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Dissemination and implementation science frameworks and strategies to increase breast cancer screening for at-risk women in the United States: A scoping review

Meera Rao[1], Sebastian Densley[1], Adeife Marciniak[1], Sara Burgoa[1], Yasmine Zerrouki[1], Goodness Okwaraji[1], Diana Lobaina[1], Vama Jhumkhawala[1], Michelle Knecht[1], Panagiota Kitsantas[1] and Lea Sacca[1]

Abstract

Dissemination and implementation science (D&I) can help bridge the gap between research and practice by addressing how to facilitate and maintain pre-existing evidence-based interventions (EBIs) in various contexts within different fields, including that of breast cancer screening and treatment. Yet, despite the availability of D&I frameworks and strategies, there is a lack of studies exploring knowledge transfer dissemination and implementation models, strategies, and frameworks in the setting of breast cancer care. There is a need for studies that create guidelines and roadmaps built on theoretical foundations of D&I research to scale up successful D&I of strategies, frameworks, and protocols proven to cater to the needs of all breast cancer patients when seeking screening and treatment services. The Arksey and O'Malley (2005) York methodology was used as guidance for this review: (1) identifying research questions; (2) searching for relevant studies; (3) selecting studies relevant to the research questions; (4) charting the data; (5) collating, summarizing, and reporting results. Most cited barriers ($n = 46$) sorted into the category of "Recruitment, Measurement, and Delivery Challenges." The predominant ERIC strategy, featured in a noteworthy 84% of studies, was "Tailor strategies" (#16), which belongs to the "Adapt and tailor to context: culture, language, data analysis, collection" domain. This study can guide researchers, physicians, and community workers in improving accessibility, affordability, and quality of breast cancer screening and adequate follow-up opportunities through D&I strategies and models improving the reach and sustainability of evidence-based programs in at-risk female populations.

Keywords

Breast cancer, dissemination strategies, implementation science, frameworks, cancer prevention, women

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Significance for public health

Dissemination and implementation science (D&I) can help bridge the gap between research and practice by addressing how to facilitate and maintain pre-existing evidence-based interventions (EBIs) in various contexts, including that of breast cancer screening. Currently, there is a lack of research exploring D&I strategies and frameworks are lacking for breast cancer screening in the setting of breast cancer care. There is a need for studies that create guidelines and roadmaps to scale up successful D&I of strategies, frameworks, and protocols proven to cater to the needs of all breast cancer patients when seeking screening and treatment services. The purpose of this scoping review was to identify common barriers and effective mitigating D&I models and strategies to successfully disseminate and

[1]Schmidt College of Medicine, Florida Atlantic University, Boca Raton, FL, USA

Corresponding author:
Lea Sacca, Department of Population Health and Social Medicine, Schmidt College of Medicine, 777 Glades Road BC-71, Boca Raton, FL 33431, USA.
Email: lsacca@health.fau.edu

implement evidence-based breast cancer screening and treatment programs for at-risk U.S. women aged ≥40 years. Most cited D&I barriers sorted into the category of "Recruitment, Measurement, and Delivery Challenges." Most cited ERIC strategy was #16 "Tailor strategies," with the primary reason being perceived relevance of screening. Lessons learned from barriers and challenges to the successful D&I of evidence-based breast cancer screening and treatment programs and/or protocols were also highlighted. This paper will contribute to informing and guiding future D&I initiatives aimed at reducing breast cancer health disparities in this population.

Background

In the United States, approximately one in eight women are estimated to develop invasive breast cancer during their lifetime, and 3% of women will die from the disease.[1] In fact, in 2022, the most common cancer amongst women in the US was breast cancer, with the estimated prevalence set at four million women across the country.[2] With such a high prevalence of breast cancer, the importance and value of mammograms in early detection has been emphasized and the benefits of early screening are well-publicized.[3] Despite screening awareness efforts, nearly one-third of women aged 40 and above in the US reported having no recent mammogram.[4] A report of a recent mammogram was more common among women aged 50–79, married women, women with higher educational attainment or income, and those with health insurance and a regular source of recent health care.[5] Accessibility to mammograms was a main barrier hindering annual adherence to screening.[5–7] Studies have shown that a lack of an adequate number of X-ray machines can create longer screening appointment wait times.[5] Increased wait times have been noted as a barrier with not only screening but cancer treatment as well, resulting in treatment delays.[6] Another access-related barrier includes a shortage of staff, particularly radiologists, and technologists.[7]

Women also face barriers to breast cancer screening beyond the facility.[8,9] A recent study found that transportation and a lack of paid time off were the most significant barriers overall to seeking a mammography amongst women aged 40 and above, regardless of whether their care was at an inner-city safety or a suburban county one.[8] Lack of childcare services was also a prominent barrier across income quartiles and, for women specifically at the inner-city safety net hospital, fear of the procedure and/or the results understanding was noted as the most prohibitive barrier to abnormal screening work-up.[8] Findings remained disparate across city versus county patients, highlighting the place of residence as a possible contributor to health care access and, in turn, ultimately to breast cancer screening and treatment.[8]

In oncology, especially, there is a general trend of emphasizing treatment over prevention.[10] Yet, more than half of cancers today are preventable by pre-existing knowledge, emphasizing the need for improved methods of dissemination and implementation of this information.[10] This knowledge base includes recommendations such as increasing physical activity, consuming a healthier diet, and limiting alcohol consumption, but many of these concepts are embedded within contextual issues such as policy, food insecurity, and structural inequities that recommendations often do not address with enough specificity.[11] The National Comprehensive Cancer Network and the Breast Health Global Initiative have even developed resource-stratified, evidence-based guidelines for breast cancer control and management; however, the publication of such recommendations does not translate to their use and to meeting breast cancer control needs.[12] Dissemination and implementation science (D&I) can help bridge this gap between research and practice by addressing how to facilitate and maintain pre-existing evidence-based interventions (EBIs) in various contexts within different fields, including that of breast cancer screening and treatment.[13]

D&I science is the scientific study of methods, frameworks, and strategies that promote the uptake and application of evidence-based practices and interventions into real-world contexts to prevent disease and improve the quality and efficacy of services in healthcare.[12] As this field grows, studies have begun using D&I frameworks to examine the implementation of different breast cancer EBIs, such as the Peace of Mind Program (PMP)—an EBI to increase mammography appointment attendance.[13,14] Another study used the Dynamic Adaptation Process (DAP) and Exploration, Preparation, Implementation, Sustainment (EPIS) frameworks to assess the implementation and application of Project ADAPT, an adaptation of the Ending Metastatic Breast Cancer for Everyone (EMBRACE) program, to the St. Louis region.[15] Despite the utility and availability of such frameworks, limitations of their application remain, along with concerns regarding strategies and frameworks themselves, including inconsistency with terminology and lack of sufficient detail for real-world replication.[14–16]

To address these limitations, groups of strategies have been clarified and created to help facilitate the adoption, use, and eventual sustainability of EBIs. One such taxonomy consists of the Expert Recommendations for Implementing Change (ERIC).[16] ERIC is a compilation of 73 implementation strategies organized into nine thematic clusters that cover areas including but not limited to financial strategies, infrastructure changes, developing stakeholder relationships, and consumer engagement.[17,18] As these strategies continue to be studied and adapted to achieve their maximal value, they already demonstrate their utility in two key features: (1) they provide conceptual

clarity and consensus among implementation strategies and terminology and (2) they use recommendations from multiple stakeholders to develop implementation strategies that are context-sensitive.[19] Yet, despite the availability of these strategies, there is a lack of studies exploring knowledge transfer dissemination and implementation models, strategies, and frameworks in the setting of breast cancer care.[20,21] There is a need for studies that create guidelines and roadmaps built on theoretical foundations of D&I research to scale up successful D&I of strategies, frameworks, and protocols proven to cater to the needs of all breast cancer patients when seeking screening and treatment services.[12]

The purpose of this scoping review was to identify common barriers and effective mitigating D&I models and strategies to successfully disseminate and implement evidence-based breast cancer screening and treatment programs for at-risk U.S. women aged ≥40 years. It will also explore lessons learned from barriers and challenges to the successful D&I of evidence-based breast cancer screening and treatment programs and/or protocols. This paper may further contribute to informing and guiding future D&I initiatives aimed at reducing breast cancer health disparities in this population.

Methods

The PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping reviews) was used as a reference checklist for this review.[22] This scoping review was guided by Arksey and O'Malley's (2005) York Methodology.[23] This framework methodology is composed of five steps: (1) identify research questions; (2) search for relevant studies); (3) select studies relevant to the research questions; (4) chart the data; and (5) collate, summarize, and report results.

