RESEARCH PAPER

Guidelines for Early Screening of Breast Cancer in India: A Systematic Review

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Abstract
Breast Cancer is becoming the predominant cause affecting the life expectancy of women in India. The incidence rate and mortality rate from the disease are continuously rising in the country. High-income countries, despite a high incidence rate, could successfully achieve the mortality reduction by adopting organised screening programs. Against this backdrop, there is an urgent need for coherent, evidence-based early screening guidelines tailored to India's epidemiologic profile, resource constraints, and sociocultural context. This paper synthesizes national and international evidence on screening modalities (CBE, BSE, mammography, and emerging technologies), programmatic experiences, and cost effectiveness to propose pragmatic breast cancer early screening guidelines for India. The objectives are to define context-appropriate target age groups, screening intervals, and to outline health-system and community strategies to enhance the uptake, equity, and sustainability of early detection efforts nationwide.

Keywords: Breast Cancer, Screening Age, Screening Interval, screening strategy, National and International Research Agencies
How to cite this article: Kaur K, Baldi A. Guidelines for early screening of breast cancer in India: a systematic review. Int J Drug Deliv Technol. 2026;16(3s): 666-673; DOI: 10.25258/ijddt.16.3s.85

Introduction

In the present era, cancer has been observed as the leading cause affecting life expectancy in almost every country of world (1,2). Breast cancer is also the most frequently diagnosed cancer among females in a large number of countries. Among Global Cancer Incidences, Mortality and Prevalence (2018) estimates that one in four female cancer cases is diagnosed with breast cancer. Breast cancer incidence rate is high in developed countries; however, the mortality rate from the disease has been decreasing. In contrast, developing countries has lower incidence rate and disproportionately higher mortality rate (3,4). It has also been observed that in these countries, breast cancer is diagnosed at an advanced stage, which leads to increased mortality. The World Health Organization (WHO) has also stated that early breast cancer is a curable disease. Screening is the key in identifying asymptomatic individuals who are likely to have the disease. Considering its importance different developed and developing countries across the globe adopted 'risk-based breast cancer screening programs' or 'population-based breast cancer screening programs' with an intent to diagnose the disease at its earliest stage when it is localized to organ of the origin without metastasis to surrounding tissues or other organs. In Australia, a national screening program (Breast Screen Australia) resulted in decreasing breast cancer mortality from 74 deaths per lakh women aged between 50-74 to 40 deaths per lakh women in 2018 (5). In Canada, a reduction in breast cancer mortality rate has been recorded as 44% in 2017 due to increased screening participation rate, better screening techniques and improved treatments (6). A study on Taiwanese women by Yen et al. (2016) shows that breast cancer screening with mammography plays a potential role in reducing mortality from the disease (7). Beau et al. (2017) evaluated in their study that the breast cancer screening program resulted in a 23 percent reduction in breast cancer mortality and also 2.3 percent of overdiagnosed breast cancer cases in Denmark. Breast Screen Aotearoa (New Zealand), an organized breast screening program have been estimated to lower the mortality rate by 23 percent at the average rate of participation of 64 percent(9). In India, breast cancer has accounted for 27.7 percent (1,62,468) of all newly detected cancer cases (5,87,429) and 23.5 percent (87,090) of all cancer-related deaths (3,71,302) in women (10). Though breast cancer cases are continuously on the rise in the country, there is no organized screening program. It has been roughly estimated from the hospital-based cancer registers (HBCR) and population-based cancer registers (PBCR) reports that 5 years survival rate of breast cancer in India is not even 60 percent, which is almost 89 percent in America. Hence, it is imperative to develop breast cancer guidelines suitable to Indian situation.

Objective of the study

The objective of the study is to draft comprehensive guidelines for breast cancer screening of Indian women covering related aspects viz., age of screening, screening interval and screening strategy, on the basis of 'integrative review meta-analyses' of the prevalent guidelines in leading countries and published studies related to breast cancer screening.

Material and Methods

A limited literature search was performed, with main concepts appearing in the titles, subjects, or major

subject headings, on the key sources including PubMed, Scopus, National Center for Biotechnology Information (NCBI), U.S. National Library of Medicine, Google Scholar, National and International Research Agencies, as well as a focused internet search. Search filters were applied to limit the retrieval to the studies relevant to breast cancer screening. Retrieval was further limited to the female population and English language documents published between January, 2015 and January, 2021

Selection Criteria
Initially, titles and abstracts were reviewed and relevant articles were retrieved. These articles were further assessed for inclusion. Full-text articles were selected on the basis of the inclusion criteria mentioned below.

