Review Article

Status of breast cancer screening strategies and indicators in Iran: A scoping review

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Background: This scoping review aimed to investigate the status of breast cancer (BC) preventive behaviors and screening indicators among Iranian women in the past 15 years. BC, as the most common cancer in women, represents nearly a quarter (23%) of all cancers. Presenting the comprehensive view of preventive modalities of BC in the past 15 years in Iran may provide a useful perspective for future research to establish efficient services for timely diagnosis and control of the disease. **Materials and Methods:** The English and Persian articles about BC screening modalities and their indicators in Iran were included from 2005 to 2020. English electronic databases of Web of Science, PubMed, and Scopus, and Persian databases of Scientific Information Database (SID) and IranMedex were used. The critical information of articles was extracted and classified into different categories according to the studied outcomes. **Results:** A total of 246 articles were assessed which 136 of them were excluded, and 110 studies were processed for further evaluation. Performing breast self-examination, clinical breast examination, and mammography in Iranian women reported 0%–79.4%, 4.1%–41.1%, and 1.3%-45%, respectively. All of the educational interventions had increased participants' knowledge, attitude, and practice in performing the screening behaviors. The most essential screening indicators included participation rate (3.8% to 16.8%), detection rate (0.23–8.5/1000), abnormal call rate (28.77% to 33%), and recall rate (24.7%). **Conclusion:** This study demonstrated heterogeneity in population and design of research about BC early detection in Iran. The necessity of a cost-effective screening program, presenting a proper educational method for increasing women's awareness and estimating screening indices can be the priorities of future researches. Establishing extensive studies at the national level in a standard framework are advised

Key words: Breast cancer, Iran, prevention, scoping review, screening

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INTRODUCTION

Breast cancer (BC) is the most common female cancer worldwide, representing nearly a quarter (23%) of all cancers in women.[1] In Iran, in 2015, the number of BC patients was 12802, and the age-standardized incidence rate was 32.63/100,000. Hence, the age distribution of BC compared to its counterparts is low because of its relatively young population. Almost 51% of patients were under 50 years old. It is estimated that about 10,000 women are diagnosed and treated for BC each year.[2,3]

Approaches to reducing cancer's global burden include two major strategies: Screening and early detection and active preventive intervention.[4] Screening, as one of the most critical early detection methods, has been performed in low- and middle-income countries in only 2.2% of women aged 40–49 years.[5] The findings confirmed that screening methods were less common in Iranian women,[2] and there is no systematic screening strategy for BC in Iran.[6]

Screening methods are mammography, breast self-examination (BSE), and clinical breast examination (CBE).[7] Although mammography

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screening was approved as an effective method, a study demonstrated that this method is not cost-effective in Iran.[6] BSE can enhance women's awareness, empowerment, and responsibility to their health.[8] The previous studies showed that almost 60% of females did not know how to perform BSE or did not have the necessary skills to do it.[9-11] CBE is considered a low-cost method with a broader implementation ability that requires no equipment.[5] Different factors such as demographic variables, awareness, literacy, social, and economic conditions can affect BC screening behaviors[12] which should be considered in planning a cost-effective strategy to control BC in Iranian women.

Presenting the comprehensive view of preventive modalities of BC in the past 15 years in Iran may provide a helpful perspective for future research to establish efficient services for timely diagnosis and control of the disease. Hence, this scoping review aims to present an overall demonstration of observational and interventional screening status in Iran. Introducing screening indicators in related articles may provide useful data for policy-makers to implement a proper strategy to control the disease.

Scoping review question

"What are the results of articles related to BC screening strategies and indicators in Iran in the past 15 years?"

Scoping review sub-questions

"What are the status of BC prevention behavior and influencing factors on screening behaviors?"

"Which educational interventions are effective in improvement of screening behavior?"

"What are the statistical indicators of BC screening?"

Inclusion criteria

All the published articles about BC prevention in Iran from January 2005 to January 2020 were included in the study. English online electronic databases of Web of Science, PubMed and Scopus, and Persian databases of SID and IranMedex were used.

METHODS

This study is part of a big project to study different aspects of BC in Iran. All of the published articles about BC in Iran within the defined time horizon were included in the study. They covered various aspects of epidemiology, genetics, prevention, diagnosis, treatment, and supportive care in BC. The prevention subgroup was categorized into two themes, screening modalities and indicators, prevention behaviors, and their barriers. The studies in the field of screening strategies and indicators were assessed in this scoping review.

Search strategy

Details of data sources and methodology of the big project between 2005 and 2015 time horizon have been presented in another article.[13] The same methodology was extended to articles published up to 2020. The current study consists of all articles published from January 2005 to 2020. English online electronic databases of Web of Science, PubMed, and Scopus, and Persian databases of SID and IranMedex were used. English search formula was "BC" OR "breast carcinoma" OR "breast tumor" OR "breast neoplasm" AND Iran. Persian search formula was a combination of Iran with the words of سرطان پستان، سرطان سینه، Breast tumor, BC, Breast carcinoma, and Breast neoplasm [Appendix 1].

Source of evidence screening and selection

Screening of primary search and dividing to subgroups was achieved by three experienced reviewers in the field of BC; two surgeons and one epidemiologist. Totally 7478 studies consisting of 4893 English and 2585 Persian abstracts were included in the main project, of which 949 abstracts were located in the prevention subgroup. In this step, 522 items (225 English and 297 Persian) were included by deleting unrelated studies and duplicated titles, abstracts, and full text of articles. The results of 246 articles in the field of screening strategies and indicators were considered eligible for this review. After assessing full texts, 136 articles were excluded, and 110 studies consisting of 81 English and 29 Persian were evaluated.

It should be noted that the results of the two articles have been presented in two tables jointly. Reasons of exclusion were irrelevancy (53 articles), just abstract presentation (7 articles), no relation to the Iran population (8 articles), letter to editor (3 articles), review article (2 articles), BC population study (4 articles), inaccessible full paper (1 article), qualitative study (3 articles), and duplication (55 articles). In this phase, the reason for duplications was to publish an article in either Persian and English or two or more journals [Chart 1].

Studies reviewed were classified into three categories according to their main themes, including observational (58 articles), interventional (37 articles), and statistical indicators (17 articles).

Data extraction

The research team obtained the full texts of the abstracts. If it was not available, a letter was sent to the author to take the necessary information. Two reviewers critically evaluated the selected articles by a checklist. In case of disagreement, they discussed and decided about their eligibility.

Because of the wide variation in the methodology and results of the included studies, an Excel sheet was designed

for data extraction. The first part of the datasheet was "general information" such as the title, the place and time of the study, and publication year. The second part included "methodological information" consisting of study design, sample size, studied population, intervention modality, and measurement tools. The third part was composed of "outcome measurements", such as performance of the screening method, effect of interventions, different screening indicators such as recall rate, participation rate, response rate, and detection rate. All of the articles were extracted by two reviewers, and the research team manager organized the two extracted forms into one sheet.

Since the main objective of this scoping review was to demonstrate the distribution of BC prevention researches in Iran, no article was excluded from the study due to low quality. To show the limitations of studies, we assigned the incomplete data with "NA," which stands for "Not Assigned."

Analysis and presentation of results

Rate of screening behavior performance, affecting factors, the impact of different educational interventions and statistical indicators such as detection rate, recall rate, and participation rate were extracted from the included studies. Articles that more than one-third of the presented data pertained to the years before 2005 were excluded from the study. If an article was published in either Persian and English or two or more journals, just their English version and the first publication were included. The details of data in each subject were presented in a separate table.