Step 1: Identify research questions

Four guiding research questions for this scoping review were: (1) Which theories, models, and/or frameworks have been used to promote the dissemination and implementation of breast cancer screening and prevention evidence-based programs for at-risk U.S. women aged ≥40?; (2) What are the main barriers encountered in the D&I of breast cancer screening and prevention evidence-based programs for at-risk U.S. women aged ≥40?; (3) What implementation strategies have been used for evidence-based breast cancer screening and prevention program and intervention adoption, implementation and/or maintenance in at-risk U.S. women aged ≥40?; (4) What are the major limitations encountered when establishing sufficient follow-up opportunities for U.S. women aged ≥40 who are at-risk of or have developed breast cancer?

Step 2: Search for relevant studies

Acronyms were developed (Supplementary File 1) with the involvement of a research librarian (MK) who has expertise in writing scoping reviews and developing the protocol relevant for this study. Search terms included: dissemination science; implementation science; frameworks; strategies; theoretical frameworks; health promotion theories; breast cancer; mammography; screening/prevention; follow-up; doctor visits; women/female; United States. The review of the literature was completed over a period of 4 months, beginning in January 2023 and ending in April 2023. Screening of the articles was carried out by the senior author (LS) and co-authors (MR, SB, YZ, AM, SD, GO, DL, VJ).

Inclusion criteria. Included were peer-reviewed studies, published in English between 2000 and 2020 that (1) described the use of D&I models, frameworks, and theories to increase the dissemination, implementation, or maintenance of evidence-based or evidence-informed breast cancer screening and prevention programs, (2) were conducted in the U.S., and (3) addressed women aged ≥40 years.

Exclusion criteria. Excluded were studies that targeted women outside the age range (not ≥40 years of age) or not located in the U.S., studies focusing solely on improved behavioral or health outcomes with no reference to the D&I field, and studies that only reported general recruitment strategies, or that focused solely on ethical issues related to the implementation of these programs. Narrative, scoping, and systematic reviews were excluded as well.

Step 3: Selection of studies for the research questions

The senior author (LS) reviewed all tabulated data to resolve any discrepancies. All co-authors (MR, SB, YZ, AM, SD, GO, DL, VJ) extracted and summarized data. Summary tables included 1 evidence table describing characteristics (Table 1). Table 2 included a list of barriers that were first classified based on the Socio-Ecological Model and then further stratified based on emerging barrier themes that were common across studies retained for analysis. D&J models were identified using the '*Dissemination and Implementation Models in Health Research and Practice Webtool*'. Table 3 consisted of the D&I strategies that were categorized and coded based on ERIC strategies. These strategies both help to clarify concepts and provide consensus on implementation strategies and terminology, as well as to develop context-sensitive implementation strategies using stakeholder recommendations.[19]

Table 1. Study characteristics.

Primary author (year)	Study design	Sample size	Priority population	Study purpose	Setting	Stakeholders	D&I theory/ framework
Aleshire et al. (2021)	Qualitative study	*N* = 39	Black women in an urban city in southeast US with limited access to preventive health services and primary care providers	To examine Black women's mammography perspectives and experiences with specific foci on barriers to mammography access and associated practice and policy implications	ED of a southeastern US academic medical center for non-urgent care	Patients (Black women in southeast US), investigators, research team, providers, healthcare staff, medical center administration	N/A
Avis et al. (2004)	Prospective randomized trial study	*N* = 562	Underserved Caucasian, African-American, and Hispanic women aged 50–70 in Massachusetts	To develop and test the effectiveness of a videotape for increasing mammography screening	Three areas in each of three cities in Massachusetts with the largest proportions of minority residents—Boston, Lawrence, and Springfield	Caucasian, African-American, and Hispanic women aged 50–70 in Massachusetts, Advisory Committee of community health education experts and physicians specializing in women's health, physicians	Ajzen's theory of planned behavior and the health belief model
Coronado et al. (2014)	Randomized controlled trial study	*N* = 540	Latinas ages 42 and 74 years of age who have been seen by a community health partner clinic within the past 5 years and who are out of compliance with current recommendations for mammography	(1) To determine the effects of a patient-level intervention and a clinic-level intervention on mammography utilization in a sample of Latino women in western Washington State, (2) To assess the cost effectiveness of the intervention program, (3) To assess the influence of neighborhood-level characteristics on the program effect	Sea Mar Community Health Centers, 2 clinics in King, Snohomish, and Skagit counties, federally sponsored health clinics in western Washington, and Seattle Cancer Care Alliance, a mobile mammography unit	Latinas that go to federally sponsored health clinics, clinic staff, clinic providers, clinic administration, research team	Health Disparities Framework by Warneke et al.
Davis et al. (2017)	Quasi-experimental atudy	*N* = 357	African American women in socioeconomically disadvantaged areas in Memphis, Tennessee	To discuss the development, implementation, and evaluation of a community-based participatory research program designed to increase breast cancer screening awareness in an underserved African American population	Ten churches and community centers in two socioeconomically disadvantaged counties within Memphis Tennessee	Researchers, community-based breast cancer support organization, community-based healthcare providers, community leaders, human and social service organizations, churches, community center staff, community members	CBPR, CDC social ecological model of health promotion
Ferrante et al. (2011)	Case study	*N* = 1	Patient navigators in urban underserved communities	To describe the personal account, barriers faced, and responses to challenges of a patient navigator in promoting breast cancer screening and facilitating diagnosis and treatment among urban mostly African American women	Underserved community and university public safety-net hospital in Newark, New Jersey	Patient navigators, patients, research team, hospital staff, physicians, community members, volunteers, social workers, healthcare administrators	N/A
Gorin et al. (2006)	Randomized control trial study	*N* = 168	Medically underserved predominantly African American and Hispanic urban female patients over the age of 40	To assess the efficacy of academic detailing in increasing recommendations for breast cancer screening in a sample of community-based urban physicians compared with physicians in a similar community	Community-based urban primary care offices in northern Manhattan (Harlem and Washington Heights) and South Bronx	Primary care physicians; patients; radiologists; Master's level health educators; primary care office staff; physician advisory board; departments of public health; pharmaceutical companies; insurance companies	N/A
Guerra et al. (2021)	Descriptive study	*N* = 1974	Un- and under-insured, racially and ethnically diverse urban women	To describe the use of the Plan-Do-Study-Act (PDSA) framework to the process of developing a breast cancer screening navigation program for un- and under-insured women, its key successes, as well as the challenges and how these challenges were overcome	Abramson Cancer Center (ACC) of the University of Pennsylvania, a National Cancer Institute Comprehensive Cancer Center in Philadelphia	Patient navigator; patients; radiology departments; financial departments; grant sponsors; primary care clinics at federally qualified health centers; health care providers; patient service associates; radiology managers; nonprofit community organizations; Pennsylvania DOH; CDC; Susan G. Komen Foundation and other similar sources of institutional funding; interpreters; state county assistance office; Abramson Cancer Center of the University of Pennsylvania (academic health centers); ACC financial advocacy team; cancer specialists; nurse navigators; obstetrics and gynecology service providers	N/A

(Continued)

Table 1. (Continued)

