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Breast Cancer Screening Strategies and Indicators in Iran, A Systematic Review

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Abstract

Background

A lot of individual health behaviors and multi-faceted approached have been introduced for breast cancer early diagnosis and prevention. This systematic review aimed to investigate the status of Breast cancer preventive behaviors and screening indicators among Iranian women.

Methods

In this study, two reviewers included English and Persian articles about breast cancer screening modalities and its indicators in Iran from January 2005 to 2020. English electronic databases of Web of Science, PubMed and Scopus and Persian databases of SID and IranMedex were used. The critical information of articles was extracted and classified to different categories according to the studied outcomes.

Results

A total of 246 articles were assessed which 129 of them were excluded and 114 studies were processed for further evaluation. Performing BSE, CBE, and Mammo in Iranian women had been reported 0- 79.4%, 4.1%-41.1%, and 1.3%-45%, respectively. All of the educational interventions had increased the knowledge, attitude and practice of participants in performing the screening behaviors. The most important screening indicators included participation rate (3.8% to 16.8%), detection rate (0.23 to 8.5 per 1000), abnormal call rate (28.77% to 33%), and recall rate (24.7%).

Conclusion

This systematic review demonstrated a lot of heterogeneity in population and design of researches about breast cancer 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 big studies at the national level in a standard framework are advised

Background

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 breast cancer patients was 12802, and the Age Standardized Incidence Rate (ASR) was 32.63 per 100,000. So, the age distribution of breast cancer 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 breast cancer each year (2, 3).

Approaches to reduce the global burden of cancer 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 to 49 years (5). The findings confirmed that the use of screening methods was low in Iranian women (2), and there is no systematic screening strategy for breast cancer in Iran (6).

Screening methods are mammography, Breast self- examination (BSE), and Clinical breast examination (CBE) (7). Although mammography 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). Results of the previous studies showed almost 60% of females did not know how to perform BSE or didn't have the necessary skills to do it (9-11). CBE is considered a low-cost method with a broader implement 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 useful perspective for future research to establish efficient services for timely diagnosis and control of the disease. So, this systematic 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.

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. Prevention subgroup was categorized into two themes, screening modalities and indicators, and prevention behaviors and its barriers.

Data Sources:

Details of data sources and methodology of this 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 □□□□□□ □□□□□ □□□□□ □□□□□ Breast tumor, BC, Breast carcinoma, and Breast neoplasm. Totally 7478 studies consisting of 4893 English and 2585 Persian abstracts were included in this review.

Study 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. In this step, 949 abstracts included in the prevention subgroup which classified into preventive behaviors, screening barriers, cause of delay, observational screening studies, interventional modalities for early detection, and methodological indicators. Some of the articles were specified to more than one of the categories. By deleting unrelated studies and duplicated title, abstract and full text of articles, a total of 522 items (225 English and 297 Persian) were included in prevention subgroup. The results of 246 articles about observational and interventional modalities for early detection and methodological indicators of screening were evaluated in the current review. The other categories will be published in a different article.

Data Extraction:

The research team downloaded the full texts of the abstracts. In some occasions, which the full texts were not available, a letter was sent to the author to take the necessary information. Two reviewers critically evaluated the selected articles by a checklist. If there were any disagreement, they discussed and decided about the eligibility of the studies.

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 datasheet was general information about the title, the place of study, article year, journal name and publication year. The second part included methodological information consisting of study design, sample size, studied population, intervention modality, and measurement tools. Finally, the third part of it composed of outcome measurements, such as performance of the screening method, effect of interventions, recall 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 study was to demonstrate the distribution map 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 abbreviation, which stands for "Not Assigned".

Results

In total, 246 articles were considered as eligible ones for study in screening strategies. In the evaluated papers, 132 articles were excluded from the systematic review and 114 studies consisting of 84 English, and 30 Persian were included. It should be noted that the results of the two articles have been presented in two tables jointly. Reasons of exclusion was irrelevancy (52 articles), just abstract presentation (7 articles), no relation to Iran population (7 articles), forbidden to be published in the systematic review (1 article), letter to editor (3 articles), review article (2 articles), breast cancer population study (4 articles), inaccessible full paper (1

article) and duplication (55 articles). The reason for duplications in this phase was publishing an article in either Persian and English language or publishing an article in two or more journals.

Studies reviewed were classified into three categories according to their main themes, including observational (61 articles), interventional (38 articles), and statistical indicators (17 articles). The extracted results of the articles are as follows:

Observational studies of BC screening:

Among 61 articles of table 1, 56 items were cross-sectional, 3 items were qualitative, and 2 items were survey studies. Most of the studied populations were females referred to HCCs. Some factors influencing on screening behaviors consisted of HBM components, fear, proactive coping, state of mind and advocacy, educational level, positive BC_FH, 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 Mammo had been performed in 1.3%-45% of females. Results of three studies showed 52.9%, 30.9%, and 60% of females, did not know how to perform BSE or didn't have the necessary skills to do it (9-11). The mean of 5-year and lifetime BC risk perception was calculated 0.89 ±0.89 and 8.87 ±3.84, respectively (18). It was demonstrated that a higher 5-year risk perception had more predictive power for performing Mammo, while it did not predict achieving BSE or CBE.

