

Low-Cost Interventions to Improve Cervical Cancer Screening: An Integrative Review

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PROBLEM IDENTIFICATION: Cervical cancer (CC) is a major public health problem in low- and middle-income countries. Although screening can reduce CC incidence, screening programs are difficult to implement in resource-limited countries, making innovative interventions necessary.

LITERATURE SEARCH: PubMed®, MEDLINE®, CINAHL®, LILACS, and SciELO databases were searched for studies published within the past five years that explored interventions to improve CC screening.

DATA EVALUATION: Of the 486 articles identified, 35 were included in the review. The evidence was summarized, analyzed, and organized by theme.

SYNTHESIS: Several low-cost interventions improved aspects of CC screening, most of which were associated with a significant increase in adherence and uptake. Other interventions led to better baseline knowledge and involvement among patients and healthcare providers and a higher proportion of patients receiving treatment. Screening programs can use single or multiple approaches and match them to the local conditions and available resources.

IMPLICATIONS FOR PRACTICE: By understanding the various interventions that can mitigate CC incidence, healthcare providers can select the best approach to reach women eligible for CC screening.

KEYWORDS cervical cancer; mass screening; interventions; uterine cervical neoplasms

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Cervical cancer (CC) is the fourth most frequently diagnosed type of cancer and the fourth leading cause of cancer deaths in women, with a worldwide estimate of 604,000 new cases and 342,000 deaths in 2020. This global public health problem primarily affects low- and middle-income countries (LMICs), where about 90% of cases occur (Sung et al., 2021). During the 73rd World Health Assembly, the World Health Organization (WHO, 2020) established the 90-70-90 targets within the scope of the global strategy for CC elimination. The 90-70-90 targets recommend that 90% of girls be vaccinated against human papillomavirus (HPV) at age 15 years, 70% of women be screened with a high-performance test at ages 35 and 45 years, and 90% of women identified to have CC be treated, with the goal of reducing the incidence of CC to less than 4 cases per 100,000 women within the 21st century (WHO, 2020).

Effective screening programs can decrease CC mortality rates (Jansen et al., 2020). High-income countries have successfully controlled CC through sophisticated population-based screening policies (Vale, Teixeira, et al., 2021); however, LMICs lack robust resources to quickly fund such programs and typically have fragile healthcare systems and fewer skilled technicians and equipment. As a result, CC incidence rates in LMICs are much higher than those in high-income countries (Gossa & Feters, 2020).

The structure of a screening program is usually undervalued. Sometimes analyses focus on the performance of diagnostic tests, a critical component of screening. However, analyses of how the cancer screening program is organized, how its methods are implemented, how equitable access is, and how well CC is controlled are also important (Vale, Teixeira, et al., 2021). A contributing factor to effective CC screening programs is adequate uptake within the target population (Paulauskiene et al., 2019). Regardless of the diagnostic test used for screening, the participation of eligible patients at regular intervals is

necessary for success (Tsoa et al., 2017). Evidence shows that compared with opportunistic approaches, well-organized population-based screening that invites the target population generates better results and is more effective (Arbyn et al., 2010; Ferroni et al., 2012). In opportunistic screening, uptake depends on the initiative of the individual woman or a provider because the target population is not systematically invited (Arbyn et al., 2010; Paulauskiene et al., 2019).

Interventions, such as invitation letters, education, telephone calls, and text messages, have all been shown to improve CC screening (Albrow et al., 2014; Huff et al., 2017; Kiran et al., 2018; Naz et al., 2018). A combination of low-cost methods might increase adherence in eligible populations. Interventions of increasing complexity and cost may then be used to encourage resistant individuals to participate in CC screening (Firmino-Machado et al., 2019). Combining interventions is highly relevant, not only in LMICs where resources are limited, but also in countries with

organized CC screening with low uptake. Therefore, the purpose of this review was to synthesize low-cost interventions used to organize or improve CC screening. The findings can provide direction and recommendations, particularly for LMICs where most CC cases occur.

Methods

Search Strategy

This integrative review was based on the methods described by Whittemore and Knafl (2005) and guided by the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework (Moher et al., 2009). The stages of the process were as follows: identification of the problem, definition of the literature search strategy, data selection, data extraction and analysis, and synthesis of the main findings. PubMed®, MEDLINE®, CINAHL®, LILACS, and SciELO databases were searched using the following terms and their equivalents in Portuguese: *uterine cervical neoplasms* and *mass screening and organization and strateg** or *intervention*.