Primary author (year)	Study design	Sample size	Priority population	Study purpose	Setting	Stakeholders	D&I theory/ framework
Gunn et al. (2014)	Qualitative study	*N* = 10	Women eligible for breast cancer health services	To determine how closely a published model of navigation reflects the practice of navigation in breast cancer patient navigation programs	Breast cancer navigation programs throughout the US funded by a single foundation	Patients; navigators; health practitioners; volunteers; sources of institutional funding; hospitals/clinics; medical assistants; nurses; health educators; social workers; community organizations; nurse practitioners; data managers; nutrition team; LPNs; outreach nurses; physicians assistants; radiology staff	N/A
Highfield et al. (2015)	Descriptive study	*N* = 466	Women between the ages of 40–64 who are at or below 200% of the federal poverty level for a family of four and who lack health insurance	To evaluate a theoretically based, systematically designed implementation strategy to support adoption and implementation of a patient navigation-based intervention aimed at improving breast cancer screening among underserved women	FQHCs and charity clinics that are members of the Breast Health Collaborative of Texas (BHCT) network in the Houston area	Patients; safety net health care delivery systems (ex. FQHCs, charity clinics); local mobile mammography providers; safety net health care staff; state-certified trainers; patient navigators	N/A
Juon et al. (2006)	Randomized control trial study	*N* = 186 (control (*n* = 95) and intervention groups (*n* = 105))	Korean women over the age of 40	To develop and evaluate a culturally integrated cancer education program among Korean American women using a Korean-language photo novel	Korean churches and low-income senior housing in the Baltimore Washington Metropolitan area	Patients; health educators; healthcare providers; local health departments; Korean outreach workers; Korean church members, low-income senior housing staff; mobile mammogram program staff; Korean community hub leadership	N/A
Kenny et al. (2020)	Qualitative study	*N* = 61	African American, Chinese, Latina, and White women between the ages of 40–74 with an abnormal mammogram and a recommendation for biopsy in the previous year	To explore abnormal mammogram follow-up experiences reported in in-depth qualitative interviews with an ethnically diverse sample of participants (African American, Chinese, Latina, and White) receiving care in different healthcare settings (academic, community, and safety-net)	One of three San Francisco Mammography Registry-participating health organizations (academic, community, safety net)	Academic/community/safety net hospital systems and their staff; patients; primary care physicians; pathologists; radiology staff; interpreters; nurses; social workers; navigators	N/A
Le Clair et al. (2022)	Mixed-methods study	*N* = 7	Women undergoing breast cancer treatment in Boston	To conduct a baseline assessment of navigation processes at six Boston hospitals that provide breast cancer care in preparation for an implementation trial of standardized navigation across the city	Hospitals in Boston, MA	Clinical supervisors, oncologists, nurses	N/A
Loo et al. (2022)	Qualitative study	*N* = 17	Patient navigator team members of the pragmatic TRIP trial	To build upon prior evaluation work of patient navigation interventions by assessing patient navigator and clinical team perspectives regarding barriers and facilitators to implementing an evidence-based breast cancer patient navigation intervention	Hospitals in Boston, MA	Clinical supervisors, oncologists, nurses, patient navigators, navigator supervisors	Consolidated framework for implementation research
Meneses et al. (2009)	Randomized control trial study	*N* = 53	Breast cancer survivors living in rural locations	To establish the feasibility of rural breast cancer survivors participating in a longitudinal intervention trial and evaluate the effects of an established and effective psychoeducational support intervention (BCEI) on overall quality of life	Rural cancer centers or oncology offices in the Southeast of the United States	Nurses, oncologists, patients, research investigators, BCEI research office	N/A
Messina et al. (2002)	Quasi-experimental study	*N* = 1601	Women aged 50–80 years old in New York who were not regular mammography users at baseline	To determine if BSTC or CME intervention strategies could increase regular use of mammography screening	4 counties in New York	Patients, physicians, researchers, physician offices	N/A

(Continued)

Table 1. (Continued)

Primary author (year)	Study design	Sample size	Priority population	Study purpose	Setting	Stakeholders	D&I theory/ framework
Onega et al. (2014)	Descriptive study	N/A	N/A	To identify new measures to optimize benefits to harms tradeoffs in population-based screening	N/A	Nurses, physicians, patients	N/A
Padela et al. (2018)	Mixed methods study	*N* = 58	Muslim American Women in Chicago	To examine the structure and outcomes associated with a peer-led group education program specifically designed to address the needs of Muslim women and encourage their intent to undergo mammography screenings	Mosques	Community advisory board (CAB), Peer educators, religious scholars, guest lecturers, community leaders from mosques and organizations	N/A
Paskett et al. (2006)	Randomized control trial study	*N* = 851	Women over the age of 40 in Robeson County, North Carolina	To evaluate the effectiveness of a lay health advisor (LHA) intervention in improving mammography attendance among triracial rural population of women residing in Robeson County, North Carolina	Robeson Health Care Corporation (RHCC) in Robeson County, NC	RHCC patients, Lay health advisors (former nurses, social workers, research study interviewers), Wake Forest ROSE Project Managers, Primary care physicians of the women	Precede-Proceed Model
Ro et al. (2022)	Qualitative study	*N* = 44	Women over the age of 40, primary care providers, and stakeholders engaged in the development of policies and guidelines for mammography screening	To examine the existing practices and beliefs regarding mammography screening frequency and gather perspectives on the utilization of risk-based screening to determine screening intervals	Virtual Individual interviews conducted with each participant using Zoom web-conferencing technology	Patients, primary care providers, breast radiologists, radiology administrators, patient advocates	Consolidated Framework for Implementation Research (CFIR)
Rodriguez et al. (2020)	Mixed methods study	*N* = 22	Community health workers in south Florida who work with Latinx farmworkers	To develop a culturally appropriate training intervention for South Florida CHWs aimed at educating Latinx immigrant farmworkers on breast cancer and early detection	Community-based organizations (CBO) in Homestead, Florida	Farmworker community members who work or are married to men who work in agricultural produce fields or in plant nurseries, CBO leaders and staff, Community health workers, Breast oncology experts, Health care providers	N/A
Schonberg et al. (2014)	Quasi-experimental study	*N* = 45	Women over the age of 75 attending a PCP clinic	To create and assess the effectiveness of a mammography screening decision aid (DA) specifically designed for women aged 75 years and older	Boston academic primary care practice	Primary care providers, research assistants	N/A
Silvia et al. (2008)	Qualitative study	*N* = 12	Providers who practice in routine clinical practice within community settings	To investigate the existing resources and obstacles involved in integrating breast cancer Patient Decision Aids (PtDAs) into routine clinical practice	Breast care centers and hospitals in MA	Nurses, social workers and/or patient educators, physicians/providers	N/A
Tu et al. (2002)	Cross-sectional survey	*N*= 400 Cambodian women, in all, examined for screening behavior (*n* = 398 for CBE analysis and *n* = 248 for mammography analysis)	Cambodian American women	1.To describe breast cancer screening stages of adoption in Cambodian American community 2. Identify factors associated with each stage in this underserved community	Seattle, Washington	Cambodian women, physicians	N/A

(Continued)

Table 1. (Continued)

Primary author (year)	Study design	Sample size	Priority population	Study purpose	Setting	Stakeholders	D&I theory/ framework
Wang et al. (2012)	Randomized controlled trial	*N* = 664 Chinese American immigrant women, older than 40 years, nonadherent to annual mammography screening guidelines, and no medical appt. for mammogram w/n last 6 months	Chinese American women from Washington, DC and New York City	Examine the efficacy of the cultural and generic videos in increasing Chinese-American immigrant women's mammography screening behavior relative to a control group that receive a fact sheet	Washington, DC and New York City from November 2006 to 2009	Chinese-American women, other underserved ethnic and cultural groups, intervention programs, community workshops, clinical settings	N/A
Ziegler et al. (2003)	Repeated measures survey methodology	• *N* = 10 women with PMH of breast cancer • *N* = 2 registered nurse group facilities	Participants and facilitators of a community sponsored breast cancer support group	To report the findings of a programme evaluation project that was designed to identify the experiences of both the participants in and facilitators of a community hospital-sponsored breast cancer support group	Rural state in the New England region of the USA	Participants and facilitators of a community sponsored breast cancer support group, nurse, health professionals, organizational development consultant	N/A

Table 2. Dissemination and implementation barriers classified based on the socio-ecological model and barrier category themes.

Primary author (year)	Barriers	Socio-ecological model					Barrier Theme Category										
		Ind	Inter	Org	Com	Soc/pol	Geographic and transportation challenges	Limited healthcare accessibility, affordability, and quality	Communication and health literacy challenges	Funding and Reimbursement Challenges	Lack of Integration with Cultural and Religious Values	Distrust	Recruitment, Measurement, and Delivery Challenges	Misconceptions and Negative Assumptions about Breast Cancer Screening	Social Norms and Family Related Issues	Lack of Adequate Knowledge about Patient Suitability for Breast Cancer Screening	Structural and Regulatory Challenges in Healthcare Settings	Generalizability
Aleshire at al. (2021)	Lack of geographic accessibility to mammography screening	X		X	X		X											
	Lack of transportation	X	X	X	X		X											
	Lack of insurance and cost of healthcare	X		X		X		X		X							X	
	Lack of primary care provider	X	X		X			X										
	Lack of childcare support	X	X		X										X			
	Inadequate knowledge related to mammography	X		X	X											X		
	Scheduling conflicts/wait times	X		X				X					X				X	
	Negative experiences within health care system	X		X								X		X				
	Failure of health care providers to provide mammography information and recommendation			X				X					X			X		
	Skepticism and mistrust, perceptions of racism	X	X		X						X	X						
	Pain and fear of pain from mammography	X												X				
	Faith/spirituality and cultural beliefs	X									X							
	Fear of mammography results, fatalism	X									X			X	X			
	Convenience sampling and recruitment			X									X					

(Continued)

Table 2. (Continued)

