

Evaluation of Financial Interventions in Breast Cancer Care Worldwide: A Systematic Review

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Background: Out-of-pocket costs are burdensome for breast cancer patients. Cost-reducing interventions, though implemented, have unclear comparative efficacy. This study aimed to critically evaluate characteristics of successful versus unsuccessful interventions designed to decrease out-of-pocket costs for breast cancer patients.

Methods: A systematic review was conducted in accordance with the PRISMA checklist. Embase, PubMed, Global Index Medicus, and Global Health were queried from inception to February 2021. Articles describing a financial intervention targeting costs for breast cancer screening, diagnosis, or treatment and addressing clinical or patient-level financial outcomes were included. Methodological quality was evaluated using the QualSyst tool. Interventions were organized in accordance with timing of implementation, with narrative description of intervention type, success, and outcomes.

Results: Of the 11,086 articles retrieved, 21 were included in this review. Of these, 14 consisted of interventions during screening, and seven during diagnosis or treatment. Free/subsidized screening mammography was the most common screening intervention; 91% of these programs documented successful outcomes. Patient navigation and gift voucher programs demonstrated mixed success. The most successful intervention implemented during diagnosis/treatment was reducing medication costs. Low-cost programs and direct patient financial assistance were also successful. Limitations included lack of standardization in outcome metrics across studies.

Conclusions: Financial interventions reducing prices through free screening mammography and decreasing medication costs were most successful. Less successful interventions were not contextually tailored, including gift card incentivization and low-cost treatment modalities. These findings can facilitate implementation of broader, more generalizable programs to reduce costs and improve outcomes during evaluation and management of breast cancer. (*Plast Reconstr Surg Glob Open* 2024; 12:e5683; doi: 10.1097/GOX.0000000000005683; Published online 23 May 2024.)

INTRODUCTION

Cancer patients and their caregivers spend as much as 42% of their annual income on out-of-pocket costs

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(OOPC) associated with cancer care.¹⁻³ This burden is commonly referred to as financial toxicity because of the detrimental impact high costs can have on patient outcomes.^{2,4} For cancer patients, these costs originate from direct medical costs such as the price of screening tests, insurance deductibles, co-payments, and pharmacologic treatments. Costs from direct nonmedical sources also contribute, including travel, lodging, and food. Additionally, cancer patients face considerable indirect costs in the form of lost wages and time away from work.^{5,6} As a result of these costs, over 42% of cancer patients experience catastrophic expenditures, defined as OOPC over 40% of nonfood household expenditure.⁷ These costs affect patients' treatment decisions; those

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who believe they will incur high OOPC are more likely to refuse surgery.⁸ Patients fearful of high OOPC also delay diagnosis, given variability in screening radiography costs, and are more likely to discontinue or be nonadherent to therapy.^{9–11}

Patients with breast cancer are at particularly greater risk of high OOPC due to annual screenings, short- and long-term pharmacologic treatments, and numerous procedural interventions.^{9–13} Breast cancer care results in greater OOPC than do lung, colorectal, and prostate cancer, with direct medical costs as high as US \$100,000.^{14,15} As such, 35% of women in high-income countries incur financial burden, and up to as many as 95% of women in low-income countries incur catastrophic expenditures from breast cancer care.^{8,16} Interventions designed to mitigate this impact are critical to improve breast cancer outcomes, particularly in low-income countries where breast cancer mortality is especially high and is rising. Because such programs require significant financial and organizational investment, it is important to understand factors that increase success likelihood; programs must be critically evaluated to justify financial investment for all stakeholders responsible.^{17–19}

Various financial interventions have attempted to ameliorate OOPC associated with breast cancer screening and treatment.^{17,20,21} Effectiveness of interventions designed to decrease OOPC for these patients have been studied individually, but a comprehensive, comparative assessment of these interventions is lacking. Contrasting and critiquing the relative success of interventions can educate policy changes optimizing our ability to design cost-effective interventions aligning with fiscal government priorities. The aim of this study was to systematically review and critically evaluate features of successful and unsuccessful financial interventions targeting OOPC for women presenting for evaluation and management of breast cancer. With this information, stakeholders may be able to better adapt successful techniques to new settings, particularly resource-constrained environments, and build effective context-specific interventions.

METHODS

This systematic review was developed using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist.²² The protocol was registered in PROSPERO under protocol ID CRD42021228015.