Inclusion and Exclusion Criteria

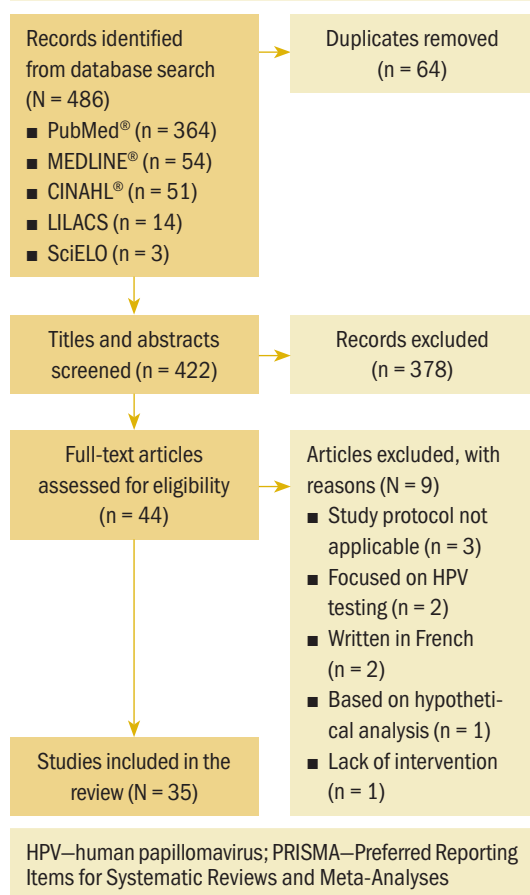
Studies written in Portuguese or English published between 2016 and 2021 with an exclusive focus on interventions to organize or improve CC screening were included. The search was limited to five years to include current studies about cost-effective CC screening interventions. This time frame also considered the WHO (2021) guideline for screening and treatment of cervical precancer lesions for CC prevention, which recommends using HPV testing as the primary screening method rather than visual inspection with acetic acid (VIA) or cytology.

Commentaries, expert opinions, protocols, dissertations, reviews, and studies that used a hypothetical model, such as projections and population estimates, were excluded. Studies that used HPV testing for screening were also excluded because of the high cost.

Data Collection and Evaluation

The initial search returned 486 records (see Figure 1). After eliminating duplicates, titles and abstracts from the remaining 422 articles were reviewed. Of the 44 full-text articles screened for eligibility, 35 met the inclusion criteria and were included in the synthesis. The 35 studies were individually reviewed to extract data concerning purpose and design, population and sample, methods or intervention, main results, and limitations. Findings were grouped thematically and compiled for presentation.

FIGURE 1. PRISMA Flow Diagram



Results

Study Characteristics and Target Populations

Thirty-five studies were selected (see Table 1). Most studies were conducted in North America ($n = 11$), Africa ($n = 8$), and Europe ($n = 7$); the remaining studies took place in Latin America ($n = 4$), Asia ($n = 4$), and the Middle East ($n = 1$). Among the 21 countries represented, the United States was the locale for 8 studies (Adler et al., 2019; Asgary et al., 2017; Emerson et al., 2020; Krok-Schoen et al., 2016; Magnani et al., 2016; Peitzmeier et al., 2016; Savas et al., 2021; Thompson et al., 2017). LMICs were the focus of 15 studies.

Few studies ($n = 5$) were conducted in both urban and rural communities (Cooper et al., 2021; Firmino-Machado et al., 2018, 2019; Paulauskiene et al., 2019; Vu et al., 2018); only three were conducted in rural areas (Awolude et al., 2018; Eghbal et al., 2020; Thompson et al., 2017) and three in resource-limited or high service need places (Bernstein et al., 2018; Colón-López et al., 2017; Cooper et al., 2021). Health centers were the most common study site ($n = 18$). Specific sites described included an emergency department (Adler et al., 2019), shelters and shelter clinics (Asgary et al., 2017), hospitals (Bernstein et al., 2018; Ouedraogo et al., 2018), schools (Mendes et al., 2018), jails (Emerson et al., 2020), an HIV clinic (Tchounga et al., 2019), and community organizations and centers (Savas et al., 2021; Wong et al., 2019). The study designs were diverse, with most studies being randomized controlled or clinical trials (Adler et al., 2019; Colón-López et al., 2017; Firmino-Machado et al., 2018, 2019; Krok-Schoen et al., 2016; Savas et al., 2021; Thompson et al., 2017; Tapero-Bertran et al., 2017; Wong et al., 2019).

