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Breast cancer awareness in reproductive women in the low- and middle-income countries: a scoping review

Review

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Abstract: **Objective:** This study aimed to assess breast cancer (BC) awareness among reproductive women in low- and middle-income countries (LMICs), identify influencing factors, and propose feasible interventions or programs.
Methods: We followed a 5-step process using a modified version of Arksey and O'Malley framework methodology. A comprehensive search was conducted on the Embase, PubMed, and CINAHL electronic databases for literature published within 10 years (from 2012 to 2022).
Results: Thirty-three papers published between 2012 and 2020, spanning 18 countries, were included. Of these, 45.6% described a good level of knowledge, while 24.2% reported that women at reproductive ages had good awareness. Twelve influencing factors were identified in 3 categories: socio-demographic (family history, personal history, marital status, age, religion, income status, living place, and occupation), personal (self-efficacy, education, and perceived level), and external (advertisements promoting awareness). Educational programs were recommended in most (>72%) of the included studies.
Conclusions: While most studies reported high levels of knowledge and awareness, some found low prevalence among certain groups. Factors affecting knowledge and awareness were classified into socio-demographic, personal, and external categories, with socio-demographic factors such as age, education, income, and marital status being the most frequently cited. The studies recommended implementing educational programs, health prevention strategies, and social interventions to increase BC knowledge and awareness

Keywords: *awareness • breast cancer • low- and middle- income countries • reproductive women • scoping review*

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1. Introduction

Cancer is currently a major global health concern, with an estimated 10 million deaths in 2022 alone, according to the World Health Organization (WHO).[1] Cancer-related mortality is particularly prevalent in low- and middle-income countries (LMICs), where lower incidence rates may be correlated with higher mortality rates compared to high-income countries. By 2035, it is estimated that 2/3 of new cancer diagnoses will occur in developing countries.[2] On the other hand, breast cancer (BC) is the most commonly diagnosed type, accounting for approximately 2.26 million cases worldwide.[3]

BC is an increasingly urgent problem in LMICs, where historically low incidence rates have been rising by up to 5% per year and mortality rates remain high or continue to rise.[3] In 2010, over half of the 425,000 BC deaths occurred in LMICs rather than in high-income

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countries.[4] BC cancer deaths disproportionately affect individuals in LMICs, with 5-year survival rates >90% in high-income countries compared to 66% in India and 40% in South Africa.[4,5]

There is substantial evidence that a lower level of education and income are associated with patient delay, lack of information about breast health, restricted choices for early detection due to limited access to routine care and examination, and lack of access to mammography and high-quality treatment options.[6,7] Reducing the incidence of BC in developing countries could have a significant impact through limiting alcohol consumption, maintaining an optimum body weight, engaging in regular physical activity, and avoiding post-menopausal hormone replacement therapy.[6] Barriers to reducing the incidence of BC include a lack of awareness due to poor health education.[8] A systematic review suggests that to effectively reduce patient delay, interventions should focus primarily on increasing accessible and affordable healthcare access, as well as improving BC awareness.[7] Understanding the importance of early detection of BC plays a crucial role in reducing mortality rates and improving the prognosis of the disease.[9]

It is evident that less emphasis is placed on screening to lower cancer prevalence in LMICs. This is consistent with other research, which suggests that most LMICs are focused mainly on maternal health in terms of resources, while cancer overall, and BC, takes a back-seat.[10] Furthermore, policymaker awareness remains low in LMICs regarding the cost-effectiveness of BC screening and early detection as a "best buy" opportunity to reduce health costs. This, coupled with a lack of research on cost-effective screening and early detection methods, as well as little community awareness about BC being a treatable disease, results in most LMICs losing a large number of women at an early age.[11] Previous studies show that in 2017, 38.0% of Nigerians had poor knowledge about breast self-examination (BSE) and 67.3% were unaware of mammograms.[12] Moreover, in 2021, 41.7% of nursing students in India had average knowledge of BSE, while 10% had below-average knowledge.[13]

No previous studies have provided a comprehensive summary of the current situation of breast cancer awareness in LMICs. Therefore, our study aimed to examine the levels of BC awareness and knowledge, the factors that influence them, and the potential interventions to improve them. We addressed the following research questions: "What is the level of BC awareness among reproductive women?" "What are the factors that influence BC awareness among reproductive women?," and "What are the effective programs or interventions to increase BC awareness among reproductive women?"

