

Willingness to Pay for Breast Cancer Screening: A Systematic Review

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ABSTRACT

Background: Women's breast cancer was identified as the primary contributor to global cancer cases. This condition puts a significant economic burden on both society and the healthcare system, with the highest expenses related to medical treatment costs.

Objectives: The study aims to review the willingness to pay (WTP) for breast cancer screening and the factors influencing it.

Methods: Four databases (Scopus, PubMed, ProQuest, and Google Scholar) were used to search related articles that mentioned the WTP for breast cancer screening. Preferred Reporting Items for Systematic Reviews (PRISMA) guideline was used to execute this systematic review study. Finally, 11 articles were included in this study. The quality of reviewed studies was assessed using a JBI cross-sectional study and a JBI quasi-experimental study.

Results: The study found that the WTP value for breast cancer screening varied from \$1 to \$500 in Iran, Malaysia, Singapore, the US, and Canada. Most studies explained that willingness to pay and willingness to take breast cancer screening were affected by sociodemographic aspects such as family history of ovarian or breast cancer, income status, education status, age, and marital status.

Conclusion: Governmental authorities should consider the implementation of a breast cancer screening program or explore cost-sharing mechanisms for breast screening, to mitigate the incidence of breast cancer.

Keywords: breast cancer screening; mammography; willingness to pay; WTP

INTRODUCTION

Globocan (Global Cancer Statistics) reported that breast cancer among women now became the primary contributor to global cancer incidents in 2020. In previous studies, it emerged as the prevailing diagnosis, surpassing lung cancer. Globocan data showed an estimated 2.3 million new cases of breast cancer, representing 11.7% of all cancer cases.¹ The prevalence of breast cancer among women was 1 in 4 cancer cases where 1 in 6 cancer deaths. Almost 685.000 women die because of breast cancer, which ranks as the fifth leading cause of cancer mortality globally.¹

Based on a recent study, amount of breast cancer cases is predicted to rise by more than 40% to around 3 million per year until 2040. Likewise, the mortality caused by breast cancer also increased by over 50% from 685.000 cases in 2020 to 1 million in 2040.² Breast cancer puts a significant economic burden on both society and the healthcare system, with the highest cost associated with direct medical costs. According to a study conducted in Iran, the direct medical cost expenses associated with breast cancer accounted for approximately 1.7% of the overall health expenditure. This expenditure was based on the country's total health budget, estimated at 39.5 billion USD, which represented 6.71% of the gross domestic product (GDP) according to the World Bank's latest report.³ This high direct medical cost is related to receiving various services from several health centers, high prices, and also the long duration of breast cancer treatment. To reduce the cost, previous studies suggest increasing insurance coverage, using advanced radiotherapy techniques, establishing low-cost

accommodations, providing specialized medical services, and carrying out free screening programs.³ Another study of the economic burden caused by breast cancer in Iran reported that the majority of the expenses (77%)

Table I. Searching keywords

No	Database	Keywords
1	Scopus	'willingness to pay' AND 'breast cancer screening' OR 'mammography'
2	PubMed	'willingness to pay' AND 'breast cancer screening'
3	ProQuest	'breast cancer' OR 'mammography' OR 'cancer screening' OR 'willingness to pay'
4	Google Scholar	'WTP' AND 'breast cancer screening'

were attributed to the loss of productivity resulting from breast cancer-related fatalities, while the direct medical costs constituted 18.56% of the overall estimated expenditure.⁴ This study concludes that due to the increasing incidence rate, the economic burden cause of breast cancer is predicted to increase significantly. Prevention and early detection the healthcare system of the national cancer control program should prioritize strategies of breast cancer.

