REVIEW

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Prevalence of Breast Cancer Screening in Asia: Systematic Review and Meta-analysis

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Abstract

Background: Breast cancer is one of the leading causes of cancer-related mortality among women above 50 years of age. This systematic review and meta-analysis aimed at identifying the prevalence and trend of breast cancer screening among selected Asian countries. **Methods:** We searched three databases including, PubMed, Web of Science, and Scopus using our search terms. Two independent reviewers screened titles and abstracts applying the inclusion and exclusion criteria specified in the PROSPERO (registration ID: CRD42023401516) and any conflicts were resolved through discussion. Two independent reviewers and conflicts also completed the full-text screening, which was solved. Relevant information was extracted in an Excel sheet and random effects meta-analysis was performed to identify the pooled estimate of breast cancer screening in Asia using Stata 17. **Results:** We identified 41 studies from 14 selected Asian countries reporting breast cancer screening rates from 2012-2023. The pooled estimate of four countries (China, Iran, Japan, and Korea) with more than three data points on clinical breast examination and mammographic screening showed a screening rate of 24% (95% CI: 0.20 - 0.27) and 18% (95% CI: (0.14 - 0.21) in the last ten years respectively. **Conclusion:** Most Asian countries do not have sufficient data on breast cancer screening due to a lack of nationally representative surveys or national-level cancer registries. Therefore, it is crucial to strengthen cancer control policies including breast cancer screening programs.

Keywords: Breast cancer- screening- Asia- meta-analysis- ANCCA

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Introduction

Breast cancer (BC) is among the most diagnosed and prevalent cancer sites in the world [1]. About 2.3 million people were diagnosed with breast cancer in 2020 globally with about 685,000 deaths [2]. It is one among the most common causes of cancer related mortality among women [3]. The BC survival rate has increased in the last few decades thanks to the introduction of early detection methods and its treatment and surgical advancements [4]. The Global Breast Cancer Initiative (GBCI) of the World Health Organization (WHO) aims at reducing the global BC mortality by 2.5% each year which would avert a quarter of deaths related to BC by 2030 and to about 40% by 2040 among women <70 years of age [5]. Breast cancer incidence (42.9%), mortality (47.3%) and prevalence (39.1%) was the highest in Asia in 2022 compared to other continents [6]. The incidence of BC is rapidly increasing in many low-and-middle income countries (LMICs) in Asia particularly due to the lack of early detection and screening services in those countries [7].

Preventing and controlling cancer is a major public health issue, most Asia countries lack national level strategies and policies to prevent the incidence of cancer [8]. The lack of national breast cancer screening (BCS) programs is one of the biggest hindrances towards early diagnosis of BC leading to delayed diagnosis and poor survival outcomes [9]. Diagnosis is made via opportunistic screening in resource limited countries due to financial constraints [10, 11]. Several other factors like culture, religion, age, privacy related concerns, educational status, health literacy level, etc. influence a women's decision to utilize BCS services [12, 13]. Regular breast self-examination (BSE) can detect any abnormal changes in the breast early however, mammography is considered the most effective BCS method [14].

WHO has provided information on the use of mammography in some Asian countries among women aged 50-69 [15]. However, there might be some within country variance in the utilization of service based on the

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geographical location, availability of screening services, availability of trained professionals, cost, perception of community residents, etc. [16]. The Demographic and Health Survey (DHS) collects nationally representative data on breast cancer screening among women, however in a selective age group and in few Asian countries [17-19]. Countries in East-Asia like China, Japan and Korea have the national breast cancer screening programs for certain targeted age-groups [20, 21]. However, low participation rate in screening programs remains a challenge [22]. Hence, community sensitization on BCS has not been enough even in high income countries in Asia.

With lack of the national level statistics, the prevalence of BCS obtained from individual studies may provide some insights on the screening services and its utilization in a specific country. Identifying and comparing findings from the individual studies to the population-based or national level reports could explore whether these studies are a reliable source of information in resource limited setting or not. Hence, this study aimed at identifying relevant studies providing information on breast cancer screening rate among 21-member countries of the Asian National Cancer Center Alliance (ANCCA) and explore the situation of BCS in those countries.

Materials and Methods

Data sources and search strategy

All relevant literature was searched from PubMed, Scopus and Web of Science using the search strategy shown in Supplementary file 1. We included articles on breast cancer screening from 2012-2023 and excluded reviews, reports, and meta-analysis from this study. We also performed a hand search using google scholar and checked the reference list of the selected articles to identify additional studies on breast cancer screening.

Study population

Studies from the 21-member countries of the Asian National Cancer Center Alliance (ANCCA) were included in this review. We only included adults, however, didn't limit the age-group of the screened population. We excluded studies conducted among migrants and the screening rate of only the healthy population or controls were analyzed in the meta-analysis for quasi experimental studies.

Study selection

EndNote was used to remove duplicate articles identified from three databases and then the studies were imported into Rayyan, a software to review the articles for screening. The title and abstract of the articles were screened by two independent reviewers (AKB and ZW) and the conflicts were resolved. Any disagreements between the two reviewers were resolved by a third reviewer (RP). Full text screening was also performed by two independent reviewers (AKB and ZW) and data extraction was carried out independently by four reviewers (AKB, RP, ZW, and MM) in an excel sheet.