2. Methods

We have chosen the scoping review method as the most appropriate approach for our research, as our aim is not to draw conclusions from the synthesis of effectiveness, but rather to map the available evidence and identify knowledge gaps.[14] To ensure a rigorous and transparent process, we used a modified 5-step of Arksey and O'Malley scoping review framework by Levac et al.[15] Within this framework, we are following the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) extension for Scoping Review.[16]

The 5-stage framework includes: identifying the research question, identifying relevant studies, selecting studies, extracting data, and collating, summarizing, and reporting the results.

2.1. Step 1: Identifying the research question

To address our research objectives, we developed and determined primary and secondary questions. The primary question of this study is "What is the current state of BC awareness among reproductive women?" The secondary questions include "What are the predictors of BC awareness in reproductive women?" and "What are the appropriate programs or recommendations to enhance BC awareness among reproductive women?"

2.2. Step 2: Identifying relevant studies

In this study, we used elements of Population, Concept, and Context (PCC) to determine the inclusion and exclusion criteria, which are stated in Table 1. We conducted a comprehensive search of the Embase, PubMed, and Cumulative Index to Nursing and Allied Health Literature (CINAHL) electronic databases for articles published until November 2022 using keywords based on Medical Subject Headings (MeSH) and Boolean operators. The MeSH terms identified were "breast cancer", "awareness", and "knowledge"; these terms were combined with "young woman", "reproductive women" and "low middle income countries" using AND/OR. Additionally, we identified potential articles through the academic search engine Google Scholar and by manually reviewing the reference lists of selected articles. These techniques were used to identify articles that were retrieved during the search, but missed during the screening process due to a lack of direct relevance in the bibliographic records despite their similarity to other articles.[17] All search strategies in the databases were limited to English language and human studies. The search results from all databases were imported into Endnote X9 reference manager software for duplication and screening.

Item	Inclusion criteria	Exclusion criteria
Population	Women of reproductive age (15–49 years) according to World Health Organization	Women with BC or history of BC
Concept	BC awareness; Knowledge; Perception; Attitude	
Context	The low- and middle-income countries (According to World Bank classification)	Developed countries
Language	English	Non-English—Literature
Study design	Observational and intervention studies	Literature review, secondary analysis, mixed methods, study protocol
Publication year	10 years (2012–2022)	

Note: BC, breast cancer.

Table 1. Inclusion and exclusion criteria.

2.3. Step 3: Study selection

The selection process was conducted in 2 stages. In the first stage, the literature obtained from all databases was collected in a single reference manager, and duplicates were removed automatically or manually. Three authors independently filtered the literature based on the title and abstract. In the second stage, articles that passed the screening according to the inclusion and exclusion criteria and had available full text were included in the scoping review.

2.4. Step 4: Data extraction

The study characteristics were independently extracted by 3 authors and reviewed collectively to reach a consensus. The extracted information included the author, year of publication, country, study design, study population, age range, observed variables, and other relevant characteristics.

2.5. Step 5: Collating, summarizing, and reporting the results

The results of this scoping review were summarized both quantitatively, using numerical calculations, and qualitatively, using thematic analysis, to provide qualitative descriptions. We summarized the data and identified key findings in response to the research questions. Table 2 presents a summary of the main characteristics of the included studies. The key findings, based on the research questions, were grouped into themes (Figures 2 and 3). We considered studies to have a good level of knowledge or awareness if their prevalence was at least 50%.

3. Results

A total of 3350 articles were identified through database searching and other sources, including Google Scholar and citation searching. After screening the titles and abstracts, 3267 articles were excluded. The full texts of 56 articles were assessed for eligibility based on the inclusion and exclusion criteria. Of these, 23 articles were excluded for reasons listed in the PRISMA flow diagram (Figure 1). Ultimately, 33 studies were included in this review.

3.1. Characteristics included studies

As shown in Table 2, 33 papers were conducted in 17 countries: four from Nigeria,[12,18,19] three each from India,[13,20,21] Iran,[22–24] Pakistan,[25–27] and Ethiopia [28–30]. Two each from Bangladesh,[31,32] Cameroon,[33,34] Ghana,[35,36] Indonesia,[37,38] and Turkey,[39,40] and one each from Jordan,[41] Malaysia,[42] Mexico,[43] Nepal,[44] Palestine,[45] Philippines,[46] Rwanda,[47] and Somalia.[48] These studies were published between 2012 and 2020. Over 88% of the included studies used a cross-sectional study design ($n = 29$), while others were randomized controlled trials ($n = 2$) or quasi-experimental studies ($n = 2$).