RESULTS

Search results

The results of 246 articles in the field of screening strategies and indicators were considered eligible for this review. After assessing full texts, 136 articles were excluded, and 110 studies consisting of 81 English and 29 Persian were evaluated [Appendix 2].

Inclusion of sources of evidence

The included studies in this field were subcategorized in observational studies (58 articles), educational interventions (37 articles), and statistical indicators (17 articles). The essential data of those three objectives consisting of general information, methodological information, and outcome measurement indices were

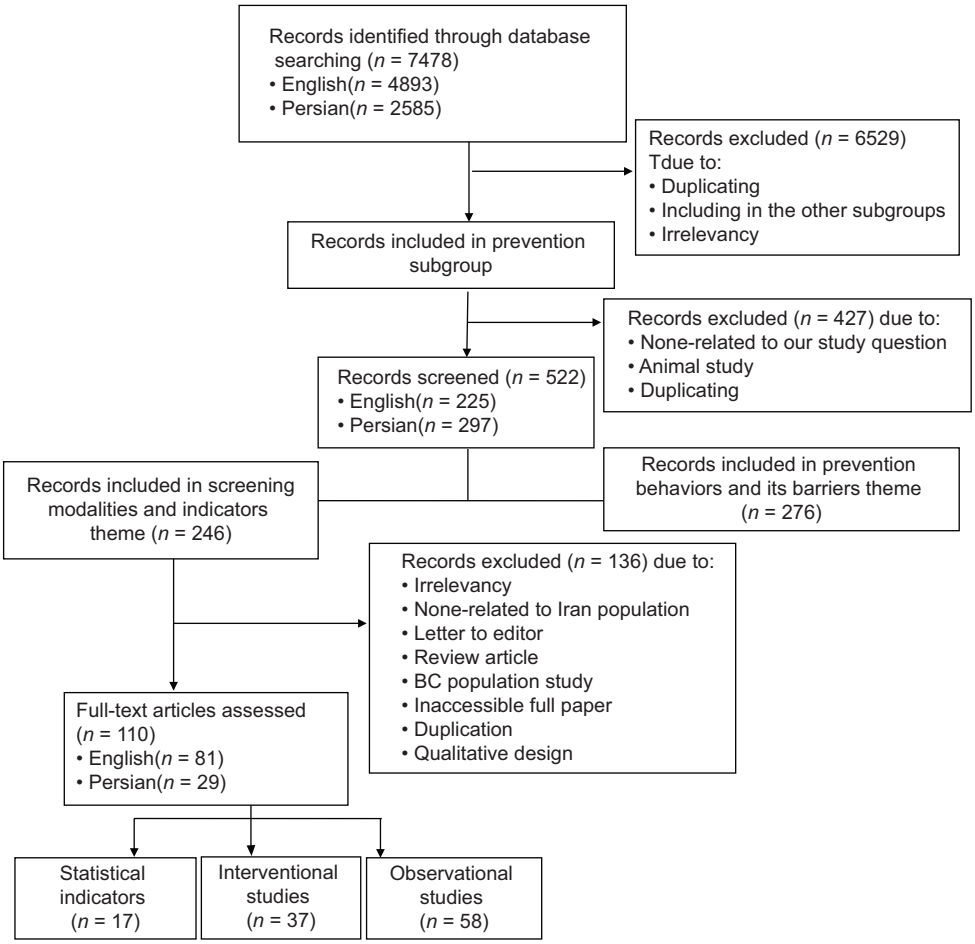

Chart 1: PRISMA chart of recruitment of articles in the study

recorded in separated tables. More details have been presented in Appendix 3.

Review finding

The finding results are presented in three following subheadings:

Observational studies of BC screening

Among 58 articles in Table 1, 56 items were cross-sectional, and 2 items were survey studies. Most of the studied populations were females referred to Healthcare centers (HCCs). Factors influencing screening behaviors consisted of health belief model (HBM) components, fear, proactive coping, state of mind and advocacy, educational level, positive family history of breast cancer, family support, awareness, physician recommendation, and age. Four articles had introduced "physicians and treatment staff" as the most important sources of information about screening behaviors.[14-17]

Achievement of BSE by the best estimate varied from no experience to 79.4%. As well as, regular BSE was 4.5% to 47.5%. Performing annual CBE was reported in 4.1%-41.1% of participants, and mammography had been performed in 1.3%-45% of females. The results of three studies showed 52.9%, 30.9%, and 60% of females did not know how to perform BSE or did not have the necessary skills to do it.[9-11] The 5-year and lifetime risk perception of BC was subjectively assessed by the visual analog scale (VAS) from 0 to 100. The mean of 5-year BC risk perception was 0.89 ± 0.89, and its lifetime risk perception was 8.87 ± 3.84.[18] Higher 5-year risk perception was demonstrated to have more predictive power for performing mammography while not predicting achieving BSE or CBE.

Effect of educational interventions on screening behavior

Table 2 demonstrates 37 studies related to educational interventions and their impact on BC screening promotion. The design of studies was clinical trial (6 articles), randomized clinical trial (29 articles), and randomized field trial (2 articles). Females who referred to HCC_s consisted majority of participants. The number of the sample ranged from 43 to 600 subjects. The educational methods mostly were in-person, except for two studies which were telephone counseling. Most educational models were HBM (13 studies), extended parallel process model (1 study), BASNEF (1 study), theory of planned behavior (TPB) (2 studies), systematic comprehensive health education and promotion (1 study), and HBM + TPB (1 study). The in-person education was achieved by methods like group discussion, role-playing, or peer education. Different instruments such as short messages, PowerPoint, media, lecture, mobile phone were applied. The result of the studies showed that educational interventions increased the knowledge, attitude, and practice of participants in performing the screening behaviors such as mammography, CBE, and BSE. It led to improved health belief, self-efficacy, the behavioral intention of screening, and perceived susceptibility/severity/benefits/barriers.

The statistical indicators of BC screening

This category includes the results of statistical studies in the field of BC prevention [Table 3]. Seventeen studies with different designs consisting of cross-sectional (13 articles), clinical trial (1 article), field trial (1 article), longitudinal (1 article), and cost-effectiveness (1 article) were included in this subgroup. The majority of participants were females referred to HCC_s. Some studies had presented the psychometric assessment of the Persian version of BSE Behavior Predicting Scale, BC awareness measure, and Champion HBM Scale. The development of some tools in BC prevention strategies consisted of MSS (Mammography Social Support scale in Iran), BC screening chart, and ASSISTS instrument and model. In two studies, the response rate to BSE and CBE ranged from 81% to 100%.[100,106] The participation rate in the screening program was reported from 3.8% to 16.8% in two studies.[52,107] BC detection rate has been reported in some studies with different designs. In a cross-sectional study on females admitted to the mammography center in a hospital, BC was detected in 2.3% of 526 screened patients.[107] BC detection rate of non-diagnostic mammography in 9395 subjects was 8.5 per 1000 mammography.[108] In BC screening of 26606 females, the detection rate of 24 per100000 was reported in CBE and mammography evaluation; the false-positive detection rate of mammography was 7.5% in this screening program.[109] Sehhati Shafaie conducted a project on 5,000 females referred to BC hospital for screening. They recorded 996 sonography and 636 mammography reports with 40 and 183 abnormal cases, respectively, and found one BC by performing 14 fine needle aspiration (FNA).[110] The screening mammography, diagnostic sonography, biopsy, and abnormality rates were 27.4%, 26%, 1.4%, and 33% in a screening project, respectively.[107] Results of a study indicated that the mean scores of females' BC screening belief and multidimensional health locus of control were 40.72 ± 10.41 and 67.78 ± 17.67, respectively.[111]