Search Strategy and Selection Criteria

Original, English-language articles describing a financial intervention targeting direct costs for breast cancer screening, diagnosis, or treatment were eligible for inclusion. We restricted the review to articles that contained clinical outcomes or patient financial burden descriptions, allowing for assessment of relative intervention success. Quantitative and qualitative experimental as well as observational studies were included. Records

Takeaways

Question: What are the features of successful and unsuccessful financial interventions targeting out-of-pocket costs for women undergoing breast cancer evaluation and management?

Findings: We conducted a systematic review on financial interventions targeting costs for breast cancer screening, diagnosis, or treatment that also addressed clinical or patient-level financial outcomes and found that interventions reducing prices through free screening mammography and decreased medication costs were most successful.

Meaning: Context-specific and tailored approaches to alleviate out-of-pocket costs demonstrated the greatest success with free mammography programs and reduced medication costs emerging as the most effective universal strategies in reducing the financial burden for breast cancer patients.

were excluded if they assessed only cost-effectiveness without addressing clinical or patient-level financial outcomes, or if they were nonfinancial interventions (ie, awareness campaigns), studied iterations of preexisting programs (ie, adjustment in cost sharing for patients who already have insurance), or were abstracts, commentary, or reviews.

Four databases, PubMed, Embase (Elsevier), Global Health (EBSCO), and Global Index Medicus were systematically searched from inception to February 2021. A robust search strategy was developed with expertise of a medical librarian. Relevant articles were retrieved using the combined concepts “breast cancer” and “out of pocket finances/financial stress” to query the databases using controlled vocabulary and keyword searching. All records were imported into the web-based systematic review software, Covidence, for screening.

Study Assessment and Data Extraction

Standard methodological procedures were used. Deduplication was accomplished with Covidence algorithms and manual examination. Two authors independently performed title and abstract screening and full-text review of records to determine inclusion; a third author resolved conflicts.

A standardized data extraction tool was created to minimize bias. Two authors independently extracted data from a records subset using this tool and compared results for tool validation. All remaining records were extracted using this tool. Variables extracted were sample size, study design, cohort and control group definitions, inclusion and exclusion criteria, demographics, treatments, location, follow-up time, description and scale of intervention, length of implementation, clinical outcomes, patient-level financial outcomes, and other outcome measures. Study method and reported outcome heterogeneity precluded a meta-analysis. Narrative descriptions of intervention success and associated factors were compiled.

RESULTS

Risk of Bias Assessment

The “QualSyst” checklist developed by Kmet et al²³ was used to determine study quality. This framework allowed extensive scoring ability for various study designs. Studies were independently assessed by two reviewers, with disagreements resolved by consensus. Fourteen key criteria were assessed and a score attributed to each criterion depending on the degree with which it was met, with 0 for no, 1 for partial, and 3 for yes. Criterion not applicable to a particular study design was marked “N/A” and excluded from the summary score calculation. The sum of all scores was divided by the highest possible score, giving quality scores ranging from 0 (worst) to 1 (best). In a similar, but more stringent, manner to Van Cutsem et al, scores of more than 0.80, more than 0.60 to 0.80 or more, and 0.60 or less reflected strong, moderate, and weak quality, respectively.²⁴ (See table, Supplemental Digital Content 1, which displays quality assessment “QualSyst” for all studies included in the systematic review. <http://links.lww.com/PRSGO/D225>.)

Search Results

A total of 11,086 records were identified through the initial database search. After deduplication, 9006 titles and abstracts remained. After screening, 325 full-text articles were assessed for eligibility. Ultimately, 21 studies were included in the final review (Fig. 1). Quality assessment demonstrated 18 studies of strong quality and three studies of moderate quality. Those of moderate quality had inadequate result reporting.

Study Characteristics

The 21 studies included were published between 1994 and 2021. A vast majority were undertaken in the United States of America (n = 14),^{17,18,20,25–35} followed by Korea (n = 2),^{21,36} Mexico (n = 2),^{37,38} Australia (n = 1),³⁹ Japan (n = 1),⁴⁰ and Iran (n = 1).⁴¹ Sample size ranged from 69³⁸ to 4,460,789³⁶ study participants. (See table, Supplemental Digital Content 2, which displays financial interventions targeted at breast cancer screening. <http://links.lww.com/PRSGO/D226>.)

