Iran J Public Health, Vol. 54, No.1, Jan 2025, pp.88-100

Review Article

A Scoping Review of 20 Years Breast Cancer Screening Programs in Iran

Pouran Raeissi Dehkordi [1], ****Zeinab Dolatshahi*** [1], ***Hassan Abolghasem Gorji*** [1], ***Seyed Massoud Hashemi*** [2], ***Nahid Reisi*** [3], ***Toraj Harati Khalilabad*** [1]

1. *Department of Healthcare Services Management, School of Health Management and Information Sciences, Iran University of Medical Sciences, Tehran, Iran*
2. *Department of Anesthesiology, School of Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran*
3. *Department of Pediatric Hematology and Oncology, Child Growth and Development Research Centre, School of Medicine, Isfahan University of Medical Sciences, Isfahan, Iran*

***Corresponding Author:** Email: mitradoulat@gmail.com

(Received 11 May 2024; accepted 24 Jul 2024)

Abstract

Background: Breast cancer (BC) is the leading cancer among women globally. Early detection through screening is vital for reducing mortality, complementing advancements in treatment.

Methods: We aimed to overview BC screening practices in Iran over two-decades to inform policymakers for future research directions and prompt timely diagnoses. A scoping review was conducted on BC studies in Iran from 2000 to 2023, following PRISMA guidelines.

Results: We analyzed 129 articles on BC in Iranian women, and finding six main areas.

Conclusion: Iran's health system lacks an organized BC screening initiative, facing challenges like inadequate infrastructure, sociocultural barriers, unintegrated health insurance packages, and limited research on key indicators.

Keywords: Breast cancer; Burden; Epidemiology; Iran

Introduction

Cancer ranks second among NCD-related deaths globally, with 9.3 million deaths in 2019. Predictions indicate it could cost $25.2 trillion by 2050 (1). Breast cancer (BC) ranks third in economic cost among cancer types, with 75.1% of deaths occurring in low- and middle-income countries (2). BC is the foremost cause of women death, with significant mortality rates in the Mena region, including Iran, reaching 35,405 deaths, and 1,222,835 DALYs in 2019 (3, 4). Iranian studies suggest BC onset almost a decade earlier than global counterparts, 71% of cases are diagnosed at advanced stages (5, 6). Screening and early detection programs (S&EDPs) identify diseases in asymptomatic and initial stages, significantly improving outcomes (7, 8). However, population-based BC S&EDPs are lacking in Iran, despite the country's aging population trend.

Therefore, this review aims to address below fundamental questions:

1- What are incidence and mortality rate related to BC among Iranian women?
2- What are risk factors, barriers and challenges related to managing BC-S&EDP?
3- What BC-S&EDP strategies have been implemented for Iranian women over the last two decades?
Given limited review articles on BC S&EDPs in Iran and narrow study scopes, this review aimed to offer a comprehensive perspective to guide health policymakers in enhancing these programs, establishing BC registries, and developing infrastructure and research plans (9, 10).

Methods

We reviewed Iranian BC research from the late 20th century to October 2023, following scoping review standards outlined by Peters et al. and Tricco et al.'s, using the PRISMA-ScR checklist for standardized methodology (11-12).

Search Strategy

We searched databases on BC-S&EDPs, including PubMed, Google Scholar, Scopus, and Web of Science for English, and MagIran and SID for Persian publications. The study selection process is outlined in Fig. 1.

Protocol Template

The selection criteria for articles were those published within the last 20 years focusing on breast cancer screening issues in Iran, with a minimum of 200 female participants aged 20 to 80, with a key concept on the management of BC-ED programs in Iran. Consensus was achieved through discussion and interaction among the authors' team to select the articles.

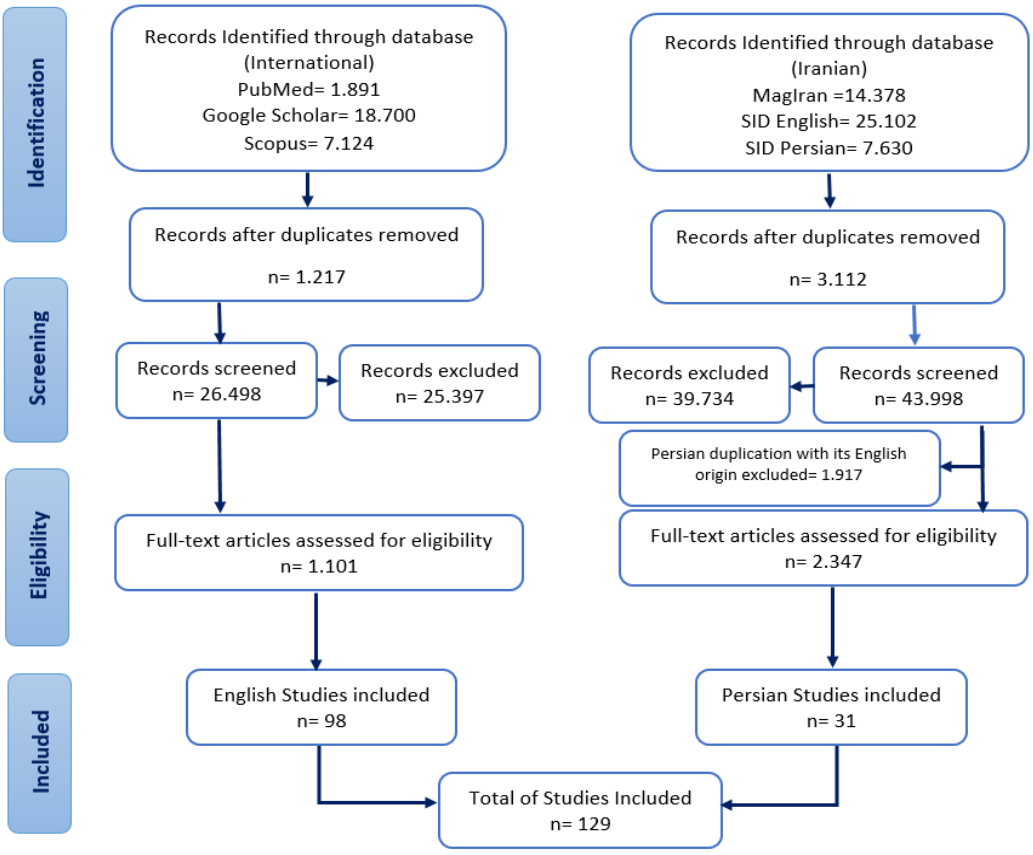

Fig. 1: Study selection process flow diagram

Results

We examined 129 articles, divided into six strata on BC in Iranian context, outlined in Fig. 2.