The study populations included in this review were adolescent girls, female students, and young adult women of reproductive age, ranging from 15 to 49 years old. Three major variables were observed: (1) knowledge of BE, including clinical breast examination (CBE) and breast ultrasound scan, (2) knowledge, perception, and barriers to BSE, and (3) knowledge, awareness, perception, and screening of BC. Some studies also used the champion's health belief model to assess BC and BSE awareness. Additionally, other traits were mentioned in the articles that should be examined alongside these variables, such as education, financial situation, and marital status.

3.2. Knowledge and awareness, prevalence, and distribution in included studies

As shown in Figure 2, out of the 33 articles included in this review, 45.6% reported a good level of knowledge,

No.	Author (year)	Country	Study design	Study population (n)	Age M (SD)/% (years)	Observed variables	Other characteristics
1.	Sarker et al. (2022)[32]	Bangladesh	Cross-sectional study	Female students (400)	35.3% (18–20) 31.0% (21–23) 33.8% (24–26)	BE knowledge, BSE practice and barrier	86.0% unmarried, 18.3% had family history of BC
2.	Assfa Mossa (2022)[34]	Cameroon	Cross-sectional study	Young adult women (392)	21.25 (1.32)	BSE knowledge, practice and perception	92.23% single, 62.73% live in rural area, 54.42% of them attended primary to secondary school.
3.	Prakash et al. (2022)[44]	Nepal	Cross-sectional study	Female adolescents (120)	16.7 (0.92)	BC and BSE knowledge	66.7% science faculty, 33.3% commerce faculty
4.	Hussain et al. (2022)[26]	Pakistan	Cross-sectional study	Female university students (774)	23.06 (4.35)	BC awareness	87.4% were single, 74.9% at the undergraduate level, 76.7% had rural residency
5.	Calbayram and Guven (2021)[39]	Turkey	Quasi-experimental design	Adolescent girls (133)	15.77 (0.61)	BC and BSE awareness ánd pratice, champion's health belief model	10.5% had high income, 82% middle income, 7.5% had low income; 58.6% age (10–12) of menarche, 41.4% in age 13 and older menarche
6.	Igiraneza et al. (2021)[47]	Rwanda	Cross-sectional study	Women (246)	28.5% (16–19) 30.9% (20–29) 32.9% (30–39) 7.7% (40–49)	Knowledge about BSE, CBE, breast ultrasound scan	61.8% only primary education, 14.2% did not have basic education, 24% attended secondary or university education.
7.	Labrague et al. (2021)[46]	Philippine	Randomized controlled trial	Reproductive women (128)	CG: 29.51 (7.90) EG: 30.56 (8.99)	BSE knowledge	29.69% of the control group were high school graduates. 32.81% of the experimental group were college undergraduates.
8.	Rachna (2021)[13]	India	Cross-sectional study	Female nursing students (60)	65% (18–22) 28% (23–30) 7% (31–40)	BSE knowledge	83% of nursing students had 10 + 2 qualification (education degree) and 17% of them had graduated.
9.	Osei-Afriyie et al. (2021)[36]	Ghana	Cross-sectional study	Female undergraduate students (385)	22 (2.78)	BC awareness and risk perception	83.1% were single; 74.0% were Christians and 18.9% were Muslims
10.	Altunkurek and Mohamed (2022)[48]	Somalia	Cross-sectional study	Women (413)	22 (11.21)	champion health belief model, BC knowledge, and BSE practice	72.2% had a university education level, and 58.1% had a medium economic status, 61.5% were single
11.	Alam et al. (2021)[25]	Pakistan	Cross-sectional study	Women (1007)	33.47 (12.37)	BC awareness, knowledge, and attitude	79.3% married, 19.3% undergraduate, 42.9% had socio economic status
12.	Akter and Ullah (2021)[31]	Bangladesh	Cross-sectional study	Female university students (567)	21.61 (1.56)	BC awareness	97.32% were single
13.	Baburajan et al. (2021)[21]	India	Cross-sectional study	Adult women (416)	31.60 (13.7)	BC and BSE awareness	92.3% Hindu, 85.1% housewives, 92.5% were unmarried
14.	Dinegde et al. (2020)[29]	Ethiopia	Cross-sectional study	Female students (358)	20.84 (2)	BSE knowledge and practice	85.2% single, 67% Christian, 77.7% grew up in urban setting
15.	Ifediora and Azuike (2018)[18]	Nigeria	Cross-sectional study	Reproductive-age women (810)	33.42 (7.81)	Likelihood of performing BSE	55.9% Can't read and write, 44.1% had educational background
16.	Dadzi and Adam (2019)[35]	Ghana	Cross-sectional study	Women (385)	24.54 (7.19)	Awareness and practice of BSE	59% single, 39.5% married, 1.5% divorced
17.	Solikhah et al. (2019)[38]	Indonesia	Cross-sectional study	Indonesian women (856)	30 (11)	BC knowledge and attitude	49.8% single, 46.6% married, 3.6% divorced