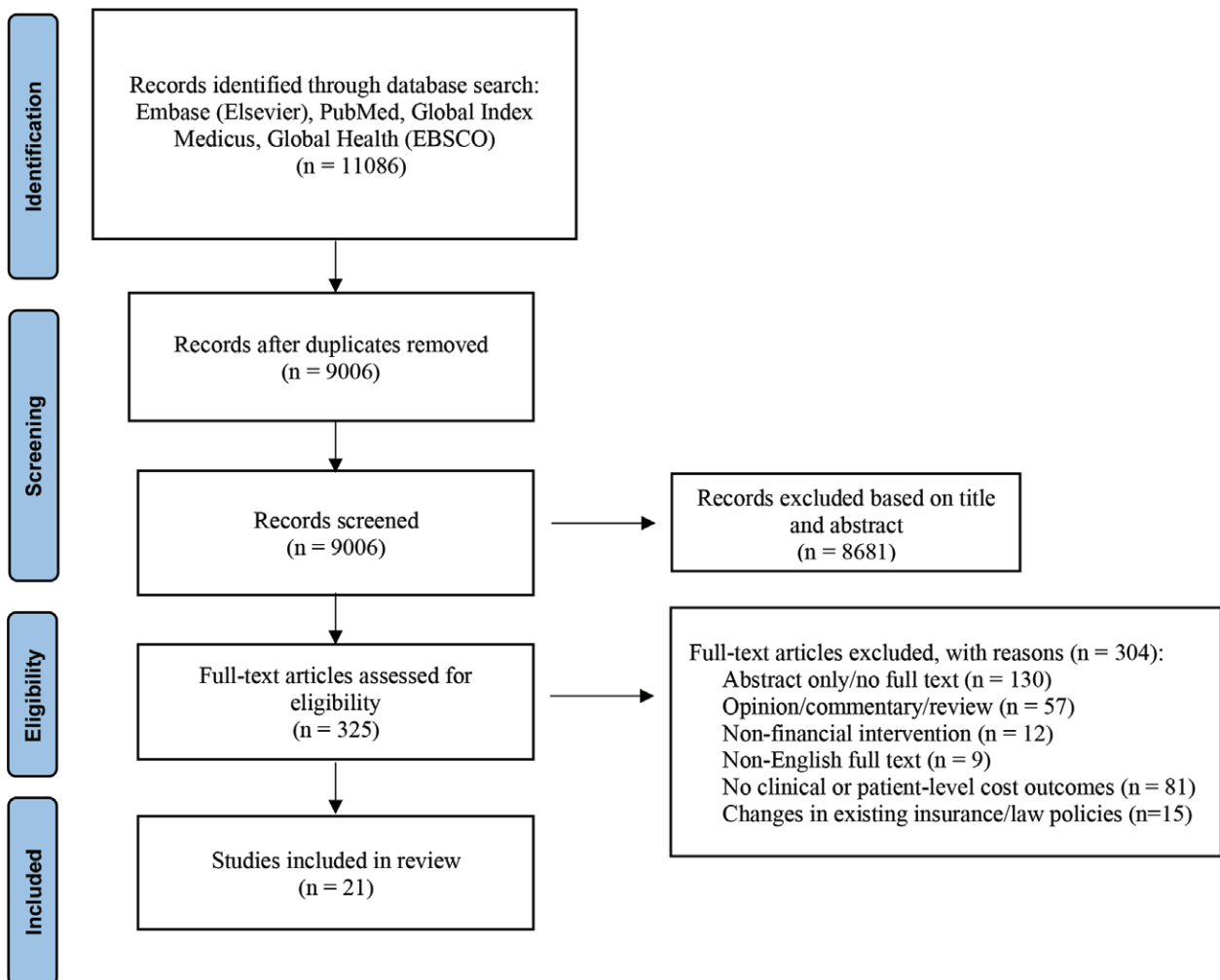


Fig. 1. PRISMA flow diagram of screening and selection process for identified studies.

(See table, Supplemental Digital Content 3, which displays financial interventions targeted at diagnosis and treatment. <http://links.lww.com/PRSGO/D227>.)

Eight studies used a cross-sectional design, six were prospective cohorts, four were retrospective cohorts, and three were randomized controlled trials. Additional description of study characteristics is given in Supplemental Digital Contents 2 and 3. All studies incorporated financial interventions targeting costs of breast cancer care. Studies were categorized by phase of care targeted and intervention type (Fig. 2).