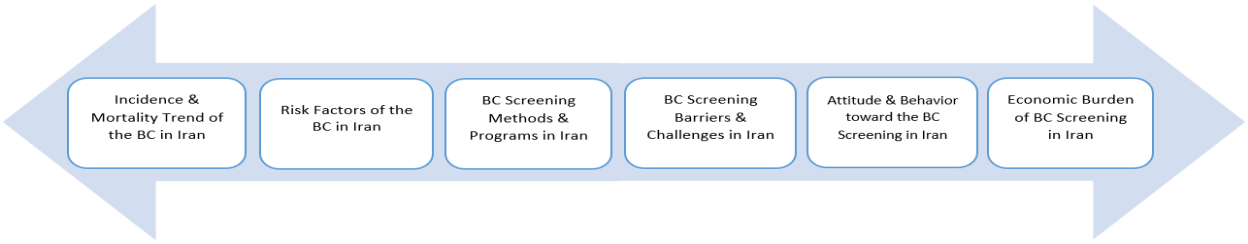

Fig. 2: Six Strata of BC Screening in Iran

Incident & Mortality Trend

This subsection contains 17-articles. Recent studies showed BC in Iran with an ASR of 32.1/100,000, comprising 24.4% of all cancers; ranking fifth in cancer deaths and first malignancy diagnosed (13-15). Othaghvar et al. reported 6,160 malignancy cases annually with a 20% mortality rate (15). In 2021, 40,000 cases were diagnosed, with 7,000 new cases each year (15, 16). The Iranian Ministry of Health's National Cancer Registration Program (IMOH-NCRP) reported female BC-ASR rates at 44.43/100,000 (17). Most patients were aged 40-49 (18).

Table 1 illustrates rising trend of BC across provinces from 2015 and 2018, these changes are marked with arrows, with some regions showing significant increases such as North-Khorasan with the highest rise (73%) followed by Alborz-68%, Kurdistan-66%, Gilan-59%, and Tehran-57%.

Table 1: BC trends across Iran's Provinces IMOH-NCRP data of 2015 and 2018

Provinces	ASR of BC		Provinces	ASR of BC	
	2018(20)	2015(19)		2018(20)	2015(19)
East Azerbaijan	↑37.06	25.17	Sistan_Baluchestan	↑17.48	12.45
West Azerbaijan	28.39	25.72	Fars	49.62	36.95
Ardabil	22.41	16.85	Qazvin	25.85↓	27.47
Isfahan	52.38	45.05	Qom	45.08	Not Reported
Alborz	↑63.85	37.82	Kurdistan	↑34.00	20.78
Ilam	33.58	29.41	Kerman	32.78	32.49
Bushehr	29.79	25.14	Kermanshah	↑37.38	26.49
Tehran	↑62.69	39.59	Kohkiloye_Boyerahmad	25.19↓	28.87
Chaharmaha_Bakhteyari	↑28.86	19.71	Golestan	40.64	35.76
South Khorasan	24.62	23.08	Gilan	↑51.41	32.44
North Khorasan	↑21.25	12.48	Mazandaran	↑56.40	39.88
Central Khorasan	34.59	32.58	Araak	↑42.99	28.64
Khuzestan	49.96	37.73	Hormozgan	30.45	26.42
Zanjan	18.05↓	19.36	Hamadan	29.63	22.17
Semnan	39.29	37.89	Yazd	52.98	44.46

Conversely, some provinces experienced declines such as Kohgiluyeh (19, 20). ASR rates varied from 1.18 to 19.7/100,000 in the west and east, and between 29.3 and 29.7 in the south and cen-

ter of Iran (17). Urban areas had an ASR of 15/100,000, while large cities recorded 34.6. Iran exhibits increasing BC incidence, especially in Tehran (14, 21-23). Other provinces like Ardabil, Mazandaran, and Kurdistan showed diverse trends, likely due to differing lifestyles, age demographics, and individual health behaviors (23, 24). Haghighat et al. reported a rise in female BC-ASR from 15.96 to 40.72/100,000 in 2003-2017 (13). Hamedan rose from 48.2 in 2004 to 115.0 in 2009 and Tabriz from 21.68 in 2007 to 36.91 in 2016 (25, 26).

Risk Factors

This subsection with 31-articles, categorizing them into modifiable, non-modifiable, and protective factors.

Modifiable Risk Factors

Obesity and high body mass index are major risk factors (27-36). Another debated factor is a woman's age at first childbirth. Young (≤18 yr) and old (≥35) age at the first pregnancy could notably increase the risk of BC (27, 30, 33, 35, 37-42). Other factors include induced abortion history, oral contraceptives, marriage age, nutritional habits characterized by high consumption of dairy, sweets, and meat, marital status, night shifts occupations (flight attendant), stress, alcohol and drug consumption, hormone replacement therapy, and surprisingly, fathers' age at the time of the baby's birth (30, 31, 41-46). Contrary to the expected association between smoking and BC, passive smoking, along with hookah use, has been affirmed as a higher risk-factor in women compared to direct smoking (27, 30, 32, 35, 42, and 47).

Non-Modifiable Risk Factors

Family history of BC, especially among first-degree-relatives, was the most frequently cited risk-factor (27, 28, 30, 31, 33, 34, 36, 37, 42, 44, 45, 48-52). Other risk-factors include the age at menarche and at menopause (30, 31, 34, 36, 38, 40-42, 44, 45, 49, 50, 53-56). History of chest radiation exposure, increasing age, stillbirth history, ethnicity, and race have been mentioned in some studies (28-30, 33, 34, 38, 39, 44, 46, 51, 54, 55, and 57).