Breast cancer screening is an important preventive action due to the substantial expenses associated with breast cancer prevalence. The primary screening methods are breast self-examination, clinical self-examination, Magnetic Resonance Imaging (MRI), mammography, biopsy, and ultrasound. Nowadays, advanced technology for the early detection of breast cancer has been developed, that is, BRCA genetic test.⁵ WHO (World Health Organization) recommends conducting mammography regularly every 2 years in well-equipped facilities for women at average risk of breast cancer (aged 50 to 69 years).⁶ A previous systematic review of studies of the effectiveness of breast cancer screening stated that breast cancer mortality was generally reduced by mammography.⁷ Most of the guidelines recommended mammography screening for average-risk women (aged 40-74 years).⁸ The majority of Randomized Control Trials (RCT) from developed countries found that screening mammograms between the ages of 50 and 69 had the greatest impact on mortality reduction.⁹

Previous studies have explored breast cancer screening programs' clinical effectiveness and public health impact. However, there is still limited research that systematically examines how much individuals are willing to pay (WTP) for these services. This research gap is significant as it highlights a lack of comprehensive study on the economic preferences and financial considerations regarding breast cancer screening, which is crucial for designing cost-effective and accessible screening programs. By combining and analyzing WTP data across sociodemographic, country, and type of breast cancer screening, this systematic review aims to fill this gap, offering insights to the policymakers and enhancing the affordability of breast cancer screening through the national health program.

Research should be carried out on willingness to pay (WTP) for breast cancer screening due to the high health costs and nominal out-of-pocket payments. Willingness to pay (WTP) is the highest cost a customer will pay for a specific amount of a good or service.¹⁰

This study examined studies evaluating willingness to pay (WTP) for breast cancer screening, as preference expression studies are crucial for providing more precise and policy-oriented information. As a result, all aspects that could influence WTP were considered.

METHODS

Study design

Articles collected in this systematic review study consisted of eight cross-sectional studies^{5,11-17} and three experimental studies.¹⁸⁻²⁰

Search strategy

A literature search was executed through 4 electronic databases: Scopus, PubMed, ProQuest, and Google Scholar. All articles related to willingness to pay for breast cancer screening are included in this systematic review. A search strategy using keywords as follows (Table I)

Eligibility criteria

This systematic review included all studies that investigated breast cancer screening willingness to pay (WTP). Breast cancer screening is defined as mammography, genetic testing, or other related tests aimed at detecting breast cancer. We selected full-text available articles published within 10 years, to keep the data up to

date. The language of the studies was restricted to English. The quality of the reviewed studies was assessed using a JBI cross-sectional study and JBI quasi-experimental study.