Breast Cancer Screening Interventions

Interventions targeting breast cancer screening were described by 14 studies. A description of each intervention, primary outcome measures, and conclusions of each study are available in Supplemental Digital Contents 2–3. Most studies were in the United States (n = 8); four studies were international, from Australia (n = 1),³⁹ Korea (n = 2),^{21,36} and Japan (n = 1).⁴⁰

Free or subsidized screening mammography programs were the most popular intervention type, with 85% of the studies adopting this strategy to reduce direct medical OOPC (n = 12).^{17,18,20,21,25–29,36,39,40} Successful outcomes were defined predominantly by increased rates of screening mammography (n = 8).^{18,20,21,25–27,36,40} Some studies also measured time to diagnosis, clinical outcomes, and decreased treatment costs at individual and governmental levels (n = 4).^{17,28,29,39} Studies introducing free or subsidized mammography mainly reported successful outcomes. Only one study by Tu et al²⁵ found mixed results of lower mammography rates among the subgroup of Chinese-American women aged 50 or older despite subsidized cost strategies. All other studies demonstrated success. These studies demonstrated increased mammography rates up to 157%.³⁶ A five-fold increase in mammography compliance was demonstrated by Stoner et al²⁰; double the likelihood of localized cancer detection was relayed by McCoy et al.¹⁷ Improvements in clinical outcomes projected more than 20% increase in 5-year survival rates with

free screening interventions.²⁹ Monetary benefits at the intervention/governmental level were described with savings of \$61 per mammogram and up to \$9800 per cancer detected.²⁹ At the individual level, 2 years after diagnosis, OOPC and overall costs drastically decreased by up to \$860,802.^{28,39}

The remaining 15% of studies (n = 2)^{30,31} use patient navigation programs to help with direct nonmedical costs such as travel (n = 1)³⁰ and small gift card incentives (n = 1)³¹ to motivate women to obtain screening mammograms. The navigation program demonstrated success, with the implementation project reaching 89% of the target population, whereas the gift card incentive noted no statistically significant increase in screening mammography uptake.

In the United States, interventions tended to target low-income women through local community programs that offered either screening mammograms or a free screening voucher (n = 8).^{17,18,20,25–29} The definition of low-income was extremely heterogeneous. Only one US program offered regional services; the remainder were local interventions. Internationally, programs were government-sponsored and delivered at a national level. Services were available to all low-income women in Australia (n = 1),³⁹ Korea (n = 2),^{21,36} and Japan (n = 1).⁴⁰

Breast Cancer Diagnosis and Treatment Interventions

There were seven studies describing financial interventions targeting diagnosis and treatment stages of breast cancer, including four from the United States,^{32–35} one from Iran,⁴¹ and two from Mexico.^{37,38} Complete descriptions are available in Supplemental Digital Contents 2 and 3.

Studies designed to reduce breast cancer medication costs were successful in decreasing OOPC and improving medication adherence.^{32,33} Studies conducted in the United States compared generic medications as cheaper alternatives to brand-name equivalents, demonstrating a patient adherence increase by more than 3%. Neuner et al³² additionally demonstrated a decrease in OOPC. Cohorts without low-income subsidies, a federal

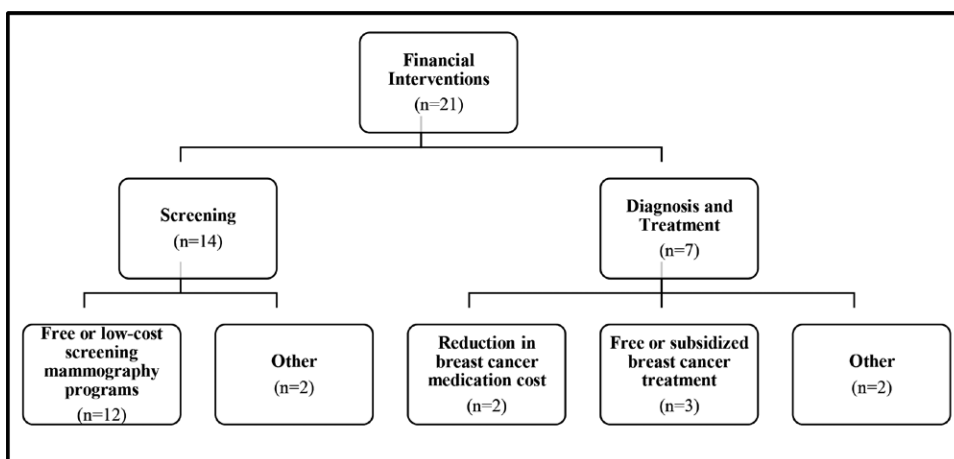


Fig. 2. Diagram illustrating the categorization of included financial interventions.

government supplementary drug coverage for Medicare beneficiaries below 150% of the federal poverty level, had an OOPC decrease of greater than \$85. Those with low-income subsidies saw OOPC fall from \$8 to \$2 and \$1 for anastrozole and other aromatase inhibitors, respectively.