Quality assessment

For the quality assessment of the selected studies, Newcastle – Ottawa Quality Assessment Scale (NOQAS) was used for cross-sectional and the JBI critical appraisal checklist was used for quasi-experimental studies. The NOQAS categories a study into very good, good, satisfactory, and unsatisfactory study based on the study selection, comparability, and the outcome assessment. It provides a maximum of 10 points for a study [23]. The studies which were identified as unsatisfactory with NOQAS points of less than or equals to four were not included in the meta-analysis. Similarly, the JBI critical appraisal checklist rates the quasi-experimental studies in a four-point Likert scale on nine different aspects of the study like the casual pathway of the study, comparability of the groups, presence of control group, etc. Based on the Likert scale the study was deemed to be included or excluded from further analysis [24].

Data synthesis

Breast cancer screening rate was defined as the number of people screened for breast cancer by total sample size of the study and the frequency of screening was often obtained using a question like "have you ever participated in the breast cancer screening" or "have you ever had breast cancer screening" in the cross-sectional studies. We removed studies only mentioning Breast Self-Examination (BSE) as a breast cancer screening method BSE is a cancer detection method rather than cancer screening. We also removed studies focusing solely on the diagnosis of breast cancer and not in the screening process. We combined estimates from more than one paper to examine the pooled screening rate by country using the sub-group meta-analysis of proportion when studies examined the rate of breast cancer screening in the same country or state. We also showed the pooled estimates by type of breast cancer screening (CBE and mammography). We used the study with highest sample size when the year of screening was similar in a country. We used random-effect model to provide a conservative estimate of effect accounting for heterogeneity between studies. All analyses were conducted in Stata 17.

Results

The study identified 41 articles on breast cancer screening in 14 ANCCA member countries (Bangladesh, China, India, Indonesia, Iran, Japan, Korea, Malaysia, Nepal, Philippines, Singapore, Taiwan, Thailand, and Vietnam) from 2012-2023. The detailed Prisma flow chart has been shown in Figure 1. Table 1 shows the detailed information of the included studies. Some studies had BCS rate by various screening methods hence, we presented the screening rate by screening methods. Most of the studies were from Iran (N = 10) followed by China (N = 7), India (N = 5), Malaysia (N = 4) and others. Two studies were quasi-experimental studies and the rest 39 were cross-sectional studies. BSE (N = 17), CBE (N = 33), and mammography (N = 25) were frequently reported screening methods. We identified irregular screening interval for breast cancer (Table 1).

Table 1. Description of Studies Included in the Systematic Review (N = 41)

S.N.	Country	Authors	year of screening	age group	screening interval	Screening methods	Total population
1	Bangladesh	Islam, R. M. et al, 2016 (41)	2013	30-59	NA	CBE	1590
2.1	Bangladesh	Alam, N. E et al, 2021 (42)	2019	15-75	ever screened	BSE	198
2.2	Bangladesh	Alam, N. E et al, 2021 (42)	2019	15-75	ever screened	CBE	122
2.3	Bangladesh	Alam, N. E et al, 2021 (42)	2019	15-75	ever screened	Mammography	59
2.4	Bangladesh	Alam, N. E et al, 2021 (42)	2019	15-75	ever screened	Ultrasonography	324
3.1	China	Wu, T. Y. et al, 2012 (43)	2012	>=40	once every month	BSE	348
3.2	China	Wu, T. Y. et al, 2012 (43)	2012	>=40	less than 2 years	CBE	398
3.3	China	Wu, T. Y. et al, 2012 (43)	2012	>=40	past 5 years	Mammography	326
3.4	China	Wu, T. Y. et al, 2012 (43)	2012	>=40	past 5 years	Ultrasonography	326
4	China	Zhang, M. et al, 2021 (44)	2015	>=20	ever screened	Breast	88879
5.1	China	Gan, Y. X. et al, 2018 (45)	2016	40-60	once a month	BSE	417
5.2	China	Gan, Y. X. et al, 2018 (45)	2016	40-60	1-2 years ago,	CBE	417
5.3	China	Gan, Y. X. et al, 2018 (45)	2016	40-60	once every 3 years or more	Mammography	417
6	China	Li, H. et al, 2023 (46)	2017	35-64	ever screened	NA	1446
7	China	Sun, Y. et al, 2022 (47)	2018	18-64	NA	NA	3500
8.1	China	Zhang, X. et al, 2022 (48)	2019	>=40	2 years	CBE	406
8.2	China	Zhang, X. et al, 2022 (48)	2019	>=40	2 years	Mammography	406
8.3	China	Zhang, X. et al, 2022 (48)	2019	>=40	2 years	Ultrasonography	406
9.1	China	Zhang, S. et al, 2022 (49)	2020	>=18	ever screened	BSE	1816
9.2	China	Zhang, S. et al, 2022 (49)	2020	>=18	ever screened	CBE	1816
9.3	China	Zhang, S. et al, 2022 (49)	2020	>=18	ever screened	Mammography	1816
10	India	Khokhar, A., 2015 (50)	2012	>=40	ever screened	Mammography	230
11.1	India	Dey, S. et al, 2015 (51)	2013	All	currently	BSE	1982
11.2	India	Dey, S. et al, 2015 (51)	2013	All	last 2 years	CBE/ Mammography	2017
12	India	Zhu, C. K. et al, 2022 (52)	2015	15-49	ever screened	NA	699686
13	India	Sen, S. et al, 2022 (53)	2019	30-49	ever screened	NA	357353
14	India	Khapre, M. et al, 2022 (54)	2019	30-35	ever screened	CBE	1061
15	Indonesia	Solikhah, S. et al, 2021 (55)	2016	>18	ever screened	NA	827
16.1	Iran	Ebrahimi, F. et al, 2022 (56)	2012	20-69	ever screened	BSE	17255
16.2	Iran	Ebrahimi, F. et al, 2022 (56)	2012	>40	ever screened	Mammography	17255
17.1	Iran	Farshbaf Khalili, A. and Shahnazi, M., 2012 (57)	2012	20-50	NA	CBE	400
17.2	Iran	Farshbaf Khalili, A. and Shahnazi, M., 2012 (57)	2012	20-50	NA	Mammography	400