Protective Factors

Various factors have been identified as potential protective elements; extended breastfeeding period and the number of pregnancies (27, 33, 42, 45, 49, 51, 55, 58). Some studies suggesting a protective effect for five or more pregnancies (32, 35, 39, 41, 42, 53). While others find no significant association (29, 50). Physical activity and healthy dietary habits (vegetable consumption) are associated with a reduced risk of BC, while a sedentary lifestyle may increase the risk (34, 35, 42, 47, 51, 52, 59-60). However, the role of educational attainment in BC-risk is mixed and there are conflicting findings (29, 35, 38, 44, 55, 59).

Screening Methods & Programs

This subsection with 15-articles on BC-S&ED modalities in Iran, focuses on BSE, CBE, and mammography, as recommended by the American Cancer Society (2). Some RCTs found no mortality reduction with BSE and CBE, but they still contribute to awareness enhancement. Mammography, offered opportunistically or organized screening, is crucial for detecting breast tumors < 2-cm, enabling timely treatment and enhancing survival (63-65). Two studies found no organized national Iranian BC screening, with screening being opportunistic. Results showed regularly 14.3% performed BSE, 20.7% received CBE, and only 3.5% underwent mammography every three-years (66, 67). Among women >20-yr, regularly 12.3% practiced BSE, 6% CBE, and 2.4% underwent mammography (68). Similar rates were reported in Ardabil and in Tabriz among women > 20-yr. Jalilian et al. found inequalities in access to CBE among Kurdish women, with a concentration index of 0.188 across urban and rural regions (68, 69). Age positively impacted mammogram uptake in Tehran (70). Mirfarhadi et al. found delays in mammogram uptake: 16.8% system delays, 13% delays in diagnosis-treatment, and 60% personal delays of up to one-month, with 30% enduring delays of over three-months (71).

Barriers & Challenges

Through 17-articles of this subsection, BSE and CBE are the primary methods in Iran (72). A recent study identified four barriers: health system, community, individual, and interpersonal (73). We address them here and in the next subsection. In Zahedan, only 8.3% of women were familiar with BC screening. Among them, 4.5% regularly performed BSE, 4.1% CBE, and just 1.3% had a mammogram (74). A study conducted 15 years later in there revealed barriers to mammography, including absence of breast symptoms-62.7%, discomfort with male health workers-57.5%, no perceived test priority-57.2%, reliance on health workers' examination-55.8%), and embarrassment during mammography-51.5% (75). In Golestan Province only 4.0% of Turkmen women had sufficient information about BC (76). In Yazd and Sirjan 80% of women never consulted a specialist, only 3% regularly performed CBE, and just 15.4% of those with close-relatives with BC had a mammogram (74, 77, 78). Safarpour et al. discovered only 22.3% of northern Iranian participants had good knowledge about BC screening, while Montazeri et al. showed that 61% in Tehran acquired information through electronic media like television (34%) and radio (14%) (76, 79). A decade later, two studies found 42.1% and 44.3% of Tehran and Isfahan participants had undergone mammography respectively (80, 81). This range in Rasht and Tabriz was 45% and 38.2% (82, 83).

Attitude and Behavior

This subsection with 26-articles, explores how social determinants of health (SDH) affect screening acceptance. Women with positive attitudes show higher participation rates: 21.9% BSE, 15.8% CBE, and 16.7% for mammography (84). Studies stress the significant of public awareness initiatives, targeted group sensitization, self-efficacy, and positive attitudes toward mammography adoption, particularly within Muslim communities (56, 85-87). Awareness deficits are particularly prominent among women in rural areas of Iran (78, 88). Furthermore, factors like monthly income, possession of health insurance, and having social support display a positive correlation with their engagement in BC screenings (78, 80, 81, 85, 89-91). Various access barriers, including cultural obstacles, geographical limitations, language barriers, along with prolonged waiting lists and financial constraints are significant factors (82-86). Low socioeconomic status discourages participation, while middle-income status (80, 88, 92, 93). Feelings of embarrassment and shame, fear of results, pain, and the associated stigma, fatalistic and religious beliefs, and past negative experiences negatively impact women's attitudes toward BC screening (28, 71, 78, 79, 89, 93-98). Conversely, positive impacts on women's decision-making regarding these programs arise from healthy beliefs having a family history, and sensitization (74, 78, 80, 83, 93, 96, 99, 100).

Economic Burden

This subsection reviews 23-articles primarily focusing on treatment, with some estimating the economic impact of BC screening (22, 59, 101-115). A study in Tehran evaluated the cost-effectiveness of a national mammography BC screening for women> 35, finding a total cost of $77,797 and $5,742 per case detected, indicating limited cost-effectiveness for women under 50 (116). In Shiraz BC screening, including sonography and mammography, for women> 25 cost $5,847,544.96 for age groups 25–34 and those aged≥35, underlining the considerable expense of screening programs (117). In 2016, Haghighat et al. evaluated mammography rounds in a BC screening, finding an initial ICER of $37,350/QALY gained (118). Later rounds showed higher ICERs, reaching $389,148, with mammography proving cost-effective in 53% of cases. In Kerman a cost-effectiveness study of 19,651 rural women aged 35-69 revealed a total cost of $7,067.69 for a mammography screening (119). The ICER for DALYs averted was $6,264 compared to no-screening interventions. In 2022, researchers in Shiraz using Purchasing Power Parity, found the expected screening cost to be $7,556, compared to $7,840 for no screening. Screening demonstrated dominance with a 16% difference in effectiveness (120). In Tehran, re-

searchers examined the economic evaluation of mobile mammography across Iran's provinces, noting comparable sensitivity-&-specificity between fixed and portable devices (121). Mobile screening costs approximately $37,000 per QALY. A study, comparing mammography and ultrasonography techniques found that ultrasonography's sensitivity for detecting BC was not significantly higher than that of mammography (122).