Across all studies, a total of 3,390,237 women were approached. The target age range was 15–70 years. Most studies prioritized engaging women who had not undergone CC screening in the preceding 2.9–3.5 years or greater ($n = 15$). Other studies focused on specific populations, such as women who were homeless (Asgary et al., 2017), HIV positive (DeGregorio et al., 2017; Tchounga et al., 2019), in jail (Emerson et al., 2020), or members of ethnic minority groups (Magnani et al., 2016; Thompson et al., 2017; Wong et al., 2019).

Interventions

CC screening methods used in the studies included Papanicolaou (Pap) tests and VIA. Pap tests were the most common method used ($n = 23$). Some interventions were contextualized to breast cancer screening (Asgary et al., 2017; Colón-López et al., 2017; Jonah et al., 2017; Magnani et al., 2016; Romero et al., 2017; Savas

et al., 2021). In these studies, delivering interventions to improve CC and breast cancer screening simultaneously were successful. The interventions consisted of providing free cancer screening (Magnani et al., 2016), opt-out patient navigation (Asgary et al., 2017), education outreach (Colón-López et al., 2017), electronic reporting as an audit and feedback tool (Jonah et al., 2017), organization and management of the healthcare service (Romero et al., 2017), and the use of lay healthcare workers (HCWs) (Savas et al., 2021).

Various screening interventions were described, and most studies used multiple methods simultaneously. Therefore, the interventions were categorized by the group for which they were intended (e.g., patients, HCWs, service) and by content (see Table 2). Invitation letters, telephone calls, and education/counseling sessions were the approaches most used with patients to improve CC screening. For HCWs, specific training and the use of navigators, lay HCWs, *promotoras* (lay Hispanic or Latino community members), and key informants were frequently used. Regarding the screening service itself, scheduling appointments and offering screen-and-treat days were the main interventions described. Integrating CC screening with other health services for women, such as HIV clinics, was shown to be an effective way of enabling women to address additional healthcare needs (DeGregorio et al., 2017; Tchounga et al., 2019).

Outcomes and Costs

All included studies obtained positive outcomes of various types or amplitudes. Some authors described an absolute improvement on screening uptake ranging from 1.4% to 17.3%, with a mean absolute improvement of 11.2%, when comparing intervention and control groups (Adler et al., 2019; Firmino-Machado et al., 2018, 2019; Jonah et al., 2017; Lönnberg et al., 2016). Other studies that compared intervention and control groups obtained better CC screening rates among experimental populations: 36% versus 21% (Peitzmeier et al., 2016), 14.1% versus 8.5% (Tavasoli et al., 2016), 53.4% versus 34% (Thompson et al., 2017), 43% versus 28.4% (Tsoa et al., 2017), and 64.5% versus 43.5% (Savas et al., 2021).

An increase in uptake was also observed in studies using an experimental group when comparing pre- and postintervention data. Hamers et al. (2018) showed an increase in uptake of 12%, and Mbachu et al. (2017) found an increase of 6.8%. In other studies, the rates improved as follows: 10% to 44% (Maia et al., 2018), 9.6% to 41% in urban areas and 14.7% to 50.5% in rural areas (Paulauskiene et al., 2019), 18.7%

TABLE 1. Selected Studies (N = 35)