Inclusion criteria
-Full text published in English language
Published research work
Studies addressing breast cancer screening in terms of its five main aspects- screening program, screening age, screening interval, screening techniques
Studies involving female population
Primary qualitative and quantitative empirical research and secondary syntheses of primary qualitative and quantitative empirical research

Exclusion criteria
Duplicate publication reporting on the same data

Methods of Analysis
Published qualitative and quantitative research has been analyzed using "integrating systematic review meta-analysis". The method provides an ideal mechanism for screening and translating scientific evidences in to informed policy making. National breast cancer screening guidelines of certain developed and developing countries and breast cancer screening recommendations of certain health agencies have been systematically reviewed and quantitative synthesis of the findings from a range of studies related to age and cost effectiveness of screening has been done along with equal consideration to alarming facts of disease in India and thus a new integrative interpretation is produced. This has been done in the spirit of weighing harms and risks associated to breast cancer screening in context to Indian setting to make informed suggestions for screening guidelines in the country.

Results: A total 1349 citations have been identified in the literature search. 1286 citations were excluded on the basis of reviewing titles and abstracts. On conducting full text review only 21 studies were included for guideline preparation (figure 1).
Table 1 enlist the details of 21 papers included for guideline preparation. Out of these 9 were National health agencies/ not for profit health organizations recommendations related to breast cancer screening, 3 research papers and 9 studies were meta-analysis.

Table 1: List of studies included for guideline preparation

	Health agencies/ not- for-profit organizations (Integrating Systematic Review)
1.	American Cancer Society (ACS) (11)
2.	US Preventive Task Force (USPTF) (12)
3.	Cancer Australia (13)
4.	China Anti-Cancer Association (CACA) (14)
5.	Canadian Task Force on Preventive Health Care (6)
6.	World Health Organization (WHO) (15)
7.	National Comprehensive Cancer Network (NCCN) (16)
8.	Brazilian Ministry of Health (17,18)
9.	EUSOBI (19)
	Research studies
1.	Ginsberg et al., 2020 (20)
2.	Sun et al., 2018 (21)
3.	Agrawal et al., 2014 (22)
	Meta- Analysis
1.	Moss et al., 2006 (UK Age Trial a randomized controlled study) (23)
2.	Helliquist et al. 2011 (24)
3.	Jonsson et al., 2007 (Observational study) (25)
4.	Carter et al., 1993 (26)
5.	Rosenquist et al., 1994 (27)
6.	Salzmann et al., 1997 (28)
7.	VanInevald et al.,1993 (29)
8.	Szeto et al., 1996 (30)
9.	Okonkwo et al., 2008 (31)

Dimensions for Breast Cancer Screening Guidelines

There is overwhelming evidence suggesting that breast cancer screening results in mortality reduction. Apart from this, other associated benefits of screening have been observed as reduced treatment cost (32), improved prognosis, increased potential for cure, decreased need for chemotherapy, less extensive surgical procedure, and less time off work (17,33,34). Diagnosing breast cancer at a later stage complicates the treatment and deteriorates its outcomes, whereas diagnosing it earlier has greater benefits- effective treatment options, increased survival, and improved quality of life. Due to economic and logistical constraints, there is a limited organized attempt for early diagnosis of breast cancer in developing countries (35). Apart from this, the detection of breast cancer at an advanced stage is partly due to low awareness about breast cancer among the women of these countries (36). Early detection of the disease not only decreases the mortality rate among women but also lowers the cost of treatment that leads to reduced financial burden on healthcare services. Numerous studies show that early detection of breast cancer with screening leads to reductions in morbidity and mortality among women (7, 37,35). Weighing up these potential benefits, the recommendations for breast cancer screening guidelines emphasized screening age and screening interval

The World Health Organization recommends cancer screening only when resources are sufficient to reach a high proportion of the at- risk patients and to cover the costs of diagnosis and treatment of detected modalities. As per the GLOBOCAN, 2012 and GLOBOCAN, 2018 estimates, age adjusted incidence rate of breast cancer (25.8 per 100,000 person)in India is far lower than U.S. (84.9) (1). But the India has the worst ratio of women dying of it. This alarming situation indicates Indian women needs access to screening programmes. But in country like India with limited health budgets cost effective screening strategy which can be accessed by majority of population is very important.

Based on these three dimensions for development of screening guidelines were identified shown in figure 2

Screening Age

It has been widely observed that in developing countries, there is higher frequency of young age at breast cancer onset. (3,38,39). Whereas in the developed countries breast cancer onset age is almost a decade higher than the developing countries (Bidoli et. al, 2019).

Peak onset age for breast cancer in America is above 50 years (40). American Cancer Society(2015) with an objective to update ACS (2003) breast cancer screening guidelines commissioning a systematic evidence review recommends that women with an average risk should go for regular screening starting at the age of 45. Women aged 40- 44 years should have the opportunity to begin screening. Women should continue screening mammography as long as their overall health is good and they have life expectancy of 10 years or longer.

In Australia, about 75 percent of breast cancer cases are found in women aged 50 years and above(42). Cancer Australia, on the basis of the best available evidence, recommends that women aged 50-74 years with an average risk attend Breast Screen Australia for screening mammograms. Women aged 40-49 and above 75 with an average risk are eligible to receive free screening mammograms, weighing its potential benefits and risks for them. Mammogram screening is not recommended for women younger than 40. For women with an increased risk of developing breast cancer "an individualized surveillance program" is to be developed in consultation with women's general practitioner and specialist.