Discussion

BC poses a significant threat to women in developing nations like Iran, being a leading cause of mortality. Data suggests Iranian women may face BC at earlier ages than those in developed countries (6, 8). Statistics highlight challenges for Iranian women, including delayed diagnosis and a higher occurrence of non-palpable lesions (123). A recent study predicts a significant rise in new cancer cases in Iran, with BC being a major contributor. BC has shown a significant increase in the ASR from 32.63/100,000 in 2015 to 44.43 in 2018 (124). Projections indicate a rise from 112,000 cases to 160,000 during 2016-2025, marking a substantial 42.6% increase. Of these, 13.9% and 28.7% are attributed to changes in risk-factors and demographic shifts, respectively (9, 13, 19, 20). The ASR rate over the last two-decades, has fluctuated across Iranian provinces, with consistently higher rates in southern and central regions (17). Disparities persist between rural and metropolitan areas. Recent analysis reveals a significant 15.2% increase in female BC incidence (125). The lowest significant increase was observed in the 40-44 age group, contrasting with previous findings indicating a majority of patients in the 40-49 age range (18). BC screening method adoption in Iran varies by region due to barriers such as geographical remoteness, infrastructure gaps, and cultural beliefs (66). The lack of a structured screening policy and limited public awareness contribute to low mammography utilization rates, even in major urban areas like Tehran (2, 126). While some studies indicate partial cost-effectiveness of national BC screening, low participation rates among specific demographics pose challenges in integrating these programs into health insurance packages (118, 121). Limited data on mammography efficacy in women over 69 exist, but studies suggest it's comparable to younger counterparts. Individualizing screening for older women in Iran, given its aging population, becomes crucial, considering their health status and life expectancy (127, 128).
Modifiable BC risk factors like obesity and lifestyle choices, along with protective factors such as regular physical activity and healthy dietary habits, can be addressed or modified to mitigate BC-risk (27-36, 38, 42, 44, 50, 57). Educational interventions and health promotion interventions effectively raise BC screening rates by improving knowledge, sensitization, perceived behavioral control, and subjective norms (129). A quasi-experimental study demonstrated significant improvement in knowledge, attitude, and a 78% intent to undergo mammography six months after the intervention in the experimental group compared to the control group (129, 130).

Conclusion

Iran's healthcare system faces challenges like inadequate infrastructure, sociocultural barriers, and economic constraints, preventing comprehensive BC screening plans. In response to the study questions, our findings suggest three potential-options:

1. Conduct targeted local research to gather national data and identify key indicators. Offer policy insights for policymakers to enhance healthcare infrastructure and allocate resources effectively.
2. Implementing a comprehensive program targeting priority modifiable risk factors and SDH in investment strategies can indirectly reduce BC incidence.
3. Engage community leaders and NGOs in educational programs to address BC effectively.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

Acknowledgements

This research is part of the doctoral thesis on Health Policy at IUMS, registered with the ethics ID IR.IUMS.REC.1402.416.

Conflict of interest

The authors declare that there is no conflict of interests.

References

1. Chen S, Cao Zh, Prettner K, et al (2023). Estimates and projections of the global economic cost of 29 cancers in 204 countries and territories from 2020 to 2050. *JAMA Oncol*, 9(4): 465–472.
2. Sung H, Ferlay J, Siegel RL, et al (2021). Global cancer statistics 2020: Globocan estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin*, 71(3):209–249.
3. Farhood B, Geraily G, and Alizadeh A (2018). Incidence and mortality of various cancers in iran and compare to other countries: a review article. *Iran J Public Health*, 47(3):309-316.
4. Azadnajafabad S, Saeedi-Moghaddam S, Mohammadi E, et al (2023). Burden of breast cancer and attributable risk factors in the north africa and middle east region, 1990–2019: a systematic analysis for the global burden of disease study 2019. *Front Oncol*, 13:1132816.
5. Harirchi I, Karbakhsh M, Kashefi A, et al (2004). Breast cancer in iran: results of a multi-center study. *Asian Pac J Cancer Prev*, 5(1):24-7.
6. Kazemi M, Yadegarfar M, Hamyali Ainvand M, et al (2022). Iranian women diagnosed with breast cancer a decade earlier than british women? *Journal of Kerman University of Medical Sciences*, 29(1): 106-111.
7. Oussama M.N. Khatib, and Modjtabai A (2006). Guidelines for the early detection and screening of breast cancer. *EMRO Technical Publications Series,* 30. NLM Classification: WP 870:24–6.
8. Kazeminia M, Salari N, Hosseinian-Far A, et al (2022). The prevalence of breast cancer in iranian women: a systematic review and meta-analysis. *Indian J Gynecol Oncolog*, 20:14.
9. Omidi Z, Koosha M, Nazeri N, et al (2022). Status of breast cancer screening strategies and indicators in iran: A scoping review. *J Res Med Sci*, 27:21.
10. Kalan Farmanfarma Kh, Mahdavifar N, Heidarpour-Kiasaraet S, et al (2022). Determinants of mammography screening in iranian women: A systematic review and meta-analysis. *Breast Dis*, 41(1):279-294.
11. Peters MDJ, M Godfrey Ch, Khalil H, et al (2015). Guidance for conducting systematic scoping reviews. *Int J Evid Based Healthc*, 13(3):141-6.
12. Tricco AC, Lillie E, Zarin W, et al (2018). Prisma extension for scoping reviews (prisma-scr): checklist and explanation. *Ann Intern Med*, 169(7):467-473.
13. Haghighat S, Omidi Z, and Ghanbari-Motlagh A (2022). Trend of breast cancer incidence in iran during a fifteen-year interval according to national cancer registry reports. *Iranian Journal of Breast Disease*, 15 (2) :4-17.
14. Taghavi A, Fazeli Z, Vahedi M, et al (2012). Increased trend of breast cancer mortality in iran. *Asian Pac J Cancer Prev*, 13(1):367-70.
15. Alizadeh-Otaghvar H, Hosseini M, Tizmaghz A, et al (2015). A review on metastatic breast cancer in iran. *Asian Pac J Trop Biomed*, 5(6): 429–433.
16. Amini A, Khadivar P, Ahmadnia A, et al (2021). Crisis of breast cancer in iran: Focus on epidemiology and risk factors. *Gastric & Breast Cancer*, 16(1):12–23.
17. Abachizadeh K, Moradi-Kouchi A, Ghanbari-Motlagh A, et al (2018). Breast cancer in iran: Levels, variations and correlates. *Community Health*, 5(1):11-21.
18. Mousavi SM, Montazeri A, Mohagheghi MA, et al (2007). Breast cancer in Iran: an epidemiological review. *Breast J*, 13(4):383-91.

