/family doesn't assist me to do mammography.	0.80	0.4	4.10	Accept without change
14	I'm ashamed to do mammography.	0.90	1	4.10	corelate with qulitative recommendations of expert panel and confirm the reaserch team
15	Accessing the mammography imaging centers is difficult for me.	0.97	1	4.20	Accept without change
16	The mammography centers are crowded and I should be wait in the long queues.	0.97	1	4.20	Accept without change
17	Mammography imaging staffs do not behave respectfully with clients.	0.97	1	3.60	Accept without change
18	In case of being diagnosed by breast cancer, my family will be involved with my problems.	0.97	0.80	3.70	Accept without change
19	Cost of mammogram is high.	0.93	1	4.40	Accept without change
20	In case of mastectomy because of breast cancer I will lose my women's charms.	0.70	0.40	3.90	corelate with qulitative recommendations of expert panel and confirm the reaserch team
21	In case of being diagnosed by breast cancer, others will look at me as a flawed woman.	0.90	0.80	4	Accept without change
22	Mammography is not a reliable method to early diagnose of breast cancer.	0.90	1	4.20	corelate with qulitative recommendations of expert panel and confirm the reaserch team
23	Breast cancer cannot be cured even if it is diagnosed earlier.	1	0.80	4	corelate with qulitative recommendations of expert panel and confirm the reaserch team

Construct Validity

To investigate the construct validity, Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) was used. The items were extracted into eight dimensions of breast conflict (2 items), believe destiny (2 items), defensive avoidance (3 items), fear (3 items), lack of knowledge (4 items), contrasting/competing priorities (2 items), distrust of mammography screening (2 items), and inconveniences/difficulties of mammography screening (5 items).

The EFA was carried out by the principal component method with direct oblimin rotation, and the Kaiser–Mayer–Olkin (KMO) and Bartlett's test was used to assess the sampling adequacy of the EFA. The sample size was calculated based on the requirement to conduct an EFA. There is no agreed-upon consensus as to the appropriate ratio between the number of items in a scale and the number of respondents. Tabachnick and Fidell recommend about

300 participants for a factor analysis (14), and Burns and Grove recommend five to ten participants per item (15). We intended to recruit the maximum number of participants per item; with 23 items (after assessing content and face validity) in the Mammography Screening Barriers Scale for Persian speaking women, this meant recruiting 230 women. To obtain an adequate final sample size, 500 women were invited to participate in the study.

A correlation of 0.30 or higher between each item and its scale was considered as evidence of convergent validity. A higher correlation of each item with its scale than with the other scales was considered a successful demonstration of convergent validity. Stewart and Ware recommend that items scoring less than 0.30 should be removed from the analysis (15). Before application of EFA, KMO test was done to test the compatibility of the sample size for factoring. The KMO value was found greater than 0.60 and the Bartlett test of sphericity test was significant ($p < 0.001$) (15). For defining the construct validity, the EFA and CFA was done on 23 items as PBMS-23. It is recommend that oblique rotation should be used if the oblique factor correlation matrix displays correlations of 0.31 or higher. The oblique factor correlation matrix was inspected. Values of all factor loading in each of the subscale were higher than 0.30. The correlations of each item with its subscale exceeded the 0.30, criterion for convergent validity in all items that were accepted.

The CFA model fitness was determined using the Chi-squared/df < 5, the Root Mean Square Error of Examination (RMSEA) < 0.08, the Comparative Fit Index (CFI) > 0.9, the Goodness-of-Fit Index (GFI) > 0.9 and the Adjusted Goodness-of-Fit Index (AGFI) > 0.9.

To assess how well the EFA extracted model fits to observe data, we conducted CFA. The method of estimation was robust maximum likelihood. Asymptomatic covariance matrix was considered as a weighted matrix. Input matrix was covariance matrix of data. Fit indices and reasonable values of these indices for CFA were considered as X^2/ df < 5, RMSEA < 0.08 and also, CFI, GFI, AGFI > 0.90 (16). Statistical analysis was performed using IBM SPSS Statistics 21.0 (IBM SPSS Statistics, ARMONK, USA) and AMOS 24. P-values less than 0.05 were considered as significant.