DISCUSSION

This paper reviewed the status of BC screening strategies and indicators in Iran. The studies were assessed and discussed in three themes of observational studies, interventional studies, and statistic indicators as follows:

Observational studies of BC screening

At this time, mammography is the gold standard of the BC early detection method. Hence, it is necessary to specify

Table 1: Observational studies of breast cancer screening

First author/ city/year of publication	Study design	Study population	Sample size	Mean age (SD)	Instrument	The most important findings
Valizadeh, Tabriz, 2006[19]	Cross-sectional	Nurses in 21 therapeutic centers	420	NA	QNR	BSE: 70.2% Frequency of BSE: 39% every 2 months and more
Aghababaii, Hamedan, 2006[20]	Cross-sectional	Female nursing and midwifery students	68	NA	QNR	BSE (total: 79.4%, regular: 29.4%)
Abbaszadeh, Kerman, 2007[21]	Cross-sectional	Females >35 years	296	NA	QNR	Total HBM scores in mammography group >the group without mammography
Heidari, Zahedan, 2008[22]	Cross-sectional	Females referred to Qouds maternity hospital in Zahedan	384	28.8 (8.4)	INTVW with purposed QNR	BSE (regular: 4.5%, occasionally: 18.7%, never: 76.8%) CBE history: 4.1% Mammography history: 1.3%
Simi, Shiraz, 2009[10]	Cross-sectional	Females 25-54 years referred to Shiraz Oil company polyclinic	300	Median: 38.5 (14)	QNR	BSE (total: 53.3%, find an abnormal examination: 5.6%, positive finding: 3.8%, did not know how to do: 52.9%, do it incorrect method and time: 3%)
Khalili, Tabriz, 2009[23]	Cross-sectional	Females referred to HCC_s	400	30.1 (7.4)	QNR, C/L	BSE: 18.8% CBE: 19.1% Mammography: 3.3%
Salimi Pormehr, Ardebil, 2010[24]	Cross-sectional	Females referred to HCC_s	300	29 (8)	QNR	BSE: 4% CBE: 4.7% Mammography: 3.7%
Alavi, Mashhad, 2010[25]	Cross-sectional	Gynecologic specialists and residents	124	43.1	QNR	BSE: Normal group (regular: 33%, irregular: 44%, never: 23%) High-risk group (regular: 46.7%, irregular: 53.3%) Mammography (normal group: 11.8%, high risk group: 27.1%)
Sultan Ahmadi, Kerman, 2010[26]	Cross-sectional	Females referred to HCC_s	200	30.60 (7.89)	QNR	BSE: 22.5% CBE: 21.5%
Noroozi, Bushehr, 2011[27]	Cross-sectional	Females working in public places of Bushehr	388	34.32 (10.66)	QNR	BSE (total: 37.1%, regular: 7.5%) Mammography: 14.3% CBE: 5.9%
Hasani, Bandarabas, 2011[28]	Cross-sectional	Females referred to HCC_s	240	37.2 (6.1)	QNR	BSE (total: 31.7%, regular: 7.1%)
Yadollahie, 11 cities of Iran, 2011[11]	Cross-sectional	Females referred to HCC_s	3030	Median: 40 (14)	INTVW, QNR	BSE (total: 49.4%, incorrect method and time: 9.6%, did not know how to do: 30.9%)
Samah, Tehran, 2012[29]	Cross-sectional	Asymptomatic females 35-69 years	400	NA	QNR	Mammography: 21.5%
Harirchi, Semnan and Khorasan, 2012[30]	Cross-sectional	Females >30 years	770	46.91 (13.3)	QNR	The risk of not performing BSE, CBE, mammography for illiterate females were respectively 4.56, 2.51, 3.14, times more than literate females
Aflakseir, Shiraz, 2012[31]	Cross-sectional	Female staff at SUMS and SU	113	48 (8.02)	QNR	BSE: 51% Mammography: 21%
Moodi, Isfahan, 2012[32]	Survey	Females >40 years	384	52.24 (8.2)	INTVW, QNR	Mammography history: 44.3%
Kadivar, Tehran, 2012[33]	Cross-sectional	Female physicians and female nonhealthcare personnel	196	Physicians: 46.06 (8.0) Nonhealthcare personnel: 36.97 (9.38)	QNR	BSE (physicians: 37.6%, nonhealthcare personnel: 26.1%) CBE (physicians: 31.25%, nonhealthcare personnel: 27.59%) mammography (physicians: 18.75%, nonhealthcare personnel: 17.24%)

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First author/ city/year of publication	Study design	Study population	Sample size	Mean age (SD)	Instrument	The most important findings
Fouladi, Ardabil, 2013[34]	Cross-sectional	Females referred to HCC_s	380	38.12 (6.7)	QNR	BSE: 27% Mammography: 6.8%
Pirasteh, Tehran, 2013[35]	Cross-sectional	Married females referring to HCCs	302	NA	QNR	BSE in females with high self-efficacy was 1.17 times more than other females
Asgharnia, Rasht, 2013[36]	Cross-sectional	Females referring to Al-Zahra hospital	400	48.07 (6.44)	QNR	BSE: 43.8% Mammography: 23.2%
Akhtari-Zavare, Hamedan, 2014[37]	Cross-sectional	Females referring to HCC_s	384	30 (9.1)	INTVW, QNR	BSE (total: 26%, didn't know how to do: 72.1%)
Hajian-Tilaki, Babol, 2014[38]	Cross-sectional	Females aged 18-64 years	500	31.2 (9.4)	INTVW, QNR	BSE: 38.4% CBE: 25.2% Mammography: 12%
Mokhtary, Tabriz, 2014[39]	Cross-sectional	Female HCP of tabriz health centers	196	37.01 (7.54)	QNR	BSE: 73.2% CBE: 10.7% Mammography: 26.9%
Nojomi, Tehran, 2014[40]	Cross-sectional	Females referring to HCC_s	1012	38.2	QNR	CBE (history: 22%, intention for doing in future: 75.8%) Mammography (history: 7%, intention for doing in future: 72.1%)
Shiryazdi, Yazd, 2014[41]	Cross-sectional	Female health care workers	441	34.7 (13.7)	QNR	BSE (total: 41.9%, regular: 14.9%) Mammography: 10.6%
Ghodsi, Hamedan, 2014[42]	Cross-sectional	Females >35 years	358	NA	QNR, C/L	Performance: BSE (14.8%, 9.4% regularly), mammography 25.84%
Taymoori, Sanandaj, 2014[43]	Cross-sectional	Females >40 years referring to HCC_s	593	56.84 (5.04)	QNR	Mammography: 10.5% Most effective factors on Mammography: Self-efficacy and perceived susceptibility
Momenyan, Qom, 2014[44]	Cross-sectional	Nursing and midwifery students	113	22.5 (3.7)	QNR	BSE: 63.2% Increasing perceived susceptibility and self-efficacy scores increases the likelihood of BSE
Bahrami, Sanandaj, 2015[14]	Cross-sectional	Females >20 years referring to the HCC_s	250	36	QNR	BSE: 13.6% CBE: 4.8% Mammography: 9.6% Main information resources (physician: 62.4%, healthcare team: 16%)
Ahmadipour, Kerman, 2016[45]	Cross-sectional	Females referring to urban HCC_s	240	31.7 (7)	QNR	BSE (monthly: 25.6%, irregular: 21.8%, never: 52.6%) CBE (every year: 8.5%, irregular: 24.8%, never: 66.7%) Mammography (every year: 5.4%, irregular: 21.6%, never: 73%)
Vahedian Shahroodi, Mashhad, 2015[17]	Cross-sectional	Females health volunteer	410	34.7 (9.4)	QNR	Sig relationship between the stages of the change model and BSE ($P<0.001$) Main information resource: physician and health care staff
Tavakoliyan, Kazeroon, 2015[16]	Cross-sectional	Females 20-65 years referring to HCC_s	300	39.55 (11.08)	QNR	BSE (regular: 12.7%, never: 48.3%) CBE (more than 5 times: 1.3%, never: 56.3%) Mammography (more than 5 times: 3%, never: 82.3%) Main information resource: Healthcare team and TV