19. National Report of the National Cancer Registration Program (2015). *Publication of Ministry of Health, Cancer Department , National Secretariat of Cancer Management of Iran.*
20. National Report of the National Cancer Registration Program (2018). *Publication of Ministry of Health, Cancer Department , National Secretariat of Cancer Management of Iran.*
21. Esmaeimzadeh N, Salahi-Moghaddam A, and Khoshdel A (2015). Geographic distribution of important cancers in iran. *Hormozgan Medical Journal*, 19(2):66-76.
22. Sharifian A, Pourhoseingholi MA, Emadedin M, et al (2015). Burden of breast cancer in iranian women is increasing. *Asian Pac J Cancer Prev*, 16(12):5049-52.
23. Keyghobadi N, Rafiemanesh H, Mohammadian-Hafshejani A, et al (2015). Epidemiology and trend of cancers in the province of kerman: southeast of iran. *Asian Pac J Cancer Prev*, 16(4):1409–1413.
24. Fouladi N, Pourfarzi F, Amani F, et al (2012). Breast cancer in ardabil province in the north-west of iran: an epidemiological study. *Asian Pac J Cancer Prev*, 13(4):1543-5.
25. Dolatkhah R, Somi MH, Asghari-Jafarabadi MA, et al (2020). Breast cancer survival and incidence: 10 years cancer registry data in the northwest, iran. *Int J Breast Cancer*, 2020:1963814.
26. Zahedi A, Rafiemanesh H, Enayatrad M, et al (2015). Incidence, trends and epidemiology of cancers in north west of iran. *Asian Pac J Cancer Prev*, 16(16):7189-93.
27. Mohamadi S, Jalali F, and Rekabpour SJ (2023). Risk factors of breast cancer in women of bushehr city, a case-control study. *Iran South Med J*, 25(6): 505-518.
28. Faryabi R, Daneshi S, Rezabeigi-Davarani E, et al (2023). The assessment of risk factors and risk perception status of breast cancer in northern iran. *BMC Womens Health*, 23(1):268.
29. Rostampour F, Gasem-Soltani R, Pashaee F, et al (2022). Risk factors for breast cancer in urmia: A case-control study. *IJCCD,* 2(Supplement 2):10.53876/001c.38884
30. Khoramdad M, Solaymani-Dodaran M, Kabir A, et al (2022). Breast cancer risk factors in iranian women: a systematic review and meta-analysis of matched case–control studies. *Eur J Med Res*, 27(1):311.
31. Motie MR, Taghizadeh A, Pourali L, et al (2021). Breast cancer risk factors: A case-control study in iranian women. *Middle East J Cancer*, 12(3):439-46.
32. Manzouri L, Parhizkar S, and Amiri S (2021). Prevalence of risk factors and protective factors of breast cancer in yasuj city, iran. *J Clinic Care Skill*, 2(1): 35-39.
33. Ansari H, Mohammadi M, Mohammadi Y, et al (2018). Assessment of socio-economic and menstrual-reproductive factors related to estimated risk of affecting to breast cancer in the iranian woman. *Koomesh*, 20(3): 439-446.
34. Ataollahi MR, Sharifi J, Paknahad M, et al (2015). Breast cancer and associated factors: a review. *J Med Life*, 8(Spec Iss 4):6-11.
35. Namiranian N, Moradi-Lakeh M, Razavi-Ratki SK, et al (2014). Risk factors of breast cancer in the eastern mediterranean region: a systematic review and meta-analysis. *Asian Pac J Cancer Prev*,15(21):9535-41.
36. Poorolajal J, Akbari ME, Ziaee F, et al (2018). Breast cancer screening chart: a basic and preliminary model for making screening mammography more productive and efficient. *J Public Health (Oxf)*, 40(2):e118-e125.
37. Marzbani B, Taymoori P, and Nouri B (2017). Assessment of risk factors for breast cancer among women under 50 years old. *SJSPH*, 15(1): 47-60.
38. Mirghafourvand M, Mohammad-Alizadeh-Charandabi S, Ahmadpour P, and Rahi P (2016). Breast cancer risk based on the gail model and its predictors in iranian women. *Asian Pac J Cancer Prev*, 17(8):3741–3745.
39. Rahimi G, Faizi-Khankandy I, Nemati A, et al (2016). Survey of demographic characteristics of referred patients for mammography and their results at fatemy hospital in ardabil. *Journal of Health*, 7(1):95–101.[In Persian].
40. Ahmadinejad N, Movahedinia Saj, Movahedinia Sam, et al (2013). Distribution of breast density in iranian women and its association with breast cancer risk factors. *Iran Red Crescent Med J*, 15(12):e16615.
41. Veisy A, Lotfinejad Sh, Salehi K, and Zhian F (2015). Risk of breast cancer in relation to reproductive factors in north-west of iran, 2013-2014. *Asian Pac J Cancer Prev*, 16(2):451-5.