Primary author (year)	Barriers	Socio-ecological model					Barrier Theme Category										
		Ind	Inter	Org	Com	Soc/ pol	Geographic and transportation challenges	Limited healthcare accessibility, affordability, and quality	Communication and health literacy challenges	Funding and Reimbursement Challenges	Lack of Integration with Cultural and Religious Values	Distrust	Recruitment, Measurement, and Delivery Challenges	Misconceptions and Negative Assumptions about Breast Cancer Screening	Social Norms and Family Related Issues	Lack of Adequate Knowledge about Patient Suitability for Breast Cancer Screening	Structural and Regulatory Challenges in Healthcare Settings	Generalizability
Avis et al. (2004)	Mammograms are uncomfortable or painful	X												X				
	Paying more attention to family needs than one's own health	X	X								X				X			
	Concern about too much X-ray exposure	X												X				
	Women are more likely to read a pamphlet than watch a video	X											X					
	Believing one has control over getting a mammogram is related to recent mammography	X												X				
	Mammography screening rates were higher at baseline than anticipated, leaving less room for either materials to have an effect	X											X					
	Did not have a control group that did not receive any education materials	X											X					
	Other delivery methods such as showing the video in physician offices or other settings may be more likely to reach women who would not ordinarily watch or read the materials	X							X				X				X	
Coronado et al. (2014)	Cost of mammography services	X		X				X		X								
	Lack of cultural appropriateness	X			X						X				X			

(Continued)

Table 2. (Continued)

Primary author (year)	Barriers	Socio-ecological model					Barrier Theme Category											
		Ind	Inter	Org	Com	Soc/ pol	Geographic and transportation challenges	Limited healthcare accessibility, affordability, and quality	Communication and health literacy challenges	Funding and Reimbursement Challenges	Lack of Integration with Cultural and Religious Values	Distrust	Recruitment, Measurement, and Delivery Challenges	Misconceptions and Negative Assumptions about Breast Cancer Screening	Social Norms and Family Related Issues	Lack of Adequate Knowledge about Patient Suitability for Breast Cancer Screening	Structural and Regulatory Challenges in Healthcare Settings	Generalizability
Davis et al. (2017)	Concerns about cost	X		X		X		X		X								
	Fear of finding cancer	X												X				
	Myths that getting treated for breast cancer is worse than the disease, having an operation for breast cancer can expose it to the air and cause it to spread	X			X						X			X	X			
	Worry about radiation	X												X				
	Present-time oriented people are less likely to engage in procedures such as cancer screening	X												X		X		
	Policy barriers at local and state levels					X											X	
	Focus is on African America female population in only one area, Memphis, Tennessee				X						X							
	No control group to compare outcomes			X														X
	Could not confirm the participants who indicated they had scheduled mammography through medical records			X									X				X	
Ferrante et al. (2011)	Those that require education are those that are not often in attendance at health fairs and events of such nature			X	X								X					
	Other social needs that take precedence over breast cancer screening	X													X			
	Safety of patient navigators when working in the field in urban community			X	X								X					
	Patient navigator's need to set boundaries with patients while promoting compliance		X												X			
	Patient navigator burnout	X											X					
	Perspective of only one patient navigator	X		X				X					X					X

(Continued)

Table 2. (Continued)

Primary author (year)	Barriers	Socio-ecological model					Barrier Theme Category										
		Ind	Inter	Org	Com	Soc/ pol	Geographic and transportation challenges	Limited healthcare accessibility, affordability, and quality	Communication and health literacy challenges	Funding and Reimbursement Challenges	Lack of Integration with Cultural and Religious Values	Distrust	Recruitment, Measurement, and Delivery Challenges	Misconceptions and Negative Assumptions about Breast Cancer Screening	Social Norms and Family Related Issues	Lack of Adequate Knowledge about Patient Suitability for Breast Cancer Screening	Structural and Regulatory Challenges in Healthcare Settings	Generalizability
Gorin et al. (2006)	Physicians' misperception that there is no medical indication for mammogram screening	X		X				X						X		X		
	Physicians' misperception that mammogram screening is low-yield	X		X				X						X		X		
	Physicians' misperception that mammogram poses a high risk of radiation	X		X				X						X		X		
	Resistance by patients	X										X		X				
	Perceived cost of mammography exam	X						X		X								
	Physician fear of causing unnecessary worry for patients	X	X											X				
	Physicians' perception of the risk of false positives	X		X										X				
	Patient discomfort/pain	X												X				
	Patients' preference for a female provider for screening	X	X								X	X			X		X	
	Providers generally receive no additional payment for performing CBEs			X		X				X							X	
	Institutional performance standards for CBS are inconsistent			X													X	
	Academic detailing intervention may not be fiscally feasible in certain communities due to moderate cost (approx. $721.77 per participant)			X				X		X								

(Continued)

Table 2. (Continued)

Primary author (year)	Barriers	Socio-ecological model					Barrier Theme Category										
		Ind	Inter	Org	Com	Soc/ pol	Geographic and transportation challenges	Limited healthcare accessibility, affordability, and quality	Communication and health literacy challenges	Funding and Reimbursement Challenges	Lack of Integration with Cultural and Religious Values	Distrust	Recruitment, Measurement, and Delivery Challenges	Misconceptions and Negative Assumptions about Breast Cancer Screening	Social Norms and Family Related Issues	Lack of Adequate Knowledge about Patient Suitability for Breast Cancer Screening	Structural and Regulatory Challenges in Healthcare Settings	Generalizability
Guerra et al. (2021)	Securing funding for program's operating support (navigator salary, benefits, and training)			X		X				X								
	Logistical challenges to reaching difficult-to-reach population before engaging in the program and after for follow up care (ex. transient phone/housing access result in inability to communicate using traditional methods)	X	X		X								X					
	Challenge of securing insurance for patients in a timely manner once they are diagnosed with cancer			X				X		X								
	Language and communication barriers related to the majority of the patient population speaking a language other than English or having low health literacy	X	X		X				X		X		X					
	Differences in cultural beliefs between the provider and the patient affecting how the patients perceive medical information and the concept of health and illness in general	X	X		X						X							
	Transportation-related issues	X	X	X	X		X											
	Fear of a cancer diagnosis, especially after receiving an abnormal mammogram result	X												X				

(Continued)

Table 2. (Continued)

Primary author (year)	Barriers	Socio-ecological model				Barrier Theme Category											
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Gunn et al. (2014)	Patient navigation is a new care delivery system and a complex innovation that interacts with several professional groups, so it is often nonlinear and disorderly			X									X				X	
	Tension in balancing worker capacity with community needs			X				X					X				X	
	Lack of reimbursement for navigation			X		X				X								
	Reliance on institutional, foundation, or research grant funding to establish and maintain programs			X		X				X								
Highfield et al. (2015)	Patient-level socioeconomic differences like education, insurance, and income	X						X										
	Differences in skills and qualifications of providers attending to different racial-ethnic groups		X					X										
	Inadequacies in health care systems which provide care for the underserved			X				X										
	Beliefs and misconceptions	X												X				
	Linguistic and communication barriers		X						X									
Juon et al. (2006)	Personal patient-level barriers to screening including work, lack of time, and so forth	X						X										
	Age-related barriers involving transportation and logistics, modesty, and age-related fatalism (ex. the belief that one is "too old for mammogram")	X												X				
	Language and communication barriers		X						X									

(Continued)

Table 2. (Continued)

Primary author (year)	Barriers	Socio-ecological model				Barrier Theme Category											
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Kenny et al. (2020)	Difficulty understanding providers who use medical jargon, complicated explanations of procedures, or provided results without context	X							X									
	One-way results communication through voice messages that limit patients' understanding of next steps and connection to the clinic			X				X										
	Unavailability of interpretation services and bilingual staff			X				X										
	Patient navigation programs may be costly and require additional trained personnel			X						X								
	Limitations in facility staff capacity			X						X								
	Unclear definitions for timely follow up			X									X					
Le Clair et al. (2022)	Lack of standardization in which patients should be targeted for navigation services			X													X	
	Lack of standardization for how to identify patients' social needs and how to address identified needs			X													X	
	Lack of care across the treatment spectrum with multiple hand-offs or fragmentation of navigation			X													X	

(Continued)

Table 2. (Continued)