Table 1: Observational Studies of BC screening

No	First author/ City/ Year of publication	Study Design	Study Population	Sample Size	Mean Age (SD)	Instrument	The Most Important Findings
1	Valizadeh, Tabriz, 2006 (19)	Cross-Sectional	Nurses in 21 therapeutic centers	420	NA	QNR	BSE: 70.2%. Frequency of BSE: 39% every two months and more.
2	Aghababaii, Hamedan, 2006 (20)	Cross-Sectional	Female nursing and midwifery students	68	NA	QNR	BSE (total: 79.4%, regular: 29.4 %)
3	Abbaszadeh, Kerman, 2007 (21)	Cross-Sectional	Females >35Y_s	296	NA	QNR	Total HBM scores in Mammo group > the group without Mammo.
4	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% Mammo history: 1.3%
5	Simi, Shiraz, 2009 (10)	Cross-Sectional	Females 25–54Y_s referred to Shiraz National Iranian 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%)
6	Farshbaf 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% Mammo: 3.3%
7	SalimiPormehr, Ardebil, 2010 (24)	Cross-Sectional	Females referred to HCC_s	300	29(8)	QNR	BSE: 4% CBE: 4.7% Mammo: 3.7%
8	Alavi, Mashhad, 2010 (25)	Cross-Sectional	Gynecologic specialist and residents	124	43.1	QNR	BSE: Normal group (regular: 33%, irregular: 44%, never: 23%) High-risk group (regular: 46.7%, irregular: 53.3%) Mammo (normal group: 11.8%, high risk group: 27.1%)
9	Sultan Ahmadi, Kerman, 2010 (26)	Cross-Sectional	Females referred to HCC_s	200	30.60(7.89)	QNR	BSE: 22.5% CBE: 21.5%.
10	Noroozi, Bushehr,	Cross-Sectional	Females working in public places of Bushehr	388	34.32(10.66)	QNR	BSE (total: 37.1%, regular: 7.5%) Mammo: 14.3%

	2011 (27)						CBE: 5.9%
11	Hasani, Bandarabas, 2011 (28)	Cross-Sectional	Females referred to HCC_s	240	37.2(6.1)	QNR	BSE (total: 31.7%, regular: 7.1%)
12	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%)
13	Abu Samah, Tehran, 2012 (29)	Cross-Sectional	Asymptomatic females 35-69Y_s	400	NA	QNR	Mammo: 21.5%
14	Harirchi, Semnan and Khorasan, 2012 (30)	Cross-Sectional	Females >30Y_s	770	46.91(13.3)	QNR	Risk of not performing BSE, CBE, Mammo for illiterate females were respectively 4.56, 2.51, 3.14, times more than literate females.
15	Aflakseir, Shiraz, 2012 (31)	Cross-Sectional	Female staff at SUMS & SU	113	48(8.02)	QNR	BSE: 51% Mammo: 21%
16	Moodi, Isfahan, 2012 (32)	Survey	Females > 40Y_s	384	52.24(8.2)	INTVW, QNR	Mammo history: 44.3%
17	Kadivar, Tehran, 2012 (33)	Cross-Sectional	Female physicians and female non-healthcare personnel	196	Physicians: 46.06(8.0) non-healthcare personnel: 36.97(9.38)	QNR	BSE (Physicians: 37.6 %, Non-healthcare personnel: 26.1 %) CBE (Physicians: 31.25%, Non-healthcare personnel: 27.59%) Mammo (Physicians: 18.75%, Non-healthcare personnel: 17.24%)
18	Fouladi, Ardabil, 2013 (34)	Cross-Sectional	Females referred to HCC_s	380	38.12(6.7)	QNR	BSE: 27% Mammo: 6.8%
19	Pirasteh, Tehran, 2013 (35)	Cross-Sectional	Married females referring to HCC_s	302	NA	QNR	BSE in females with high self-efficacy was 1.17 times more than other females.
20	Asgharnia, Rasht, 2013 (36)	Cross-Sectional	Females referring to Al-Zahra hospital	400	48.07(6.44)	QNR	BSE: 43.8% Mammo: 23.2%
21	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%)

22	Hajian-Tilaki, Babol, 2014 (38)	Cross-Sectional	Females aged 18-64Y_s	500	31.2(9.4)	INTVW, QNR	BSE: 38.4% CBE: 25.2% Mammo: 12%
23	Mokhtary, Tabriz, 2014 (39)	Cross-Sectional	Female HCP of Tabriz health centers	196	37.01(7.54)	QNR	BSE: 73.2% CBE: 10.7% Mammo 26.9%
24	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%) Mammo (history: 7%, intention for doing in future: 72.1%)
25	Shiryazdi, Yazd, 2014 (41)	Cross-Sectional	Female health care workers	441	34.7(13.7)	QNR	BSE (total: 41.9%, regular: 14.9%) Mammo: 10.6%
26	Ghodsi, Hamedan, 2014 (42)	Cross-Sectional	Females >35Y_s	358	NA	QNR, C/L	Performance: BSE 14.8%, 9.4% regularly, Mammo 25.84%.
27	Taymoori, Sanandaj, 2014 (43)	Cross-Sectional	Females >40Y_s referring to HCC_s	593	56.84(5.04)	QNR	Mammo: 10.5% Most effective factors on Mammo: Self-efficacy and perceived susceptibility.
28	Khazaee-Pool, Tehran, 2014 (44)	Qualitative	Females >30Ys referring to HCC_s of TUMS	24	NA	INTVW	Influencing factors to practice preventive behavior: increasing awareness, positive attitudes, stronger motivational factors, fewer barriers.
29	Momenyan, Qom, 2014 (45)	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.
30	Bahrami, Sanandaj, 2015(14)	Cross-Sectional	Females >20Y_s referring to the HCC_s	250	36	QNR	BSE: 13.6% CBE: 4.8% Mammo: 9.6% Main information resources (physician: 62.4%, healthcare team: 16%)
31	Ahmadipour, Kerman, 2015 (46)	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%)

							Mammo (every year: 5.4%, irregular: 21.6%, never: 73%)
32	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.
33	Tavakoliyan, Kazeroon, 2015 (16)	Cross-Sectional	Females 20-65Y_s 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%) Mammo (more than 5 times: 3%, never: 82.3%) Main information resource: healthcare team and TV.
34	Jouybari, Kermanshah, 2016 (47)	Cross-Sectional	Females referring to urban HCC_s	116	NA	QNR	Mammo: 12.1 % Predicators to undergoing Mammo: educational level, positive BC_FH, family support, self-efficacy.
35	Tahmasebi, Bushehr, 2016 (48)	Cross-Sectional	Females 20-50Y_s referred to HCC_s	400	27.3(8.08)	QNR	BSE: 10.9% Predictive factors for BSE: self-efficacy directly, awareness.
36	Moshki, Tehran, 2016 (49)	Cross-Sectional	Females >50Y_s referred to Mammo 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%) Mammo (repeated one time: 38%) Effective factors on repeat Mammo: physician recommendation and BSE.
37	Mirzaei-Alavijeh, Abadan, 2016 (50)	Cross-Sectional	Females 35-50Y_s referred to HCC_s	385	39.12	QNR	BSE: 19.1% Mammo: 7.5% Predictive factors BC screening: age, education, BC_FH, perceived severity, self-efficacy
38	Naghibi, Kermanshah, 2016 (51)	Cross-Sectional	Female high school teachers	258	38.9(8)	QNR	BSE: 48.1% CBE: 24.8% Mammo: 9.3%
39	Ghahramanian,	Cross-	Females referred to	370	NA	QNR	BSE: 43%