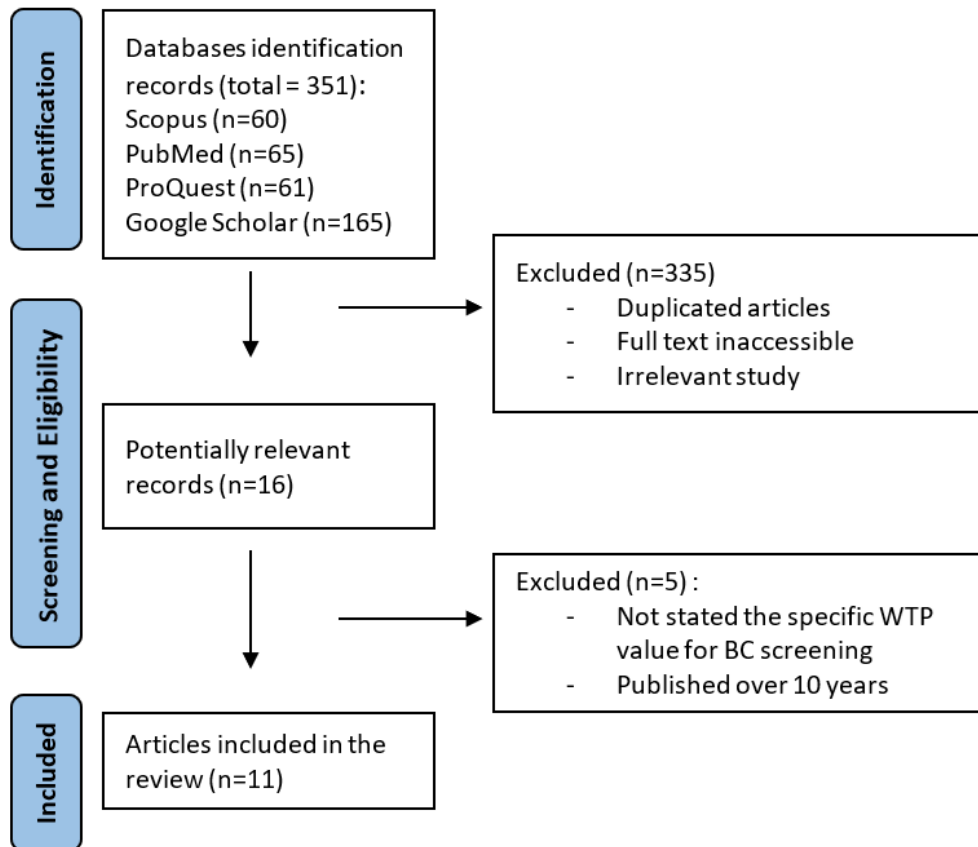


Figure 1. PRISMA flow diagram for study selection

This study excluded handbooks or guidelines, articles whose full text was not available, defines only breast cancer, treatment of breast cancer, WTP value was not stated, only WTP for breast cancer treatment, cost-effectiveness study of screening breast cancer or other pharmacoeconomic studies that not related to willingness to pay.

Data Analysis

The included studies were arranged using Mendeley Desktop V1.19.8 software following a resource search. Studies whose titles and abstracts did not match the inclusion criteria were removed. The author then went back and went through the remaining articles' full texts, extracting data.

The table form was created to extract data. Data reflecting survey participants' estimated WTP values for breast cancer screening, as well as the methods used to measure WTP, were collected. Other relevant information regarding various dimensions was collected for each study, including (1) the aim of the study, (2) the type of breast cancer screening, (3) respondents, (4) factors affecting WTP, and (4) WTP value. All reported WTP values are adjusted to 2023 United States Dollars (USD). The author makes assumptions regarding the currency year or survey year when such information is available. After summarizing all the data in tabular form, it was possible to find all eligible criteria for this study.

Search Strategy Result

The article search generated 351 articles (Scopus 60, PubMed 65 articles, ProQuest 61 articles, and Google Scholar 165 articles). The overview of the selection process is determined in Figure 2. PRISMA diagram of this review. We excluded 335 duplicate articles and full-text inaccessible and irrelevant studies. Only 16 articles were potentially relevant records. Full-text articles that did not state the specific value of WTP for breast cancer screening and publication has exceeded 10 years were removed. In the end, this systematic review included 11

articles related to women's willingness to pay for breast cancer screening. The quality of reviewed studies was assessed using a JBI cross-sectional study and a JBI quasi-experimental study.

Table II. Willingness to Pay (WTP) Study Characteristics

First Author (year)	Country	Study Aim	Type of breast cancer screening	Respondents (N = sample size)	Factor Affecting	WTP Values
Meshkani (2023) ⁵	Iran	to find out the Iranian women's subjective valuation for BRCA tests screening as breast cancer early detection, suggesting the policymakers make decisions about breast cancer genetic screening tests.	BRCA genetic test	Older women >30 years old (N = 660)	Income, family history of breast and ovarian cancer, and attitude toward genetic screening tests for BC	Mean WTP values \$20.
Nosratnejad (2023) ¹⁸	Iran	measuring mammography WTP by giving each of the women one of two scenarios that describe information of medical information of the test.	Mammography	women aged 35-55 years old (N=450)	Age, employment status, education status, having complementary insurance	Mean WTP of \$30.5 of the receiving basic medical information group and \$26.8 for complete medical information
Guo (2022) ¹⁹	US	to examine sociodemographic factors related to knowledge and attitudes toward genetic testing of altered cancer susceptibility genes among young women in a clinical sample	Genetic testing	adult women 18-65 years old (N=667)	Income level, education, attitude toward testing, risk perception, family history of breast cancer, and cultural factors	Most women 64.0% willing to pay up to \$25 for the test, 29.3% willing to pay \$25-\$500, and < 10% willing to pay more than \$500 for the test
Karimabadi (2022) ¹¹	Iran	To investigate the preferences of Iranian women and WTP based on breast self-examination level and mammography screening practice and knowledge	Mammography	Women over 35 years old (N=384)	education status, domicile, income level, health insurance status, family history of breast cancer, health, knowledge, and practice index	The mean value of willingness to pay was \$3.5