Primary author (year)	Barriers	Socio-ecological model					Barrier Theme Category										
		Ind	Inter	Org	Com	Soc/ pol	Geographic and transportation challenges	Limited healthcare accessibility, affordability, and quality	Communication and health literacy challenges	Funding and Reimbursement Challenges	Lack of Integration with Cultural and Religious Values	Distrust	Recruitment, Measurement, and Delivery Challenges	Misconceptions and Negative Assumptions about Breast Cancer Screening	Social Norms and Family Related Issues	Lack of Adequate Knowledge about Patient Suitability for Breast Cancer Screening	Structural and Regulatory Challenges in Healthcare Settings	Generalizability
Loo et al. (2022)	The majority of breast cancer patients served did not align with the targeted patient population of the TRIP program resulting in difficulties in enrolling TRIP patients at this institution, which was perceived as a misalignment of the TRIP program's goals regarding who the intervention was attempting to reach				X								X					
	The relative priority of TRIP amidst high existing caseloads and limited staff challenged implementation efforts			X				X										
	Intervention-related documentation, such as tracking of TRIP patients in the shared registry, added complexity to patient navigation tasks			X									X					
Meneses et al. (2009)	Travel challenges for individuals living in these rural areas, limiting face-to-face intervention				X		X											
	Limited data and information about non-Caucasian participants			X									X					
	Time considerations limited some individuals from participating in the study			X									X					
Messina et al. (2002)	A lot of conflicting information about how often women should have mammograms					X			X									
	Difficulty finding locations that provide mammograms				X		X											
	Other issues in life that make getting a mammogram less of a priority	X						X										
	Lack of provider continuity		X					X										

(Continued)

Table 2. (Continued)

Primary author (year)	Barriers	Socio-ecological model					Barrier Theme Category										
		Ind	Inter	Org	Com	Soc/ pol	Geographic and transportation challenges	Limited healthcare accessibility, affordability, and quality	Communication and health literacy challenges	Funding and Reimbursement Challenges	Lack of Integration with Cultural and Religious Values	Distrust	Recruitment, Measurement, and Delivery Challenges	Misconceptions and Negative Assumptions about Breast Cancer Screening	Social Norms and Family Related Issues	Lack of Adequate Knowledge about Patient Suitability for Breast Cancer Screening	Structural and Regulatory Challenges in Healthcare Settings	Generalizability
Onega et al. (2014)	Complexity of multilevel environment of healthcare delivery			X													X	
Padela et al. (2018)	Small sample size			X														X
	Particularities in the sample, e.g. English-speaking, mosque-going women			X									X					
	Limited generalizability due to variations in religiosity among Muslim Americans			X														X
	Use of one-item measures of intention, confidence, and likelihood, which may not comprehensively reflect the psychological and attitudinal changes preceding the target health behavior			X									X					
Paskett et al. (2006)	Limited generalizability due to the specific characteristics of the study population, including being rural, low income, and consisting of three racial groups (white, Native American, and African American)	X											X					X
	Cost of delivering the in-person intervention for physician offices			X				X		X			X					
	Possibility of missing data on mammography use despite the use of medical record verification			X									X					
Ro et al. (2022)	Limited generalizability due to the study being a single institution study conducted at an urban academic medical center			X									X					X
	Limited representation of radiologists and patient advocates among the interviewed stakeholders		X					X										

(Continued)

Table 2. (Continued)

Primary author (year)	Barriers	Socio-ecological model				Barrier Theme Category											
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Rodriguez et al. (2020)	While significant knowledge gains were observed immediately after the CHW training intervention, there was a decline in knowledge scores during the follow-up test conducted 4–6 months later, indicating a need for future refresher trainings to sustain and reinforce the acquired knowledge	X											X					
	The sample size of community health worker (CHW) trainees was small but can also be considered representative given the relatively small number of CHWs who typically serve this particular community			X									X					X
	There was an observed lack of engagement with men in the community, which is noteworthy due to formative findings emphasizing the significance of involving and educating male partners	X							X						X			
	The limited participation of community members in the rapid assessment survey after their interaction with CHWs made it difficult to make inferences on community perceptions of the materials	X											X					

(Continued)

Table 2. (Continued)

Primary author (year)	Barriers	Socio-ecological model				Barrier Theme Category										
		Ind	Inter	Org Com	Soc/ pol	Geographic and transportation challenges	Limited healthcare accessibility, affordability, and quality	Communication and health literacy challenges	Funding and Reimbursement Challenges	Lack of Integration with Cultural and Religious Values	Distrust	Recruitment, Measurement, and Delivery Challenges	Misconceptions and Negative Assumptions about Breast Cancer Screening	Social Norms and Family Related Issues	Lack of Adequate Knowledge about Patient Suitability for Breast Cancer Screening	Structural and Regulatory Challenges in Healthcare Settings	Generalizability
Schonberg et al. (2014)	Generalizability is limited due to small sample size and single-site study			X								X					X
	Participants in the study were predominantly highly educated, limiting generalizability to other populations	X															X
	The quasi-experimental design used in the study may not fully account for secular changes, potentially affecting the observed changes in PCP discussions and screening rates		X							X							
	The inclusion of participants aged 75 raises concerns about the appropriateness of discussions about stopping mammography in the 5 years prior to participating in the study	X	X					X							X		
	The study cannot distinguish the effect of PCP knowledge of the decision aid (DA) from the effect of the DA itself		X	X								X					

(Continued)

Table 2. (Continued)

Primary author (year)	Barriers	Socio-ecological model					Barrier Theme Category										
		Ind	Inter	Org	Com	Soc/ pol	Geographic and transportation challenges	Limited healthcare accessibility, affordability, and quality	Communication and health literacy challenges	Funding and Reimbursement Challenges	Lack of Integration with Cultural and Religious Values	Distrust	Recruitment, Measurement, and Delivery Challenges	Misconceptions and Negative Assumptions about Breast Cancer Screening	Social Norms and Family Related Issues	Lack of Adequate Knowledge about Patient Suitability for Breast Cancer Screening	Structural and Regulatory Challenges in Healthcare Settings	Generalizability
Silvia et al. (2008)	Out of the 12 sites interviewed, 3 sites reported that they had not yet been successful in implementing the use of Patient Decision Aids (PtDAs)			X									X					
	Physicians exhibited limited engagement, which was primarily attributed to time constraints		X					X					X					
	Nurses' sensitivity to patients' interest and willingness to participate in decision-making lead to the exclusion of programs for patients who were overwhelmed or reluctant	X	X										X			X		
	Limited generalizability because the study focused solely on sites located in Massachusetts, and resources and barriers related to implementing PtDAs may vary in other regions of the United States or globally			X			X											X
	The study only included interviews with providers from 12 out of 23 sites that had received the PtDAs		X	X									X					
	There was a lack of patient data regarding the effectiveness of the decision aids and their impact on decision quality	X		X									X			X		

(Continued)

Table 2. (Continued)

Primary author (year)	Barriers	Socio-ecological model					Barrier Theme Category										
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Tu et al. (2002)	Small proportion of women in combined precontemplation / contemplation stage and large proportion in relapse stage compared to Vietnamese study	X																X
	Did not assess other physician characteristics (i.e. country or period of medical training) or interview physicians regarding their recommendations that may influence physicians' preventative practice and results		X										X					
	Selection bias as cannot be certain that all Cambodians within the selected area of Seattle were identified by the surnames database	X											X					
	Not generalizable to other geographic regions or to Cambodians who do not reside in neighborhoods where the proportion of Southeast Asians is high	X	X				X											X
	Results may be subject to inaccurate recall and acquiescence bias (i.e. over-reporting of perceived behavior)	X											X					
	Results may be an overestimate of Clinical Breast Exam and mammography stages of adoption due to non-respondents potentially under-utilizing breast cancer screenings	X											X					X
	Focus on exploratory rather than confirmatory analysis; not hypothesis-driven and will need to be interpreted with care			X									X					

(Continued)

Table 2. (Continued)

Primary author (year)	Barriers	Socio-ecological model					Barrier Theme Category										
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Wang et al. (2012)	Outcome based on self-reports; future study should verify with medical records	X		X								X	X					
	Limited generalizability with narrow range of acculturation levels and community setting recruitment	X			X													X
	Could not examine long-term behavioral effects on target population	X		X									X					
Ziegler et al. (2003)	Social desirability bias as women might have tailored their responses to be more desirable for the facilitators along with potential socially desirable responses from the nurses	X	X										X	X				
	Women's experiences could have differed during the intervening months, or what happened after the evaluation project was completed; future studies should look at more frequent and extended collection of data	X		X									X					
	Study examined only women and, that too, only those with one type of cancer	X																X

Table 3. ERIC strategies by domain, rank, and percentage of citation.