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First author/ city/year of publication	Study design	Study population	Sample size	Mean age (SD)	Instrument	The most important findings
Jouybari, Kermanshah, 2016[46]	Cross-sectional	Females referring to urban HCC_s	116	NA	QNR	Mammography: 12.1% Predicators to undergoing Mammography: Educational level, positive BC_FH, family support, self-efficacy
Tahmasebi, Bushehr, 2016[47]	Cross-sectional	Females 20-50 years referred to HCC_s	400	27.3 (8.08)	QNR	BSE: 10.9% Predictive factors for BSE: Self-efficacy directly, awareness
Moshki, Tehran, 2016[48]	Cross-sectional	Females >50 years referred to mammography centers	601	58.9 (6.4)	QNR	BSE (regular: 15%, irregular: 69.4%, never: 15.6%) CBE (regular: 29.5%, irregular: 54.5%, never: 20%) Mammography (repeated one time: 38%) Effective factors in repeat Mammography: Physician recommendation and BSE
Mirzaei-Alavijeh, Abadan, 2016[49]	Cross-sectional	Females 35-50 years referred to HCC_s	385	39.12	QNR	BSE: 19.1% Mammography: 7.5% Predictive factors BC screening: Age, education, BC_FH, perceived severity, self-efficacy
Naghibi, Kermanshah, 2016[50]	Cross-sectional	Female high school teachers	258	38.9 (8)	QNR	BSE: 48.1% CBE: 24.8% Mammography: 9.3%
Ghahramanian, Tabriz, 2016[51]	Cross-sectional	Females referred to HCC_s	370	NA	QNR	BSE: 43% CBE: 23% Mammography: 38.2%
Aminisani, Baneh, 2016[52]	Cross-sectional	Females >40 years referred to HCC_s	561	43.64 (5.17)	QNR	Mammography: 22%
Farajzadegan, Isfahan, 2016[53]	Cross-sectional	Females with a BC_FH	162	37.6 (11.16)	QNR	One-third of the participants were in the action/maintenance stages of TTM
Shirzadi, Tabriz, 2017[54]	Cross-sectional	Females from three Iranian cities	1131	50.28 (7.93)	QNR	Mammography history: 28% Mammography adoption: 5.6% Predictors for mammography adoption: Perceived barriers, perceived benefits
Anbari, khoramabad, 2017[55]	Cross-sectional	Females 20-65 years referred to HCC_s	457	35.9 (9.7)	QNR	BSE: 10.3% CBE: 6% Mammography: 2.4%
Saadat, Tehran, 2017[56]	Survey	Female academics of TUMS	99	47.79 (8.19)	QNR	BSE: 47.5% Mammography (regular: 7%, once in 2 past years: 24.4%)
Neinavae, Karaj, 2017[57]	Cross-sectional	Females referred to Karaj HCC_s	200	35.5 (9.7)	QNR	BSE (aware and performed correctly: 48.5%)
Farzaneh, Ardabil, 2017[58]	Cross-sectional	Females aged 20-60 years	1134	NA	QNR	BSE: 36.7% CBE: 5.6% Mammography: 16.5%
Miri, Birjand, 2017[59]	Cross-sectional	Females referred to HCC_s	450	30.7 (5.2)	QNR	BSE (preaction: 75.8%, precontemplation: 32.9%, contemplation: 19.6%, preparation: 23.3%, no experience of BSE)
Monfared, Rasht, 2017[60]	Cross-sectional	Females residing in Rasht	1000	49.43 (10.18)	QNR	Mammography history: 45% Cause of screening: 68.4% checking health status Cause of not doing screening: 65.3% had no problem, and 3.4% had not enough information

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First author/ city/year of publication	Study design	Study population	Sample size	Mean age (SD)	Instrument	The most important findings
Mirzaei-Alavijeh, Kermanshah, 2018[61]	Cross-sectional	Females who referred to HCC_s	408	39.61 (8.28)	QNR	Mammography history: 13%
Moghaddam Tabrizi, Urmia, 2018[15]	Cross-sectional	Females referred to HCC_s	348	43.25 (5.36)	QNR, C/L	Mammography history (never: 12%, at least one: 88%) Main source of information: Doctors
Pirzadeh, Isfahan, 2018[9]	Cross-sectional	Female medical students of MUI	384	20.92 (1.26)	QNR	BSE (precontemplation: 42.8%, contemplation: 22%, preparation: 12.8%, action: 13.2%, maintenance: 19%) Didn't have skills for BSE: 60%
Darvishpour, Guilan, 2018[62]	Cross-sectional	Females 20-65 years living in East Guilan cities	304	NA	QNR	BSE predictors: perceived benefits, self-efficacy, and perceived barriers Mammography predictors: perceived benefits and perceived barriers
Hayati, Abadan, 2018[63]	Cross-sectional	Females >35 years employees of Abadan School of Medical Sciences	90	42.9 (5.8)	QNR	Mammography) total: 24.4%, once: 17.7%, twice or more: 6.7%)
Mahmoudabadi, Kerman, 2018[64]	Cross-sectional	Female nurses from Kerman educational hospitals	209	35.53 (8.01)	QNR	BSE: 9.1% CBE: 26.3% Mammography: 15.8%
Izanloo, Mashhad, 2018[65]	Cross-sectional	Patients referred to outpatient clinics and people >14 years in public urban areas	1469	38.8 (11.69)	QNR	Main screening methods (self-assessment: 41.6%, ultrasound: 46.4%)
Kardan-Souraki, Mazandaran, 2019[66]	Cross-sectional	Females participating in BC screening programs	1165	37.15 (8.84)	QNR	BSE: 62% CBE: 41.1% Mammography: 21.7%
Khazir, Khorramabad, 2019[67]	Cross-sectional	Females referred to HCC_s	262	49.62 (7.79)	QNR	Mammography: 30.85% Significant relationship between HBM component and mammography behavior
Naimi, Kermanshah, 2019[68]	Cross-sectional	Married females clients of eight HCC_s	334	39.75 (7.73)	QNR	BC screening adoption (precontemplation: 58.4%, contemplation: 26.9%, preparation: 3%, action: 9.6%, maintenance: 2.1%)
Nikpour, Babol, 2019[18]	Cross-sectional	Urban population under the coverage of HCC_s	800	47.63 (10.46)	QNR	BSE: 17.5% CBE: 15.3% Mammography: 21.6% Mean 5-year and lifetime risk: 0.89±0.89 and 8.87±3.84 Predicting mammography performance: The high 5-year calculated risk