Reliability

Alpha coefficients and ICC for dimensions of PBMS-23 were as follow: believe in fate and destiny [0.718, 0.898 (0.591–0.975)], breast conflict [-0.219, 0.873 (0.488–0.968)], defense avoidance [0.487, 0.983 (0.730–0.983)], inconveniences/difficulties of mammography screening [0.344, 0.905 (0.619–0.977)], contrasting/competing priorities [0.417, 0.145 (-2.443-0.788)], fear [0.616, 0.897 (0.584–0.974)], distrust of mammography screening [-0.096, 0.879 (0.515–0.970)], lack of knowledge [0.594, 0.507 (-0.985-0.878)]. Additionally, alpha coefficients for the total scale PBMS-23 was 0.7; this provided further support for the internal consistency reliability of the scale, indicating that the scale has adequate internal consistency reliability. ICC = 0.92 (0.688–0.981) also indicated that scale had satisfactory stability.

Scoring

Each item was rated on a five-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). The total score is arrived at by summing the scores of all items, as a result, a higher score indicated more perceived barriers of mammography screening.

Demographic Characteristics

Participants also completed a questionnaire with eight demographic characteristics including age, marital status, education status, employment, family monthly income, health insurance, family history of breast cancer, and having problems related to breast.

Statistical analysis

Data were expressed by mean Standard Deviation (SD) and frequency (percent) for numeric and categorical variables, respectively. The total score of scale was computed by summing items of it scale and used in the analysis. A Cronbach's (alpha) coefficient of 0.70 or above indicates that the instrument has acceptable reliability (17). ICC was computed to evaluate the stability over time. ICC of 0.40 was considered poor to fair, 0.41–0.60 moderate, 0.61–0.80 good and > 0.80 excellent (18).

Result

Participants

Mean age of the participants (n = 500) was 51.12 (SD = 9.18), ranging from 40 to 69 years. The majority of the participants were younger than 50 (83.30%), married (85.71%) and unemployed (86.70%) and about 43.21% of the participants had elementary and secondary level of education. Table.1 provides detailed information on the demographic characteristics of the sample.

Construct Validity

The KMO measure produced a coefficient of > 0.61, indicative of moderate sampling adequacy which was confirmed by Bartlett's test of Sphericity ($P < 0.001$). Additionally, the total variance explained was estimated at about 59.20% (an acceptable value). Model adequacy and factor loadings of the scales are shown in Table 3.

Table 3
Model adequacy and factor loadings of the scales.

	Dimension of scale	Believe in fate and destiny	Breast conflict	Defense avoidance	Inconveniences/difficulties of mammography screening	Contrasting/competing of priorities	Fear	Distrust of mammography screening	Lack of knowledge
	KMO	0.66							
	P-Value	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
	Total Variance Explained								
1	Q1	0.784							
2	Q2	0.784							
3	Q3		0.830						
4	Q4		0.830						
5	Q5			0.833					
6	Q6			0.750					
7	Q7			0.830					
8	Q8				0.786				
9	Q9				0.768				
10	Q10				0.789				
11	Q11				0.652				
12	Q12				0.629				
13	Q13					0.761			
14	Q14					0.761			
15	Q15						0.823		
16	Q16						0.810		
17	Q17						0.671		
18	Q18							0.861	
19	Q19							0.861	
20	Q20								0.832
21	Q21								0.860
22	Q22								0.683
23	Q23								0.861

As it shown in Table 4, CFA was also conducted to assess how well the EFA extracted model fits to observed data. The results of confirmatory factor analysis confirmed the factor structure of the scale. The CFA on the 23 items yielded the following results: (x2/df = 4.40, RMSEA (90% CI) = 0.064 (90% CI), GFI = 0.971, and CFI = 0.980, KMR = 0.049 and AGFI= (0.915) that indicate an acceptable fit of the proposed model. In addition, all item-scale relationship and the correlation among the scales were all significant (P < 0.05).

Table 4
Confirmatory factor parameter estimate of the scales.