New guidelines for early detection of breast cancer in Brazil are based on systematic literature review. Brazilian Ministry of Health recommends mammographic screening in women 50- 69 years of age. Mammogram screening is not recommended for the women below 50 years and above 70 years of age. Recommendations do not refer to women at high risk of developing breast cancer (35).

In China, peak onset age for breast cancer is 45-69 years (1). China Anti-Cancer Association (CACA)and National Clinical Research Centre for Cancer have formulated guidelines that recommended that women aged 45-69 years and with an average risk should undergo regular screening. Women aged 40-45 years with an average risk should be aware of benefits, harms and risks associated to breast cancer screening and thus make individualized decision on screening with the consultation of doctors. Women above 69 years of age should have the opportunity to attend screening as long as their overall health is good. Women with high risk of breast cancer such as family history of early onset of breast cancer or pathogenic genetic mutation should start regular screening at the age of 35 years. Women with high risk of developing breast cancer but without family history or pathogenic genetic mutation should start careening at age of 40 years.

Canadian Task Force on Preventive Health Care recommends screening with mammography for women aged 50-74 years and women aged 40-49 can choose to go for mammography screening on the basis of their values and preferences (6).

Table 2: summary of the results related to mortality reduction of the studies evaluating effectiveness of screening mammography for women aged 40-49 years

Studies	Age (Years)	Mortality Reduction	Follow up years
Moss et al., 2006 (U.K. Age Trial	39-49	25%	10 years

A Randomized Controlled Study) (23)	40-49	29%	16 Years
Helliquist et.al, 2011(24)			
Jonsson et. al, 2007 (an observational study) (25)	40-49	38%	--

Reviewing these recommended guidelines related to the breast cancer screening age by cancer societies or national health bodies in different developed and developing countries indicates that screening is effective for women aged 50-69 years as summarized in Table 2. IARC (2015) summarizing randomized control trials, 20 cohort studies and 20 case control studies concludes that effectiveness of screening mammography, in reducing breast cancer mortality for women aged 50-69, is confirmed and also refers to limited evidence suggesting the effectiveness of screening for women aged 40-44 and 45-49 years (43).

With reference to these suggestive evidences, it is safe to recommend screening for the women aged 50-69 years in the case of India.

But the country also has large proportion of breast cancer cases in the age group 40-49 years. As shown in GLOBOCAN, 2018 (1), India is not only witnessing rise in the number of breast cancer incidence but also a trend of age shift among these newly detected breast cancer cases. Breast cancer cases are relatively low in women aged 20-30 years and begin to increase in women aged 30-40 years. Peak onset age for breast cancer is 40-60 years and start decreasing in women aged 60 and above. It is equally important to consider age group 40-49 for screening. EUSOBI (2017) suggests that screening age and interval should be adapted to national demographics and local priorities (19). Urban et. al (2017) refers to the studies that evaluates the effectiveness of screening mammography for women aged 40-49 years (17).

Seelay and Alhassan (2018) refers that most national screening guidelines and recommendations by U.S. Preventive Task Force, American Cancer Society, Canadian Task Force on Preventive Health Care and several other North American Medical Societies give value to mammographic screening for the women in their 40s. Author also cites the observations by Pan Canadian study that Age at entry in to screening 40 years instead of 50 years did not affect the magnitude of average reduction in mortality (between 35% and 44%) (34).

Hence it is suggested that different age groups are important to be included in breast cancer screening protocols in India.

Screening strategy

Population based breast cancer screening has been widely adopted in high income countries for more than thirty years. Most of the Latin countries have national recommendations or guidelines for breast cancer screening. But in the low- and middle-income countries, developing a screening strategy is a contentious issue. Experience of the high-income countries shows that population-based BC screening with mammography has resulted in reducing mortality from the disease. Mammography has been observed as most effective screening tool (43-45).Visintini (2018) by analyzing a limited literature infers that population-based mammography screening strategy results in higher detection rate and lower mortality rate compared to risk -based screening strategy (46). But risk-based screening strategy is more cost effective than universal screening. It results in reduced cost, over diagnosis and false positive results. Cost effectiveness of mammography screening varies across countries.