(*Continued*)

Table 2. Continued

No.	Author (year)	Country	Study design	Study population (n)	Age M (SD)/% (years)	Observed variables	Other characteristics
18.	Sari et al. (2019)[37]	Indonesia	Cross-sectional study	Female students (118)	16.13 (15-17)	BC knowledge and perception	11.9% had family history of cancer, 28% elementary graduated
19.	Koc et al. (2018)[40]	Turkey	Cross-sectional study	Female university students (161)	20.53 (2.3)	BSE knowledge and practice	2.5% had low income, 50.3% middle income, 47.2% high income
20.	Elshami et al. (2018)[45]	Palestine	Cross-sectional study	Women (3055)	26.4 (12.8)	BC awareness and practice	57.2% adults, 42.8% adolescents
21.	Kardan-Souraki et al. (2018)[23]	Iran	Cross-sectional study	Women (1165)	37.15 (8.84)	BC screening	44.5% had not earned their high school diploma.
22.	Olufemi et al. (2017)[12]	Nigeria	Cross-sectional study	Undergraduate female students (266)	21.7 (5.9)	BC knowledge and awareness	87.6% are single, 12.4% are married, 79.7% are Christians and Islam 20.3%.
23.	Birhane et al. (2017)[30]	Ethiopia	Cross-sectional study	420 Female students	21.1 (1.65)	BSE knowledge	60% single, 84.5% had no family history of BC
24.	Sama et al. (2017)[33]	Cameroon	Cross-sectional study	Female undergraduate students (345)	22.5 (3.2)	BC awareness, knowledge, and attitude	90.7% Christians, 64.6% first year of undergraduate, 18% were married
25.	Akhtari-Zavare et al. (2016)[42]	Malaysia	Randomized controlled trial	Female undergraduate students (370)	21.79 (1.24)	Knowledge, champion's health belief model, BSE practice	96.5% single, 3.5% married
26.	Nwaneri et al. (2016)[19]	Nigeria	Cross-sectional study	Women (349)	30.1% (20–30) 19.2% (31–40) >50.7% (>40)	BC awareness and knowledge	52.4% married, 25.2% single; 37.0% had tertiary education, 4.3% had no formal education
27.	Memon et al. (2015)[27]	Pakistan	Cross-sectional study	Young women (300)	21.5	BSE knowledge and practice	29.7% married, 70.3% single
28.	Tazhibi and Feizi (2014)[24]	Iran	Cross-sectional study	Young women (2250)	36.8 (9.1)	BE knowledge and awareness	51.9% had university educational attainment and 81.9% were married
29.	Ameer et al. (2014)[28]	Ethiopia	Cross-sectional study	Medical female students (126)	38.1% (18–19) 36.5% (20–21) 25.4% (>22)	BSE knowledge, practice and perception	94.44% single, 56.34% Christian, 43.7% Muslim
30.	Suleiman (2014)[41]	Jordania	Cross-sectional study	Female students (840)	43.3% (18–22) 25.1% (23–27) 20.2% (28–32) 11.4% (33–37)	BC and BSE knowledge and awareness	82.3% were single, 13.2% were married, 4.5% were divorced
31.	Kratzke et al. (2013)[43]	Mexico	Cross-sectional study	Young women (544)	23.3 (7.75)	BC prevention mother's advice, BSE practice, BE knowledge and attitude	51% were non-Hispanic and 49% were Hispanic college women
32.	Godshi et al. (2013)[22]	Iran	Cross-sectional study	Women (755)	29.9 (1.25)	BC knowledge	42.8% were not employed, 45.9% had a satisfied income
33.	Doshi et al. (2012)[20]	India	Cross-sectional study	Female dental students (203)	19.6 (1.38)	BC knowledge, attitudes, and practice	No information

Note: BC, breast cancer; BE, breast examination; BSE, breast self-examination; CBE, clinical breast examination; CG, control group; EG, experiment group; SD, standard deviation.

Table 2. Characteristic of included studies.