CBE, Clinical Breast Examination; BSE, Breast Self-Examination; MRI, Magnetic Resonance Imaging; NA, Information Not available

Table 1. Continued

S.N.	Country	Authors	year of screening	age group	screening interval	Screening methods	Total population
17.2	Iran	Farshbaf Khalili, A. and Shahnazi, M., 2012 (57)	2012	20-50	NA	Mammography	400
18	Iran	Jalilian, F. et al, 2022 (58)	2014	35-65	ever screened	CBE	5289
19	Iran	Aminisani, N. et al, 2016 (59)	2014	>40	ever screened	Mammography	559
20.1	Iran	Ahmadipour, H. and Sheikhizade, S., 2016 (60)	2015	>18	monthly	BSE	240
20.2	Iran	Ahmadipour, H. and Sheikhizade, S., 2016 (60)	2015	>20	every 2-3 years	CBE	240
20.3	Iran	Ahmadipour, H. and Sheikhizade, S., 2016 (60)	2015	>=40	every 2-3 years	Mammography	37
21.1	Iran	Kardan-Souraki, M. et al, 2019 (61)	2016	40-74	NA	BSE	1165
22	Iran	Farzaneh, E. et al, 2017 (62)	2016	20-60	ever screened	CBE	1134
21.2	Iran	Kardan-Souraki, M. et al, 2019 (61)	2016	40-74	NA	Mammography	1165
23.1	Iran	Ghanbari, A. et al, 2020 (63)	2017	15-45	ever screened	BSE	1472
23.2	Iran	Ghanbari, A. et al, 2020 (63)	2017	15-45	ever screened	CBE	1472
24	Iran	Moghaddam Tabrizi, F. et al, 2018 (64)	2017	30-60	NA	Mammography	384
25	Iran	Rabiei, M. et al, 2022 (65)	2020	>40	1-3 years	CBE	859
26	Japan	Aoki, T. and Inoue, M., 2017 (66)	2015	50-74	within 2 years	NA	155
27.1	Japan	Mizota, Y. and Yamamoto, S., 2021 (67)	2016	>=40	ever screened	NA	39262
27.2	Japan	Mizota, Y. and Yamamoto, S., 2021 (67)	2017	>=40	ever screened	NA	19730
27.3	Japan	Mizota, Y. and Yamamoto, S., 2021 (67)	2018	>=40	ever screened	NA	26286
28.1	Korea	Lee, K. et al, 2022 (68)	2018	40-74	within 1 year	NA	1754
28.2	Korea	Lee, K. et al, 2022 (68)	2019	40-74	within 1 year	NA	1795
28.3	Korea	Lee, K. et al, 2022 (68)	2020	40-74	within 1 year	NA	1800
29	Malaysia	Al-Naggar, R. A. and Bobryshev, Y. V., 2012 (69)	2012	>=40	ever screened	Mammography	200
30.1	Malaysia	Farid, N. D. et al, 2014 (70)	2014	20-64	monthly	BSE	1192
30.2	Malaysia	Farid, N. D. et al, 2014 (70)	2014	20-64	ever screened	CBE	1192
30.3	Malaysia	Farid, N. D. et al, 2014 (70)	2014	20-64	ever screened	Mammography	1192
31.1	Malaysia	Mohan, D. et al, 2021 (71)	2017	>=40	monthly	BSE	250
31.2	Malaysia	Mohan, D. et al, 2021 (71)	2017	>=40	once a year	CBE	250
31.3	Malaysia	Mohan, D. et al, 2021 (71)	2017	>=40	once every 2 years	Mammography	250
32.1	Malaysia	Abdullah, N. et al, 2022 (72)	2020	40-74	ever screened	BSE	200
32.2	Malaysia	Abdullah, N. et al, 2022 (72)	2020	40-74	ever screened	Mammography	200
33.1	Nepal	Shrestha, K, 2012 (73)	2012	20-60	ever screened	BSE	110
33.2	Nepal	Shrestha, K, 2012 (73)	2012	20-60	ever screened	Mammography	110

CBE, Clinical Breast Examination; BSE, Breast Self-Examination; MRI, Magnetic Resonance Imaging; NA, Information Not available