Table 3: Summary of the studies of cost effectiveness of Breast cancer screening in women (High Income Countries)

Studies	Model	Country	Age group/ Intervals	Cost per life year gained
Carter et al 1993 (26)	MISCAN	Australia	40-69 years/ Annual 40-69 Years/Biennial 50-69 years/Biennial 50-69 Years/ Triennial	$ 27257 $20300 $14733 $13081
Rosenquist et al. 1994 (27)	Markov	USA	60-69 years/Annual 40-85 years/Annual 50-85 years/ interval not determined 50-69 Years/Annual 50-69 Years/ Biennial	$15500 $18600 $16800

Salzmann et al. 1997 (28)	Markov			$45700 $21400
Szeto etal., 1996 (30)	MICROLIFE	New Zealand	45-64 years/Biennial 50-64 years/Biennial 50-64 years/Triennial 50-69 years/Biennial	$15169 $14510 $12668 $14597
VanInevald et al., 1993 (29)	MISCAN	Netherland UK France Spain	50-70 Years/ Biennial - - -	$ 3161 $2685 $8651 $14668

Five studies summarized in Table 3, measuring cost effectiveness of breast cancer screening included in the table 3, presents that cost per life year saved ranges between $ 2685 (for the age group 50-70 years with biennial interval in UK)to $ 45700 (for the age group 50-69 years with annual interval in USA). Data in the table indicates that biennial mammography screening for the age group 50-69 or 50-70 years is cost effective (cost per life saved ranging between $14733 to $ 21400 for the age group 50-69 Years and $ 3161 to $ 14668 for 50-70 years) in the high-income countries (Australia, US, UK, New Zealand, Netherland, France and Spain).

On the other hand, studies in low- and middle-income countries (China, Ghana and Islamic Republic of Iran) suggested that population-based mammography screening is less cost effective and thus not economically attractive. The studies reported $389184/QALY incremental cost effectiveness ratio of general mammography screening in Iran and $ 12908/ QALY in Ghana. On the basis of the observations- population based mammography screening being not cost effective and high risk-based screening having higher detection rate in low-and- middle Income countries. Sun et al. (2018) adopting Markov model and using data of Government of China's cancer screening program compared life time effects, costs and cost effectiveness of breast cancer screening versus no screening (21). It has been estimated that Annual, triennial and 5 years risk-based screening of the women (age group 45-69) achieves incremental cost effectiveness ratio $ 33543, $6671 and $6917 respectively. Thus, risk-based screening with three years of interval has been observed to be most cost effective. The study has also observed that risk- based screening yielded higher QALY's compared with no screening.

Table4: Summary of Results of a study measuring cost effectiveness of Breast Cancer Screening with Mammography in India.

Study	Model	Interval/Age group	Cost per life year gained	Cost per death averted
Okonkwo et al. 2008 (31)	MISCAN	Once at age 50 Biennial /50-70 Years Once at age 40 Biennial 40-60 years	$1634 $3308 $6496 $3468	$22220 $36731 $110542 $46021

Table 4 shows the study in India estimated the cost per life year saved of four strategies- once at 50, biennial screening for 50-70, once at 40 and biennial screening for 40-60 as $ 1634, $ 3308, $6496 and $3468 correspondingly and cost per death averted as $ 22220, $36731, $110542 & $46021 respectively.

Table 5: Summary of the Results of study measuring cost effectiveness of Breast Cancer Screening with Clinical Breast Examination (CBE) in India

Study	Model	Interval/Age group	Cost per life year gained	Mortality Reduction
Okonkwo et al. 2008 (31)	MISCAN	Once at age 50 Annual/40-60	$793 $3108	2% 23.3%

		5 year/ 40-60 Biennial 40-60 years	$1251 $1341	8% 16.3%

As summarized in Table 5, study further estimated that single screening at the age of 50 with Clinical breast examination reduced 2% mortality rate at a cost of $793 per life year gained, with the interval of every five for the age group 40-60 years year mortality reduction went up to 8% at the cost of $ 1251 per life year gained and biennial and annual CBE for the same age group led to 16.3% and 23.3% mortality reduction respectively at the cost of $1341 and $ 3108 correspondingly. The study also concluded that annual screening with CBE had effects (23.3% mortality reduction) quite closer to the effects of biennial screening with mammography (25.8% mortality reduction) comparatively at the lower cost.

All the strategies reported in this study seems to be more cost effective compared with similar interventions reported in other studies. Moreover, it has been described in the study that lower incidence of breast cases in India on the cost effectiveness of screening was balanced by high incidence of advanced breast cancer which led to larger effects of screening. However, there are some discrepancies in cost effectiveness estimates of different studies perhaps due to observed variation in intervention designs and modeling approaches. Hence the chance of comparing these results is quite discouraging. Despite this, these studies increase the evidence base for informed decision making.

Thus, it can be inferred that clinical breast examination is an effective screening strategy in terms of cost and mortality reduction in Indian setting. CBE has potential to improve the stage at diagnosis in context where tumors are detected at stage 2, 3 or 4 in most of the cases. Ginsburg et al. (2015) explained in his study that due to the expenses of mammography machinery and its only use for breast imaging, accessibility to mammography is limited in low-and -middle income countries (21). In this situation ultrasound could be employed as effective screening tool adjunct to CBE most particularly for the women aged below 50, having dense breast tissues. Ultrasound is more effective imaging modality in the case of dense breasts than mammography. Screening could be effective only if all the screened cases proceed to receive diagnosis and diagnosed cases go on to receive treatment (21). Okonkwo et al. (2008) estimated the screening cost with CBE and mammography was 10% and 28% respectively of the treatment cost of breast cancer diagnosis and treatment. Considering these estimates and limited health budgets of the country (India), CBE and Ultrasound can be employed as a part of the effective screening strategy adjunct to mammography (31).