Table II. Continuing

First Author (year)	Country	Study Aim	Type of breast cancer screening	Respondents (N = sample size)	Factor Affecting	WTP Values
Aizuddin (2021) ¹²	Malaysia	to determine the willingness to pay and willingness to undergo breast cancer genetic testing in the Malaysian population	Genetic testing	respondents between 40 and 60 years old (N=641)	Family history of cancer, age, gender, level of education, income, private insurance, willingness to undergo genetic testing.	The median of willingness to pay was USD 48.31 (MYR 200.00).
Wong (2018) ²⁰	Singapore	Measuring women's preferences and marginal willingness to pay for the new technology of breast cancer genetic testing; Single Nucleotide Polymorphism (SNP) testing	Single-nucleotide polymorphism gene testing	women 40-69 years (N=300)	income, education level, sample type, the person conducting the pretest to discussion, the out-of-pocket cost	Median mWTP of Chinese is S\$8.31 (\$6.08) as compared to S\$6.99 (\$5.12) in Malays S\$7.63 (\$5.59) in Indians
Blouin-Bougie (2018) ¹³	Canada	Assessing the factors that influence women's interest and WTP for breast cancer susceptibility testing (BCST), identifying both common and specific individual factors impacting the outcomes.	Breast Cancer Susceptibility Testing (BCST)	French Speaking women aged 35-69 years old (N=1031)	Age, household income, marital status, family history of breast cancer, locus of control, health status	\$1 - \$100
Sabermahani (2017) ¹⁴	Iran	Estimating WTP of breast cancer and osteoporosis screening and comparatively examine the affecting factors	General breast cancer screening (not specifically stated the type of test)	Women aged 35-69 years for breast cancer screening group and women/men >55 years for osteoporosis screening (N=600)	Risk and income	The median of breast cancer screening WTP is \$20-\$125; the mean of breast cancer screening WTP is \$31.5 - \$131.1
Khaliq (2014) ¹⁵	US	Determines the mean amount of money that hospitalized women are willing to contribute related of a screening mammogram cost	Mammography	women aged 50 to 75 years (N=250)	income, education, age, race	72% of patients were willing to pay a mean of \$83.41
Miron-Shatz (2014) ¹⁶	US	to assess whether subjective or objective numeracy correlated with WTP	BRCA 1/2 genetic testing	N=961 participants	Subjective perceived risk of gene mutation	Mean WTP was \$143.66
Teo (2013) ¹⁷	Singapore	to determine the attitudes of Singaporean women toward screening mammography and its potential barriers.	Mammography	Eligible women were those aged between 40 and 75 years who had no prior history of breast cancer. (N=208)	Ethnicity, education level, knowledge and motivation	Amount of willingness to pay only \$24 for a mammogram compared to the subsidized cost of \$40

Table III. Willingness to pay (WTP) value based on grouped country

Country	WTP Value
Iran ^{5,11,14,18}	\$3.5 - \$131.1
US ^{15,16,19}	\$25 - \$500
Singapore ^{17,20}	\$5.12 - \$24
Malaysia ¹²	\$48.31
Canada ¹³	\$1 - \$100