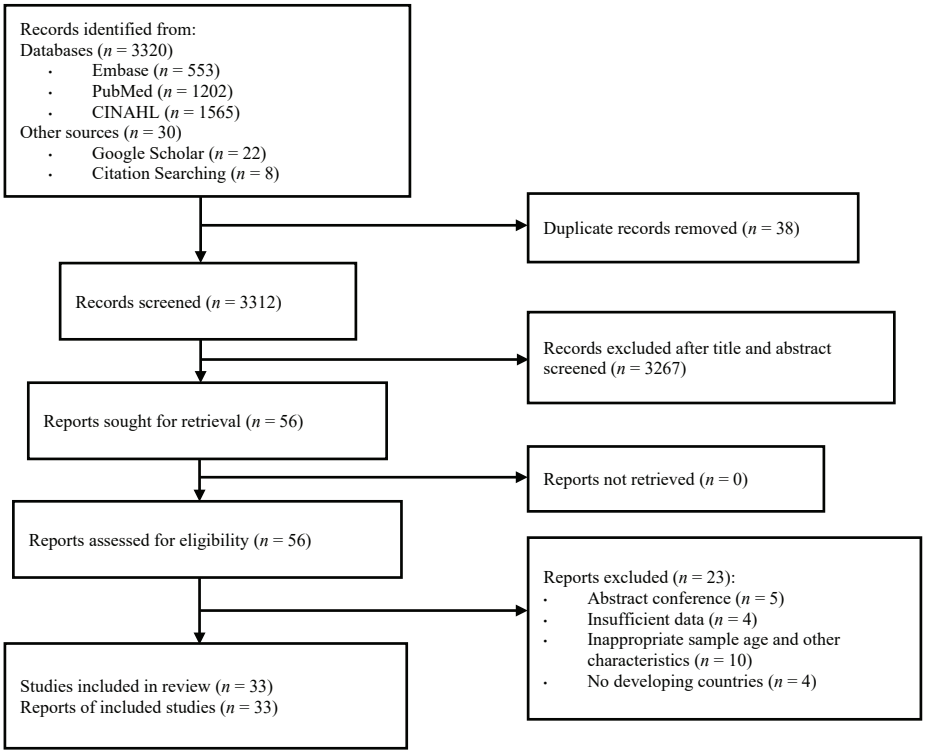


Figure 1. PRISMA 2020 flow diagram for searching process.

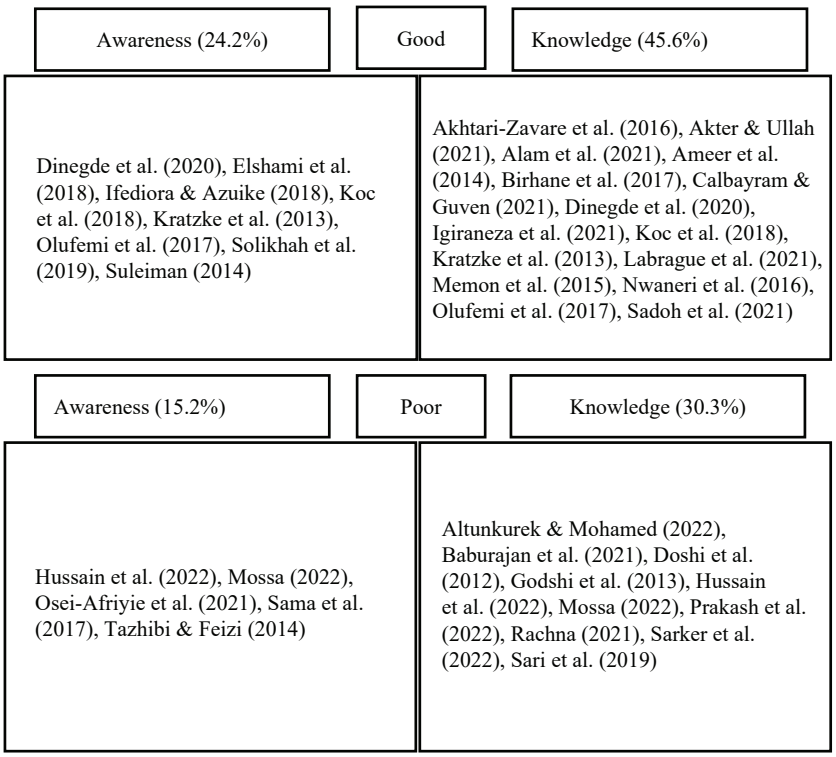


Figure 2. Mapping of awareness and knowledge prevalence of included studies (n = 33).