Studies investigating strategies to provide low-cost or free treatment for breast cancer ($n = 3$) described mixed success, though the primary outcomes measured were highly heterogeneous.^{34,37,41} These included stage at diagnosis, time to diagnosis/treatment, OOPC for patients, and adherence by clinicians to breast cancer treatment guidelines.

The first study evaluated Mexico's National Catastrophic Health Expenditure Fund that subsidized accredited hospitals, allowing for provision of free breast cancer care. Primary outcome was physician adherence to clinical guidelines for breast cancer treatment. This found that their national program to provide subsidies in accredited hospitals successfully improved adherence to clinical guidelines for breast cancer care by 12.8%.³⁷

The second study examined Iran's Health Sector Evolution Plan providing universal basic health insurance, low-cost inpatient care, and patient financial protection. OOPC for breast cancer care was the main outcome. Despite a decrease in the patient portion of cost after implementation of the plan, the study was unsuccessful. Absolute OOPC increased from \$272 to \$281 due to tariffs that increased total hospitalization cost.⁴¹

The final study in the United States examined the ability of a safety-net hospital system providing free or low-cost care to eliminate breast cancer diagnosis and treatment delays for uninsured compared with insured women. The outcome assessed was stage at diagnosis and time to diagnosis and treatment. Offering cheaper care to uninsured women through this system failed to equalize time to diagnosis or treatment; uninsured women continued to have poorer outcomes.³⁴

Other interventions studied, in the United States and Mexico, included consolidating treatments and appointments to decrease patient costs.^{35,38} These suggested that offering direct patient financial assistance³⁵ and consolidating treatments to minimize hospital trips³⁸ are successful strategies to improve financial well-being and clinical outcomes. The US study described statistically significant decreased stress, a reflection of financial burden, and the study in Mexico demonstrated a 12% cost reduction for patients. Both studies were locally conducted on small patient cohorts.

For all intervention types across studies, race, age, income, and insurance status were inconsistently reported and when reported were extremely heterogeneous; therefore, conclusions could not be drawn with regard to these factors and the financial intervention success.

DISCUSSION

Among financial interventions targeting breast cancer screening, free screening mammography represented a highly successful intervention with the potential

to reduce both mortality and high OOPC leading to financial toxicity associated with breast cancer in diverse populations. Among interventions targeting breast cancer diagnosis and treatment, reduction in medication cost appeared to be a successful strategy, provision of free or low-cost breast cancer care in the form of safety-netting or universal free health insurance, was not uniformly efficacious. Other interventions at both the stages, such as navigation or assistance programs, gift cards, and treatment collation to reduce health care visits, demonstrate mixed success. These studies were also relatively small scale and locally confined; generalizability is limited.

Free screening mammography programs are popular financial interventions demonstrating broad success. These programs have been studied in a variety of settings and seem to be successful across multiple countries, ages, and racial groups. As screening mammography has shown to reduce 10-year mortality from breast cancer by as much as 60%, increasing mammography rate through free mammography can significantly improve outcomes.⁴² In addition, earlier breast cancer detection decreases treatment costs, thus reducing patient and societal financial burden.⁴³ Our findings are consistent with previous data suggesting that eliminating the direct cost of mammograms appears to be an effective mechanism to increase mammography uptake, especially among vulnerable populations.⁴⁴ The same principle can be applied to patient navigation programs, which, although only demonstrated by a single study, eliminated direct nonmedical costs, resulting in successful outcomes. This intervention can provide additional benefit in rural or low-income settings with geographically distant healthcare centers. Even minimal costs associated with screening can greatly decrease the likelihood of obtaining preventive screening for patients from economically or geographically disadvantaged backgrounds.⁴⁵ Subsidizing, or ideally removing, any breast cancer screening associated costs can largely offset that burden.