Table IV. Willingness to pay (WTP) value based on screening type

Screening Type	WTP Value
Mammography ^{11,15,17,18}	\$3.5 - \$83.41
BRCA genetic test ^{5,16}	\$20 - \$143.66
Genetic test ^{12,19}	\$25 - \$500
SNP genetic test ²⁰	\$5.12 - \$6.08
BC Susceptibility testing ¹³	\$1 - \$100
General test ¹⁴	\$31.5 - \$131.1

Data Extraction

We identified 11 studies that observed how much WTP for an early breast cancer detection test and also the factors affecting WTP for breast cancer screening. We limited the study ranged from 2013 to 2023 (10 years). Three studies were carried out in the United States^{15,16,19}, four studies in Iran^{5,11,14,18}, one study in Canada¹³, two studies in Singapore^{17,20}, and one study in Malaysia.¹² All currency is converted into US Dollars (USD 2023) to compare the WTP values. Study characteristics are shown in Table II.

Willingness to pay (WTP) for breast cancer screening

The study sample size ranged from 65 to 1031 participants across 11 studies. All studies were conducted using questionnaires. WTP estimation was measured using the contingent valuation method (4 studies), contingent valuation method-double bounded dichotomous choice (1 study), discrete choice of experiment (2 studies), and 4 studies using another questionnaire method (not specifically mentioned).

The studies assessing willingness to pay (WTP) statistics have shown a range of mean values of WTP that are incomparable due to differences in currencies across the countries studied. The majority of the studies reported the mean or median WTP value. To compare the WTP values, all currency is converted into US Dollars (USD 2023). The WTP range obtained was \$1-\$500, which varied significantly depending on the country where the study was conducted.

There were variations in WTP values among studies conducted in the same countries. For instance, in Iran⁵ the mean WTP for tests was approximately \$20 in one study, while in another study in Iran¹⁸ was \$30.5 and \$26.8 due to women receiving basic medical information and complete medical information about breast cancer screening. In another study in Iran¹¹, the mean value of the participants' WTP was \$3.5 and in Iran¹⁴ the median of WTP for breast cancer screening was \$20-\$125 with a mean of \$31.5-\$131.1. Similar variations were observed in the US and Singapore. For example, in one study in the US¹⁹, the WTP value ranged from \$25-\$500, while in another study in the US¹⁵, the mean WTP value was \$83.41, and in the other study in US¹⁶ the mean WTP was \$143.66. Two studies in Singapore^{17,20} show that the median of WTP ranged from \$5.12-\$6.08 and \$24. The summarized results are presented in Table II. If it is grouped based on the country where the study was conducted, it generated the WTP ranges were \$3.5-\$131.1 in Iran, \$25-\$500 in the United States, \$5.12-\$24 in Singapore, \$48.31 in Malaysia, and \$1-\$100 in Canada. Based on screening type group, the WTP values were as follows: mammography: \$3.5-\$83.41, BRCA genetic testing: \$20, other genetic testing: \$25-\$500, SNP genetic testing: \$5.12-\$6.08, breast cancer susceptibility testing: \$1-\$100, and general testing: \$31.5-\$131.1. These results are presented in Table III and Table IV, respectively.

Factors associated with breast cancer screening willingness to pay (WTP)

The literature reported various factors that affected WTP. The majority of the studies indicated that WTP was influenced by sociodemographic factors such as family history of breast or ovarian cancer^{5,11-13}, income or

occupation status^{11–13,15,18,20}, educational status^{11,12,15,18,20}, private or voluntary health insurance^{11,12,18}, age^{12,13,15,18}, numeracy^{13,16}, race/ethnicity^{15,19}, health status.^{11,13} Other factors mentioned included attitude toward genetic testing⁵, domicile, knowledge, and practice index¹¹, gender, and willingness to undergo testing¹², marital status, and locus of control¹³, and perceived risk of gene mutation.¹⁶ These results are presented in Table V.