HCC=Health Care Center; BC=Breast cancer; MUI=Isfahan University of Medical sciences; TUMS=Tehran University of Medical Sciences; BC_FH=Family history of breast cancer; SUMS=Shiraz University of Medical sciences; HCP=Health care provider; SU=Shiraz University; NA=Not available; QNR=Questionnaire; INTVW=Interview; C/L=Checklist; BSE=Breast self-examination; CBE=Clinical breast examination; HBM=Health belief model; TTM=Transtheoretical model; SD=Standard deviation; TV=Television

the status of mammography performance in Iran. In the current study, the range of performing of mammography between 2005 and 2020 was 1.3%–45%, while in a systematic review assessing Persian language articles of two databases between 2001 and 2010, 3%–26% of Iranian females had done mammography screening.[12] Although a study showed that the rate of screening mammography in Iran was lower than in developed countries such as the USA and the UK,[52] the results of a screening program in Saudi Arabia resulted in 27.7% of mammography achievement.[120] One of the reasons

Table 2: Effect of educational interventions on screening behavior

First author/ city/year of publication	Study design	Intervention	Study population	Sample size	Mean age (SD)	Instrument	The most important findings
HajiKazemi, Tehran, 2006[69]	CT	Health counselling	Females attending premarital health counselling program	600	21.82 (3.94)	QNR	After/before: Significant_ difference in mean_score of awareness
Yeke Fallah, Ghazvin, 2007[70]	CT	Video and verbal training	Nursing and midwifery students of QUMS	43	18	QNR	After/before: Significant increase in mean K
Saatsaz, Amol, 2009[71]	CT	In-person education	Females high school teachers	48	NA	QNR	After/before: Significant improvement of P. about BSE, CBE, mammography
Hatefnia, Tehran, 2010[72]	RCT	HBM-based education	Females>35 years	220	NA	QNR	Intervention/control: Significant improvement in mean_score of K., HBM structures and mammography behavior
Moshfeghi, Arak, 2011[73]	RCT	Media and powerpoint	Physicians	128	NA	QNR	Significant_difference in mean_score of KAP after intervention in each group No significant_difference in KAP between two methods
Hajian, Tehran, 2011[74]	RCT	Health counseling	Females with BC_FH	100	37.8 (11.7)	QNR	After/before: Significant_ difference in mean K., HBM structures, BSE in intervention group Intervention/control (BSE: 82%/62%, *P*=0.021, CBE: 40%/18%, P=0.014, Mammography: 36%/30%, *P*=0.52)
Rahmati Najar Kolaie, Tehran, 2012[75]	CT	HBM-based education	Students living in the dormitory of TU	99	21 (1.11)	QNR	After/before: Significant improvement of HBM structures
Farma, Zahedan, 2013[76]	CT	In-person education	Females guidance school teachers	240	39.4 (7.4)	QNR	Intervention/control: Significant_difference in mean-score of KAP
Ghasemi, Shahrekord, 2014[77]	RCT	In-person education	Employee females in universities of Shahrekord	50	33.5 (18)	QNR, C/L	After/before: Significant_ difference in mean-scores of KAP, performing BSE
Khalili, Lavizan, 2014[78]	CT	HBM-based education	Females referred to HCCs	144	34 (8.23)	QNR	After/before: Significant increase in mean K., HBM structures Intervention/control: Enhance the mean of K., HBM structures (*P*<0.001)
Torbaghan, Zahedan, 2014[79]	RCT	HBM-based education	Female employees of ZAUMS	130	Intervention 35.38 (8.01) Control 34.39 (8.98)	QNR	Intervention/control: Significant_difference in mean-scores of awareness, perceived susceptibility, perceived benefits, perceived barriers, *P*
Rezaeian, Isfahan, 2014[80]	RCT	Health counselling	Females>40 years	290	50.48 (6.81)	QNR	After/before: Significant. improvement means K., HBM structures Intervention/control: Significant_difference in HBM structures, health beliefs about BC and mammography Sc_Behavour

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Table 2: Contd...

First author/ city/year of publication	Study design	Intervention	Study population	Sample size	Mean age (SD)	Instrument	The most important findings
Sargazi, Zahedan, 2014[81]	RCT	TPB-based education	Females referred to the clinics	140	Intervention 31.6 (0.9) Control 32.6 (1.1)	QNR	After/before: Significant increase scores of K., A., control of perceived behavior, behavioral intention, adopting Sc_Behavior in the intervention group
Haghighi, Birjand, 2015[82]	RCT	In-person education	Employee females of BU	89	39.2 (7.3)	QNR	After/before: Significant increase in mean K., A. toward BSE and number of females who performed BSE
Absavaran, Zabol, 2015[83]	RCT	Lecture method/ cell phone method	Nurses in Zabol hospitals	105	Intervention 29.3 (4.4) Intervention 28.3 (4.4) Controll 29.1 (4.7)	QNR	After/before: Significant_ difference in mean_score KAP in both intervention groups. Increase in A., P in mobile phone group was significantly more than in the lecture group
Taymoori, Sanandaj, 2015[84]	RCT	Health counselling	Females>50 years	184	55.93 (7.80)	QNR	Intervention/control: Significant_difference in mean HBM and TPB structures and percent mammography
Sadeghi, Sirjan, 2015[85]	RCT	BASNEF model-based education	Females 20–40 years attending to HCCs	200	Intervention 35.86 (2.53) Control 36.12 (2.24)	QNR	After/before: K. significantly increased in both groups. A., *P*., enabling factors increased in Intervention Intervention/control: Significant_difference in mean_scores of KAP, subjective norms, and enabling factors
Ghahremani, Shiraz, 2016[86]	RCT	Self-care education	Females referred to HCCs	168	Intervention 35.3 (7.5) Control 36.6 (8.5)	QNR	Intervention/control: Significant_difference in mean_scores of TTM structures and BSE behavior (P<0.001)
Mirzaii, Mashhad, 2016[87]	RCT	SHEP-model-based education	All the health volunteers and females covered by two urban health centers	120	NA	QNR, C/L	Intervention/control: Significant_difference in mean_scores of A. and BSE (*P*<0.001)
Parsa, Hamedan, 2016[88]	RCT	Educational counselling	Females referred to HCCs	150	Intervention 47.64 (7.03) Control 46.6 (8.68)	QNR, C/L	Intervention/control: Significant_difference in mean_scores of perceived benefits, perceived barriers, self-efficacy, health motivations, K. and BSE practice
Khiyali, Fasa, 2017[89]	RCT	HBM-based education	Healthy females	92	Intervention 30.39 (8.19) Control 28.23 (7.3)	QNR	Intervention/control: Significant_difference in mean_scores of K., HBM structures and BSE behavior (*P*<0.001)
Nahidi, Abadeh, 2017[90]	RCT	HBM-based education	Females 30–39 years referred to HCCs	144	Intervention 38.5 Control 39.44	QNR	Intervention/control: Significant_difference in mean_scores of awareness., perceived susceptibility and performance Significant_difference in mean_score of performance in BSE (*P*<0.001)

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Table 2: Contd...