	Tabriz, 2016 (52)	Sectional	HCC_s				CBE: 23% Mammo: 38.2%
40	Aminisani, Baneh, 2016 (53)	Cross-Sectional	Females >40Y_s referred to HCC_s	561	43.64(5.17)	QNR	Mammo: 22%
41	Farajzadegan, Isfahan, 2016 (54)	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.
42	Shirzadi, Tabriz, 2017 (55)	Cross-Sectional	Females from three Iranian cities	1131	50.28(7.93)	QNR	Mammo history: 28% Mammo adoption: 5.6% Predictors for Mammo adoption: perceived barriers, perceived benefits.
43	Anbary, khoramabad, 2017(56)	Cross-Sectional	Females 20-65Y_s referred to HCC_s	457	35.9(9.7)	QNR	BSE: 10.3% CBE: 6% Mammo: 2.4%
44	Saadat, Tehran, 2017 (57)	Survey	Female academics of TUMS	99	47.79(8.19)	QNR	BSE: 47.5% Mammo (regular: 7%, once in 2 past years: 24.4%)
45	Neinavae, Karaj, 2017 (58)	Cross-Sectional	Females referred to Karaj HCC_s	200	35.5(9.7)	QNR	BSE(aware and performed correctly: 48.5%)
46	Farzaneh, Ardabil, 2017 (59)	Cross-Sectional	Females aged 20-60Y_s	1134	NA	QNR	BSE: 36.7% CBE: 5.6% Mammo: 16.5%
47	Miri, Birjand, 2017 (60)	Cross-Sectional	Females referred to HCC_s	450	30.7(5.2)	QNR	BSE (pre-action: 75.8%, pre-contemplation: 32.9%, contemplation: 19.6%, preparation: 23.3%, no experience of BSE)
48	Monfared, Rasht, 2017 (61)	Cross-Sectional	Females residing in Rasht	1000	49.43(10.18)	QNR	Mammo History: 45% Cause of screening: 68.4% checking health status. Cause of not doing screening: 65.3% had no problem, and 3.4% not enough information.
49	Mirzaei-Alavijeh, Kermanshah, 2018 (62)	Cross-Sectional	Females who referred to HCC_s	408	39.61(8.28)	QNR	Mammo history: 13%

50	Moghaddam, Urmia, 2018 (15)	Cross-Sectional	Females referred to HCC_s	348	43.25(5.36)	QNR, C/L	Mammo history (never: 12%, at least one: 88%) Main source of information: doctors
51	Safizadeh, Kerman, 2018 (63)	Qualitative	Females health volunteers from HCC_s	24	42	INTVW	BSE: 20.8% CBE: 16.7% Mammo: 25%
52	Noori, Tehran, 2018 (64)	Qualitative	Females 30-67Y_s	22	40.8(12.5)	INTVW	Perceived severity: in majority of females was low Perceived susceptibility: in about half of females was high. Perceived benefit: in all females was high. Self-efficacy: in majority of females was low
53	Pirzadeh, Isfahan, 2018 (9)	Cross-Sectional	Female medical students of MUI	384	20.92(1.26)	QNR	BSE (pre-contemplation: 42.8%, contemplation: 22%, preparation: 12.8%, action: 13.2%, maintenance: 19%) Didn't have skills for BSE: 60%
54	Darvishpour, Guilan, 2018 (65)	Cross-Sectional	Females 20-65Y_s living in East Guilan cities	304	NA	QNR	BSE predictors: perceived benefits, self-efficacy, and perceived barriers. Mammo predictors: perceived benefits and perceived barriers.
55	Hayati, Abadan, 2018 (66)	Cross-Sectional	Females >35Y_s employees of Abadan School of Medical Sciences	90	42.9(5.8)	QNR	Mammo) total: 24.4%, once: 17.7%, twice or more: 6.7%)
56	Mahmoudabadi, Kerman, 2018 (67)	Cross-Sectional	Female nurses from Kerman educational hospitals	209	35.53(8.01)	QNR	BSE: 9.1% CBE: 26.3% Mammo: 15.8%
57	Izanloo, Mashhad, 2018 (68)	Cross-Sectional	Patients referred to outpatient clinics and people >14Y_s in public urban areas	1469	38.8(11.69)	QNR	Main screening methods (self-assessment: 41.6%, ultrasound: 46.4%)
58	Kardan-Souraki, Mazandaran, 2019 (69)	Cross-Sectional	Females participating in BC screening programs	1165	37.15(8.84)	QNR	BSE: 62% CBE: 41.1% Mammo: 21.7%
59	Khazir, Khorramabad,	Cross-Sectional	Females referred to HCC_s	262	49.62(7.79)	QNR	Mammo: 30.85% Sig. relationship between HBM

	2019 (70)						component and Mammo behavior.
60	Naimi, Kermanshah, 2019 (71)	Cross-Sectional	Married females clients of eight HCC_s	334	39.75(7.73)	QNR	BC screening adoption (pre-contemplation: 58.4%, contemplation: 26.9%, preparation: 3%, action: 9.6%, maintenance: 2.1%)
61	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% Mammo: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.

Effect of educational interventions on screening behavior:

Table 2 demonstrates 38 studies related to the educational interventions and their impact on BC screening promotion. The design of studies was clinical-trial (35 articles), field trial (2 articles), and mixed model (1 article). Majority of participants were females who referred to HCC_s. 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 counselling. Most models used for education were HBM (13 studies), EPPM (1 study), BASNEF (1 study), TPB (2 studies), SHEP (1 study), and HBM plus TPB (1 study). The in-person education was achieved by methods such as group discussion, role-playing or peer-education. Different instruments such as short messages, PowerPoint, media, lecture, mobile phone were applied for this purpose. The result of studies showed that educational interventions increased the knowledge, attitude and practice of participants in performing the screening behaviors such as Mammo, CBE, and BSE. It led to the improvement of health belief, perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, and the behavioral intention of BC screening.