Table 1. Continued

S.N.	Country	Authors	year of screening	age group	screening interval	Screening methods	Total population
33.3	Nepal	Shrestha, K, 2012 (73)	2012	20-60	ever screened	Ultrasonography	110
34.1	Nepal	Bhandari, D. et al, 2021 (74)	2018	>=40	monthly	BSE	500
34.2	Nepal	Bhandari, D. et al, 2021 (74)	2018	>=40	once a year	CBE	500
34.3	Nepal	Bhandari, D. et al, 2021 (74)	2018	>=40	once every 2 years	Mammography	500
35.1	Nepal	Poudel, S. and Dhakal, R., 2021 (75)	2021	30-69	within last 3 months	BSE	269
35.2	Nepal	Poudel, S. and Dhakal, R., 2021 (75)	2021	30-69	within last 3 years	CBE	269
35.3	Nepal	Poudel, S. and Dhakal, R., 2021 (75)	2021	30-69	within past 5 years	Mammography	269
35.4	Nepal	Poudel, S. and Dhakal, R., 2021 (75)	2021	30-69	within 1 year	Ultrasonography	269
36.1	Philippines	Wu, T. Y. and Lee, J., 2019 (76)	2017	>=20	once a month	BSE	920
36.2	Philippines	Wu, T. Y. and Lee, J., 2019 (76)	2017	>=20	ever screened	CBE	893
36.3	Philippines	Wu, T. Y. and Lee, J., 2019 (76)	2017	>=20	ever screened	Mammography	887
37	Singapore	Chan, T. K. et al, 2021 (77)	2015	>=50	every 2 years	Mammography	2532
38	Taiwan	Hsieh, H. M. et al, 2021 (78)	2018	45-69	ever screened	Mammography	621
39.1	Thailand	Kotepui, M. et al, 2015 (79)	2012	>20	once a month	BSE	217
39.2	Thailand	Kotepui, M. et al, 2015 (79)	2012	>20	once a year	CBE	217
39.3	Thailand	Kotepui, M. et al, 2015 (79)	2012	>20	once a year	Mammography	217
40	Vietnam	Duong, L. T. et al, 2020 (80)	2018	>=40	ever screened	Mammography	120
41.1	Vietnam	Ngan, T. T. et al, 2022 (81)	2019	30-74	ever screened	CBE	508
41.2	Vietnam	Ngan, T. T. et al, 2022 (81)	2019	30-74	ever screened	Mammography	508
41.3	Vietnam	Ngan, T. T. et al, 2022 (81)	2019	30-74	ever screened	MRI	508
41.4	Vietnam	Ngan, T. T. et al, 2022 (81)	2019	30-74	ever screened	Ultrasonography	508

CBE, Clinical Breast Examination; BSE, Breast Self-Examination; MRI, Magnetic Resonance Imaging; NA, Information Not available

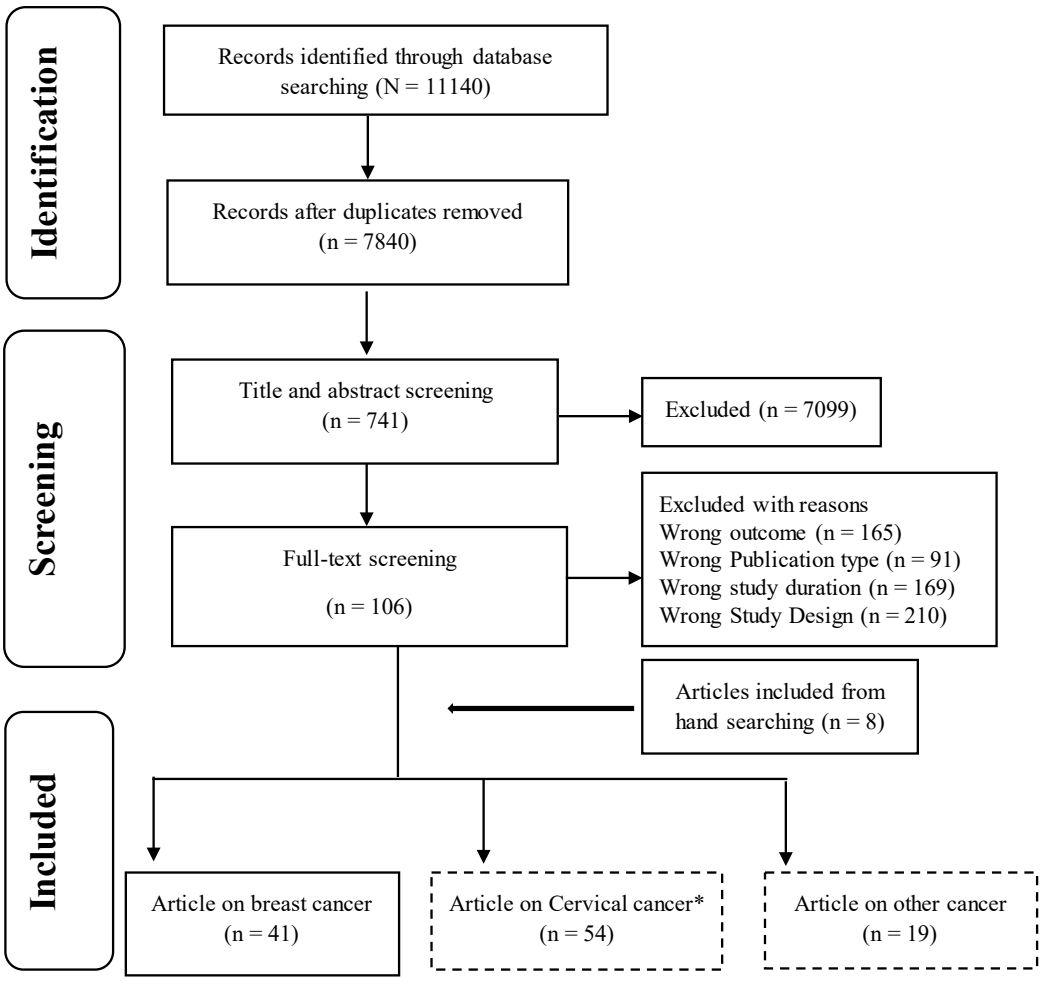

Figure 1. Prisma Flow Diagram of the Included Studies. The dotted box in the included section represents studies which were identified as a part of the review process as per the PROSPERO registration but has not been included in this specific systematic review and meta-analysis. "*" sign represents study which is currently under consideration by some other journal.