Cost alone did not determine the success of screening interventions. Subgroup analysis in one free screening mammography study demonstrated lower mammography rates for Chinese-American women over 50 years old, indicating that only cost elimination is insufficient to improve screening rates in all populations.²⁵ Adding educational outreach about screening mammogram benefits may also be necessary to account for cultural variation and its impact on program efficacy. Additionally, it is important to evaluate the population at hand before applying an intervention. For example, the ineffectiveness of the program focused on gift card incentives to increase mammography rates may be attributable to study conduction among privately insured women who may not benefit from monetary incentives.³¹

Notably, all included studies focusing on breast cancer screening took place in high-income countries. Universal screening mammography or cost-cutting programs may not be ideal for all settings as implementation requires significant investment in programming and infrastructure with considerable upfront costs compared with modalities

like educational endeavors or screening reminders.⁴⁶ However, screening has been shown to be cost-effective, even in low-and-middle-income countries (LMICs), especially if used judiciously in a risk-based manner.^{36,47,48} Thus, adoption of free or subsidized breast cancer screening programs should be strongly considered even in LMICs.

Among interventions targeted at breast cancer diagnosis and treatment, reduction in medication cost proved to be a highly successful strategy to increase patient adherence. At an individual level, cancer drugs can be extremely costly given the duration and potentially experimental treatment nature. In LMICs like India, where most healthcare associated costs are out-of-pocket, breast cancer medication costs can range from \$985 to \$10,206 per month.⁴⁹ In high-income countries like the United States, the cost is similarly high; direct medical costs of new cancer medications often exceed \$100,000.⁵⁰ At a systems level, there is greater nonadherence to medication for cancer compared with other diseases, leading to a significant cost burden on healthcare systems.⁵¹ Thus, medication pricing interventions may have a larger impact than cost reduction for other aspects of diagnosis or treatment. Access to generic medications has been a successful strategy implemented for many disease processes in LMICs but may have limited application to cancer drugs depending on the developmental phase.⁴⁹ For developed drugs, nonprofit generic companies could produce cancer medication at immensely lower costs.⁵²

The mixed success of provision of free or low-cost breast cancer treatment may be due to the contrasting outcomes chosen as metrics of success but may also be due to a lack of adequate consideration of contextual and patient-related social factors. The difference between the success of the study in Mexico³⁷ compared with lack thereof in the United States³⁴ and Iran⁴¹ demonstrates that interventions must account for additional barriers to care, including patient education, travel and medication costs, or ability to take time off work. Reducing the cost of breast cancer treatment is not solely sufficient to address the multifactorial barriers to equitable cancer care among low-income women.⁴ Interventions must be carefully considered in conjunction with the economic environment and allied policies to ensure a net benefit. Cutting patient treatment costs through other methodologies impacting direct nonmedical costs has been shown to be effective. These are novel interventions, however, described only by single studies.

Although our review identified both successful and unsuccessful interventions, one important limitation is publication bias. Especially for novel financial interventions, successful results have greater publication likelihood than unsuccessful interventions. This study also did not investigate elimination of cost-sharing for insured patients, which is evidenced to impact financial outcomes. However, cost-sharing studies predominantly dissected the US Affordable Care Act—a very specific, geographically limited policy intervention requiring a separate detailed analysis beyond the scope of this article. Another limitation is the context-specific nature of intervention success specifically related to socioeconomic status and cultural

norms. Several novel interventions were described by a single study; although it is important to identify these successes, generalizability remains unclear. To address this, adequate description of key confounding factors in single-center studies and multicenter studies is essential. Generalizability may also be limited due to inclusion of English-language articles alone. Nonetheless, these findings serve as a foundation on which to build future work and may benefit countries that are beginning to address the impact of OOPC on patients with breast cancer. (See document, Supplemental Digital Content 4, which displays the search strategy. <http://links.lww.com/PRSGO/D228>.) (See document, Supplemental Digital Content 5, which displays the PRISMA Checklist. <http://links.lww.com/PRSGO/D229>.)

CONCLUSIONS

Free screening mammography programs and financial interventions to reduce medication prices were the most successful types of financial interventions. The universal success of screening mammography programs indicates that such interventions may be beneficial as a starting point for those designing programs in developing countries and rural areas of developed regions. Successful interventions are those that are contextually specific, tailored to the target population, and carefully consider other environmental factors that can impact the intervention. This work can serve as a starting point for clinicians and policymakers interested in implementing interventions that address the growing problem of OOPC among breast cancer patients.

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