Apart from this, late detection of breast cancer is partly due to the relatively low awareness about the disease among the women of developing countries. World Health Organization (WHO) and Breast Health Global Initiative (BHGI) recommends that awareness of screening and importance of early detection is important to integrate as an important part of screening strategy in developing countries. Autier et al. (2015) describes that in Swedish Clinical Trials breast cancer mortality reduced partly due to the awareness of the women in the screened group (37). In Taiwan, Japan, Korean, Singapore and Hong Kong, reduction in breast cancer mortality can be attributed to awareness of breast cancer along Breast cancer prevention and implementation of screening programs. Hence the value of raising awareness, of the women about breast cancer to make early detection of the disease effective, is undeniable.

Screening Interval

Different countries and agencies recommend different screening interval for women with average risk of breast cancer. American Cancer Society (ACS) recommends annual screening for the women aged 45-54 years and biennial screening for the women aged 55 and above (11). The U.S. Preventive Task Force (USPTF) recommends biennial screening for the women aged 50-74 years (12). A committee of breast cancer in Chinese Anti-Cancer Society recommends annual opportunistic screening for women aged 40-49 years and annual or biennial opportunistic or population-based screening for women aged 50-69 years. These evidences related to the recommendation of breast cancer screening suggest annual screening for the women below 50. Because tumors at young age are more likely to be aggressive and spread quickly. To make the early detection possible, shorter interval of screening for this age group is advisable. But in the case of mammography screening, biennial periodicity preserves almost all benefits of annual screening reducing the risks nearly by half.

Screening for women at high risk of breast cancer

Aggarwal et al. (2014) defines the factors that put women at higher risk of breast cancer- a mutation in BRCA1 or BRCA2 mutation or first degree relative with BRCA1 or BRCA2 mutation, a strong family history of breast or ovarian cancer at age 40 or younger, radiation treatment to the chest area during childhood or young adulthood, mutation in the TP53 or PTEN genes or a first degree relative with TP53 or PTEN gene mutation, personal history of invasive breast cancer, DCIS, LCIS or atypical hyperplasia (22). American Cancer society recommends MRI screening for women at greater risk of breast cancer. A committee of breast cancer in China Anti-Cancer Society recommends annual screening with mammography and MRI below the age of 40 for high-risk women. National Comprehensive Cancer Network recommends annual breast cancer screening with mammogram or breast MRI for the women at high risk starting at the age of 25 to 40 years. Studies also suggest that women with elevated lifetime risk should be screened annually using breast MRI due to its exhibiting high sensitivity (22, 47, 48).

Limitations of Breast Cancer Screening

Breast Cancer Screening also involves some risk such as false positive, false negative and over diagnosis. False positive refers to the screen detected changes in breasts that may not be due to breast cancer. It is most common adverse effects for which women have to undergo number of investigations to examine a change that is not due to breast cancer. It may be due to many factors such as greater mammographic density, first mammogram, large intervals between screens, lack of previous mammograms for comparison and difference in training and performance of the interpreting radiologists (49). False negative is when screening fails to detect the changes in breasts due to breast cancer. It is more likely to happen in the women with dense breast tissues (34). Over diagnosis refers to diagnosing some cancer by screening that may not identified clinically or caused a problem in an individual's lifetime. So, the guidelines for breast cancer screening should be designed considering these limitations also.

Conclusion and recommendations for breast cancer screening guidelines

To conclude, it can be inferred that age of initiation for breast cancer screening should be 40 years. Screening guidelines of developed and developing countries and the research studies related to screening suggest that screening is effective for the age group 50-69 as well as 40-49. Considering the disease characteristic of the Indian women it is equally important to consider both age groups for regular screening. Related to the screening strategy, it highly suggestive that screening with mammography is effective in reducing mortality. But considering the situation of the country where majority of health care cost is borne by the patient rather than government and availability of the limited national health budgets, screening methods- clinical breast examination (CBE) and ultrasound (US) have the potential role to play for early detection. Awareness as an integral part of screening strategy is needed to be enhanced. Further weighing the risks and benefits, shorter intervals (a year or less than a year) for screening women below the age of 50 years and two years interval for the women aged 50 and above is advantageous. Breast MRI has been observed as effective screening tool for women at increased starting the age of 25. Based on the analysis of different studies related to breast cancer screening, following strategies of screening guidelines are suggested.