Several studies have investigated other factors that affect WTP results, such as women's receiving basic medical scenarios and additional medical scenario¹⁸, breast self-examination level, mammography screening practice, and knowledge¹¹, women's preferences in genetic testing such as sample type, person conducting pretest discussion, out-of-pocket cost, and test location²⁰. The summarized results are presented in Table II.

RESULTS AND DISCUSSION

This research has systematically reviewed all studies that investigated willingness to pay (WTP) for breast cancer screening. The systematic review of willingness to pay for breast cancer screening has been not reported yet. The global representation of comprehensive research on willingness to pay for breast cancer screening remains limited, despite breast cancer being a significant economic burden in many countries. Overall, this review included eleven selected studies from six countries. The selected studies showed that there are several types of screening tests, including mammography, BRCA genetic testing, Single Nucleotide Polymorphism (SNP) test, Breast Cancer Susceptibility Testing (BCST), or other unspecified genetic testing. Most studies examined mammography since it was the most common breast cancer screening method used today and mammography stands as the gold standard for breast cancer screening. World Health Organization (WHO) also recommends mammography due to its proven effectiveness in early detection and management of breast cancer.²¹ The second alternative screening was genetic testing, whether BRCA or another genetic testing. Although genetic testing is a new and advanced method for generating breast cancer screening, it requires much higher costs than mammography. The effectiveness of mammography screening has been proven by the research of Duffy et al.²² that women who participated in mammography screening had a statistically significant reduction in their risk of dying of breast cancer and the rate of advanced breast cancers.

Previous research data on willingness to pay (WTP) for breast cancer treatment and reducing side effects due to breast cancer treatment provide a greater value than WTP for breast cancer screening, leading to a significant economic burden. Systematic review studies on WTP for cancer treatment and outcome have found that the WTP value for breast cancer treatment reached approximately \$500,000²³ and the WTP value for avoiding metastatic breast cancer treatment side effects was approximately \$3000.²⁴ Another study in Korea also stated that the WTP for treatment of metastatic breast cancer was \$7555 and recently diagnosed was \$11254.²⁵ These values are much greater than the WTP value for breast cancer screening (comparable with the WTP value in Table II). Therefore, a study on WTP for breast cancer screening is essential to reduce the burden of future treatment costs. This systematic review studies generated that WTP for breast cancer screening varied based on implementing country and type of test. The reported WTP value varied from \$1 to \$500 in Iran, Malaysia, Singapore, the US, and Canada with different types of tests (mammography, BRCA genetic testing, general test) and the highest cost was in the form of genetic testing. This range is quite wide considering that the studies were conducted in various countries on different continents. It is also affected by sociodemographic factors, interventions/study scenarios, patients' preferences, and other reasons based on the reviewed articles.

Besides reviewing the value of WTP, this systematic review also examined the factors affecting women's willingness to pay. Most of the studies explained that women's willingness to pay was affected by sociodemographic aspects such as the family history of breast or ovarian breast cancer, income status, education status, age, and marital status). Study based on scenarios that were made towards breast cancer screening: giving basic medical information versus additional medical information was not significantly different in influencing the WTP.¹⁸ Sociodemographic has played an important role in some studies related to cancer screening. The previous study about WTP for prostate screening also stated that sociodemographic factors such as; age, income, family history of cancer, educational level, and having a good financial status were identified as positive factors for WTP.²⁶ Studies have consistently shown that income plays a significant role in WTP for breast cancer screening. Higher-income individuals are more likely to afford screening costs and prioritize preventive healthcare services. Conversely, lower-income individuals may face financial barriers, affecting the WTP.²⁷ Higher education is associated with better health literacy and awareness. Women with higher education tend to understand the importance of early detection through screening, leading to increased WTP. Married women may have better social support and shared decision-making regarding healthcare. Women with a personal or family history of breast cancer may perceive a higher risk, which will impact their motivation and WTP for screening.⁵

Table V. Factors that influence willingness to pay (WTP) for breast cancer screening