Table 2 shows the rate of breast cancer screening by CBE from 2012 to 2023 along with the national breast cancer screening rate identified in the latest government reports like Demographic and Health Survey (DHS) reports, population census reports, etc. The most recent study exploring the rate of cervical cancer screening in 2019 in Bangladesh showed a rate of 12.3% [95% CI = (6.1 – 18.5)] which was more than 10 times than the national statistics of the country in the same year with a screening rate of about 1.7% [25]. There was not a single satisfactory study on breast cancer screening rate from Cambodia, however the demographic and health survey report of Cambodia in the year 2021/22 reported the BCS rate of about 11% among women in the reproductive age group [17]. The study conducted in Sichuan in 2017 [SR = 38.7%, 95% CI = (35.5 – 41.9)] and in Jiangsu province of China in 2018 [SR = 44.1%, 95% CI = (41.9 – 46.3)] showed higher BCS rate than those conducted in Macao in 2016 [SR = 13.9%, 95% CI = (10.3 – 17.5)] or the eastern China in 2020 [SR = 12.9%, 95% CI = (11.2 – 14.5)]. India showed BCS rate of about 9% in 2015 with another study showing a rate of about 2.3% in 2019, however the DHS report 2019/21 showed the BCS rate of only 6% [19].

Similarly, there were only one studies from countries like Indonesia, Philippines, Thailand, and Vietnam. The studies conducted in Iran showed huge variation in the screening rate from 9.8% in 2016 to 52.6% in 2020 with some ups and downs in between. The study conducted in 2015 in Japan showed a high BCS rate [41.3%, 95% CI = (31.2 – 51.4)] but studies in subsequent years showed the BCS of only about 9% (in 2018) while the national statistics showed a rate of 15.1% in 2017 [26]. The national breast cancer screening rate in Korea was about 56.7% in 2016 [27], however the individual studies identified in this systematic review showed the screening rate of nearly half of that of the national statistics in the year 2018-2020. Studies from Malaysia also showed varying results as there was a BCS rate of about 53.3% in 2014 [95% CI = (49.1 – 57.4)] and 36% in 2017 [95% CI = (28.6 – 43.4)]. Two studies found in Nepal showed similar BCS rate which was 3% lower than that of the DHS report in 2022 [18] (Table 2).

Table 3 shows the results of the quality assessment of the cross-sectional studies (N = 39) and based on the given findings six studies were identified as unsatisfactory hence, were excluded from the meta-analysis. These studies

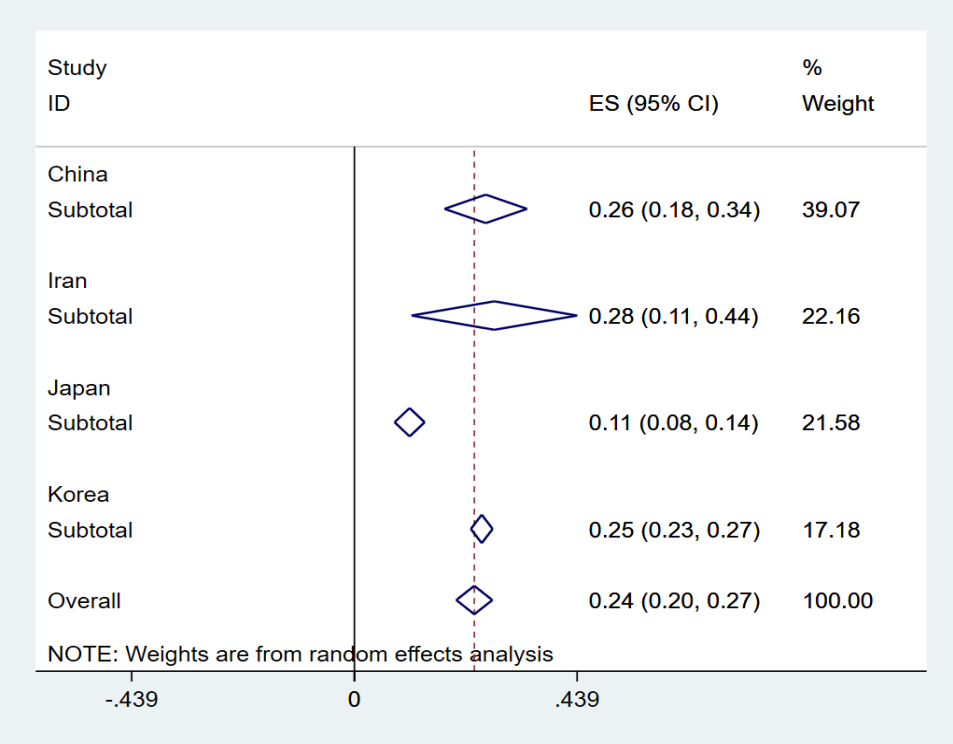

Figure 2. Meta-Analysis of the Rate of Clinical Breast Cancer Screening in Asia.