Designing and implementing effective educational programs that increase women's awareness about breast cancer are important steps to make screening a successful strategy for reducing the burden of breast cancer in low to middle income countries like India.Women of all age groups including younger ones below the age of 40 Years

- Mass media campaigns – advertisements by nationwide TV and radio, print media via posters and broachers, social media via Facebook, Instagram, Whatsapp or other social sites- could become a potential agent for disseminating information about breast cancer sign, symptoms, risk factors, screening, techniques of self- breast examination and accessing other screening services among the women of all age groups most particularly the women of younger age.
- It is suggested that ASHA (Accredited Social Health Activist) workers should be trained for creating awareness about breast cancer among the rural women. They should be made to train the rural women for self-breast examination.
- Health Workers (Medical and Paramedical personnel) with good communication skills can increase the awareness of women about the importance of breast cancer screening. Improving communication of medical personnel could be done through training or by introducing topic in curricula of the faculty of medicine.
- Knowledge of different aspects of breast cancer, self- breast examination and other screening services should be imparted to young girls as a part of school education.

Women aged 40- 49 Years at average risk of breast cancer

- Women of this category should undergo clinical breast examination (CBE) annually.
- They should be advised to perform self -breast examination monthly.
- Breast ultrasound is suggested as supplementary screening method for the women aged 40-44 years having dense breast tissues.
- It suggested that for the women aged 45-49 years, Mammography should be recommended adjunct to CBE.

Women aged 50-69 at average risk of breast cancer

It is suggested that women aged 50-69 years should undergo clinical breast examination annually.

Regular biennial mammography must be recommended for the women of this age group.

Women aged 70 and above

Regular screening is not suggested for the women aged 70 and above. But women of this age group should have the opportunity to continue screening if they wish so or having good health or having10 years more life expectancy.

Women at high risk

- It is suggested that women with BRCAI or BRCA2 mutation or first degree relative with mutation should be recommended annual screening with Mammography and breast MRI after the age of 25 years.
- Women with strong family history of breast or ovarian cancer should be screened annually using

mammography and breast MRI above the age of 30 years

- Women with TP53 or PTEN gene mutation should be recommended to start screening with breast MRI between the age 20 and 25.
- Women with personal history of invasive breast cancer, DCIS, LCIS or atypical hyperplasia should be recommended annual screening.

Awareness about breast cancer is a key component for the success of any early detection guidelines. The women should be aware to undergo clinical breast examination and supplementary screening methods according to age and additional risk factors.

References

1. Bray, F., Ferlay, J., Soerjomataram, I., Siegel, R. L., Torre, L. A., & Jemal, A. (2018). Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA: a cancer journal for clinicians, 68(6), 394-424.
2. Yeshitila, Y. G., Kassa, G. M., Gebeyehu, S., Memiah, P., & Desta, M. (2021). Breast self-examination practice and its determinants among women in Ethiopia: A systematic review and meta-analysis. PloS one, 16(1), e0245252.
3. Bhikoo, R., Srinivasa, S., Yu, T. C., Moss, D., & Hill, A. G. (2011). Systematic review of breast cancer biology in developing countries (part 2): Asian subcontinent and South East Asia. Cancers, 3(2), 2382-2401.
4. Donnelly, T. T., Al Khater, A. H., Al Kuwari, M. G., Al-Bader, S. B., Al-Meer, N., Abdulmalik, M., ... & Fung, T. (2015). Do socioeconomic factors influence breast cancer screening practices among Arab women in Qatar?. BMJ open, 5(1), e005596.
5. Australian Institute of Health and Welfare (2020). Breast Screen Australia Monitoring Report 2020. Cancer Series 129, Canberra: AIHW
6. Canadian Task Force on Preventive Health Care (2018). Recommendations on screening for breast cancer in average-risk women aged 40-74 years. CMAJ 2018; 183:1991-2001.
7. Yen, A. M. F., Tsau, H. S., Fann, J. C. Y., Chen, S. L. S., Chiu, S. Y. H., Lee, Y. C., ... & Chiou, S. T. (2016). Population-based breast cancer screening with risk-based and universal mammography screening compared with clinical breast examination: a propensity score analysis of 1 429 890 Taiwanese women. JAMA oncology, 2(7), 915-921.
8. Beau, A. B., Lynge, E., Njor, S. H., Vejborg, I., & Lophaven, S. N. (2017). Benefit-to-harm ratio of the Danish breast cancer screening programme. International journal of cancer, 141(3), 512–518. https://doi.org/10.1002/ijc.30758
9. Ministry of Health. 2020. BreastScreen Aotearoa National Policy and Quality Standards. Wellington: Ministry of Health.
10. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, Bray F. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. CA Cancer J Clin. 2021 May;71(3):209-249. doi: 10.3322/caac.21660. Epub 2021 Feb 4. PMID: 33538338.
11. American Cancer Society. American Cancer Society Recommendations for the Early Detection of Breast Cancer. 2019. https://www.cancer.org/content/dam/CRC/PDF/Public/8579.00.pdf cancer.org | 1.800.227.2345
12. Siu A L. Screening for Breast Cancer: U.S. Preventive Services Task Force Recommendation Statement Ann Intern Med. 2016;164:279-296. doi:10.7326/M15-2886
13. Cancer Australia (2015). Early detection of breast cancer. retrieved from https://www.canceraustralia.gov.au/publications-and-resources/position-statements/early-detection-breast-cancer on March, 2021.
14. Huang, Y., Tong, Z., Chen, K., Wang, Y., Liu, P., Gu, L., Liu, J., Yu, J., Song, F., Zhao, W., Shi, Y., Li, H., Xiao, H., & Hao, X. (2019). Interpretation of breast cancer screening guideline for Chinese women. Cancer biology & medicine, 16(4), 825–835. https://doi.org/10.20892/j.issn.2095-3941.2019.0322
15. World Health Organization (WHO). Breast Cancer. Retrieved from https://www.who.int/cancer/prevention/diagnosis-screening/ breast-cancer/en/on April 12, 2021.
16. Febbraro T, Robison K, Wilbur JS, et al. Adherence patterns to National Comprehensive Cancer Network (NCCN) guidelines for referral to cancer genetic professionals. Gynecol Oncol. 2015;138(1):109-114. doi:10.1016/j.ygyno.2015.04.029
17. Urban, Linei Augusta Brolini Dellê et al (2017). Breast Cancer Screening: Updated Recommendations of the Brazilian College of Radiology and Diagnostic Imaging, Brazilian Breast Disease Society, and Brazilian Federation of Gynecological and Obstetrical Associations. Revista Brasileira de Ginecologia e Obstetrícia [online]. 39(10). pp. 569-575. Retrieved from: <https://doi.org/10.1055/s-0037-1606348>. ISSN 1806-9339. https://doi.org/10.1055/s-0037-1606348 on March 1, 2021.
18. Migowski, Arn et al (2018).Guidelines for early detection of breast cancer in Brazil. II - New national recommendations, main evidence, and controversies.Cadernos de Saúde Pública [online]34(6),retrieved from: <https://doi.org/10.1590/0102-311X00074817>. Epub 21 June 2018.ISSN 1678-4464. https://doi.org/10.1590/0102-311X00074817, on Feburary 26, 2021.
19. Sardanelli, F., Aase, H.S., Álvarez, M. et al. (2017). Position paper on screening for breast cancer by the European Society of Breast Imaging (EUSOBI) and