First author/ city/year of publication	Study design	Intervention	Study population	Sample size	Mean age (SD)	Instrument	The most important findings
Nasiriani, Yazd, 2017[91]	Randomized field-trial	Telephone counseling and education	Females with BC_FH	90	Intervention 45.8 (7.51) Control 46.77 (8)	QNR	Intervention/control: Significant_difference in mammography performing (77.8%/24.4%) After/before: Significant_ difference in mammography performing in the intervention group. No significant_difference in mammography performing in the control group
Savabi-Esfahani, Baharestan, 2017[92]	RCT	Role-playing, lecture	Females enrolled in community cultural centers	314	45.53 (10.99)	QNR	After/before: Significant_ difference in mean_scores of K. about BC and screening in both educational groups Role playgroup/lecture group: Mean_score of K. (94.5/88.8)
Shahbazi, Borujen, 2017[93]	RCT	Direct and indirect education	Nursing and midwifery personnel in Valiasr Hospital	89	31.95 (6.57)	QNR	After/before: Significant. increase scores of K., in both groups, A. increased only indirect group Direct training versus indirect training: Significant_difference in K. and A. about BSE
Matlabi, Gonabad, 2018[94]	Randomized field-trial	In-person education	Married Females 20–49 years	140	37.27 (6.69)	QNR	Intervention/ control (immediately after: Action 21.4% versus 22.9%, *P*=0.001, maintenance 40% versus 24.3%, *P*=0.001, 3 months after: Action 25.7% versus 24.3%, *P*=0.001, maintenance 57.1% versus 24.3%, *P*=0.001)
Ghaffari, Isfahan, 2019[95]	RCT	HBM-based education	Health volunteers of HCCs	480	NA	QNR, C/L	Intervention/control: Immediately and two months after: Significant_difference in means of K., HBM structures related to BSE and mammography, BSE skill. No significant_difference in BSE behavior and mammography
Ghaffari, Karaj, 2018[96]	RCT	Education based on the integrated behavioral model	Females who were attended to HCCs	138	NA	QNR	Intervention/control: Immediately and two months after: Significant_ difference in mean_score of K. and all structures except the perceived benefits of mammography and mammography behavior (*P*<0.001)
Masoudiyekta, Dezful, 2018[97]	RCT	HBM-based education	Females 20–59 years referred to HCCs	226	39.75 (9.05)	QNR	Intervention/control: Significant increase rate of BSE and mammography, mean_scores of K. and HBM structures three months after (*P*<0.001). No significant_difference in the score of CBE

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Table 2: Contd...

First author/ city/year of publication	Study design	Intervention	Study population	Sample size	Mean age (SD)	Instrument	The most important findings
Mirmoammadi, Hamadan, 2018[98]	RCT	HBM-based consultation	Females>40 years attending Hamadan HCCs	150	Intervention 64.47 (7.3) Control 60.46 (8.8)	QNR	Intervention/ control (significant_difference in mammography: 49.3%/20%, CBE: 52%/28%, mean_scores of K., HBM constructs except for susceptibility and severity)
Naserian, Mahshahr, 2018[99]	RCT	Short messages and group training	Females 40–60 years referred to HCCs	210	Intervention 48.1 (5.8) Intervention 48.7 (5.8)	QNR	After/before: Significant. increase in mean_score K. In each group (P=0.001), no significant increase between groups (P=0.061) Group training was better in BSE (P<0.001) SMS group was better in CBE (P=0.02)
Mashhod, Tehran, 2018[100]	RCT	HBM-based education	Females referred to HCCs	94	Intervention 35 Control 32.5	QNR	After/before: Significant_ difference in mean_scores of HBM structures except for perceived benefits in the experimental group Intervention/control: Significant_difference in mean_scores o K., HBM structures except for perceived benefits, BSE performance
Fathollahi-Dehkordi, Isfahan, 2018[101]	RCT	Health counselling	Females>20 years with BC_FH	107	Intervention 36.04 (10.90) Control 35.58 (10.22)	QNR	Intervention/control: Significant_differencein screening practice. Time factor and time-group interaction affected K.and HBM structures significantly Most females in the action stage of CBE vesrsus in the contemplation stage (P<0.001)
Alizadeh Sabeg, Abish Ahmad, 2019[102]	RCT	Health counselling	Females 40–69 years	60	Intervention 47.6 (5.7) Control 48.2 (5.8)	QNR	Intervention/control: Significant_difference in mean_scores of total K. and K. about symptoms, risk factors, age-related and lifetime risk, BC screening, frequency of BSE 2 months after
Termeh Zonouzy, Tehran, 2019[103]	RCT	Intervention based on fear appeals using the EPPM model	Females>40 years with no BC_FH	600	53.2 (9.45)	QNR	After/before: Significant_ difference in mean_scores of A., behavioral intention in the intervention group Intervention/control: Significant_difference in mean_scores of A., behavioral intention
Rokhforouz, Rafsanjan, 2019[104]	RCT	In-person education	Health volunteers working in HCCs in Rafsanjan	92	46.84 (10.67)	QNR, C/L	Intervention/control: Significant_differencef in movement in the stages of change, mean scores of HBM structures except for perceived barriers

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Table 2: Contd...

First author/ city/year of publication	Study design	Intervention	Study population	Sample size	Mean age (SD)	Instrument	The most important findings
Molaei-Zardanjani, Isfahan, 2019[105]	RCT	Individual and peer education	Females referred to selected HCCs	100	NA	QNR	After/before: Significant improvement in A. toward behavior, subjective norms, perceived behavioral control, intention behavior in both groups Mean_score of A. in the individual education group was higher (P<0.05) Mean_score of subjective norms in the peer education group was higher (P<0.05) No significant_difference in mean_scores of perceived behavioral control constructs and behavioral intention between groups (P>0.05)

CT=Computed tomography; RCT=Randomised clinical trial; HBM=Health belief model; TPB=Theory of planned behavior; BASNEF=Beliefs, attitudes, subjective norms, and enabling factors; SHEP=Systematic comprehensive health education and promotion; EPPM=Extended parallel process model; HCC=Health Care Center; BU=Birjand University; BC_FH=Family history of breast cancer; ZAUMS=Zahedan University of Medical Sciences; TU=Tehran University; QUMS=Qazvin University of Medical Sciences; NA=Not available; QNR=Questionnaire; C/L=Checklist; BSE=Breast self-examination; CBE=Clinical breast examination; KAP=Knowledge/attitude/practice; BC=Breast cancer; TTM=Transtheoretical model; SMS=Short Message Service

for this difference may be the lack of a BC screening program in Iran; hence, the results reported were extracted from various limited studies with high heterogeneity regarding the study population, sample size, and design. On the other hand, some research has revealed that mammography is an expensive modality and not a cost-effective method for BC screening in Iran.[6,109] Further, studies focusing on other screen methods are suggested.

BSE and CBE are considered as more available, low-cost, and low-technical requirement screening strategies. This study showed that the performance of BSE and CBE ranged between 0%–79.4% and 4.1%–41.1%, respectively, and 30.9%–60% of females did not have appropriate skills to do BSE. Similar to our results, a study on Arab females demonstrated that 69% of subjects did not know how to do BSE.[121] According to the current review, the low self-efficacy of females in applying screening behaviors may affect BSE achievement.[44] Self-efficacy is one of the most important predictors of screening behaviors,[43,44,46,47] and the performance of BSE in females with higher self-efficacy is 1.17 times more than others.[35] Therefore, it can be concluded that by improving females' self-efficacy, their skills in screening behaviors will also improve. Hence, education about BC screening methods is worthy of being insisted on by the health system. It may be a more logical strategy for low- and middle-income countries in which breast awareness is more beneficial, too. In conclusion, since there is no national study to demonstrate accurate indicators, most of the current results have been reported from small and limited studies, which cause a wide range of affectivity. It seems that more accurate epidemiologic studies are necessary to indicate the frequency of BSE and CBE achievement in Iranian women.