#	Strategy	Domain	Rank	%
16	Tailor strategies	Adapt and tailor to context: culture, language, data analysis, collection	1	84
15	Promote adaptability	Adapt and tailor to context: culture, language, data analysis, collection	2	80
41	Distribute educational materials	Train and educate stakeholders	2	80
8	Obtain and use patients/consumers and family feedback	Use evaluative and interactive strategies	2	80
53	Intervene with patients/consumers to enhance uptake and adherence	Engage consumers	3	72
40	Develop educational materials	Train and educate stakeholders	3	72
54	Involve patients/consumers and family members	Engage consumers	4	68
36	Conduct educational meetings	Train and educate stakeholders	5	60
55	Prepare patients/consumers to be active participants	Engage consumers	5	60
20	Capture and share local knowledge	Develop stakeholder interrelationships	6	56
1	Assess for readiness and identify barriers and facilitators	Use evaluative and interactive strategies	6	56
19	Build a coalition	Develop stakeholder interrelationships	7	52
33	Use advisory boards and workgroups	Develop stakeholder interrelationships	7	52
31	Promote network weaving	Develop stakeholder interrelationships	8	48
7	Develop and implement tools for quality monitoring	Use evaluative and interactive strategies	8	48
37	Conduct educational outreach visits	Train and educate stakeholders	8	48
4	Conduct local needs assessment	Use evaluative and interactive strategies	8	48
24	Identify and prepare champions (representation)	Develop stakeholder interrelationships	8	48
9	Purposely reexamine the implementation	Use evaluative and interactive strategies	9	44
6	Develop and organize quality monitoring systems	Use evaluative and interactive strategies	9	44
2	Audit and provide feedback	Use evaluative and interactive strategies	9	44
5	Develop a formal implementation blueprint	Use evaluative and interactive strategies	9	44
32	Recruit, designate, and train for leadership	Develop stakeholder interrelationships	10	40
39	Create a professional learning collaborative	Train and educate stakeholders	11	36
14	Provide local technical assistance	Provide interactive assistance	11	36
43	Provide ongoing consultation	Train and educate stakeholders	12	32
12	Facilitation	Provide interactive assistance	12	32
22	Develop academic partnerships	Develop stakeholder interrelationships	12	32
21	Conduct local consensus discussions	Develop stakeholder interrelationships	12	32
38	Conduct ongoing training	Train and educate stakeholders	13	28
51	Revise professional roles	Support educators	13	28
25	Identify early adopters	Develop stakeholder interrelationships	13	28
48	Develop resource sharing agreements	Support educators	13	28
58	Alter incentive/allowance structures	Use financial strategies: structure of hospital, incentives, fees/insurance	13	28
56	Use mass media	Engage consumers	14	24
26	Inform local opinion leaders	Develop stakeholder interrelationships	14	24
49	Facilitate relay of clinical data to providers	Support educators	14	24
30	Organize clinician implementation team meetings	Develop stakeholder interrelationships	14	24
17	Use data experts	Adapt and tailor to context: culture, language, data analysis, collection	15	20
47	Create new clinical teams	Support educators	15	20
52	Increase demand	Engage consumers	15	20
11	Centralize technical assistance	Provide interactive assistance	15	20
70	Change service sites	Change infrastructure: policy at organization level	15	20
18	Use data warehousing techniques	Adapt and tailor to context: culture, language, data analysis, collection	15	20

(Continued)

Table 3. (Continued)

#	Strategy	Domain	Rank	%
45	Use train-the-trainer strategies	Train and educate stakeholders	15	20
59	Alter patient/consumer fees	Use financial strategies: structure of hospital, incentives, fees/insurance	15	20
28	Model and simulate change	Develop stakeholder interrelationships	16	16
50	Remind clinicians	Support educators	16	16
27	Involve executive boards	Develop stakeholder interrelationships	16	16
29	Obtain formal commitments	Develop stakeholder interrelationships	16	16
68	Change physical structure and equipment	Change infrastructure: policy at organization level	16	16
42	Make training dynamic	Train and educate stakeholders	17	12
13	Provide clinical supervision	Provide interactive assistance	17	12
46	Work with educational institutions	Train and educate stakeholders	17	12
69	Change record systems	Change infrastructure: policy at organization level	17	12
3	Conduct cyclical small tests of change	Use evaluative and interactive strategies	18	8
35	Visit other sites	Develop stakeholder interrelationships	18	8
72	Mandate for change	Change infrastructure: policy at organization level	18	8
23	Develop an implementation glossary	Develop stakeholder interrelationships	18	8
44	Shadow other experts	Train and educate stakeholders	18	8
57	Access new funding	Use financial strategies: structure of hospital, incentives, fees/insurance	18	8
61	Fund and contract for the clinical innovation	Use financial strategies: structure of hospital, incentives, fees/insurance	18	8
10	Stage implementation scale up	Use evaluative and interactive strategies	19	4
62	Make billing easier	Use financial strategies: structure of hospital, incentives, fees/insurance	19	4
34	Use an implementation advisor	Develop stakeholder interrelationships	19	4
65	Use other payment schemes	Use financial strategies: structure of hospital, incentives, fees/insurance	19	4
67	Change liability laws	Change infrastructure: policy at organization level	19	4
71	Create or change credentialing and/or licensure standards	Change infrastructure: policy at organization level	19	4
73	Start a dissemination organization	Change infrastructure: policy at organization level	19	4
60	Develop disincentives	Use financial strategies: structure of hospital, incentives, fees/insurance	20	0
63	Place innovation on fee for service lists/formularies	Use financial strategies: structure of hospital, incentives, fees/insurance	20	0
64	Use capitated payments	Use financial strategies: structure of hospital, incentives, fees/insurance	20	0
66	Change accreditation or membership requirements	Change infrastructure: policy at organization level	20	0

Step 4 and 5: Data charting and collation, summarization, and reporting of results

Study characteristics were tabulated for primary author/year, study design, sample size, priority population, study purpose, setting, stakeholders, D&I theory/framework (Table 1). Twelve barrier theme categories were identified based on recurrence across studies (Table 2). D&I strategies were matched with the ERIC strategies and ranked by frequency of occurrence, as well as ranked by most cited strategies within each domain (Table 3).

Results

The initial study extraction resulted in 886 articles from PubMed ($n=281$), EMBASE ($n=538$), Web of Science ($n=50$), and Cochrane ($n=17$) (Figure 1). Studies were excluded due to targeting women outside the age range

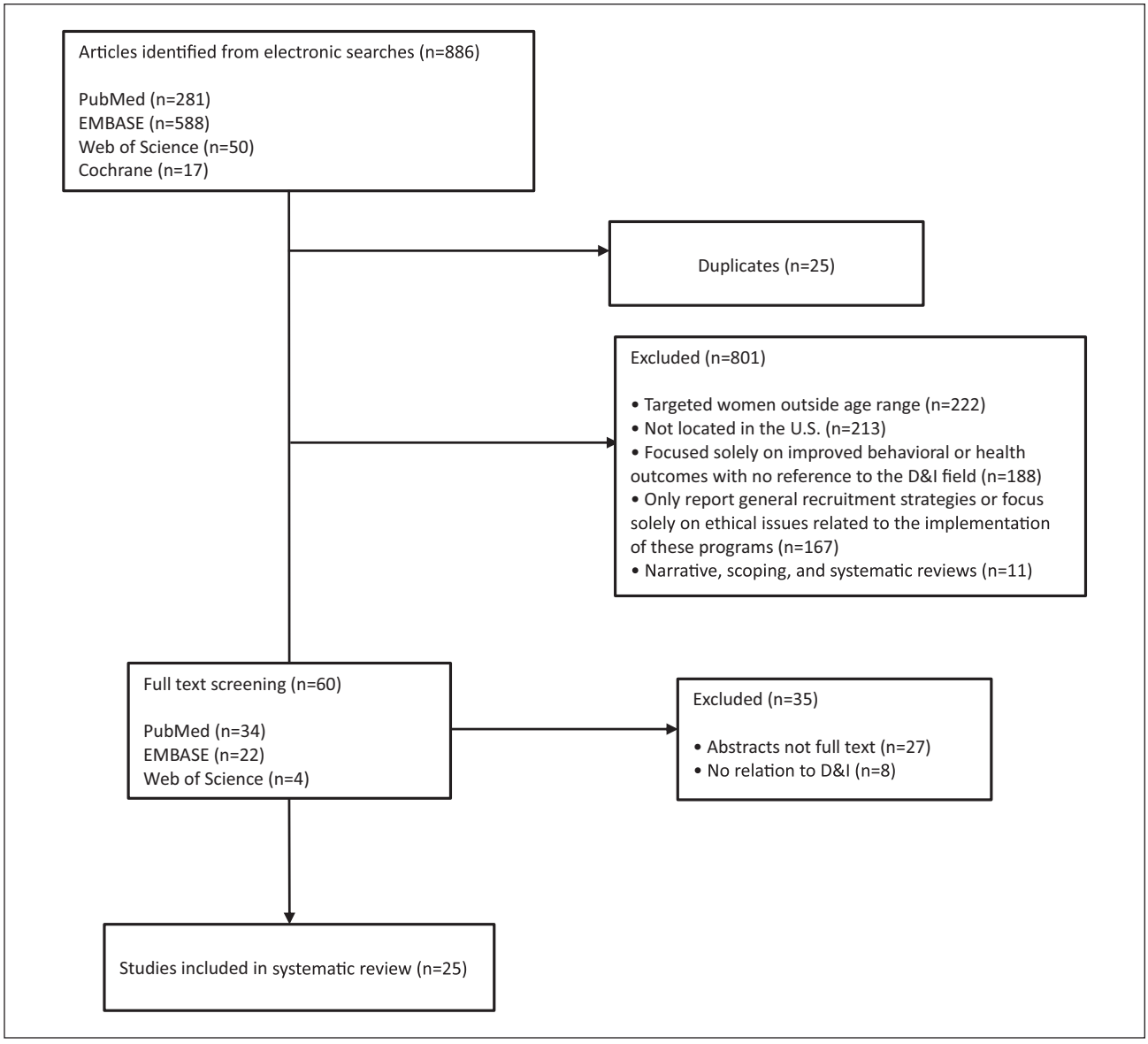

Figure 1. Flow selection of the study process.