Study	Design, Purpose, and Sample	Methods or Intervention	Results	Limitations
Adler et al., 2019	An RCT that assessed the feasibility and potential efficacy of a text message-based intervention in 95 U.S. women aged 21–65 years who were nonadherent to screening recommendations	Participants in the intervention received 3 text messages at 30-day intervals over 90 days. Text messages consisted of a reminder to schedule screening and contact information for the usual provider of women's health care. All randomized enrollees received a follow-up call at 150 days to determine whether they had scheduled or undergone CC screening.	During the follow-up period (8 weeks), 36% of the control cohort and 43% of the intervention cohort received or scheduled screening, which was statistically nonsignificant ($p = 0.643$). The intervention cohort demonstrated greater uptake, a preliminary indicator of the efficacy of the intervention.	The findings are not generalizable because the sample was collected from a single emergency department. The sample size was not sufficient to demonstrate statistically significant differences between study conditions.
Asgary et al., 2017	An observational study that developed and assessed an opt-out breast and CC screening navigation program in 162 U.S. women aged 50–74 years who were residing in shelters or using shelter clinics in New York, New York	The navigator used a private room to provide culturally tailored health education, address specific barriers, schedule screening appointments, and follow up regularly to ensure screening appointment attendance during the 6-month period postenrollment. The navigator was a bilingual minority woman experienced with underserved communities.	Of the women who were unhoused, 119 (83%) completed CC screening. Navigation is feasible and may mitigate barriers to cancer screening for women with unstable housing. Accessibility for follow-ups and scheduling was improved for participants. Having a female minority navigator may have helped to build better rapport.	Participants receiving navigation were not compared to those not receiving it. The results might not apply to individuals who are unhoused or unsheltered in all U.S. urban areas.
Awolude et al., 2018	A cross-sectional comparative study that evaluated the effects of training for HCWs in 950 Nigerian women attending primary healthcare centers and 1 hospital in a rural community in Oyo State	HCWs were trained in the principles and practice of VIA over 5 days. The training combined didactic lectures, picture training, pelvic model practice, clinic-based hands-on training on performing and interpreting VIA tests, appropriate evaluation, and treatment of eligible individuals using cryotherapy. In addition, supervisory site visits were conducted during the pilot.	51 HCWs were trained. Knowledge improved from 52.4% before training to 91.5% after training. In 1 year, a total of 950 women were screened. Percentage agreement with nurses by community health extension workers (88.1%) and community health officers (92.3%) implied good and very good agreement, respectively. True positive rates were higher for nurses (93.5%) than for community health extension workers and community health officers (82.6%). The study provided evidence for the possibility of a task-sharing program for CC screening to achieve universal coverage in LMICs.	None reported

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TABLE 1. Selected Studies (N = 35) (Continued)

Study	Design, Purpose, and Sample	Methods or Intervention	Results	Limitations
Azlina et al., 2021	A quasi-experimental pre-/post-test study that identified whether the FEMALE health education package affected knowledge, attitudes, and self-efficacy of CC screening among 428 housewives aged 15–59 years who were never screened in Indonesia	The FEMALE health education package consisted of lectures, methods, video of CC screening, and booklets. The activity was carried out through 3 meetings lasting 30–45 minutes during a 4-week period. Following the workshop, respondents were given daily self-monitoring forms.	Significant differences were found in knowledge, attitude, and self-efficacy ($p = 0.000$, $p = 0.015$, and $p = 0.032$, respectively) between respondents in the intervention and control groups after the FEMALE package intervention. It can be used by HCWs as an educational tool to improve women's self-efficacy in undergoing CC screening.	None reported
Bernstein et al., 2018	A study that evaluated a 1-week CC screening campaign and efforts toward implementation of a screen-and-treat model using VIA and cryotherapy among 614 Tanzanian women meeting with local healthcare providers at a hospital in a resource-limited community	The model consisted of education and certification for local healthcare providers in VIA and cryotherapy, patient visits for examination and treatment during a screen-and-treat week, and monthly follow-up. The curriculum included a lecture. Providers who attended were invited to complete their training by applying their knowledge during the screen-and-treat week. In the 3 months prior, flyers were posted in public venues, and government-approved announcements were made over a loudspeaker by a paid driver during the campaign.	Of women who attended screenings, 556 were screened with VIA, with 59 being VIA positive. Of the women who were VIA-positive, 49 received cryotherapy; the others did not for reasons including suspicion of advanced cancer, refusal, or pregnancy. The initiative was successful in training healthcare professionals and in recruiting, screening, and treating a large population of women. Advertising techniques like mobile loudspeakers appeared to be most effective, with attendance increasing dramatically.	The cost of upkeep is a potential barrier. Pressurized carbon dioxide tanks are expensive and difficult to transport. Patients received cards with their results and follow-up instructions, but continuing medical care can be difficult because of distance from hospitals.
Colón-López et al., 2017	An RCT that described a community academic partnership to implement an evidence-based education outreach program to increase breast and CC screening among 444 Puerto Rican women aged 21 years or older in Canóvanas	The Cultivando La Salud intervention consisted of LHWs trained to educate peers in a culturally appropriate manner, a flip chart for 1-on-1 education, a breast model to facilitate discussion with the LHWs, and an information sheet about local providers of low-cost or free screening services. Women in the intervention group received an individualized educational intervention visit and follow-up.	14 LHWs were recruited and trained to deliver the intervention. Of the 444 women recruited, 48% were educated through this effort. 84% of the mammography cohort and 90% of the Pap cohort indicated that the element they liked best was the conversation with the LHW at the educational session. Although the area was hard to access, making the task of reaching homes time-consuming, the technology tools and the intervention used were successful.	Some collaborating groups indicated that the flip chart images did not represent the target community culture. Management turnover in the academic research space and in the community-based organization affected the logistics of the study.