30 national breast radiology bodies from Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Israel, Lithuania, Moldova, The Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Spain, Sweden, Switzerland and Turkey. Eur Radiol 27, 2737–2743 https://doi.org/10.1007/s00330-016-4612-z

20. Ginsburg, O et al. (2020). Breast Cancer Early Detection: A phased Approach to Implementation. Wiley online library. DOI: 10,1002/cncr.32887.
21. Sun, L., Legood, R., Sadique, Z., dos-Santos-Silva, I., & Yang, L. (2018). Cost–effectiveness of risk-based breast cancer screening programme, China. Bulletin of the World Health Organization, 96(8), 568.
22. Agrawal, A., Tripathi, P., Sahu, A., & Daftary, J. (2014). Breast screening revisited. Journal of family medicine and primary care, 3(4), 340.
23. Moss, S. M., Cuckle, H., Evans, A., Johns, L., Waller, M., & Bobrow, L. (2006). Effect of mammographic screening from age 40 years on breast cancer mortality at 10 years' follow-up: a randomised controlled trial. The Lancet, 368(9552), 2053-2060.
24. Hellquist, B. N., Duffy, S. W., Abdsaleh, S., Björneld, L., Bordás, P., Tabár, L., ... & Jonsson, H. (2011). Effectiveness of population-based service screening with mammography for women ages 40 to 49 years: evaluation of the Swedish Mammography Screening in Young Women (SCRY) cohort. Cancer, 117(4), 714-722.
25. Jonsson, H., Bordás, P., Wallin, H., Nyström, L., & Lenner, P. (2007). Service screening with mammography in Northern Sweden: effects on breast cancer mortality–an update. Journal of Medical Screening, 14(2), 87-93.
26. Carter, R., Glasziou, P., van Oortmarssen, G., de Koning, H., Stevenson, C., Salkeld, G., & Boer, R. (1993). Cost-effectiveness of mammographic screening in Australia. Australian Journal of Public Health, 17(1), 42-50.
27. Rosenquist, C. J., & Lindfors, K. K. (1994). Screening mammography in women aged 40-49 years: analysis of cost-effectiveness. Radiology, 191(3), 647-650.
28. Salzmann, P., Kerlikowske, K., & Phillips, K. (1997). Cost-effectiveness of extending screening mammography guidelines to include women 40 to 49 years of age. Annals of Internal Medicine, 127(11), 955-965.
29. van Ineveld, B. M., van Oortmarssen, G. J., de Koning, H. J., Boer, R., & van der Maas, P. J. (1993). How cost-effective is breast cancer screening in different EC countries?. European Journal of Cancer, 29(12), 1663-1668.
30. Szeto, K. L., & Devlin, N. J. (1996). The cost-effectiveness of mammography screening: evidence from a microsimulation model for New Zealand. Health policy, 38(2), 101-115.
31. Okonkwo, Q L., Draisma,G., Kinderen, A., Martin L. &Brown, Koning, B H J. (2008). Breast Cancer Screening Policies in Developing Countries: A Cost-effectiveness Analysis for India, JNCI: Journal of the National Cancer Institute, 100(18),1290–1300, https://doi.org/10.1093/jnci/djn292
32. Montero, A. J., Eapen, S., Gorin, B., & Adler, P. (2012). The economic burden of metastatic breast cancer: a US managed care perspective. Breast cancer research and treatment, 134(2), 815-822.
33. Smith, R. A., Saslow, D., Sawyer, K. A., Burke, W., Costanza, M. E., Evans III, W. P., ... & Sener, S. (2003). American Cancer Society guidelines for breast cancer screening: update 2003. CA: a cancer journal for clinicians, 53(3), 141-169.