Effect of educational interventions on screening behavior

The effect of various educational modalities on screening behaviors has been studied in different Iranian researches. The in-person method was used by most studies, except for two studies that used telephone counseling. Most of them showed that education effectively enhanced females' knowledge, attitude, practice of screening behaviors. Still, no study compared in-person with virtual education to reveal which method is more effective in Iran. Given the growth of using the Internet, novel technologies such s online social networks, smartphone applications, and virtual learning can be cost-effective. Some features of this technology, such as more availability, low_price, and offering a more attractive platform, make it a helpful modality for future research studies.

In this scoping review, most educational interventions resulted in satisfied effects.[70,73,76,77] It may show that the health system's educational modalities for BC prevention are more important than the training methods. Selecting a suitable educational method facilitates access to defined objectives, and it depends on many factors, such as socioeconomic status, health priorities, and cancer preventive policies.[122] If early detection of BC is a priority of the health system of Iran, indeed, education programs should be organized as one of the essential correlated factors. On the other hand, promoting the population's awareness induces some diagnostic and treatment demands for BC detection. If we do not provide needed requirements, our

Table 3: The statistical indicators of breast cancer screening

First author/ city/year of publication	Study design	Study population	Sample size	Mean age (SD)	Reported index	The most important findings
Taymoori, Sanandaj, 2009[112]	Cross-sectional	Employed females in governmental institutes and departments	606	37.08 (9.81)	Instrument	Developing and validating CHBMS to assess Iranian females' beliefs related to BC and screening
Barfar, 10 cities of Iran, 2014[109]	Cost-effectiveness	Females >35 years	26,606	NA	Detection rate	Detection rate: 24 per 100,000 The cost per cancer detected:$15,742 False-positive detection rate: 7.5%
Miller, Yazd, 2015[106]	Field-trial	Females residing in urban areas	12,602	NA	Response rate to BSE + CBE screening of BC	Response rate: Data collection at patients' homes in both groups: 100% Visiting HCC in the intervention group: 84.5%
Jafari, Kerman, 2015[106]	Cross-sectional	Females 35-69 years	15,794	NA	Participation rate	Participation rate: Urban region 3.8%, villages and towns 16.34%
Saghatchi, Zanjan, 2015[107]	Cross-sectional	Females admitted to the mammography center of Mousavi Hospital	526	44.3	Detection rate Abnormality rate	Screening mammography rate: 27.4% Diagnostic sonography rate: 26% Biopsy rate: 1.4% Detection rate: 2.3% Abnormality rate: 33%
Khazaee_Pool, Tehran, 2016[113]	Cross-sectional	Females referred to TUMS HCC_s	585	41.25 (6.34)	Instrument	Developing and validating an instrument to identify factors affecting females' BC prevention behaviors named ASSISTS
Aminisani, Baneh, 2016[52]	Cross-sectional	Females >40 years referred to HCC_s	561	43.64 (5.17)	Participation rate	Participation rate in mammography program: 16.8% The lowest level of participation: Females >60 years, illiterate, postmenopausal
Shafaie, Tabriz, 2016[110]	Cross-sectional	Females referred for screening to BC clinic of Behbood Hospital	5000	37.45 (10.81)	Abnormal finding rate	After CBE: 759 abnormal cases After 996 sonography: 40 abnormal cases After 636 mammography: 183 abnormal cases After 14 FNA: One cancer case (7.1%)
Moshki, Sanandaj, 2017[114]	Cross-sectional	Females referred to HCC_s in Sanandaj	482	47.35 (9.8)	Instrument	A valid instrument for mammography self-efficacy and fear of BC scales in Iranian women
Alikhassi, Tehran, 2017[108]	Longitudinal	Females referred to a university hospital	9395	49.84 (9.19)	Recall rate, detection rate of opportunistic screening mammography	Recall rate: total: 24.7%, first mammography: 29%, subsequent Mammography: 22%, micro-calcification: 21.1%, mass: 49.3%, distortion: 34.8%, asymmetry: 48.1% Cancer detection rate: 8.5 per 1000 mammography
Poorolajal, Tehran, 2018[115]	Cross-sectional	Native Iranian women	1422	Intervention 48.37 (10.79) Control 42.37 (9.84)	Instrument	Age alone is not a strong predictor of BC The chart: facilitates making decisions on the threshold for recommending screening mammography, detects high-risk individuals
Khazaee_Pool, Sanandaj, 2018[116]	Cross-sectional	Females referred to HCC_s in Sanandaj	434	48.12 (8.91)	Instrument	Response rate: 91% A valid instrument: MSS
Pourhaji, Tehran, 2018[117]	Cross-sectional	Females >40 years referred to HCCs of SBMU	200	Median (45.6)	Model	A valid instrument: BSEBPS
Heidari, Isfahan, 2018[118]	Cross-sectional	Persian language females	1078	36.5 (11.65)	Instrument	Transcultural adaptation and validation of an instrument: BCAM

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Table 3: Contd...

First author/ city/year of publication	Study design	Study population	Sample size	Mean age (SD)	Reported index	The most important findings
Fathollahi_ Dehkord, Isfahan, 2018[101]	Clinical-trial	Females with a BC_FH	98	Intervention 36.04 (10.90) Control 35.58 (10.22)	Response rate to CBE screening	Response rate: 81%
Khazaee-Pool, Tehran, 2018[119]	Cross-sectional	Females 30-75 years referred to HCCs of TUMS	260	45.12 (5.92)	Model	Seven constructs of model: Perceived social support, attitude, motivation, self-efficacy, information seeking, stress management, self-care A, motivation, self-efficacy, information seeking, social support influence self-care behavior and stress management
Saei Ghare Naz, Tehran, 2019[111]	Cross-sectional	Females referred to HCCs of SBMU	325	34.82 (11.73)	BCSB and MHLC score	BCSB: 40.72±10.41 MHLC: 67.78±17.67

SD=Standard deviation; TUMS=Tehran University of Medical Sciences; HCC=Health Care Center; BC=Breast cancer; SBMU=Shahid Beheshti Medical University; BC_FH=Family history of breast cancer; BSE=Breast self-examination; CBE=Clinical breast examination; NA=Not available; BCSB=Breast cancer screening belief; MHLC=Multidimensional health locus of control; CHBMS=Champion Health Belief Model Scale; FNA=Fine-needle aspiration; MSS=Mammography social support; BSEBPS=Breast Self-Examination Behavior Predicting Scale; BCAM=Breast cancer awareness measure

health policy goal won't be reached. Related studies in Iran have focused on identifying the educational needs of the specified Iranian population with different races, cultures, incomes, etc.[77,79,82,84,95,96] Hence, they cannot be generalized to the total population of Iran. Thus, implementing national research with a more potent methodology and stratified demographic characteristics is suggested.