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TABLE 1. Selected Studies (N = 35) (Continued)

Study	Design, Purpose, and Sample	Methods or Intervention	Results	Limitations
Cooper et al., 2021	An observational study that reported on the feasibility of using VIA and analyzed the impact of an educational video on HPV and CC knowledge in 825 women aged 18 years or older attending health centers in a resource-limited area and a rural area in Tanzania	Recruitment was encouraged using banners and announcements at prominent locations, as well as a van equipped with loudspeakers. Participants answered a 6-question survey before and after watching a 15-minute educational video. After completing the educational intervention, women progressed to VIA screening, optional HIV testing, and cryotherapy when indicated.	Of women screened, 207 were VIA positive, and 147 received same-day cryotherapy. 764 women completed questionnaires. The mean knowledge score at baseline was 2.22 (SD = 1.76) and 3.86 (SD = 1.78) postvideo. The postvideo change in score was significantly greater at the urban site (1.99 to 2.07) than at the rural site (1.07 to 1.95). This brief low-cost audiovisual media intervention improved access to accurate information. It is important to determine whether an educational intervention has any effect on patient follow-up.	Participation was voluntary, so other women who also could have benefited from the intervention did not attend. Patients predominantly spoke a language or dialect different from those available in the educational films.
DeGregorio et al., 2017	A retrospective review that documented strategies for successful implementation of a nurse-led CC screening program in 46,048 Cameroonian women who were aged 21 years or older and HIV positive or aged 25 years or older and HIV negative	Program staff were trained to provide CC screening and education about positive health-seeking behaviors. Attendees were screened for CC, were treated with cryotherapy when indicated, and underwent biopsy when lesions were suspicious. Digital cervicographs were taken with an inexpensive digital camera before and after VIA and after Lugol's iodine. Other services, such as breast examination, were offered.	Of all women screened, 44,979 underwent screening with VIA. The number of women screened increased yearly from 349 to 12,191. Integration of other women's health services into CC screening can facilitate access. The program demonstrated that using VIA is acceptable, scalable, and self-sustaining, and that the program could serve as a model for other LMICs that require a cost-recovery model.	None reported
Eghbal et al., 2020	A quasi-experimental study that investigated the effects of an educational intervention based on the Health Belief Model on undergoing Pap testing in 160 married Iranian women aged 20–65 years	The experimental group received an educational program based on the Health Belief Model, which consisted of 50- to 60-minute sessions held over 3 weeks. A pamphlet about Pap testing benefits was given to participants in the experimental group. 5 weeks after the intervention, participants received a telephone call and a weekly text message containing health information as a reminder.	Mean knowledge scores increased significantly, and the mean score for perceived barriers declined in the experimental group ($p < 0.001$). Pap test uptake in the experimental group increased from 18.7% to 78.7%. The program improved knowledge and uptake of Pap testing. Interventions based on the Health Belief Model in health centers are therefore recommended.	Not controlled for effects of other information sources on the experimental and control groups

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TABLE 1. Selected Studies (N = 35) (Continued)