Table 2: effect of educational interventions on screening behavior

NO	First author/ City/ Year of publication	Study design	Intervention	Study population	Sample size	Mean Age (SD)	Instrument	The most important findings
1	HajiKazemi, Tehran, 2006 (72)	Clinical-Trial	Health counselling	Females attending premarital health counselling program	600	21.82(3.94)	QNR	After/before: Sig_Dif in mean_score of Awr.
2	Yeke Fallah, Ghazvin, 2007 (73)	Clinical-Trial	Video and verbal training	Nursing and Midwifery students of QUMS	43	18	QNR	After/before: Sig. increase in mean K.
3	Saatsaz, Amol, 2009 (74)	Clinical-Trial	In-person education	Females high school teachers	48	NA	QNR	After/before: Sig. improvement of P. about BSE, CBE, Mammo.
4	Hatefnia, Tehran, 2010 (75)	Clinical-Trial	HBM-based education	Females >35Y_s	220	NA	QNR	Int./Cont.: Sig. improvement in mean_score of K., HBM structures and Mammo behavior.
5	Moshfeghi, Arak, 2011(76)	Clinical-Trial	Media and PowerPoint	Physicians	128	NA	QNR	Sig_Dif in mean_score of KAP after intervention in each group. No Sig_Dif in KAP between two methods.
6	Hajian, Tehran, 2011 (77)	Clinical-Trial	Health counseling	Females with BC_FH	100	37.8(11.7)	QNR	After/before: Sig_Dif in mean K., HBM structures, BSE in intervention group Int./Cont. (BSE:82%/62%, p=0.021, CBE:40%/18%, p=0.014, Mammo:36%/30%, p=0.52)
7	Rahmati Najar Kolaie, Tehran, 2012 (78)	Clinical-Trial	HBM-based education	Students living in the dormitory of TU	99	21(1.11)	QNR	After/before: Sig. improvement of HBM structures.
8	Kalan FarmanFarma, Zahedan, 2013 (79)	Clinical-Trial	In-person education	Females guidance school teachers	240	39.4(7.4)	QNR	Int./Cont.: Sig_Dif in mean-score of KAP.
9	Ghasemi, Shahrekord, 2014 (80)	Clinical-Trial	In-person education	Employee Females in universities of Shahrekord	50	33.5(18)	QNR, C/L	After/before: Sig_Dif in mean-scores of KAP, performing BSE.
10	Khalili,	Clinical-	HBM-based	Females	144	34(8.23)	QNR	After/before: Sig.

	Lavizan, 2014 (81)	Trial	education	referred to HCC_s				increase in mean K., HBM structures. Int./Co.: enhance the mean of K., HBM structures ($p<0.001$).
11	Eskandari-Torbaghan, Zahedan, 2014 (82)	Clinical-Trial	HBM-based education	Female employees of ZAUMS	130	Int. 35.38(8.01) Cont. 34.39(8.98)	QNR	Int./Cont.: Sig_Dif in mean-scores of Awr., perceived susceptibility, perceived benefits, perceived barriers, P.
12	Rezaeian, Isfahan, 2014 (83)	Clinical-Trial	Health counselling	Females $>40Y_s$	290	50.48(6.81)	QNR	After/before: Sig. improvement means K., HBM structures. Int./Cont.: Sig_Dif in HBM structures, health beliefs about BC and Mammo Sc_Behavour.
13	Sargazi, Zahedan, 2014(84)	Clinical-Trial	TPB-based education	Females referred to the clinics	140	Int. 31.6(0.9) Cont. 32.6(1.1)	QNR	After/before: Sig. increase scores of K., A., control of perceived behavior, behavioral intention, adopting Sc_Behavour in the intervention group.
14	Haghighi, Birjand, 2015 (85)	Clinical-Trial	In-person education	Employee females of BU	89	39.2(7.3)	QNR	After/before: Sig. increase in mean K., A. toward BSE and number of females performed BSE.
15	Absavaran, Zabol, 2015 (86)	Clinical-Trial	Lecture method/ cell phone method	Nurses in Zabol hospitals	105	Int.29.3(4.4) Int.28.3(4.4) Con.29.1(4.7)	QNR	After/before: Sig_Dif in mean_score KAP in both intervention groups. Increase in A., P in mobile phone group was significantly more than the Lecture group.
16	Taymoori, Sanandaj, 2015 (87)	Clinical-Trial	Health counselling	Females $>50Y_s$	184	55.93(7.80)	QNR	Int./Cont.: Sig_Dif in mean HBM and TPB structures and percent Mammo.
17	Sadeghi, Sirjan, 2015 (88)	Clinical-Trial	BASNEF model-based education	Females $20\text{-}40Y_s$ attending to HCC_s	200	Int. 35.86(2.53) Cont. 36.12(2.24)	QNR	After/before: K. significantly increased in both groups. A., P., enabling factors increased in Int. Int./Cont.: Sig_Dif in mean_scores of KAP, subjective norms and enabling factors.