Dimension of the scale	Items	Standardized Estimate	S.E.	P
Believe in fate and destiny				
	Q1	.433		
	Q2	.533	.104	< 0.001
Breast conflict				
	Q3	.689		
	Q4	.550	.065	< 0.001
Defense avoidance				
	Q5	.708		
	Q6	.616	.066	< 0.001
	Q7	.749	.068	< 0.001
Inconveniences/difficulties of mammography screening				
	Q8	.679		
	Q9	.700	.088	< 0.001
	Q10	.652	.063	< 0.001
	Q11	.639	.073	< 0.001
	Q12	.513	.066	< 0.001
Contrasting/competing priorities				
	Q13	.563		
	Q14	.284	.079	< 0.001
Fear				
	Q15	.571		
	Q16	.545	.071	< 0.001
	Q17	.519	.050	< 0.001
Distrust of mammography screening				
	Q18	.709		
	Q19	.678	.068	< 0.001
Lack of knowledge				
	Q20	.674		
	Q21	.728	.083	< 0.001
	Q22	.628	.089	< 0.001
	Q23	.602	.083	< 0.001

Discussion

In this study, we described the development and psychometric properties of a new instrument, called the mammography screening barriers scale or PBMS-23 for Iranian women. To our knowledge, PBMS-23 is the first scale designed to specifically measure barriers of mammography screening in Iranian women.

Generally, the findings showed satisfactory psychometric properties for the PBMS-23. Finally, the scale contained 23 items and 8 dimensions (Table 5) was finalized. The results showed that the content validity was reasonable. A content validity assessment is required, since inferences are made based on the final scale items. The item content must be deemed valid to instill confidence in all consequent inferences (19).

Table 5
The Perceived Barriers of Mammography Scale (PBMS-23)

Dimension	Item	Item content I will not do mammogram because…….	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Fear	1	I am afraid to be diagnosed with cancerous tumor in my breasts by mammography.					
	2	Procedure of doing of mammogram is painful.					
	3	To be exposed by mammography's radiation will hurt my body.					
Defense avoidance	4	I do not want to think about breast cancer					
	5	Breast cancer happen only in older ages, I'm still young enough to do regular mammography.					
	6	For being more relaxed, I prefer to be unaware about my probable breast cancer.					
Lack of knowledge	7	I am healthy and don't have disease or problem in my breasts					
	8	I think breast self-examination is enough to diagnose breast cancer.					
	9	Mammography is not necessary unless my physician recommend it.					
	10	I don't know what to do for getting a mammogram.					
Believe in fate and destiny	11	I believe in divine destiny and Mammography will not save my life.					
	12	Mammography will not save my life.					
Inconveniences/difficulties of mammography screening	13	My spouse/family doesn't assist me to do mammography.					
	14	I'm shy to do mammography.					
	15	Accessing to mammography imaging centers is difficult for me.					
	16	The mammography centers are crowded and I should be wait in the long queues.					
	17	Mammography imaging staffs do not behave respectfully with clients.					
Contrasting/competing priorities	18	In case of being diagnosed by breast cancer, my family will be involved with my problems.					
	19	Cost of mammogram is high.					
Breast conflict	20	In case of mastectomy because of breast cancer I will lose my feminity.					
	21	In case of being diagnosed by breast cancer, others will look at me as a flawed woman.					
Distrust of mammography screening	22	Mammography is not a reliable method for early diagnosis of breast cancer.					
	23	Breast cancer cannot be cured even if it is diagnosed earlier.					

In addition, the results of construct validity showed a good structure for our PBMS-23. Construct validity is most directly related to the question of what the instrument is in fact measuring—what construct, trait, or concept underlies an individual's performance or score on a measure. This refers to the degree to which inferences can be legitimately made from the observed scores to the theoretical constructs about which these observations are supposed to contain information(19).

Items included in the "believe in fate and destiny dimension" reflect this belief that all events that comprise the life of an individual are predetermined. These beliefs including that women are unable to do anything to prevent breast cancer, belief in fatalism and the inability to change fate might be barriers for screening health behavior (20).