Study	Design, Purpose, and Sample	Methods or Intervention	Results	Limitations
Emerson et al., 2020	A pre-/post-test study that assessed effectiveness of a sexual health empowerment program on cervical health literacy and up-to-date Pap testing among 182 women aged 18 years or older who were detained in 1 of 3 urban jails in Kansas City, Kansas	Sexual health empowerment was conducted in jails during a 5-day period with 2–10 participants each week. Lessons addressed cervical health literacy through shared knowledge and experience. Sessions were administered by an experienced sexual health educator and assistant.	At 1 year postintervention, 82% of participants reported up-to-date Pap testing, compared to 72.2% at baseline ($p < 0.05$). The results suggested that a brief cervical health literacy empowerment-based intervention may reduce health disparities in an underserved population of women.	Control group and self-reported Pap testing data were limited.
Firmino-Machado et al., 2018	An RCT that assessed the effectiveness of an intervention using automated and customized messages, telephone calls, and reminders about CC screening in 1,220 Portuguese women aged 25–29 years from 2 primary care units	The invitation method used (in sequence for participants who remained nonadherent after each step) customized text messages, automated telephone calls, reminders, manual telephone calls, and a health professional appointment.	Compared to standard care, the intervention increased adherence to CC screening in 13.3% of participants. Effectiveness was higher for urban women (OR = 1.97; 95% CI [1.49, 2.6]) and for those who did not regularly participate in organized screening (OR = 2.12, 95% CI [1.47, 3.05]).	Only women aged younger than 50 years were included; thus, conclusions may not apply to older women with more limited digital literacy. Nearly half the medical doctors invited did not participate in the study because they felt that they lacked the time.
Firmino-Machado et al., 2019	An RCT that assessed the effectiveness of an intervention using automated and customized messages, telephone calls, and reminders about CC screening in 1,220 Portuguese women aged 25–29 years from 2 primary care units	The intervention consisted of automated text messages or telephone calls, manual telephone calls, and face-to-face interviews applied sequentially to women who were nonadherent. During face-to-face interviews, physicians addressed frequently asked questions and tried to overcome any barriers to participants agreeing to CC screening.	Adherence to CC screening was 17% higher among women invited through the 3-step intervention than among women receiving the standard invitation letter. The intervention has the potential to be broadly implemented because of the low requirements for technology and training.	The study included only women aged younger than 50 years because the intervention required the use of a mobile telephone, and the proportion of mobile telephone users is higher among younger women.
Gyulai et al., 2018	A questionnaire-based survey of 88 Hungarian women aged 25–65 years that tested whether the involvement of GPs in the CC screening program process could increase the participation rate	GPs were informed of patients' participation in the CC screening program and attempted to motivate those who refused. Information letters requested the patients' involvement in the study and included a screening invitation signed by the GP and a leaflet. GPs tried to reach the women who had not attended screening after 6 weeks in person or by telephone.	GPs effectively motivated 24 women (95% CI [18, 38]) who initially refused to participate in the screening program. On 17 occasions, a letter from the GP was sufficient to prompt screening, and a personal conversation changed the participant's mind in 7 cases. The involvement of GPs in the organization of the CC screening program increased participation among women who generally refused.	The study sample size was small.

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TABLE 1. Selected Studies (N = 35) (Continued)

Study	Design, Purpose, and Sample	Methods or Intervention	Results	Limitations
Hamers et al., 2018	An observational study of 1,319,660 French women aged 25–65 years that presented the results of a pilot intervention based on an organized screening program for CC	Personal invitation letters were sent to participants. Nonparticipants were sent a further reminder 9–12 months after the initial invitation.	Invitations and reminders led to 278,767 additional women being screened, an absolute increase in screening uptake of 12 percentage points. Of the additional screenings, 230,955 occurred up to 12 months after the initial invitation (response rate of 17.5%), and 47,812 occurred after the women received a reminder (12.1%).	To measure the net invitation effect, a control group without invitations would have been required.
Jonah et al., 2017	A retrospective cohort study that evaluated the effectiveness of a PCSAR intervention on CC screening participation in 1,348,005 Canadian women aged 21–69 years who were receiving primary care in Ontario	PCSAR provides aggregate screening rate data and details about patients' screening status (due for screening within the next 6 months, overdue for screening, normal result, abnormal result requiring follow-up). PCSAR is located on a secure web portal that requires ID registration; registrations and PCSAR logins were associated with screening participation.	The positive association between use of the PCSAR and screening participation was small but encouraging. The participation rates for patients of physicians who logged into the PCSAR represented an absolute increase of 1.4% in CC screening related to ID registration by the physician.	Access to the report is not easy and depends on registration with ID, which can introduce bias because physicians who register may also have greater interest in screening independent of the PCSAR.
Krok-Schoen et al., 2016	An RCT that evaluated data from 80 women aged 18 years or older in need of a Pap test and who attended health clinics in Appalachian Ohio in the United States	Participants randomized to the LHA intervention received 2 in-person visits (baseline and 10 months), 2 telephone calls (1 and 5 months), and 4 mailed postcards (2, 3, 6, and 7 months) targeted to the participant's stage of change from 1 of 4 trained LHAs.	From the initial LHA visit to the end of the intervention (visit 2), 57 women moved forward at least 1 stage toward completing a Pap test ("being in action" stage), 26 remained in the same stage, and 7 moved back at least 1 stage.	Eligibility interview participation was modest. No follow-up was conducted to measure long-term effectiveness in increasing screening. The results have limited generalizability.
Lönnberg et al., 2016	A randomized intervention that estimated the benefit of adding a prescheduled appointment to open reminders among 1,087 women aged 25–29 years who failed to participate in CC screening at centers in Norway during the past 4 years	Women received the standard open reminder or a reminder letter with a scheduled appointment. Reminder letters included information about the charge for screening and the professional conducting the Pap test. Letters were mailed 2–4 weeks before scheduled appointments.	At 6 months, the absolute increase in participation was 17.3% (95% CI [11.9, 22.7]). 66.8% of women in the intervention group attended screening at the scheduled appointment; the remaining 33.2% opted to schedule their own appointment. Scheduled appointments were effective at increasing participation.	The study did not detect outcome differences potentially caused by the characteristics of screening delivery, such as cost of participating or the professional conducting the test. Feasibility issues with respect to large-scale implementation remain.