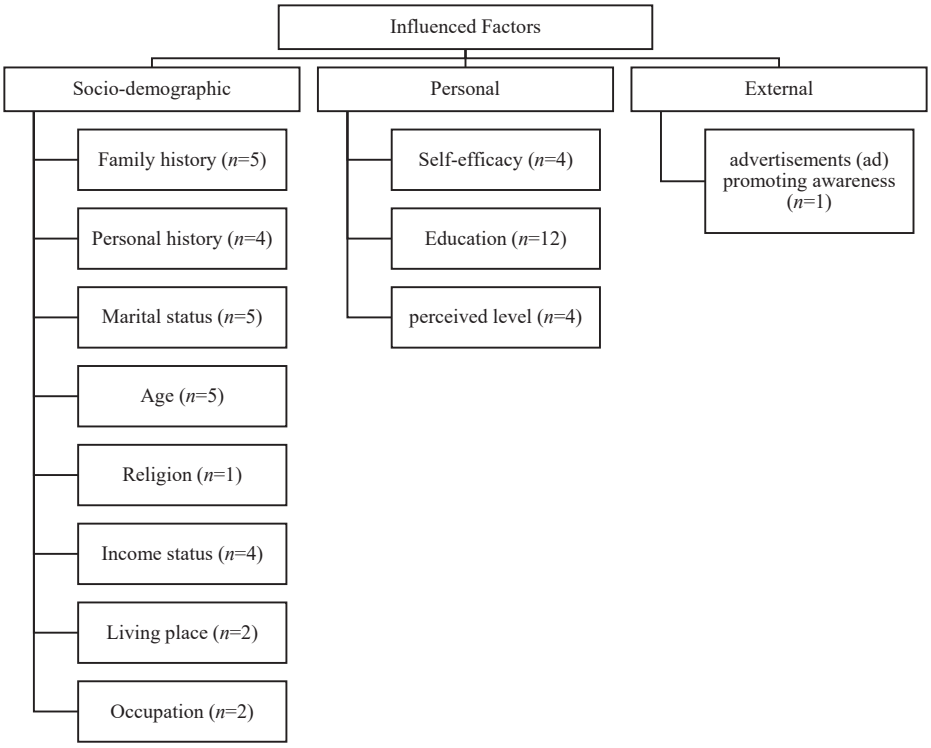


Figure 3. The influential factors for knowledge and awareness in reproductive women.

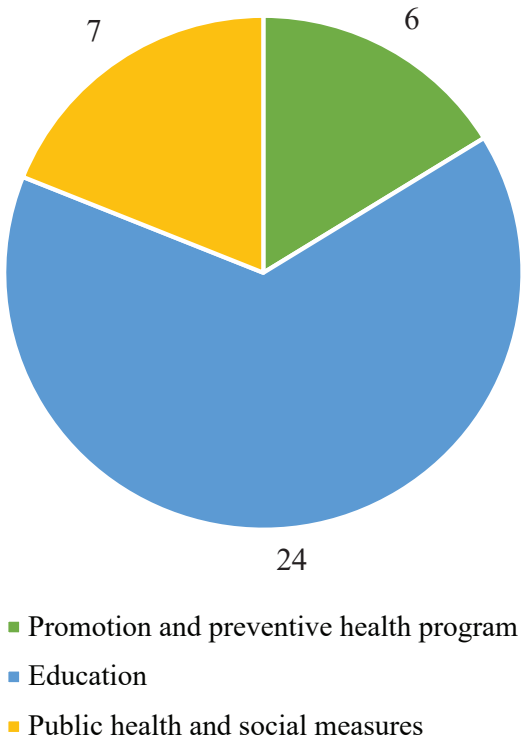


Figure 4. Recommendations for future interventions and programs.

and 24.2% reported good awareness of the study's main findings. Meanwhile, 15.2% and 30% of the included studies reported poor awareness and knowledge, respectively, as their main findings.

3.3. Influenced factors of the knowledge and awareness of reproductive women

Influencing factors were identified in 3 categories: socio-demographic, personal, and external factors. Socio-demographic factors include family history, personal history, marital status, age, religion, income status, place of residence, and occupation. Personal factors include self-efficacy, education, and perceived susceptibility. External factors were only mentioned in the context of advertisements promoting awareness. Of the 12 influencing factors, education was the most frequently mentioned factor in the included studies (n = 12). Religion and advertisements promoting awareness were only mentioned in one study each, while the other factors were mentioned in more than one study. Detailed information is presented in Figure 3.