Significant Factors	Meshkani (2023) ⁵	Nosratnejad (2023) ¹⁸	Guo (2022) ¹⁹	Karimabadi (2022) ¹¹	Aizuddin (2021) ¹²	Wong (2018) ²⁰	Blouin-Bougie (2018) ⁴	Sabermahani (2017) ¹⁴	Khaliq (2014) ¹⁵	Miron-Shatz (2014) ¹⁶	Teo (2013) ¹⁷
Breast cancer or ovarian cancer family history	√	-	-	√	√	-	√	-	-	-	-
Income or occupation status	√	√	-	√	√	√	√	√	√	-	-
Education	-	√	-	√	√	√	-	-	√	-	-
Private or voluntary supplementary health insurance	-	√	-	√	√	-	-	-	-	-	-
Age	-	√	-	-	√	-	√	-	√	-	-
Numeracy	-	-	-	-	-	-	√	-	-	√	-
Race/ethnicity	-	-	√	-	-	-	-	-	√	-	-
Perceived health status	-	-	-	√	-	-	√	-	-	-	-
Attitude toward genetic testing	√	-	-	-	-	-	-	-	-	-	-
Domicile	-	-	-	√	-	-	-	-	-	-	-
Knowledge Index	-	-	-	√	-	-	-	-	-	-	-
Practice Index	-	-	-	√	-	-	-	-	-	-	-
Gender	-	-	-	-	√	-	-	-	-	-	-
Willingness undergo test	-	-	-	-	√	-	-	-	-	-	-
Marital status	-	-	-	-	-	√	-	-	-	-	-
Locus control	-	-	-	-	-	√	-	-	-	-	-
Perceived risk of gene mutation	-	-	-	-	-	-	-	√	-	√	-

Furthermore, the reviews of these studies also showed determinant factors that affected a woman willing to undergo breast cancer screening. Women's acceptance to take the test was affected by psychological factors⁵. Fear of a positive test result, inclination to have children, fear of losing physical beauty, lack of confidence, and optimism made a woman unwilling to take breast cancer screening. Knowledge, attitude towards genetic screening tests for breast cancer, and patient preferences had an impact on women accepting genetic testing for screening breast cancer. Women with good knowledge of breast cancer risk factors, symptoms, and screening methods are more likely to participate in screening programs and reduce breast cancer mortality. Education regarding the benefits and importance of screening may influence willingness to pay for this program.^{27,28} Sociodemographic factors such as family history of breast cancer, age, income, education, and perceived risk of breast cancer also gave positive factors for willingness to do breast cancer screening.^{16,17}

This study has several limitations. The studies on willingness to pay (WTP) were conducted in a limited number of countries (Iran, the US, Malaysia, Singapore, and Canada), and still, few published research data, in contrast to the Globocan Data Report 2020 which revealed that breast cancer incidence in women was observed in 159 countries and for mortality in 110 countries.¹ Generalizing the results of this study to all countries is not possible due to the study being conducted in various countries across different continents. Thus, it is essential to design new studies that consider the specific characteristics of the continent and country of interest or the income level of the country.

CONCLUSION

Breast cancer is the leading cause of cancer-related deaths among women and the fifth most common cause of cancer-related deaths worldwide. The increasing incidence of breast cancer and the high cost of related treatments could be a significant burden on the healthcare system of the country. Therefore, the healthcare system needs to focus on early detection and screening of breast cancer to identify the cancer among women

promptly and reduce the related costs. The study results provide information about the willingness to pay (WTP) for breast cancer screening. Additionally, this study assesses the factors affecting WTP and women's acceptance of breast cancer screening. Sociodemographic factors have a positive and significant effect on women's willingness to pay and willingness to undergo breast cancer screening. Based on the study results, it is recommended that the government implement a breast cancer screening program or share the cost of breast screening to reduce the incidence of breast cancer.

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CONFLICT OF INTEREST

The authors declare no conflict of interest

STATEMENT OF ETHICS

Not Applicable

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