The statistical indicators of BC screening

The statistical indicators are one of the most important principles for health policymaking to evaluate the cost-effectiveness of an intervention. They include abnormal rate, detection rate, recall rate, participation rate, etc.[123] The BC detection rate in three studies was reported with a different study population. In one of the studies achieved in Zanjan, a city of Iran, 526 women admitted to the mammography center were assessed. The detection rate had been reported by 2.3% of 526 screened patients.[107] Another research was conducted at a tertiary referral university hospital, and 9395 digital mammographies were performed, and they detected 8.5 cancer patients in 1000 women who underwent nondiagnostic mammography.[108] The third study was conducted in ten cities of Iran in which over 26,000 women aged 35 and higher with low socioeconomic status were evaluated. The results showed a detection rate of 24 per 100000 females.[109] Although all three studies have reported a detection rate, differences in methodology make them non-integral. The detection rates of invasive BC based on accurate population screening are targeted at >0.5, ≥2.7, and ≥5 per 1000 screens in Canada, the United Kingdom, and Australia, respectively. Also, the detection rates for *in situ* BC in the United Kingdom and Australia are considered ≥0.4 and ≥1.2 per 1000 screens, respectively.[123] The detection rate in Iran has been reported higher than in European countries and even higher than 2.7 in Asian counterpart countries.[124] One of the reasons for this difference is how females were evaluated, which means the reported statistics indicators in Iran were not extracted from a national study and some of them are just the result of limited research in a specific population. The studied population, the recruited sample size, or study design can affect these indices. On the other hand, the limitation of detection rates estimation factors like workforce skill, sensitivity or specificity of equipment, and essential resources have not been appropriately assessed in Iranian studies. Hence, it seems that the evaluation of screening effectiveness in randomized controlled clinical trials at the national level is necessary to reach more accurate information.

Another statistic indicator is the abnormal call rate, which is vital to assessing mammography image quality and interoperation. It is defined as a percentage of abnormal mammography per number of screens.[123] In Iran, it has been reported 28.77% and 33%.[107,110] The abnormal call rate for the initial screen in Europe is considered <7, and in all of the countries like Canada, the United Kingdom, Australia, and New Zealand are considered <10.[123] This indicator is related to the recall rate. Recall rate indicates if screening mammography resulted in a recommendation for further imaging or surgical/clinical visit because of an abnormality on the screening exam.[125] The European Guidelines and the American College of Radiology considered recall rates <7% and <10%, respectively, as acceptable recall rates.[125] A high abnormal rate induces a high recall rate and increases unnecessary tests and false positives results.[123] According to our result, the recall rate in Iran was 24.7% in total, and for the first and subsequent mammography was 29% and 22%, respectively.[113] Similar to the previously reported indices,

the abnormal call rate and recall rate in Iran has not been extracted from a national screening study. As a result, to determine whether our country needs a BC screening program or not, these indicators must be estimated in the standard and targeted studies, and it is beneficial to be considered as a research priority in the health policy system of Iran.

The participation rate represents the percentage of people who participate in a screening program and can be affected by acceptability, accessibility, promotion of screening, and the capacity of the plan.[123] This index showed 16.8%, 20% in urban areas, and 10% in rural areas of Iran.[52,107] The participation rate in screening mammography in Canada, the United Kingdom, Australia, and New Zealand is estimated at ≥70%. The comparison between statistics shows a low participation rate among Iranian women, which can have consequences such as reducing the cost-effectiveness of screening programs. It may be due to the low level of awareness in Iranian females, which impacts their attitude toward the importance of BC prevention. Females' attitudes can be reformed by cooperating with mass media such as radio, television, or social networks with the health system.

On the other hand, most of the screening costs are paid by patients themselves and may affect their acceptability of some screening strategies and lowers this index compared to the other countries. Some studies have shown that mammography screening is not a cost-effective intervention in Iran.[6,109] Hence, most insurances support the cost of diagnostic modalities, and the screening tests should be paid out of pocket. Proving more insurance coverage or accessibility facilities by the health system of Iran can improve the participation rate index.

In this review, we did not find any study for evaluating the BSE or CBE cost-effectiveness in the Iranian population. Considering the importance of those screening methods in limited resources countries, establishing a comparative analysis will provide helpful evidence for policy-makers for early detection of BC in Iran.

CONCLUSION AND RECOMMENDATIONS

This scoping review demonstrated that we have many unknown facts about BC early detection in Iran. It is not clear which strategy is the best. Establishing the national level studies with a standard framework may present screening indices more accurately.

Implications of the findings for research

The necessity of a national screening program in a country with a low incidence of BC, presenting a proper educational method for increasing women's awareness, and estimating screening indices can be the priorities of future Iranian researches.

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Conflicts of interest

There are no conflicts of interest.

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APPENDIX 1: SEARCH STRATEGY

Details of data sources and methodology of the big project between 2005-2015 time horizon have been presented in another article (13). The same methodology was extended to articles published up to 2020. The current study consists of all articles published from January 2005 to 2020. English online electronic databases of Web of Science, PubMed, and Scopus, and Persian databases of SID and IranMedex were used. English search formula was "BC" OR "breast carcinoma" OR "breast tumor" OR "breast neoplasm" AND Iran. Persian search formula was a combination of Iran with the words of سرطان سینه، سرطان پستان، Breast tumor, BC, Breast carcinoma, and Breast neoplasm.

APPENDIX 2

After reviewing the title, 522 items (225 English and 297 Persian) were included by deleting unrelated studies and duplicated titles, abstracts, and full text of articles. The results of 246 articles in the field of screening strategies and indicators were considered eligible for this review. After assessing full texts, 136 articles were excluded, and 110 studies consisting of 81 English and 29 Persian were evaluated.

Reasons of exclusion were irrelevancy (53 articles), just abstract presentation (7 articles), no relation to Iran population (8 articles), letter to editor (3 articles), review article (2 articles), BC population study (4 articles), inaccessible full paper (1 article), qualitative study (3 articles), and duplication (55 articles).

Prisma Checklist

Section	Item	Prisma-ScR checklist item	Reported on page#
Title			
Title	1	Identify the report as a scoping review	1
Abstract			
Structured summary	2	Provide a structured summary that includes (as applicable): Background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives	1
Introduction			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach	2
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives	3
Methods			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number	NA
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale	3
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed	4
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated	4
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review	4
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators	7

Contd...

Prisma Checklist

Section	Item	Prisma-ScR checklist item	Reported on page#
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made	5
Critical appraisal of individual sources of evidence[§]	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate)	NA
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted	5,6
Results			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram	8
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations	8
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12)	NA
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives	10–22
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives	10–22
Discussion			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups	23–27
Limitations	20	Discuss the limitations of the scoping review process	NA
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps	28
Funding			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review	30

NA=Not available

Appendix 3: Data extraction instrument

Section	Description
Scoping review details	
Scoping review title	Status of breast cancer screening strategies and indicators in Iran: A scoping review
Review objective/s	Providing useful data for policy-makers to implement a proper strategy to control the disease
Review question/s	What are the results of articles related to breast cancer screening strategies and indicators in Iran in the past 15 years?
Inclusion/exclusion criteria	
Population	Iranian females
Concept	Prevention of breast cancer
Context	Screening behaviors, educational interventions, statistical indicators
Types of evidence source	All of the published articles on the prevention of breast cancer in Iran
Evidence source details and characteristics	
Citation details (e.g., author/s, date, title, journal, volume, issue, pages)	They have been presented in tables
Country	Iran
Context	Screening behavior, educational interventions, statistical indicators
Participants (details e.g., age/sex and number)	They have been presented in tables
Details/results extracted from the source of evidence (in relation to the concept of the scoping review)	
Screening behaviors	Table 1
Educational interventions	Table 2
Statistical indicators	Table 3