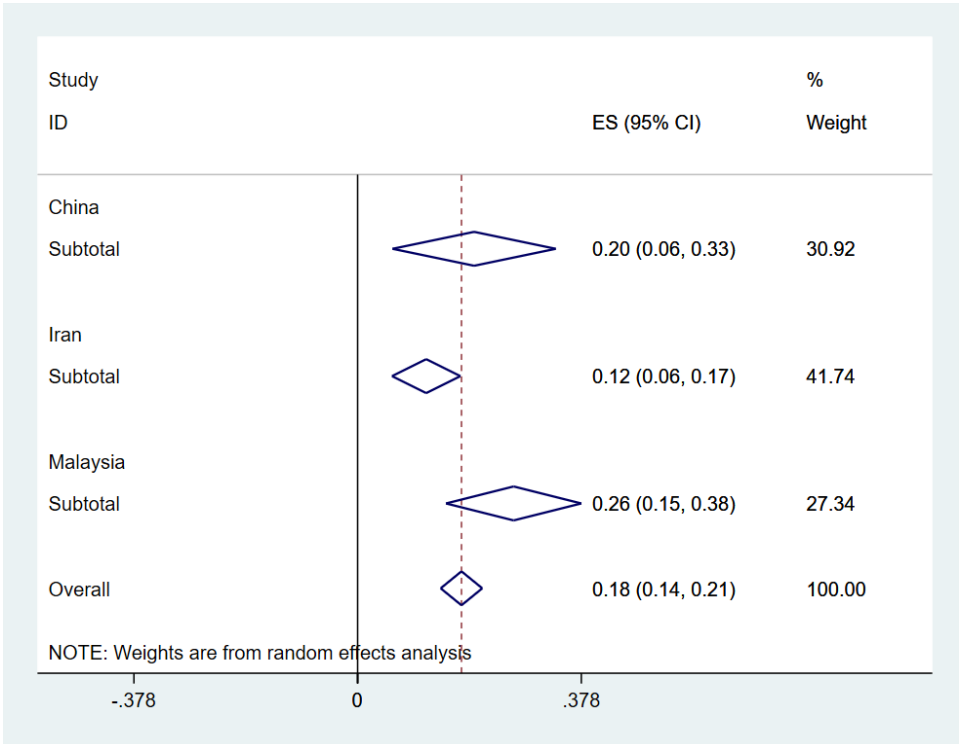

Figure 3. Meta-Analysis of the Rate of Breast Cancer Screening by Mammography in Asia.

scored low on selection and comparability during the QA. Meanwhile, none of the studies scored more than 9 points and only 15 studies were regarded as good studies with 7-8 points in the assessment. Rest of the studies were scored as satisfactory during the analysis. (Table 3) The quality assessment of two quasi-experimental studies have been included in the supplementary file 1.

The pooled estimate of CBE in four countries (China, Iran, Japan, and Korea) with more than three data points and those identified as satisfactory to good studies in the quality assessment showed the overall breast cancer screening rate of 24% [95% CI = (0.20 – 0.27)] in the last ten years. Studies from China and Iran alone contributed to more than 60% weight of the estimate. Japan showed the

Table 2. Breast Cancer Screening Rate by Clinical Breast Examination (CBE) among ANCCA Member Countries from 2012-2023

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	National BCS rate
Bangladesh	-	0.08 (0.07-0.09)	-	-	-	-	-	0.12 (0.06-0.19)	-	-	0.017 ((2019) (26)
Cambodia	-	-	-	-	-	-	-	-	-	-	0.11 (2021/22) (17)
China	0.34 (0.28-0.40)	-	-	0.19 (0.18-0.19)	0.14 (0.10-0.18)	0.39 (0.36-0.42)	0.44 (0.42-0.46)	0.19 (0.15-0.24)	0.13 (0.12-0.15)	-	-
India	-	-	-	0.09 (0.09-0.09)	-	-	-	0.02 (0.01-0.03)	-	-	0.06 (2019/21) (19)
Indonesia	-	-	-	-	0.19 (0.16-0.22)	-	-	-	-	-	-
Iran	0.19 (0.15-0.23)	-	0.12 (0.11-0.13)	0.24 (0.18-0.30)	0.1 (0.08-0.12)	0.29 (0.27-0.32)	-	-	0.53 (0.48-0.58)	-	-
Japan	-	-	-	0.41 (0.31-0.51)	0.06 (0.06-0.06)	0.11 (0.10-0.11)	0.09 (0.09-0.10)	-	-	-	0.151 (2017) (26)
Korea	-	-	-	-	-	-	0.26 (0.24-0.29)	0.26 (0.24-0.29)	0.23 (0.21-0.25)	-	0.567 (2016) (27)
Malaysia	-	-	0.53 (0.49-0.57)	-	-	0.36 (0.29-0.43)	-	-	-	-	-
Nepal	-	-	-	-	-	-	0.07 (0.05-0.10)	-	-	0.07 (0.04-0.10)	0.04 (2022) (18)
Philippines	-	-	-	-	-	0.15 (0.13-0.18)	-	-	-	-	-
Thailand	0.48 (0.39-0.58)	-	-	-	-	-	-	-	-	-	-
Vietnam	-	-	-	-	-	-	-	0.51 (0.45-0.57)	-	-	-

BCS, Breast cancer Screening; -, information Not Available

lowest BCS rate of about 11% [95% CI = (0.08 – 0.14)] and Iran showed highest rate of 28% [95% CI = (0.11 – 0.44)]. (Figure 1) Similarly, the pooled estimate of breast cancer screening by mammography was 18% [95% CI = (0.14-0.21)] in three countries with more than three data points for meta-analysis (China, Iran, and Malaysia). Iran had the lowest BCS rate by mammography [SR = 0.12, 95% CI = (0.06-0.17)] than the other two countries. (Figure 2) Publication bias based on the observation of the funnel plot was minimal (Figure 3,4).

Discussion

This systematic review and meta-analysis identified the proportion of breast cancer screening across Asian countries from 2012 to 2023. The rate of breast cancer screening was less than 25% within this decade in Asia. This study identified huge disparities across and within countries regarding the breast cancer screening.