42. Shamshirian A, Heydari K, Shams Z, et al (2020). Breast cancer risk factors in iran: a systematic review & meta-analysis. *Horm Mol Biol Clin Investig*, 41(4).
43. Yeganeh Z, Sheikhan Z, Kariman N, et al (2018). Relationship between pregnancy-associated variables and breast cancer risk: A systematic review. *Iran J Obstet Gynecol Infertil,* 21:85–97.
44. Pezeshki M, and Ansari J (2018). Evaluating the risk factors of breast Cancer. *Paramedical Sciences and Military Health,* 13(3):1-11.
45. Motie MR, Besharat S, Torkjazi R, et al (2011). Modifiable risk of breast cancer in northeast Iran: hope for the future. a case-control study. *Breast Care (Basel)*, 6(6):453-6.
46. Kardan-Souraki M, Moosazadeh M, Khani S, et al (2019). Factors related to breast cancer screening in women in the northern part of iran: A cross-sectional study. *Open Access Maced J Med Sci*, 7(4):637-642.
47. Danaei M, Hoseini Z, and Momeni M (2021). The frequency of breast cancer risk factors and the correlation of the results of the risk assessment models in the iranian population. *Iranian Journal of Blood and Cancer*, 13(3): 72-77.[In Persian].
48. Amini-Sani N, Shamshir-Garan M, Ghavam-Nasiri M, et al (2005). Direct and indirect effects of smoking on breast cancer. *J Babol Univ Med Sci*, 7 (1) :63-68.[In Persian].
49. Tehranian N, Shobeiri F, Hafezi-Pour F, et al (2010). Risk factors for breast cancer in iranian women aged less than 40 years. *Asian Pac J Cancer Prev*, 11(6):1723-5.
50. Sepandi M, Akrami M, Tabatabaee H, et al (2014). Breast cancer risk factors in women participating in a breast screening program: a study on 11,850 iranian females. *Asian Pac J Cancer Prev*, 15(19):8499-502.
51. Jafarinia B, Bahadorzai M, Delpisheh A, et al (2016). Risk factors of breast cancer in dezful city of iran: a case-control study. *Tehran Univ Med J*, 74(2):135-9.[In Persian].
52. Saki A, Hajizadeh E, and Tehranian N (2011). Evaluating the risk factors of breast cancer using the analysis of tree models. *Intern Med Today*, 17(1): 60-68.
53. Sharif-Zadeh Gh, Hosseini M, Kermani T, et al (2011). Breast cancer and the related factors: A case control study. *J Birjand Univ Med J*, 18 (3) :191-199. [In Persian].
54. Yavari P, Moussa-Zadeh MA, Sadrolhefazi B, et al (2006). Investigating women's risk factors related to breast cancer in patients referred to Shahada Tajrish Hospital in Tehran. *Pajouhandeh (Journal of Shahid Beheshti University of Medical Sciences)*, 10;11(7):9-15. [In Persian].
55. Ayyoubzadeh SM, Almasizand A, Niakan-Kalhori R, et al (2021). Early breast cancer prediction using dermatoglyphics: data mining pilot study in a general hospital in iran. *Health Educ Health Promot*, 9(3): 279-285.
56. Hosseinpour R, Haji-Nasrolah E, Ranjpoor F, et al (2011). Evaluation of the risk of breast cancer, based on the Gail model, in women of more than 35 years old: at health centers of Yasouj during 2010-2011. *Iranian Journal of Surgery*, 10(3):8-21. [In Persian].
57. Rafeemanesh E, Taghizadeh-Kermani A, Khajedaluee M, et al (2018). Evaluation of breast cancer risk in relation to occupation. *Middle East J Cancer*, 9(3): 186-194.
58. Ziyari K, Rahmani O, and Eslami R (2018). Are flight staffs at higher risk for breast cancer? *EBNESINA (J of Iran Army University of Medical Sciences)*, 19(4): 53-68.[In Persian].
59. Mirmohammadkhani M, Ghahremanfard F, Tayyebi Kh, et al (2019). Early direct costs of diagnostic and therapeutic services for patients with cancer: A descriptive study in semnan, iran, 2011-2014. *Middle East J Rehabil Health Stud*, 6(1):e55457.
60. Kashfi F, Nikofar AR, and Mohammadi R (2002). Fertility factors predisposing to breast cancer. *J Reprod Infertil*, 3(1):38-45.[In Persian].
61. Holakouie-Naeini K, Ardalan A, Mahmoudi M, et al (2006). Risk factors for breast cancer in Mazandaran Province, 2004. *sjsph*, 4 (1) :27-36 [In Persian].
62. Rouhparvarzadeh N, and Parsa A (2014). Prevalence of breast cancer risk factors in women aged 20 to 69 in Isfahan. *ijbd*, 7 (1) :52-61.[In Persian].
63. Thomas DB, Li Gao D, Ray RM, et al (2002). Randomized trial of breast selfexamination in Shanghai: final results. *J Natl Cancer Inst,* 94(19):1445-57.
64. Miller AB, To T, J. Baines C, et al (1992). Canadian National Breast Screening Study: 1. Breast cancer detection and death rates among women aged 40 to 49 years. *CMAJ*, 147(10):1459-76.