($n=222$), not being located in the U.S. ($n=213$), focusing solely on improved behavioral or health outcomes with no reference to the D&I field ($n=188$), only reporting general recruitment strategies or focusing solely on ethical issues related to the implementation of these programs ($n=167$), or for being narrative, scoping, or systematic reviews ($n=11$). Duplicate studies were removed ($n=25$ from PubMed; $n=16$ from EMBASE, $n=7$ from Web of Science, and $n=2$ from Cochrane). Sixty studies met the inclusion criteria from PubMed ($n=34$), EMBASE ($n=22$), and Web of Science ($n=4$). An additional 35 studies were excluded after completing a full study review due to (1) being abstracts only and not full text ($n=27$) and (2) having no relation to D&I ($n=8$). A total of 25 eligible studies were retained for analysis.

The 25 retained studies were published between 2002 and 2022 (Table 1). About one-third of studies (8/25, 32%) were published in 2018 or later ($n=8$). Study designs included qualitative studies ($n=6$); quasi-experimental studies ($n=3$); randomized control trial studies ($n=7$); descriptive studies ($n=3$); mixed-methods studies ($n=3$); case study ($n=1$); cross-sectional study ($n=1$); and repeated measures survey methodology ($n=1$). Sample size ranged from $n=1$ patient navigator in an urban underserved community to $n=1974$ un- and underinsured racially and ethnically diverse urban women. Studies for this review occurred in various settings including health and medical centers ($n=9$); state and national registries ($n=7$); primary care practices, FQHCs, and community clinics ($n=4$); religious settings and

community centers ($n=3$); virtual via Zoom ($n=1$); and national foundations ($n=1$).

Priority populations and key stakeholders

Priority adult female populations included women from diverse racial and ethnic backgrounds residing in rural and/or underserved communities experiencing accessibility, affordability, and quality issues when it comes to breast cancer screening. Key stakeholders included patients, investigators, research teams, medical centers, medical staff, and providers (Table 1).

D&I models

D&I models included the Consolidated framework for implementation research ($n=2$); Ajzen's Theory of Planned Behavior ($n=1$); Health Belief Model ($n=1$); Health Disparities Framework by Warneke et al. ($n=1$); CDC Social Ecological Model of Health Promotion ($n=1$); Precede-Proceed Model ($n=1$) (Table 1).

D&I barriers

One hundred and eighty four barriers to implementation were reported in 25 studies,[24–49] representing the five levels of the socio-ecological model (SEM): individual ($n=68$), interpersonal ($n=27$), organizational ($n=61$), community ($n=19$), and society/policy ($n=8$) (Table 2). Barriers were also sorted into 12 categories (Table 2) based on major themes that were established through similarity of barriers highlighted across studies at the various levels of SEM. Some barriers fit into the SEM levels, and thus generated more than one theme. Most cited barriers ($n=46$) sorted into the category of "Recruitment, Measurement, and Delivery Challenges." A majority of studies also cited "Limited Healthcare Accessibility, Affordability, and Quality" ($n=26$), "Misconceptions and Negative Assumptions about Breast Cancer Screening" ($n=21$); "Generalizability" ($n=15$), and "Structural and Regulatory Challenges in Healthcare Settings" ($n=14$). Other barrier categories included Funding and Reimbursement Challenges ($n=7$); Lack of Integration with Cultural and Religious Values ($n=11$); Lack of Adequate Knowledge about Patient Suitability for Breast Cancer Screening ($n=9$); Social Norms and Family Related Issues ($n=9$); Communication and Health Literacy Challenges ($n=8$); Geographic and Transportation Challenges ($n=7$) and Distrust ($n=5$) (Table 2).

Breast cancer screening & treatment implementation strategies

All ERIC domains ($n=9$) were represented, and all extracted D&I strategies were matched to relevant ERIC strategies (Table 3). However, not all ERIC strategies were represented in the included studies. Two hundred and forty-three D&I strategies ($n=243$) were identified, corresponding to 69 (95%) of the ERIC strategies. The remaining 5% of ERIC strategies ($n=4$) that lacked representation were as follows: "Develop disincentives" (#60), "Place innovation on fee for service lists/formularies" (#63), "Use capitated payments" (#64), and "Change accreditation or membership requirements" (#66). Each study revealed a diverse range of one to sixteen strategies. The predominant ERIC strategy, featured in a noteworthy 84% of studies, was "Tailor strategies" (#16), which belongs to the "Adapt and tailor to context: culture, language, data analysis, collection" domain. The next top five ERIC strategies reported were "Promote adaptability" (#15), "Distribute educational materials" (#41), "Obtain and use patients/consumers and family feedback" (#8), "Intervene with patients/consumers to enhance uptake and adherence" (#53), and "Develop educational materials" (#40).[24–49]

Discussion

This scoping review identified major barriers hindering the effective dissemination and implementation of evidence-based breast cancer screening and treatment programs for at-risk U.S. women aged ≥40 years. Lessons learned from included studies can guide future successful D&I initiatives to improve adherence to breast cancer screening guidelines and recommended treatment plan in the U.S.[24–49]

D&I models

Seven of the twenty-five studies (28%) included in the scoping review utilized D&I models to address health disparities. One such model, the Consolidated Framework for Implementation Research (CFIR), attempts to provide a foundation on which research findings may be applied by utilizing an array of 39 constructs proven to impact implementation.[50] CFIR allows for the prediction of barriers or other factors to further guide strategies for successful implementation. This strategy is especially useful in designing interventions for underserved women with regard to cancer prevention, sexual health, and other chronic diseases. Another study utilized the CDC Socio-Ecological Model, a four-level model including the individual, their relationships, their community, and their society.[51] It acts as a holistic framework in understanding multi-level underlying factors hindering screening and treatment among women with breast cancer. With this said, these models are not without their limitations. CFIR and the CDC Socio-Ecological model both struggle in their inability to distinguish between the respective importance of constructs or factors.[52] Yet, these models' ability to illuminate barriers and influence implementation outweigh

the posed limitations. With additional research, these models may be adapted to facilitate a more inclusive consideration of the weight assigned to respective constructs.[50,52] Overall, D&I models provide guidance in designing evidence-based interventions with a systematic approach to addressing health issues and their routine adoption can dramatically improve health outcomes.[50,52,53]

Identified D&I barriers

The barriers most frequently cited were under the individual ($n=68$) and organizational ($n=61$) levels of the socioecological model (SEM). Individual barriers to breast cancer screening include fears, beliefs, education, geographical accessibility, transportation, and insurance coverage. A study by Khazaee-Pool et al.[54] highlighted how deep-seated beliefs can undermine evidence-based interventions. The qualitative study included Iranian women aged ≥30 years without mammography history and limited breast cancer knowledge. This cohort attributed the emergence of breast cancer to mammography itself, a perception that hindered their willingness to undergo the procedure.[54] Another challenge that individuals face is overcoming geographical and financial barriers to healthcare access. On a geographic level, when primary care clinics and medical practitioners are not readily within reach, breast cancer screening, diagnosis, and treatment become difficult. This disproportionately affects underserved communities, as geographic disparities forces women to undertake arduous journeys to access critical services.[55] Parallel to issues of accessibility is the constraint imposed by health insurance coverage and associated costs. A recent study by Mootz et al.[56] revealed socioeconomic and insurance-related disparities in cancer outcomes, with those lacking insurance or with inadequate coverage experiencing graver outcomes.[56]