3.4. Recommendations for future interventions and programs

In summary, Figure 4 shows that there are 3 main types of recommendations for interventions and programs. Educational interventions were mentioned in >72% of the recommendations in the included studies. Secondly, several of our findings suggested knowledge promotion and preventive health programs (6/33 studies). The last type of recommendation was for public health and social measures. Additionally, social media and religious institutions can assist in communicating information about BSE and BC.

4. Discussion

We conducted a scoping review of 33 studies on BC knowledge and awareness among reproductive women aged 15–49 in LMICs. The purpose of our review was to examine the patterns of knowledge and awareness based on the main findings of the studies, to explore the factors that influence them, and to identify the gaps and recommendations for future research. Our results indicate that most of the studies reported high levels of knowledge and awareness, but some also found low prevalence of knowledge among certain groups. We classified the factors that affect knowledge and awareness into 3 categories: socio-demographic, personal, and external. The socio-demographic category was the most frequently cited in the studies, with various factors such as age, education, income, and marital status. The main recommendations from the studies were to implement educational programs, health prevention strategies, and social interventions to increase BC knowledge and awareness.

Most of the studies in our review reported high levels of knowledge and awareness among the participants. This is a crucial first step to promote BSE as an early detection method. BSE is a simple and cost-effective strategy that can help women achieve both breast awareness and early diagnosis of breast abnormalities.[11,49] Early detection of BC can increase the chances of successful treatment and reduce the mortality and morbidity associated with the disease.[31] Therefore, it is essential to empower women to perform BSE regularly and correctly, especially in LMICs, where access to other screening modalities and health services is limited.[34,50] However, there are also sociocultural barriers that may prevent women from practicing BSE or seeking professional help for breast problems, such as stigma, fear, lack of support, or low health literacy.[51] These barriers need to be addressed through culturally sensitive and tailored interventions that can enhance women confidence and motivation to take care of their breast health.[52]

BC knowledge and awareness can motivate women to adhere to the screening guidelines and identify any breast problems at an early stage.[53,54] Women aged 20–30 years should have a CBE by a healthcare professional every 3 years, while women aged 40 and above should have it every year.[26] This can enable the healthcare providers to deliver more effective and timely treatment and also track the patient's condition more closely.[55] Early detection of cancer can improve the outcomes and survival rates of cancer patients by providing care at the earliest possible stage.[56] It can also reduce the mortality and morbidity associated with the disease, as well as the costs of treatment and care. As such, it is an essential public health strategy in all settings. However, there are challenges and barriers to implementing successful early detection programs, including lack of awareness, accessibility, affordability, quality, and equity of cancer services.[57] These barriers must be addressed through comprehensive and coordinated policies and interventions that involve multiple stakeholders and sectors.[58]

Early detection of cancer is vital for improving the outcomes and survival rates of BC patients.[59] Early detection of cancer comprises 2 components: early diagnosis and screening.[60] Early diagnosis aims to detect symptomatic patients as early as possible, while screening involves testing healthy individuals to identify those with cancers before any symptoms appear, which is particularly relevant to cancers of the breast.[52,61] Screening is a more complex and resource-intensive strategy

that requires adequate capacity and infrastructure to avoid delays in diagnosis and treatment.[62] Screening programs should be undertaken only when their effectiveness has been demonstrated, when resources are sufficient to cover the target group, when facilities exist to confirm diagnoses and ensure treatment, and when the prevalence of the disease is high enough to justify the effort and costs of screening.[60,63] It should be noted that promoting early diagnosis is a necessary prerequisite to implementing population-based screening in certain situations.[59] This is because early diagnosis can enhance outcomes for all BC patients, whereas less than half of BCs are diagnosed through screening, even in the most effective programs.[27,55] As such, efforts should initially prioritize early diagnosis over opportunistic or organized screening until the requisite infrastructure and organizational requirements are established. Health planners, policymakers, and other stakeholders, including clinicians, educators, community members, and advocates, should be cognizant of the health system requirements and overall costs of these approaches tofor early detection of BC to make effective investments, plans, and policies.[59]

The results of our scoping review revealed that education, age, having family members with BC, and marital status were the most frequently reported sociodemographic factors that influenced BC knowledge and awareness among reproductive women in LMICs. These findings are consistent with previous studies that have found similar associations between these factors and BC awareness.[64–66] Education is an important factor that affects women's health literacy and access to information about BC. Women with higher education levels tend to have more knowledge and awareness of BC symptoms, risk factors, screening methods, and treatment options.[67] They are also more likely to practice BSE and seek professional help for breast problems.[68] Age is another factor that influences women's BC knowledge and awareness. Women's risk of developing BC increases with age, especially after menopause.[69] However, younger women may also be affected by BC, especially in LMICs where the incidence of premenopausal BC is higher than that in high-income countries.[26,70] Meanwhile, having family members with BC is a factor that can increase women's perceived risk of developing the disease.[65] Women who have a family history of BC may be more aware of the genetic and hereditary aspects of the disease and may seek genetic testing or counseling.[71] They may also be more motivated to adopt healthy behaviors and lifestyle changes that can reduce their risk of BC.[72] In addition, the marital status of women may have an effect on the risk of developing female BC. However, the evidence is not conclusive whether marital status is an independent risk factor for BC.[66]