These barriers do not exist in Rakowski scale that was developed based on decisional balance construct of the Trans-theoretical Model (21) and also in the Champion's scale (22) and in the "Hyman-Baker mammography questionnaire" (23), which they had been developed based on the HBM, but in the scale

that was developed for Chinese women(15) has been mentioned. Moreover in relation to our scale, the cancer fatalism scale developed by Powe, the degree of negativity and hopelessness of individuals associated with the cancer diagnosis was measured (24).

As most of Iranians are Muslim, this type of beliefs as a barrier may be as a result of Islamic teaching and ideology that heavily emphasizes “the will of God,” which means that birth, life, and death of all creatures are in God’s hands. Negative influences of spirituality and religiosity may lead to sense of fatalism or belief that the outcome of their health is controlled by fate or by God There are numerous quotations that can be provided from the main Islamic texts such as Quran, which states in the surah al-Imran that “no one will die except by God's permission” In other hand, the Islam holds individuals completely responsible for their personal wellness, health, and physical wellbeing. The dichotomy of these two apparently different points of views might provoke different beliefs.

Therefore, these types of beliefs can act as both barrier and motivated factors for mammography screening. When it comes to health care seeking behaviors, this means patients should effectively look for medical care and only then pray that God makes these medications and treatments effective. Yet, at the same time, it is reported that people have been actively engaged with their medical treatment and they showed that they are far from being passive or believe in fate (25).

“Distrust of mammography screening dimension” includes items reflect distrust in medical system, lack of expert/skill of health care providers/technicians doing mammography screening, distrust to mammography machines and misconceptions due to late detection of breast cancer and its adverse outcomes such as ineffectiveness of treatment and death. Distrust of the medical system as barrier of mammography screening was also reported previously (11).

Death due to late detection of cancer may make this belief that cancer will inevitably lead to death thus resulting in distrust of mammogram. In addition, distrust in medical diagnostics can create insecure feelings among women. Therefore, informing and educating women would be useful to create trust among women to engage voluntarily in mammography.

Breast conflict dimension represent a woman’s unpleasant feelings and dissatisfaction toward her breasts, which may adversely affect her decision to undertake the procedures for an early detection of breast cancer. Mammography is negatively related to breast conflict (26). Self-esteem and self-efficacy development interventions and consultations might be effective to eliminate the breast conflict related beliefs.

One of the domains of PBMS-23 was “defense avoidance,” which reflect women’s high fear about breast cancer and high level of fear becomes the cause of avoiding to think about cancer which consequently might lead to not engaging in mammography screening. Additionally, fear dimension includes items reflecting women’s fear and negative expectations about the screening such as pain, being informed about breast cancer, and X-ray.

According to PBMS-23, in other scales, fear of being diagnosed with breast cancer, the imagining and thinking about getting cancer and its consequences, harmfulness of mammography, and mammogram procedure are mentioned as a reasons for not getting mammograms(15, 21–23). Based on a Breast Cancer Fear Scale (27) thinking about breast cancer creates feelings such as fear, nervousness, upset, depressed, anxiety, uneasiness, tachycardia that might be considered as barriers for women’s participation in mammography screening programs.

Additionally, items of “lack of knowledge” dimension reflect low awareness about health services, screening and early detection of breast cancer as well as breast cancer. Evidences were found that breast cancer awareness interventions increase the likelihood of breast cancer screening attendance(28).

Based on health belief model, if individuals regard themselves as susceptible to a condition, would have potentially believed that anticipated benefits of taking an action for reducing either their susceptibility to or severity outweighs the barriers to action, they are likely to engage in healthy behavior(29).

In addition based on extended parallel process model and theories of stress and coping, people exposed to threading conditions doing appraisal that way if they feel capable of taking action and control threading conditions, they will control the risk accordingly. However, when they doubt their ability to minimize the threat, they focus instead on controlling their fear. They will also go into a state of denial, or defensive avoidance. In sum, perceived threat motivates action. Perceived efficacy (i.e. recommended response efficacy and self-efficacy) determines whether individuals control the danger and make behavioral changes or control their fear through psychological defense mechanisms (30, 31). Therefore, fear may motivate the individual who believes the threat of breast cancer can be reduced by taking action (i.e. engaging in screening). However, if fear is too high, the behavioral response to control the fear will result in avoidance rather than participation in screening. If fear is too low, etc., the motivation for change will not be present. As a result, health promotion and public health practitioners should design comprehensive messages and interventions about mammography and benefits of early detection of breast cancer, so that it can influence the fear and informed decision about the adoption of mammography.