18	Ghahremani, Shiraz, 2016 (89)	Clinical-Trial	Self-care education	Females referred to HCC_s	168	Int. 35.3(7.5) Cont. 36.6(8.5)	QNR	Int./Cont.: Sig_Dif in mean_scores of TTM structures and BSE behavior (p<0.001).
19	Keshavarz, Pakdasht, 2016 (90)	Mixed Model	TPB-based education	Females workers 20-40Y_s working in factories in Abbas Abad Industrial City	70	Int. 31.94 Cont. 32.48	INTVW, QNR	The qualitative section: explained factors were affecting females' health-promoting behaviors. The quantitative section: Sig. increase in A., subjective norm, perceived behavioral control, self-efficacy, intention and behavior of intervention group (p<0.001). Sig_Dif in mean_score of all constructs between groups (p<0.001).
20	Mirzaii, Mashhad, 2016 (91)	Clinical-Trial	SHEP-model-based Education	All the health volunteers and Females covered by two urban health centers	120	NA	QNR, C/L	Int./Cont.: Sig_Dif in mean_scores of A. and BSE (P<0.001).
21	Parsa, Hamedan, 2016 (92)	Clinical-Trial	Educational counselling	Females referred to HCC_s	150	Int. 47.64(7.03) Cont. 46.6(8.68)	QNR, C/L	Int./Cont.: Sig_Dif in mean_scores of perceived benefits, perceived barriers, self-efficacy, health motivations, K. and BSE practice.
22	Khiyali, Fasa, 2017 (93)	Clinical-Trial	HBM-based education	Healthy females	92	Int. 30.39(8.19) Cont. 28.23(7.3)	QNR	Int./Cont.: Sig_Dif in mean_scores of K., HBM structures and BSE behavior (P<0.001).
23	Nahidi, Abadeh, 2017 (94)	Clinical-Trial	HBM-based education	Females 30–39Y_s referred to HCC_s	144	Int. 38.5 Cont. 39.44	QNR	Int./Cont.: Sig_Dif in mean_scores of Awr., perceived susceptibility and performance. Sig_Dif in mean_score of performance in BSE (p<0.001).
24	Nasiriani, Yazd, 2017 (95)	Field-Trial	Telephone Counseling and education	Females with BC_FH	90	Int. 45.8(7.51) Cont. 46.77(8)	QNR	Int./Cont.: Sig_Dif in Mammo performing (77.8%/24.4%). After/before: Sig_Dif in Mammo performing in the intervention group.

								No Sig_Dif in Mammo performing in the control group.
25	Savabi-Esfahani, Baharestan, 2017 (96)	Clinical-Trial	Role-playing, lecture	Females enrolled in community cultural centers	314	45.53(10.99)	QNR	After/before: Sig_Dif in mean_scores of K. about BC and screening in both educational groups. Role play group/lecture group: Mean_score of K. (94.5/88.8).
26	Shahbazi, Borujen, 2017(97)	Clinical-Trial	Direct and indirect education	Nursing and midwifery personnel in Valiasr Hospital	89	31.95(6.57)	QNR	After/before: Sig. increase scores of K., in both groups, A. increased only indirect group. Direct training vs. indirect training: Sig_Dif in K. and A. about BSE.
27	Matlabi, Gonabad, 2018 (98)	Field trial	In-person education	Married Females 20-49Y_s	140	37.27(6.69)	QNR	Int./Cont. (Immediately after: action 21.4% vs. 22.9%, P=0.001, maintenance 40% vs. 24.3%, P=0.001, 3 months after: action 25.7% vs. 24.3%, P=0.001, maintenance 57.1% vs. 24.3%, P=0.001)
28	Ghaffari, Isfahan, 2018 (99)	Clinical-Trial	HBM-based education	Health volunteers of HCC_s	480	NA	QNR, C/L	Int./Cont.: Immediately and two months after: Sig_Dif in means of K., HBM structures related to BSE and Mammo, BSE skill. No Sig_Dif in BSE behavior and Mammo.
29	Ghaffari, Karaj, 2018 (99)	Clinical-Trial	Education based on the integrated behavioral model	Females who were attended to HCC_s	138	NA	QNR	Int./Cont.: Immediately and two months after: Sig_Dif in mean_score of K. and all structures except the perceived benefits of Mammo and Mammo behavior (P<0.001).
30	Masoudiyekta, Dezful, 2018 (100)	Clinical-Trial	HBM-based education	Females 20–59Y_s referred to HCC_s	226	39.75(9.05)	QNR	Int./Cont.: Sig. increase rate of BSE and Mammo, mean_scores of K. and HBM structures three months after (P<0.001). No

								Sig_Dif in the score of CBE.
31	Mirmoammadi, Hamadan, 2018 (101)	Clinical-Trial	HBM-based consultation	Females >40 Y_s attending to Hamadan HCC_s	150	Int. 64.47(7.3) Cont. 60.46(8.8)	QNR	Int./Cont. (Sig_Dif in Mammo: 49.3%/20%, CBE: 52%/28%, mean_scores of K., HBM constructs except for susceptibility and severity)
32	Naserian, Mahshahr, 2018 (102)	Clinical-Trial	Short messages and group training	Females 40-60Y_s referred to HCC_s	210	Int. 48.1(5.8) Int. 48.7(5.8)	QNR	After/before: Sig. increase in mean_score K. in each groups (P = 0.001), no Sig. increase between groups (P = 0.061). Group training was better in BSE (P<0.001). SMS group was better in CBE (P =0.02).
33	Mashhod Kermanchi, Tehran, 2018 (103)	Clinical-Trial	HBM-based education	Females referred to HCC_s	94	Int. 35 Cont. 32.5	QNR	After/before: Sig_Dif in mean_scores of HBM structures except for perceived benefits in the experimental group. Int./Cont.: Sig_Dif in mean_scores o K., HBM structures except for perceived benefits, BSE performance.
34	Fathollahi-Dehkordi, Isfahan, 2018 (104)	Clinical-Trial	Health counselling	Females >20Ys with BC_FH	107	Int. 36.04(10.90) Cont. 35.58(10.22)	QNR	Int./Cont.: Sig_Dif in screening practice. Time factor and time-group interaction affected K.and HBM structures significantly. Most females in the action stage of CBE vs. in contemplation stage (p<0.001).
35	Alizadeh Sabeg Abish Ahmad, 2018 (105)	Clinical-Trial	Health counselling	Females 40-69Y_s	60	Int. 47.6(5.7) Cont. 48.2(5.8)	QNR	Int./Cont.: Sig_Dif 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.
36	Termeh Zonouzy, Tehran,	Clinical-Trial	Intervention based on fear appeals using the	Females >40Y_s with no BC_FH	600	53.2(9.45)	QNR	After/before: Sig_Dif in mean_scores of A., behavioral