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TABLE 1. Selected Studies (N = 35) (Continued)

Study	Design, Purpose, and Sample	Methods or Intervention	Results	Limitations
Magnani et al., 2016	A 5-year experience that provided an outline for administering the See, Test and Treat program in 169 non-White women in Boston, Massachusetts	See, Test and Treat is a pathologist-driven program, consisting of a single-day event to provide breast and CC screening with same-day results and follow-up treatment. In addition to Pap tests and mammograms, the program offered a health fair, child care, activities for women and their families while waiting for test results, and educational posters.	36 patients had abnormal Pap test results. Colposcopy was performed for 12 patients with suspected dysplasia; of those, 6 had cervical intraepithelial neoplasia I, and 3 had cervical intraepithelial neoplasia II/III. The event was designed to reduce barriers for Asian women to participate in CC screening by providing care that addressed cultural and financial issues.	None reported
Maia et al., 2018	An observational study of Brazilian women aged 25–64 years that described an intervention by a family health team to improve the quality of CC screening actions	Health team members were notified of the eligible women's screening status. When visiting the clinic, those who had not been screened were offered to schedule or undergo a test. Women who did not attend the clinic were contacted via telephone or home visit and given an invitation letter signed by the family physician.	The intervention achieved 44% screening coverage, compared to the 10% coverage identified earlier. None of the 24 women with a positive screening test during the study period was lost to follow-up.	The intervention was developed during a campaign in which teams are traditionally encouraged to intensify screening. The experience may not be generalizable but was maintained for a short period.
Mbachu et al., 2017	A community-based pre- and postintervention study that examined whether peer health education would influence perceptions of CC and screening uptake among 300 women aged 21 years or older in southeastern Nigeria	Following training, 22 volunteer peer health educators provided health education sessions on CC and its prevention to women in their parishes during monthly meetings for at least 3 consecutive months. Each session consisted of 45–60 minutes of didactic teaching followed by 15–30 minutes of clarification and feedback.	A significant difference was observed in participants' individual risk for CC and perceived benefits of early detection through screening. CC screening increased 6.8%, and the observed difference was statistically significant ($p = 0.02$). Peer health education was useful for improving screening behavior.	The generalization of findings is limited to women residing in urban and peri-urban areas who attended women's meetings in an Anglican diocese in southeast Nigeria.
Mendes et al., 2018	A quasi-experimental study that verified the efficacy of health education actions addressing Pap testing to decrease morbidity and mortality rates of CC among 540 female students aged 18 years or older in Brazil	The intervention was implemented only once to a single group of women in each school. The 45-minute educational activities were based on dialogue and the exchange of knowledge between the researcher and participants. Resources included a verbal explanation of Pap testing, banners, a Pap test simulator, and a demonstration of tools used during the test.	The McNemar test revealed statistically significant differences between most answers provided pre- and postintervention. Participants improved their knowledge concerning Pap testing, which reinforces the importance of encouraging educational activities in the health field. Nurses can assume this responsibility.	The questionnaire was reapplied immediately after the educational intervention rather than after a sufficiently long period to verify whether the intervention was efficient in influencing the participants' behavior.