Educational Educational programs are a key component in raising awareness and sharing knowledge. The reason why education intervention was the most frequently mentioned in the included study (>72%) is to decrease the burden of BC morbidity and mortality by enhancing self-care abilities and increasing awareness of the disease.[73] Training is a low-cost strategy that can be used to increase knowledge of BC and BSE, reaching a large number of people with limited resources.[18,62] In terms of health prevention planning, BC awareness, education, public health, and social measures are all important.[27,52] Most people desire effective BC prevention education, which fosters healthy behaviors, not only through teaching, but also through using the breast as a model. To ensure early detection and reduce the mortality rates associated with BC, screening programs should also be implemented by healthcare professionals.[74,75]

The implications of these findings suggest that interventions tailored to the specific needs and preferences of different groups of women, based on their socio-demographic characteristics, are necessary. Such interventions should aim to increase knowledge and awareness of BC among women, as well as their self-efficacy and intention to practice early detection methods. Moreover, these interventions should involve multiple stakeholders and sectors, including health professionals, educators, media, community leaders, policymakers, and civil society organizations, to create a supportive environment for women's breast health. Additionally, public health and social measures should include the development of a public screening and education program through the healthcare system that focuses on low-educated, younger, single women without a family history. The government health administration, at both national and international levels, should play a role in raising awareness among the general public by organizing seminars. Furthermore, health professionals should promote awareness among the general population, and rural residents should have access to healthcare facilities, which should be facilitated by the government.

Our study had several strengths that enhanced the quality and comprehensiveness of our scoping review. First, we focused on women of reproductive age to capture the full spectrum of the general population of women in LMICs, who face multiple challenges and disparities in accessing health care services. Second, we conducted a systematic and comprehensive search of the literature, using not only electronic databases, but also manual searching on the academic search engine

(Google Scholar) and citation searching, to identify and retrieve relevant studies from various sources and disciplines. Third, we adhered to the guidelines established by Arksey and O'Malley's framework for scoping reviews, which provided a rigorous and transparent method for mapping and synthesizing the available evidence on our topic.

This review has several limitations that warrant consideration. Firstly, we excluded non-peer-reviewed literature from our search and only utilized reputable, worldwide, scientific databases. While this may have enhanced the quality of the studies retrieved, it may have also resulted in a lower number of studies from certain WHO regions, particularly those from countries where English is not the primary language of academic writing and publication. Secondly, despite conducting extensive database and manual searches, we may have inadvertently overlooked some relevant research. As such, we recommend that future reviews on this topic incorporate a broader range of sources and languages to ensure a more comprehensive coverage of the literature. Additionally, this review highlights several avenues for future research, including conducting more studies in under-represented regions and countries, utilizing more consistent and valid measurement tools and indicators, examining the factors that influence women's awareness and knowledge in different contexts and settings, and evaluating the impact of various interventions and strategies, to improve women's awareness and knowledge about BC in LMICs.

5. Conclusions

This scoping review mapped and synthesized the available evidence on the prevalence of awareness and knowledge of BC among women of reproductive age in LMICs. The findings revealed that there is a significant gap in the literature on this topic, as most studies focused on specific regions or countries, used different measurement tools and indicators, and reported varying levels of awareness and knowledge. This indicates that there is a lack of standardized and comparable data on the awareness and knowledge of BC in LMICs, which hinders the development and evaluation of effective interventions and policies to address this issue. The findings also suggested that there is a need to enhance the knowledge and awareness of not only BC but also self-examination in women, as these are crucial for early detection and treatment of the disease. Therefore, this review has important implications for healthcare providers, researchers, policymakers, and governments, as they should pay more attention and take more action to raise the awareness and knowledge of women about BC in LMICs. This could help women to seek timely medical care, improve their survival outcomes, and reduce the burden of BC mortality.

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Ethical approval

Ethical issues are not involved in this paper.

Conflict of interest

All contributing authors declare no conflicts of interest.

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