	2019 (106)		EPPM model					intention in the intervention group. Int./Cont.: Sig_Dif in mean_scores of A., behavioral intention.
37	Rokhforouz, Rafsanjan, 2019 (107)	Clinical-Trial	In-person education	Health volunteers working in HCC_s in Rafsanjan	92	46.84(10.67)	QNR, C/L	Int./Cont.: Sig_Dif in movement in the stages of change, mean scores of HBM structures except for perceived barriers.
38	Molaei-Zardanjani, Isfahan, 2019 (108)	Clinical-Trial	Individual and peer education	Females referred to selected HCC_s	100	NA	QNR	After/before: Sig. 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 peer education group was higher ($P < 0.05$). No Sig_Dif in mean_scores of perceived behavioral control constructs and behavioral intention between groups ($P>0.05$)

The statistical indicators of BC screening:

This category includes the results of statistical studies in the field of breast cancer 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. Majority of participants were females referred to HCC_s. Some studies had presented the psychometric assessment of the Persian version of BSEBPS (Breast Self-Examination Behavior Predicting Scale), BCAM (Breast Cancer Awareness Measure), and CHBMS (Champion Health Belief Model Scale). The development of some tools in BC prevention strategies consisted of MSS (Mammography Social Support scale in Iran), BCS chart (Breast Cancer Screening), and ASSISTS instrument and model. In two studies, the response rate to BSE and CBE ranged 81-100% (104, 109). Participation rate in the screening program was reported from 3.8% to 16.8% in two studies (53, 110). BC detection rate has been reported in some studies with different designs. In a cross-sectional study achieved on females admitted to the Mammo center of a hospital, BC was detected in 2.3% of 526 screened patients (111). BC detection rate of non-diagnostic mammography in 9395 subjects was 8.5 per 1000 Mammo (112). In BC screening of 26606 females, the detection rate of 24 per100000 was reported in CBE and Mammo evaluation the false-positive detection rate of Mammography was 7.5% in this screening program (113). Sehhati Shafaie conducted a project on 5,000 females referred to BC hospital for screening. They recorded 996 Sono, and 636 Mammo reports with 40 and 183 abnormal cases, respectively and found one BC by performing 14 FNA (114). The screening Mammo rate, diagnostic sonography rate, biopsy rate, and abnormality rate were 27.4%, 26%, 1.4%, and 33% in a screening project, respectively (111). Results of a study indicated that the mean scores of females' breast cancer screening belief and multidimensional health locus of control were 40.72±10.41 and 67.78±17.67, respectively (115).

Table 3: The statistical indicators of BC screening:

No	First author/ City/ Year of publication	Study design	Study population	Sample size	Mean Age (SD)	Reported Index	The most important findings
11	Taymoori, Sanandaj, 2009 (116)	Cross-Sectional	Employed females in governmental institutes and departments	606	37.08(9.81)	Instrument	Developing and validation CHBMS to assess Iranian females' beliefs related to BC and screening.
22	Barfar, 10 cities of Iran, 2014 (113)	Cost-Effectiveness	Females >35Y_s	26606	NA	Detection rate	Detection rate: 24 per100000 The cost per cancer detected: $15,742 False-positive detection rate: 7.5%
33	Miller, Yazd, 2015 (109)	Field-Trial	Females residing in urban areas	12,602	NA	Response rate to BSE+ CBE screening of BC	Response rate: Data collection at patients' home in both groups: 100%. Visiting HCC in the intervention group: 84.5%.
44	Jafari, Kerman, 2015 (109)	Cross-Sectional	Females 35-69Ys	15794	NA	Participation rate	Participation rate: urban region 3.8%, villages and towns 16.34%.
55	Saghatchi, Zanjan, 2015 (111)	Cross-Sectional	Females admitted to the Mammo center of Mousavi Hospital	526	44.3	Detection rate Abnormality rate	Screening Mammo rate: 27.4% Diagnostic Sono rate: 26% Biopsy rate:1.4% Detection rate: 2.3% Abnormality rate: 33%
65	Khazaee_Pool, Tehran, 2016 (117)	Cross-Sectional	Females referred to TUMS HCC_s	585	41.25(6.34)	Instrument	Developing and validation an instrument to identify factors affecting females' BC prevention behaviors named ASSISTS.
76	Aminisani, Baneh, 2016 (53)	Cross-Sectional	Females >40Y_s referred to HCC_s	561	43.64(5.17)	Participation rate	Participation rate in Mammo program: 16.8%. The lowest level of participation: females >60Y_s, illiterate, post-menopausal.
87	Sehhati Shafaie, Tabriz, 2016 (114)	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 Sono: 40 abnormal cases After 636 Mammo: 183 abnormal

							cases After 14 FNA: One cancer case (7.1%)
9 8	Moshki, Sanandaj, 2017 (118)	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
10 9	Alikhassi, Tehran, 2017 (112)	Longitudinal	Females referred to a university hospital	9395	49.84(9.19)	Recall rate, Detection rate Of Opportunistic Screening Mammo	Recall rate: total: 24.7%, first Mammo: 29%, subsequent Mammo: 22%., micro-calcification: 21.1%, mass: 49.3%, distortion: 34.8%, asymmetry: 48.1%. Cancer detection rate: 8.5 per 1000 Mammo.
11	Poorolajal, Tehran, 2017 (119)	Cross-Sectional	Native Iranian women	1422	Int. 48.37(10.79) Cont. 42.37(9.84)	Instrument	Age alone is not a strong predictor of BC. The chart: facilitates making decision on the threshold for recommending screening Mammo, detects high-risk individuals.
12 10	Khazaee_Pool, Sanandaj, 2018 (120)	Cross-Sectional	Females referred to HCC_s in Sanandaj	434	48.12(8.91)	Instrument	Response rate: 91%. A valid instrument : MSS
13 11	Pourhaji, Tehran, 2018 (121)	Cross-Sectional	Females >$40Y_s$ referred to HCC_s of SBMU	200	Median:45.6	Model	A valid instrument: BSEBPS
14 12	Heidari, Isfahan, 2018 (122)	Cross-Sectional	Persian language females	1078	36.5(11.65)	Instrument	Transcultural adaptation and validation of an instrument: BCAM
15 13	Fathollahi_Dehkord, Isfahan, 2018(104)	Clinical-Trial	Females with a BC_FH	98	Int. 36.04(10.90) Con. 35.58(10.22)	Response rate to CBE screening	Response rate: 81%.
16	Khazaee-Pool, Tehran, 2018 (123)	Cross-Sectional	Females 30-$75Y_s$ referred to HCC_s 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