Contrasting/competing priorities dimension points out to the perceived issues that are more important than mammography. Women may have another health problems, or may have personal concerns, or their health has less priority in comparison to other interests or obligations that they may have such as job, family, and childcare (11).

Inconveniences/difficulties of mammography screening dimension items reflect issues such as lack of access to screening services, time consuming screening process, modesty and privacy concerning one’s breasts and uncomfortable feeling to discuss about breast issues, lack of family support, and perceived lack of good communication skills of health care providers.

In Iranian culture, family is valued and is considered a very important institution and family cohesion is also very important. In addition, emotional relationship between family members is strong and they are interdependent. Additionally, lack of spouse/family support, both personally and financially, played a role in mammography adherence. Furthermore, issues such as upsetting the family, especially their children, and worrying about family/children’s

fate causes women to avoid pursuing their health problems or disclosing the existence of a problem. What was mentioned above, it could be explained by theory of planned behavior that whether important referent individuals approve or disapprove of performing the behavior, weighted by his or her motivation to comply with those referents. In addition, we should account for factors that are outside of control of women that may effect their screening behaviors (29). In the cultural belief scale for mammography screening which developed by Russell, et al, they explained five subscales that is consistent with our scale(32).

Support from family members, peers, healthcare workers, decision-makers and insurance systems can facilitate mammography adoption, in other word, instrumental, informational and emotional support to perform preventive behaviors is essential.

Measurement is a fundamental activity of science, since it enables researchers to acquire knowledge about people, objects, events, and processes. Measurement scales are useful tools to attribute scores in some numerical dimension to phenomena that cannot be measured directly (19). As such, we believe that this newly developed instrument may be especially helpful for healthcare teams to recognize and to plan preventive health strategies that are functional and targeted to specific conditions. The inclusion of eight domains in this scale further allows health experts to understand how domains in need can be improved. The scales also are useful in that they may be quickly administered and they allow for immediate assessments and interventions based upon the results.

Conclusion

Generally, the study findings suggest that the mammography screening barriers scale for Iranian women is a valid and reliable instrument to assess barriers affecting women's mammography screening. This research with a focus on behaviors to barriers of mammography screening offered a conceptual framework to better understand women's behavior toward breast cancer screening and how to better mitigate the problem. Based on the findings obtained in this study, to increase mammography screening rate attention must be paid to all barriers in different levels of individual, family, community, health system and legislation. Furthermore, interventions should be implemented appropriate for each level. Collaborations between health care providers and policymaker is essential to minimize the barriers faced by women. One of the aspects of this instrument is using comprehensive approach in developing it including the qualitative study findings, review of existing instruments, literature review, and content review by experts. Furthermore and based on our analysis mentioned in this research, PBMS-23 can be used by women in other countries in the Middle East area. Finally, further studies in different populations are recommended to establish stronger psychometric properties for the instrument.

List Of Abbreviations

Full term	Abbreviation
Perceived Barriers of Mammography Scale	PBMS-23
Health Belief Model	HBM
Content Validity Ratio	CVR
Content Validity Index	CVI
Exploratory Factor Analysis	EFA
and Confirmatory Factor Analysis	CFA
Kaiser–Mayer–Olkin	KMO
Root Mean Square Error of Examination	RMSEA
Goodness-of-Fit Index	GFI
Adjusted Goodness-of-Fit Index	AGFI

Declarations

Ethical approval

Ethical approval for the study was provided by Ethics Committee in Tabriz University of Medical Sciences (Ethics Code: IR.TBZMED.REC. A/149-451). Informed consent form was obtained from all the participants before the study.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interest

The authors claim no conflict of interests with other people or organizations

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Author contributions

SS, MAJ, HA designed the study. SS collected survey data. SS, MAJ, HA analyzed and present statistical results. SS, MAJ, HA were major contributors in writing the manuscript. MMH edited the manuscript. All authors read and approved the final manuscript.

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