65. Shapiro S, and Strax P (1997). Periodic Screening for Breast Cancer: The Health Insurance Plan Project and its Sequelae, 1963-1986. *J Natl Cancer Inst Monogr*, (22):27-30.
66. Dastgiri S, H de Bock G, Sanaat Z, et al (2022). Acceptability and compliance with a breast cancer prevention campaign in the northwest region, iran. *Breast Cancer Management*, 11(1):BMT62.
67. Naghibi A, Shojaeezade D, Montazeri A, et al (2013). Early detection of breast cancer among women in mazandaran, iran. *Iran J Health Sci*, 1(1): 44-49.
68. Anbari K, Ahmadi S.AY, Baharvand P (2017). Investigation of breast cancer screening among the women of khorramabad: a cross-sectional study. *Epidemiology Biostatistics and Public Health*, 14(1):e12099–1.
69. Farzaneh E, Heydari H, Shekarchi AA, et al (2017). Breast and cervical cancer-screening uptake among females in ardabil, northwest iran: a community-based study. *Onco Targets Ther*, 10:985-992.
70. Kavehie B, Fasihi-Harandi T, and Rahimzadeh M (2019). Contributors of mammography screening with zero-inflated count regression models by bayesian approach. *CJHR*, 4(2): 38-43.
71. Mirfarhadi N, Ghanbari A, Khalili M, et al (2017). Predictive factors for diagnosis and treatment delay in iranian women with breast cancer. *Nurs Midwifery Stud*, 6(2):e27452.
72. Babu GR, Samari G, Cohen SP, et al (2011). Breast cancer screening among females in iran and recommendations for improved practice: a review. *Asian Pac J Cancer Prev*, 12(7):1647-55.
73. Shirzadi S, Nadrian H, Asghari-Jafarabadi M, et al (2017). Determinants of mammography adoption among iranian women: What are the differences in the cognitive factors by the stages of test adoption? *Health Care Women Int*, 38(9):956-970.
74. Heydari Z, Mahmoudzadeh-Sagheb HR, and Sakhavar N (2008). Breast cancer screening knowledge and practice among women in southeast of iran. *Acta Med Iran*, 46(4):321-328.
75. Haghighi JD, Hormozi M, Sargolzaee N, et al (2022). Barriers to mammographic screening of breast cancer in women: a cross-sectional study in southeastern iran. *Arch Breast Cancer,* 9(2):174-8.
76. Charkazi A, Samimi A, Razzaghi K, et al (2013). Adherence to recommended breast cancer screening in iranian turkmen women: the role of knowledge and beliefs. *ISRN Prev Med*, 2013:581027.
77. Enjezab B, Faraj-Khoda T, and Bokaei M (2004). Barriers and Motivators Related to Cervical and Breast Cancer Screening. *JSSU*, 12 (3) :78-84.[In Persian].
78. Jalilian F, Jerome-D'Emilia B, Najafi F, et al (2022). Socio-economic status and clinical breast examination screening uptake: findings from the first cohort study among iranian kurdish women. *Asian Pac J Cancer Prev*, 23 (5):1555-1564.
79. Safarpour M, Tiyuri A, and Mohamadzade M (2018). Knowledge, attitudes and practice of women towards breast cancer and its screening: Babol city. *Iran J Health Sci*, 6(4): 1-9.
80. Rezaeimanesh M, Solhi M, Ebadi-Fard-Azar E, et al (2021). Determinants of mammography screening in tehranian women in 2018 based on the health belief model: A cross-sectional study. *J Educ Health Promot*, 10:119.
81. Moodi M, Rezaeian M, Mostafavi F, et al (2012). Determinants of mammography screening behavior in iranian women: A population-based study. *J Res Med Sci*, 17(8):750-9.
82. Emami L, Ghahramanian A, Rahmani A, et al (2021). Beliefs, fear and awareness of women about breast cancer: Effects on mammography screening practices. *Nurs Open*, 8(2):890-899.
83. Morowatisharifabad M, Zeidabadinezhad M, and Karimizarchi M (2015). Study of mammography practice and its barriers among close relatives of breast cancer patients in sirjan. *TB (Toloo-e-Behdasht)*, 13(6): 127-137.[In Persian].
84. Badakhsh M, Balouchi A, Taheri S, et al (2018). Attitude and practice regarding breast cancer early detection among iranian women: A systematic review. *Asian Pac J Cancer Prev*, 19(1):9-16.
85. Majidi A, Majidi S, Salimzadeh S, et al (2017). Cancer screening awareness and practice in a middle income country; a systematic review

from iran. *Asian Pac J Cancer Prev*, 18(12):3187-3194.
86. Hatefnia E, Niknami Sh, Bazargan M, et al (2010). Correlates of mammography utilization among working muslim iranian women. *Health Care Women Int*, 31(6):499-514.
87. Farshbaf-Khalili A, Shahnazi M, Vahed L, et al (2014). Status of breast self-examination performance among women referring to health centers of Tabriz, Iran. *CJMB*, 1(3): 090-096.
88. Dianatinasab M, Mohammadianpanah M, Daneshi N, et al (2018). Socioeconomic factors, health behavior, and late-stage diagnosis of breast cancer: considering the impact of delay in diagnosis. *Clin Breast Cancer*, 18(3):239-245.
89. Momenimovahed Z, Tiznobaik A, Taheri S, et al (2020). A review of barriers and facilitators to mammography in asian women. *Ecancermedicalscience*, 14:1146.
90. Monfared A, Ghanbari A, Jansar-Hosseini L, et al (2017). Status of Screening by Mammography and its Related Factors in the General Population of Women in Rasht. *IJN*, 30(107):32-41. [In Persian].
91. Montazeri A, Vahdaninia M, Harirchi I, et al (2008). Breast cancer in iran: need for greater women awareness of warning signs and effective screening methods. *Asia Pac Fam Med*, 7(1):6.
92. Mirzaei-Alavijeh M, Ghorbani P, and Jalilian F (2018). Socio-cognitive determinants of the mammography screening uptake among iranian women. *Asian Pac J Cancer Prev*, 19(5):1351-1355.
93. Saeedi H, Akbari H, Fuladiyan M, et al (2022). Social determinants associated with disease diagnosis in women with breast cancer. *IJBD*, 15(3): 45-66.[In Persian].
94. Noori K, Sahraee P, and Keshavarz-Mohammadi N (2021). Barriers to participation of breast cancer patients' relatives in mammographic screening. *IJBD*, 14(2):26–40.[In Persian].
95. Azami-Aghdash S, Ghojazadeh M, Sheyklo SG, et al (2015). Breast cancer screening barriers from the womans perspective: a meta-synthesis. *Asian Pac J Cancer Prev*, 16(8):3463-71.
96. Moghaddam-Tabrizi F, Vahdati S, Khanahmadi S, et al (2018). Determinants of breast cancer screening by mammography in women referred to health centers of urmia, iran. *Asian Pac J Cancer Prev*, 19(4):997-1003.
97. Hajizadeh A, Mohammaddokht S, Dorri-Kafrani S, et al (2023). Factors influencing iranian women's participation in breast cancer screening programs: A systematic review. *EBHPME*, 7(2): 158-171
98. Khazaee-pool M, Majlessi F, Foroushani AR, et al (2014). Perception of breast cancer screening among iranian women without experience of mammography: a qualitative study. *Asian Pac J Cancer Prev*, 15(9):3965-71.
99. Irani M, Nosrati SF, Ghaffari F, et al (2021). Knowledge, attitude, and practice of women regarding breast cancer screening behaviors in mashhad, iran. *Journal of Midwifery and Reproductive Health*, 9(2): 2726-2735.
100. Izanloo A, Ghaffarzadehgan K, Khoshroo F, et al (2018). Knowledge and attitude of women regarding breast cancer screening tests in eastern iran. *Ecancermedicalscience*, 12:806.
101. Rezapour A, Pirani N, Bouzarjomehri H, et al (2021). Cost-effectiveness of digital mammography compared to film mammography in screening of breast cancer: a systematic review. *Annals of Cancer Research and Therapy*, 28(2):118–124.
102. Vakili M, Jafarizadeh M, Sadeghian M, et al (2009). Burden of breast cancer in females of yazd province, 2006. *Feiz*, 13(1):31–36.[In Persian].
103. Daroudi R, Akbari-Sari A, Nahvijou A, et al (2015). The economic burden of breast cancer in iran. *Iran J Public Health*, 44(9):1225–1233.
104. Davari M, Yazdanpanah F, Aslani A, et al (2013). The direct medical costs of breast cancer in iran: Analyzing the patient's level data from a cancer specific hospital in isfahan. *Int J Prev Med*, 4(7):748-54.
105. Jalali FS, Keshavarz K, Seif M, et al (2023). Economic burden of breast cancer: a case of southern iran. *Cost Eff Resour Alloc*, 21(1):58.
106. Sepanlou SG, Poustchi H, Kamangar F, and Malekzadeh R (2011). Effectiveness and feasibility of lifestyle and low-cost pharmacologic interventions in the