Lack of reliable data was identified as one of the biggest concerns on BCS in this review which is consistent with previous studies. Out of 23 Asian countries we only obtained literatures on BCS from 14 countries whereas, many studies were descriptive only and mostly focusing on early cancer detection methods like Breast-Self Examination. A systematic review conducted to identify the BCS guidelines in 23 developed countries showed the mammographic screening every year or every two years was the recommended primary screening methodology among women aged more than 40 [28]. However, CBE was the most identified BCS method in this review and the screening interval were not consistent among studies conducted even within a same country. Even though our study frame was from 2012-2023, we couldn't identify a single study with follow up information on BCS. Most studies assessed lifetime BCS rate which doesn't truly represent the adequacy of the BCS. The population level data on BCS was obtained from six ANCCA member countries only which also necessitates the need of population-based data in other ANCCA countries. To prevent cancer countries should implement a comprehensive, effective national cancer control program including BCS [29]. With the lack of national commitment towards cancer control, the ANCCA member countries couldn't attend the aim of global breast cancer initiative by 2030. Even the countries with high development index had missing information on BCS probably showcasing the unsatisfactory screening services of the country or lack of utilization of screening services by the general population.

We observed some within country variations in the screening rate depending on the geographic location and study population which was quite evident in countries with relatively higher number of studies like in China, Iran, and Japan. Some studies in the past have identified similar differences in cancer screening rate by location [30, 31]. The availability of the screening services, health literacy of residents, socio-economic backgrounds of the community, etc. might have resulted in these discrepancies [32]. Hence, while developing cancer control policies it is important for those countries to closely monitor the factors influencing the uptake of screening services like

Table 3. Quality Assessment of the Cross-Sectional and Case-Control Studies (N = 39)

Country	Author, year of publication	Risk of Bias Assessment			
		Selection	Comparability	Outcome	Total points
Bangladesh	Islam, R. M. et al, 2016 (41)	***	**	***	8
Bangladesh	Alam, N. E. et al, 2021 (42)		**	***	5
China	Wu, T. Y. et al, 2012 (43)	*	**	***	6
China	Zhang, M. et al, 2021 (44)	***	**	***	8
China	Gan, Y. X. et al, 2018 (45)	***	**	***	8
China	Li, H. et al, 2023 (46)	***	**	***	8
China	Sun, Y. et al, 2022 (47)	***	**	***	8
China	Zhang, X. et al, 2022 (48)		**	***	5
China	Zhang, S. et al, 2022 (49)		**	***	5
India	Khokhar, A., 2015 (50)	*		***	4
India	Dey, S. et al, 2015 (51)		**	***	5
India	Zhu, C. K. et al, 2022 (52)	***	**	***	8
India	Sen, S. et al, 2022 (53)	**	**	***	7
Indonesia	Solikhah, S. et al, 2021 (54)	*	**	***	6
Iran	Farshbaf Khalili, A. and Shahnazi, M., 2012 (55)	**	**	***	7
Iran	Ebrahimi, F. et al, 2022 (56)	*	**	***	6
Iran	Aminisani, N. et al, 2016 (57)	*	**	***	6
Iran	Jalilian, F. et al, 2022 (58)	*		***	4
Iran	Ahmadipour, H. and Sheikhizade, S., 2016 (59)	*		***	4
Iran	Farzaneh, E. et al, 2017 (60)	**	**	***	7
Iran	Kardan-Souraki, M. et al, 2019 (61)	*	**	***	6
Iran	Moghaddam Tabrizi, F. et al, 2018 (62)		**	***	5
Iran	Ghanbari, A. et al, 2020 (63)	**	**	***	7
Iran	Rabiei, M. et al, 2022 (64)	**	**	***	7
Japan	Aoki, T. and Inoue, M., 2017 (65)	***	**	***	8
Korea	Lee, K. et al, 2022 (66)	***	**	***	8
Malaysia	Al-Naggar, R. A. and Bobryshev, Y. V., 2012 (67)		**	***	5
Malaysia	Farid, N. D. et al, 2014 (68)	*	**	***	6
Malaysia	Mohan, D. et al, 2021 (69)	***	**	***	8
Malaysia	Abdullah, N. et al, 2022 (70)	*	**	***	6
Nepal	Shrestha, K, 2012 (71)			***	3
Nepal	Bhandari, D. et al, 2021 (72)	*	**	***	6
Nepal	Poudel, S. and Dhakal, R., 2021 (73)	*	**	***	6
Philippines	Wu, T. Y. and Lee, J., 2019 (74)		**	***	5
Singapore	Chan, T. K. et al, 2021 (75)	***	**	***	8
Taiwan	Hsieh, H. M. et al, 2021 (76)		**	***	5
Thailand	Kotepui, M. et al, 2015 (77)	*		***	4
Vietnam	Duong, L. T. et al, 2020 (78)			***	3
Vietnam	Ngan, T. T. et al, 2022 (79)	*	**	***	6

geographical location, educational status of the residents, accessibility to health care facilities, cost and affordability of the screening services and the programs should be continuously monitored and evaluated [33, 34].