17 14	Saei Ghare Naz Tehran, 2019 (115)	Cross-Sectional	Females referred to HCCs of SBMU	325	34.82(11.73)	BCSB and MHLC score	Breast cancer screening belief (BCSB): 40.72±10.41 Multidimensional Health Locus of Control (MHLC): 67.78±17.67

Discussion

This paper reviewed the researches in the field of breast cancer prevention. The studies were assessed and discussed in three themes of observational studies, interventional studies, and statistic indicators as follows:

Observational Studies of BC screening:

As this time, mammography is the gold standard of breast cancer early detection method. So, it is necessary to specify the status of mammography performance in Iran. In the current study, the range of performing of Mammo between 2005-2020 was 1.3%-45%, while in another systematic review that studied only Persian language articles published in two databases between 2001-2010, 3 to 26% of Iranian females had done Mammo for early detection of BC (12). Although, a study showed that the range of screening methods like Mammo in Iran was lower than developed countries such as the USA, and the UK (53), the results of a screening program in Saudi Arabia resulted to 27.7 % of Mammo achievement (124). One of the reasons of this difference may be due to the lack of a breast cancer screening program in Iran; hence the result reported were extracted from various limited studies with high heterogeneity regarding the study population, sample size, and design. On the other hand, some researches have revealed that Mammo is an expensive modality and not a cost-effective method for BC screening in Iran (6, 113), and considering further studies focusing on other screen methods are suggested.

Breast self-examination and clinical breast examination are considered as more available, low-cost, and low-technical requirement screening strategies. Our review 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 conducted on Arab females demonstrated that 69% of subjects did not know how to do BSE (125). According to the current review, low self-efficacy of females in applying screening behaviors may affect on BSE achievement(64). Self-efficacy is one of the most important predictors of screening behaviors (43, 45, 47, 48), and performance of BSE in females with higher self-efficacy is 1.17 times more than others (35). Therefore, it can be concluded that by the improvement of females' self-efficacy, their skills about screening behaviors will also improve. So, education about breast cancer 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 real 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:

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 counselling. Most of them showed that education was effective in enhancing females' knowledge, attitude, practice of screening behaviors, but no study has revealed which method is more effective in Iran. The population and design of interventional studies varied in different researches, but no study comparing in-person with virtual education was available. Given the growth of using the Internet, it seems that novel technologies like online social networks, applications on smartphones, and virtual learning can be cost-effective methods. Some features of this technology such as more availability, lower price, more users, and offering a more attractive platform, make it a useful modality to be studied in the Iranian population in future researches.

In this systematic review, most educational interventions resulted in satisfied effects (73, 76, 79, 80). It may show that proving educational modalities for breast cancer prevention by the health system is more important than the training methods itself. 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 (126). If early detection of breast cancer 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 hands, promoting the awareness of population induces some diagnostic and treatment demands for BC detection. If we don't provide needed requirements, our health policy goal won't be reached. Related studies in Iran have focused on identifying the educational need of the specified Iranian population with different race, culture, income, etc. (80, 82, 85, 87, 99, 100). So, they can't be generalized to the total population of Iran. Thus, implementing researches at the national level, with more potent methodology and stratified demographic characteristics are suggested.

The statistical indicators of BC screening:

The statistical indicators are one of the most important principles for health policymaking and evaluating the cost-effectiveness of an intervention. They include abnormal rate, detection rate, recall rate, participation rate, etc. According to the extracted results, the BC detection rate in three studies was reported with a different population of the study. One of the studies which were achieved in Zanjan, a city of Iran, 526 women who admitted to the mammography center were assessed. The detection rate had been reported by 2.3% of 526 screened patients (111). In another research was conducted at a tertiary referral university hospital and 9395 digital mammographies performed, and they detected 8.5 cancer patients in 1000 women who underwent non-diagnostic Mammo (112). 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 the detection rate of 24 per 100000 females (113). Although all three studies have reported a detection rate, differences in methodology make them non-integral. The detection rates of invasive breast cancer based on real population screening are targeted >0.5, ≥2.7, and ≥5 per 1000 screens in Canada, the United Kingdom, and Australia, respectively. Also, the detection rates for in situ breast cancer in the United Kingdom and Australia are considered ≥0.4 and ≥1.2 per 1000 screens, respectively (127). The detection rate in Iran has been reported higher than in European countries and even higher than the rate of 2.7 in Asian counterpart countries (128). It seems that 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, limitation of detection rate estimation factors like manpower skill, sensitivity or specificity of equipment, and essential resources have not been appropriately assessed in Iranian studies. So, 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 assess the quality of Mammo image and interoperation. It is defined as a percentage of abnormal Mammo per number of screens (127). In Iran, it has been reported 28.77% and 33% (111, 114). The abnormal call rate for the initial screen in Europe are considered <7 and in all of the countries like Canada, the United Kingdom, Australia, and New Zealand are considered <10 (127). 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 (129). The European Guidelines and the American College of Radiology considered recall rate <7% and <10%, respectively, as an acceptable recall rate (129). High abnormal rate induces a high recall rate and increasing the number of unnecessary tests and false positives results (127). According to our result, the recall rate in Iran was 24.7% in total, and for the first and subsequent Mammo was 29% and 22%, respectively (112). 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 breast cancer 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 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 (127). This index was showed totally 16.8%, 20% in urban areas, and 10% in rural areas of Iran (53, 110). 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 towards the importance of breast cancer prevention. Females' attitude can be reformed by the cooperation of 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, 113). So, most insurances just support the cost of diagnostic modalities, and the screening tests should be paid out of the 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 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

This systematic review demonstrated that we have many unknown facts about breast cancer early detection in Iran. It is not clear which strategy is the best. The necessity of a national screening program in a country with a low incidence of breast cancer, presenting a proper educational method for increasing women's awareness and estimating screening indices can be the priorities of future Iranian researches. Establishing big studies at the national level in a standard framework are advised