prevention of chronic diseases: a review. *Arch Iran Med*, 14(1):46-53.
107. Mousavi SM, Mohagheghi MA, Mousavi-Jerrahi A, et al (2006). Burden of breast cancer in iran: a study of the tehran population based cancer registry. *Asian Pac J Cancer Prev*, 7(4):571-4.
108. Aryannejad A, Saeedi-Moghaddam S, Mashinchi B, et al (2023). National and subnational burden of female and male breast cancer and risk factors in iran from 1990 to 2019: results from the global burden of disease study 2019. *Breast Cancer Res*, 25(1):47.
109. Ataeinia B, Saeedi-Moghaddam S, Shabani M, et al (2021). National and subnational incidence, mortality, and years of life lost due to breast cancer in iran: trends and age-period-cohort analysis since 1990. *Front Oncol*, 11:561376.
110. Safari H, Poder TG, Afshari S, et al (2022). Determination of a cost-effectiveness threshold for cancer interventions in iran. *Front Oncol*, 12:1039589.
111. Rashidian A, Barfar E, Hosseini H, et al (2013). Cost effectiveness of breast cancer screening using mammography; a systematic review. *Iran J Public Health*, 42(4):347–357.
112. Bastani P, and Ahmad-Kiadaliri A (2012). Cost-utility analysis of adjuvant therapies for breast cancer in iran. *Int J Technol Assess Health Care,* 28(2):110-4.
113. Afkar A, Jalilian H, Pourreza A, et al (2021). Cost analysis of breast cancer: a comparison between private and public hospitals in iran. *BMC Health Serv Res*, 21(1):219.
114. Askarzade E, Adel A, Ebrahimipour H, et al (2019). Epidemiology and cost of patients with cancer in iran: 2018. *Middle East J Cancer*, 10(4): 362-371.
115. Sargazi N, Daroudi R, Zendehdel K, et al (2022). Economic burden of gynecological cancers in iran. *Value Health Reg Issues*, 28:1-6.
116. Barfar E, Rashidian A, Hosseini H, et al (2014). Cost-effectiveness of mammography screening for breast cancer in a low socioeconomic group of iranian women. *Arch Iran Med*, 17(4):241-5
117. Hatam N, Ahmadloo N,Vazirzadeh M, et al (2016). Cost-effectiveness of intensive vs.standard follow-up models for patients with breast cancer in shiraz, iran. *Asian Pac J Cancer Prev,* 17(12):5309-5314.
118. Haghighat S, Akbari ME, Yavari P, et al (2016). Cost-effectiveness of three rounds of mammography breast cancer screening in iranian women. *Iran J Cancer Prev*, 9(1):e5443.
119. Zehtab N, Jafari M, Barooni M, et al (2016). Cost-effectiveness analysis of breast cancer screening in rural Iran. *Asian Pac J Cancer Prev*, 17(2):609-14.
120. Askarian M, Dianat S, Tahmasebi S, et al (2022). Cost-effectiveness of breast cancer screening in shiraz, iran. *Int J Prev Med*, 13:147.
121. Akbari-Sari A, Zendehdel K, Harirchi I, et al (2022). Cost effectiveness of mammography focusing on mobile mammography for breast cancer screening in iran: A review study. *IJOGI*, 24(12):98-109.
122. Adibi A, Golshahi M, Sirus M, et al (2015). Breast cancer screening: Evidence of the effect of adjunct ultrasound screening in women with unilateral mammography-negative dense breasts. *J Res Med Sci*, 20(3):228-32.
123. Kalantari M, Joulaee A, Kadivar M, et al (2012). Breast cancer control in iran: Specialized breast unit/national screening: Which one is the urgent priority? *Journal of Clinical Oncology*, 30(27).
124. Roshandel G, Ferlay J, Ghanbari-Motlagh A, et al (2021). Cancer in iran 2008 to 2025: Recent incidence trends and short-term predictions of the future burden. *Int J Cancer*, 149(3):594-605.
125. Rafiemanesh H, Salehiniya H, and Lotfi Z (2016). Breast cancer in iranian woman: Incidence by age group, morphology and trends. *Asian Pac J Cancer Prev*, 17(3):1393-7.
126. Samah AA, and Ahmadian M (2012). Socio-demographic correlates of participation in mammography: a survey among women aged between 35-69 in Tehran, Iran. *Asian Pac J Cancer Prev*, 13(6):2717-20.
127. Tabár BV, Fagerberg G, Chen HH, et al. (1995). Efficacy of breast cancer screening by age. New results from the Swedish Two-County Trial. *Cancer*, 75(10):2507–2517.
128. Tabár BV, Fagerberg G, Chen HH, et al. (2000). The Swedish Two-County Trial twenty years later. Updated mortality results and new insights from long-term follow-up. *Radiol Clin North Am*, 38(4):625-51.

129. Khani-Jeihooni A, Darvishi N, and Harsini PA (2020). The effect of educational intervention based on the theory of planned behavior on mammography screening in iranian women. *J Cancer Educ*, 35(2):264-273.

130. Agide FD, Sadeghi R, Garmaroudi G, et al (2018). A systematic review of health promotion interventions to increase breast cancer screening uptake: from the last 12 years. *Eur J Public Health*, 28(6):1149-1155.