On an organizational level, barriers include health literacy issues within clinics, limited number of hospitals offering translation services, a shortage of physicians, and inadequate time to engage with patients for a thorough understanding of their needs.[57] Women with low health literacy are associated with a lower probability of mammography screening; they are also more likely to report poorer physician-patient communication and higher levels of decision regret regarding their breast cancer decisions.[57] Moreover, substantial disparities in the time taken for diagnostic follow-up of abnormal mammograms have been identified in facilities catering to larger proportions of non-English speaking patients, where the delays were observed to be the most prolonged.[58] A study by Beauchamp et al.[59] utilized two randomized control trials to demonstrate that the implementation of an intervention strategy, which involved utilizing translated mammography reminder letters and conducting in-language phone calls, led to notable improvements in mammography screening rates.[59] Physician scarcity has also reduced access to breast cancer care, including screening, diagnosis, and treatment.[60] Another constraint is the limited time available for physician-patient interactions. Clinicians often neglect to inquire about their patient's concerns, significantly reducing the chance of addressing individual priorities during clinical encounters.[61]

The most frequently cited category was Recruitment, Measurement, and Delivery Challenges ($n=46$). Barriers in this category include issues like "Limited data about non-Caucasian participants,"[38] "Particularities in the sample, e.g., English-speaking, mosque-going women,"[41] and "Outcome based on self-reports; future study should verify with medical records."[31] These barriers significantly impact both study quality and data collection, making it more difficult to assess associations and restricting the scope of assumptions. Similar challenges were faced in a study conducted by Brown et al.[62] when exploring barriers to cervical cancer screenings. The study's online format skewed recruitment towards younger adults with higher educational attainment, a group associated with higher screening rates.[12] Additionally, the assessment of screening behavior was done retrospectively via self-reports rather than validation through cervical screening registries, potentially leading to an underestimation of the count of women overdue for screening in comparison to registry data.[12] The next most cited barrier theme was Limited Healthcare Accessibility, Affordability, and Quality ($n=26$). This category encompassed obstacles like "Cost of mammography services,"[26] "Lack of insurance and cost of healthcare,"[24] and "Lack of primary care provider."[24] The third most common barrier theme was Misconceptions and Negative Assumptions about Breast Cancer ($n=21$). Some barriers included in this theme are "Fear of finding cancer"[27] and "Mammograms are uncomfortable or painful."[25] These barriers are exacerbated by the Lack of Integration with Cultural and Religious Values ($n=11$)[31] and the Lack of Adequate Knowledge about Patient Suitability for Breast Cancer Screening ($n=9$).[30] Finally, generalizability ($n=15$) emerged as an additional barrier influencing the quality of evidence within the studies. Small sample sizes impact both internal and external validity. Internally, they can introduce sampling bias and reduce statistical power, potentially leading to inaccurate or non-significant results.[63] Externally, the generalizability of findings becomes limited due to inadequate representation of diverse characteristics within the target population. This can hinder the applicability of study results to different settings, groups, or contexts.[63] This constraint in generalizability becomes evident in the context of breast cancer screening, as reflected in the USPSTF's recommendations for women at average risk.[64] These recommendations, primarily derived from studies involving non-Hispanic (NH) White women, raise inquiries about their relevance to ethnically and racially diverse groups.[64]

ERIC-adapted D&I strategies

Our review found that the most cited ERIC strategy was #16 "Tailor strategies" (84% of studies). The primary reason that tailoring strategies are important for breast cancer prevention is perceived relevance.[65] Messages about health promotion that are tailored to a group such that they address the unique needs of individuals tend to have higher perceived personal relevance of risks and use of interventions, in turn increasing the likelihood of behavioral changes such as getting screened for breast cancer.[66] By tailoring strategies, researchers can also address the lack of integration with cultural and religious values, a barrier noted in several studies reviewed by this paper ($n = 11$). For example, for ethnic minority women such as Afghan women, who comprise the largest refugee population in the world, targeting three levels—Person, Extended Family, and Neighborhood—is important as these women are part of a collectivist culture.[67] Building off these levels, researchers developed interventions such as "tea parties" with groups of women to reduce social isolation and integrated the interventions with Islamic constructs for religious relevance.[67] Male family members, with the permission of the women, were invited for educational sessions to help promote them from gatekeepers of women's breast health to advocates.[67] Similarly, strategies to increase breast cancer screening amongst African American women targeted "black radio" (radio stations targeting African American audiences), and church-based interventions given the church's role as a vital institution culturally, religiously, and socially, amongst African American populations at all levels of vulnerability.[66]

The next top five strategies noted in our review were #15 "Promote adaptability" (80% of studies), #41 "Distribute educational materials" (80% of studies), #8 "Obtain and use patients/consumers and family feedback" (80% of studies), #53 "Intervene with patients/consumers to enhance uptake and adherence" (72% of studies), and #40 "Develop educational materials" (72% of studies). A patient navigation program in Chicago's Chinatown emphasized the value of promoting adaptability, illustrating that tailoring strategies to cultural needs were important, but more important was ensuring that it was a constantly iterative process.[68] Researchers used feedback to make adaptations, like increasing the intensity of work related to health insurance, during the implementation process.[68] This was much like the Helping Her Live model, also located in Chicago, which consistently sought feedback from Community Health Workers to manage its navigation protocol.[69] Highlighting the value of developing educational materials is the "Cancer Cooking School," developed by The Georgia Breast and Cervical Cancer Cancer Program in partnership with organizations like the American Cancer Society.[70] Researchers found that this publicly accessible, 3-h class on healthy dietary guidelines and healthier life choices like smoking cessation led to 80 women being screened for breast cancer out of the 125 eligible attendees, and 40 of these women had not been screened in the prior 5 years, if ever.[70]

Not only is the development of educational materials important, but so is the distribution of these materials as reported by the Ohio Breast and Cervical Cancer Project, which saw a 32% increase in screening enrollment following a mass media campaign consisting of television commercials, radio ads, and print ads.[70] This percentage went up to 40% when a live information session was added in, illustrating the importance of the method by which materials are distributed as well.[70] While tailored educational materials, including but not limited to interactive education sessions and printed brochures, have been developed for Korean American women, studies have found that these interventions have had limited impact on increasing breast cancer screening uptake in this population as they are hard to reach.[71] In turn, this has emphasized the importance of appropriate delivery of information and has prompted considerations for new delivery methods like mobile health navigation apps.[71]

Regarding intervening with patients to improve adherence, a systematic review of patient-provider communication on screening adherence found that patient-provider interaction was important and significantly more effective at increasing uptake when factoring in nuances of these interactions.[72] Findings illustrated that patient perception of provider encouragement and enthusiasm was one of the strongest indicators of screening adherence.[72] Also important to such interventions is the use of patient feedback. This can be done through shared decision-making (SDM), where patients and clinicians work together to jointly make informed healthcare decisions.[73] The importance of using feedback extends beyond just these patient-provider interactions, with studies illustrating that patient feedback can fill gaps at a policy level on how to even define SDM and what core elements should be involved in national SDM guidelines and recommendations.[74]

Strengths and limitations

Although this study is of high value for public health, medical, and community health experts through the identification of common barriers and effective mitigating D&I strategies for breast cancer screening programs for at-risk U.S. women, several limitations need to be taken into consideration. First, this study did not include case reports, case studies, and literature reviews from the grey literature. It also did not encompass tracing of the reference lists from included studies. However, a comprehensive search of the literature in relevant psychosocial databases was carried out and involved an

initial, secondary, and tertiary screening led by the senior author and the co-authors. Second, the evaluation of the quality of the evidence as part of this scoping review was integrated as part of the barriers identified in the different studies including generalizability, and recruitment, measurement, and delivery challenges. A theoretical approach (SEM) rather than an analytical approach was used to assess the quality of the associations made, the methodology adopted, and the findings shared. Future systematic reviews are recommended to ensure an analytical evaluation of the evidence shared to account for limitations of the study designs and their impact on relevant outcomes. Third, matching the extracted D&I strategies to the ERIC strategies was a challenge due to the diversity of the terminology used to describe dissemination and implementation strategies adopted for breast cancer screening and adequate follow-up. It would be critical for experts in the field of dissemination and implementation science to work on a standardized methodology encompassing specific nomenclatures to address diverse types of chronic diseases.

Conclusion

This scoping review describes D&I barriers and strategies to the effective delivery of evidence-based breast cancer screening programs and adequate follow-up for at-risk U.S. women aged ≥40 years. The existing diversity in the cultural backgrounds, beliefs, and values of patients calls for a more culturally competent approach for future breast cancer screening D&I initiatives. This study can guide researchers, physicians, and community workers in improving accessibility, affordability, and quality of breast cancer screening and adequate follow-up opportunities through D&I strategies and models improving the reach and sustainability of evidence-based programs in at-risk female populations.

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ORCID iDs

Diana Lobaina https://orcid.org/0000-0003-0623-7650
Lea Sacca https://orcid.org/0000-0002-0629-2863

Supplemental material

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