Abbreviations

BC: Breast Cancer

BSE: Breast Self-Examination

CBE: Clinical Breast Examination

Mammo: Mammography

INTVW: Interview

QNR: Questionnaire

HCC: Health Care Center

TUMS: Tehran University of Medical Sciences

HCP: Health Care Provider

Sc_Behaviour: Screening behaviour

C/L: Checklist

BC_FH: Family history of breast cancer

Sig.: Significant

Sig_Dif: Significant difference

Mean_Score: Mean score

Ys: Years

NA: Not assigned

BU: Birjand University

TU: Tehran University

ZAUMS: Zahedan University of Medical Sciences

QUMS: Qazvin University of Medical Sciences

SBMU: Shahid Beheshti Medical University

SU: Shiraz University

SUMS: Shiraz University of Medical sciences

Sono: Sonography

MUI: Isfahan University of Medical sciences

HBM: Health Belief Model

EPPM: Extended Parallel Process Model

TPB: Theory of Planned Behavior

SHEP: Systematic Comprehensive Health Education and Promotion

FNA: Fine Needle Aspiration

K.: Knowledge

A.: Attitude

P.: Practice

Awr.: Awareness

KAP: Knowledge /Attitude /Practice

Int.: Intervention

Cont.: Control

Declarations

Ethics approval and consent to participate

This article does not contain any studies with human participants or animals performed by any of the authors. This research has been approved in Breast Cancer Research Center Ethical Committee with ethical code number “IR.ACECR.IBCRC.REC.1394.54”

Consent for publication

Not applicable.

Availability of data and materials

Not applicable.

Competing interests

The authors declare that they have no conflict of interest.

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Authors' contributions

SH managed the group and was responsible for the literature search, manuscript categorization, data extraction, writing manuscript. MK, and NN participated in the literature search, data extraction, and preparation of tables and rechecking the data. ZO was responsible for data extraction and rechecking the data. SH managed the team in developing the idea in all steps of research including search, data extraction, preparing tables, writing the manuscript. All authors have participated in providing the first draft of the manuscript and they have approved the final version.

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Figures

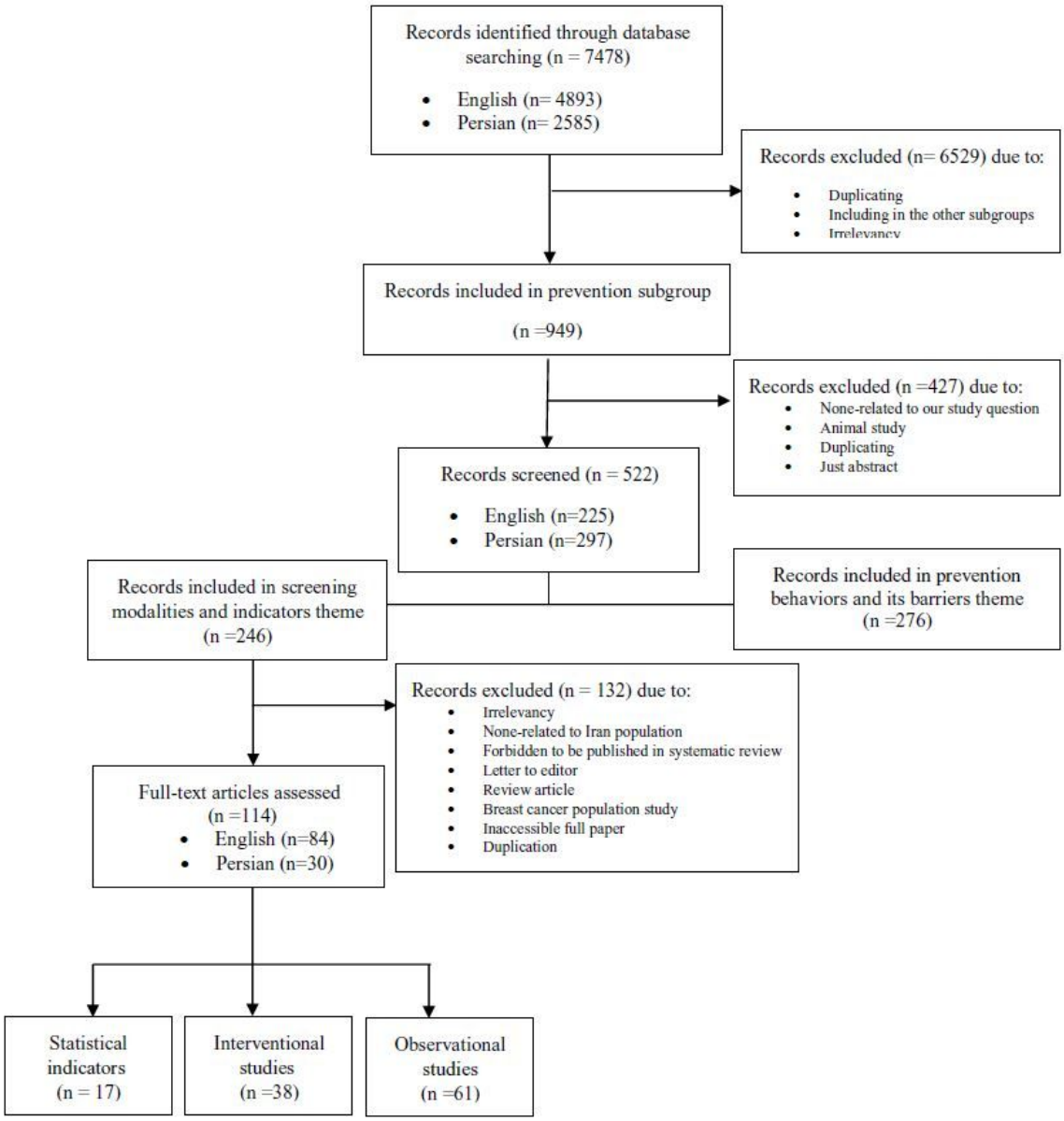


Figure 1

The Prisma diagram of the study