The Covid-19 pandemic, from 2020-2021, may have hindered the accessibility and utilization of BCS services specially among countries which were highly affected by the pandemic like China, India, Japan, etc. A systematic review conducted by Elemes S. et al in 2023 identified reduction in the rate of BCS throughout the world due to the pandemic [35]. Most of the health care facilities were overwhelmed with covid-19 patients and almost closed to patients with non-emergent symptoms or screening procedures due to the risk of exposure and spread of the disease [36]. There were some mobility restrictions with lockdowns in China [37], India [38], and some other countries [39] which might have resulted in a smaller number of primary studies conducted in those areas during the peak of pandemic. A study conducted in Canada identified some disparities across people from various

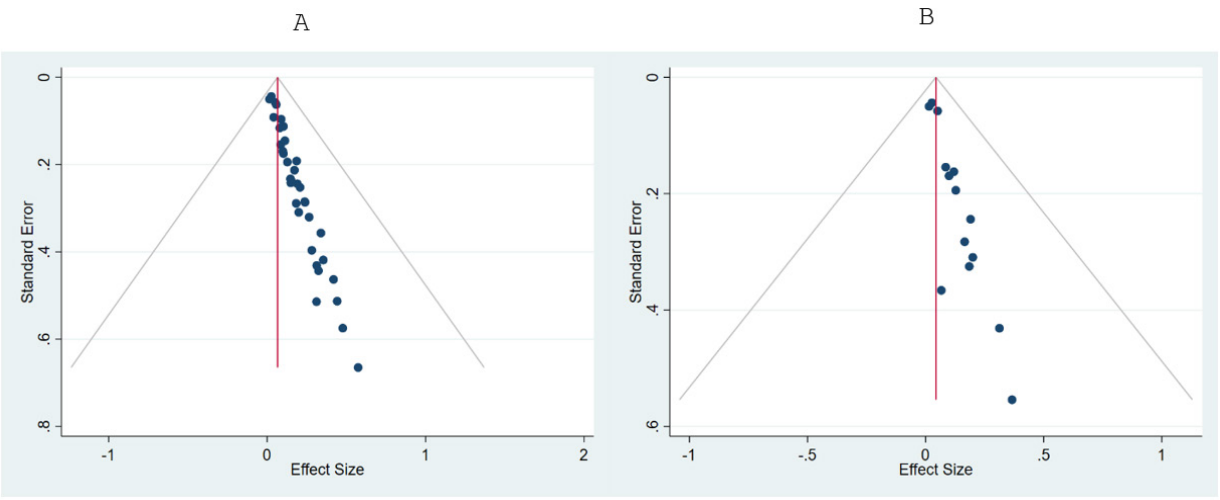

Figure 4. Funnel Plot of Breast Cancer Screening Studies by CBT and Mammography. Figure A and B are the funnel plots of breast cancer screening studies by CBT and mammography respectively

wealth quintiles on BCS before and after the pandemic [40]. It is crucial to plan BCS services based on the effects of pandemic in certain areas.

Lastly, mostly countries from East-Asia had more than three studies and we provided pooled estimate based on available dataset. For countries where resource is limited, and national cancer screening programs are not in place it is crucial to conduct some follow-up studies rather than prevalence studies so that a trend in their screening behavior could be obtained.

Strengths and limitations

The strengths of this study are that we were able to review and pool breast cancer screening rate from 41 studies conducted in several countries in Asia from 2012-2023. We also obtained information on latest population-based breast cancer screening rate from some reliable sources. However, studies from very few countries were included in the meta-analysis due to the unavailability of screening information in more than three different time points. Meanwhile, most of the weight from the pooled estimates were from few countries hence, the generalizability of the results to all ANCCA member countries is difficult. Moreover, we were not able to pool the data from countries with high development index due to lack of availability of data which could have underestimated the pooled estimates towards developed nations. Over 95% of the studies were cross-sectional studies hence, there might have been recall bias and selection biases imposed by the study design making it difficult to generalize the findings obtained from one study to the whole country. Despite of this limitations, this study might be the first of its kind to explore all published information from multiple nations and present the bird-eye view on breast cancer screening in various ANCCA member countries representing Asia.

In conclusion, breast cancer is a major cause of cancer-related mortality and morbidity among women in many Asian countries. However, there is lack of evidence on actual rate of breast cancer screening in those countries and often the screening rate is based on opportunistic screening. Most ANCCA countries do not have sufficient studies conducted on breast cancer screening and additionally, many countries lack nationally representative surveys or national level cancer registries. The community level studies show high variation in the screening rate due to the selection bias and poor methodology even though conducted in a same country and are mostly focused on cancer detection methods like BSE than other methods of breast cancer screening like CBE, mammography, etc. The coronavirus pandemic also had some adverse effect in the health service delivery including screening services in most of the countries in last few years. It is crucial to encourage governments and private sector to strengthen capacity and work in collaboration to enhance breast cancer screening rate in their respective countries.

Author Contribution Statement

Conceptualization AKB; Methodology AKB; Reviewing AKB, ZW, RP, MM; Validation AKB; Data curation & analysis AKB; Writing- original draft preparation AKB; Writing- review and editing AKB, SKA; Visualization AKB; Supervision SKA; Project administration AKB, ZW, RP, MM, SKA. All authors have read and approved the final manuscript.

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If it was approved by any scientific Body/ if it is part of an approved student thesis

The study was not approved by any scientific body or is not a part of an approved student thesis.

Ethical approval

This study utilized information from preexisting literatures hence, ethical approval was not obtained.

Availability of data

The data utilized in this scoping review are readily available on online databases.

Registration

The scoping review has been registered in PROSPERO with the registration ID: CRD42023401516.

Competing interests

None to declare. The authors have no potential financial, personal, or other conflicts of interests.

Abbreviations

ANCCA: Asian National Cancer Centers Alliance, BC: Breast Cancer, BCS: Breast Cancer Screening, BSE: Breast Self-Examination, CBE: Clinical Breast Examination, CI: Confidence Interval, DHS: Demographic and Health Survey, LMIC: Low-middle-income countries, NCD: Non-Communicable Disease, USG: Ultrasonography, WHO: World Health Organization.

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