34. Seely, J M, and T Alhassan. Screening for breast cancer in 2018-what should we be doing today? Current oncology (Toronto, Ont.) 25(1) (2018): S115-S124. doi:10.3747/co.25.3770
35. da Costa Vieira, R. A., Biller, G., Uemura, G., Ruiz, C. A., & Curado, M. P. (2017). Breast cancer screening in developing countries. Clinics (Sao Paulo, Brazil), 72(4), 244–253. https://doi.org/10.6061/clinics/2017(04)09
36. Kopeci, A., Canaku, D., Muja, H., Petrela, K., Mone, I., Qirjako, G., Hyska, J., & Preza, K. (2013). Breast cancer screening in Albania during 2007-2008. Materia socio-medica, 25(4), 270–272. https://doi.org/10.5455/msm.2013.25.270-272
37. Autier P, Boniol M, Smans M, Sullivan R, Boyle P (2015). Statistical analyses in Swedish randomised trials on mammography screening and in other randomised trials on cancer screening: a systematic review. J R Soc Med 2015; 108:440-50.
38. Corbex, M., Bouzbid, S., & Boffetta, P. (2014). Features of breast cancer in developing countries, examples from North-Africa. European journal of cancer, 50(10), 1808-1818.
39. Bidoli, E., Virdone, S., Hamdi-Cherif, M., Toffolutti, F., Taborelli, M., Panato, C., & Serraino, D. (2019). Worldwide age at onset of female breast cancer: a 25-year population-based cancer registry study. Scientific reports, 9(1), 1-8.
40. American Cancer Society. Breast Cancer Facts & Figures 2019-2020. Atlanta: American Cancer Society, Inc. 2019
41. American Cancer Society Surveillance Program (2003). Estimated new cancer cases by sex and age, Atlanta: American Cancer Society.
42. AIHW (Australian Institute of Health and Welfare) 2018. BreastScreen Australia monitoring report. Cancer series no. 112. Cat. no. CAN 116. Canberra: AIHW.
43. Lauby-Secretan, B., Scoccianti, C., Loomis, D., Benbrahim-Tallaa, L., Bouvard, V., Bianchini, F., & Straif, K. (2015). Breast-cancer screening—viewpoint of the IARC Working Group. New England journal of medicine, 372(24), 2353-2358.
44. Shapiro, C. L., Hardenbergh, P. H., Gelman, R., Blanks, D., Hauptman, P., Recht, A., ... &

Henderson, I. C. (1998). Cardiac effects of adjuvant doxorubicin and radiation therapy in breast cancer patients. Journal of Clinical Oncology, 16(11), 3493-3501.

45. De Koning, H. J. (2003). Mammographic screening: evidence from randomised controlled trials. Annals of Oncology, 14(8), 1185-1189
46. Ho, C., & Visintini, S. (2018). Risk-Based Breast Cancer Screening versus Population-Based Breast Cancer Screening: A Review of the Comparative Clinical and Cost-Effectiveness.
47. Hermann, N., Klil-Drori, A., Angarita, F.A. et al. (2020). Screening women at high risk for breast cancer: one program fits all?. Breast Cancer Res Treat 184, 763–770,https://doi.org/10.1007/s10549-020-05895-w
48. Saccarelli, C R., Bitencourt, A G V & Morris, E A., (2020). Breast Cancer Screening in High-Risk Women: Is MRI Alone Enough?, JNCI: Journal of the National Cancer Institute, 112 (2). 2020, Pages 121–122, https://doi.org/10.1093/jnci/djz130
49. Hubbard, R. A., Kerlikowske, K., Flowers, C. I., Yankaskas, B. C., Zhu, W., & Miglioretti, D. L. (2011). Cumulative probability of false-positive recall or biopsy recommendation after 10 years of screening mammography: a cohort study. Annals of internal medicine, 155(8), 481-492.