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TABLE 1. Selected Studies (N = 35) (Continued)

Study	Design, Purpose, and Sample	Methods or Intervention	Results	Limitations
Ouedraogo et al., 2018	A review that described the implementation of an integrated CC prevention program with 13,999 women aged 25–59 years who attended Burkina Faso health facilities and hospitals	The program trained providers and strengthened monitoring capacity. A 6-day training covered general gynecologic examination, recognition of cervical landmarks and lesions, and interpretation of VIA. Trained midwives facilitated informal educational discussions in the waiting areas.	Of 13,999 women screened, 985 screened positive, and 649 of those received same-day cryotherapy. At a later date, 200 women underwent loop electrosurgical excision, and 151 were referred for surgical management of suspected cancer. Women who screened negative received instructions to attend a follow-up. The program increased patient awareness of CC prevention services.	Because of a lack of supplies, some facilities could not provide services continuously. Cryotherapy machines were sometimes unavailable because of repairs. Fees were initially high, deterring use of services.
Paulauskiene et al., 2019	A pilot project that assessed the effects of systematic personal invitations on uptake of CC screening and attendance barriers among 3,434 Lithuanian women aged 25–60 years in urban and rural primary healthcare centers	Before the study, women were invited to participate in screening by a family doctor or midwife during appointments scheduled for other health issues. Women received a personal letter inviting them to have a Pap test. If a woman had not attended after 1 year, a reminder letter and information leaflet were sent. Invitation letters also included a preassigned appointment.	Invitation letters increased uptake of CC screening. In the urban healthcare center, screening uptake increased from 9.6% after an invitation from the family doctor to 31.8% after the first personal invitation letter to 41.8% after the reminder letter. In the rural healthcare center, CC screening uptake increased to 40.9% and 50.5%, respectively, from 14.7%.	Selection bias was a possibility because the study was carried out in only 1 urban and 1 rural primary healthcare center.
Peitzmeier et al., 2016	A randomized trial that examined the real-world effectiveness of various outreach methods in engaging 1,100 female primary care patients aged 21–64 years who were overdue for a Pap test in Boston, Massachusetts	Patients were randomized to the letter, email, telephone, multimodal, or control group. The control group received usual care, with providers offering Pap tests as needed during clinic visits. The intervention groups received a maximum of 3 outreach attempts at 1-month intervals. The first outreach attempt consisted of a letter sent to patients, the second attempt consisted of an email with educational information, and the last attempt consisted of a telephone call. Patients were contacted during each follow-up if they did not schedule or undergo a Pap test.	Patients in the multimodal (36% versus 21%, adjusted OR = 2.3, 95% CI [1.4, 3.6]) and telephone (29% versus 21%, adjusted OR = 1.7, 95% CI [1.1, 2.8]) outreach groups were significantly more likely to receive CC screening during the follow-up period compared to patients receiving usual care.	If the patient received a Pap test at a different practice, the patient was deemed to not have experienced the outcome in this study. Because eligibility was also determined according to the availability of cytology documentation in the medical record, some patients may have been enrolled who were not actually overdue for a Pap test.

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TABLE 1. Selected Studies (N = 35) (Continued)

Study	Design, Purpose, and Sample	Methods or Intervention	Results	Limitations
Romero et al., 2017	An experience report of an intervention for the prevention and control of cervical and breast cancers in Brazilian women aged 25–64 years and women aged 59–69 years from a basic health unit	Actions were developed for the organization and management of the service, monitoring, and control of breast and CC; public engagement; and qualification of clinical practice. Continuing education was developed, contributing to better results in the work of community health agents.	Coverage indicators for breast and CC increased to 56.6% and 88.1%, respectively. Of the eligible women, 97.7% were assessed for signs suspicious for CC and 98% for signs suspicious for breast cancer. The intervention provided increased coverage and improved organization and control.	The work of the community health agents was compromised because of their participation in other campaigns.
Savas et al., 2021	An RCT that examined the effectiveness of a behavioral intervention integrated into a state-funded breast and CC screening program among 627 Latina women who were nonadherent to either mammography or Pap testing or both from a community-based organization in El Paso, Texas	During a 1-on-1 presentation using a flip chart and video, including role models and testimonials, participants received behavioral education on breast cancer and CC. <i>Promotoras</i> were women from the community trained to provide peer-to-peer support. Navigators provided follow-up cues and logistic support through follow-up calls.	Of those in need of a Pap test, only women aged 50 years or older (intervention group) were more likely to undergo one compared to the control group (64.5% versus 43.5%, $p = 0.019$). The intervention successfully reached vulnerable women, but additional research is needed to understand why it was not effective among younger women.	The population targeted was mostly urban, and the results may not be generalizable to rural Latina populations.
Shikha et al., 2020	A pilot project that assessed innovative approaches to improve CC screening uptake among 100,836 Indian women aged 30–60 years from cities in a northern state	The project implemented a screen-and-treat approach. Private practitioners were trained through lectures and hands-on experiences in an overview of CC prevention, use of VIA, and cryotherapy. Community health workers were trained in counseling women.	During the project, 5,477 (95% CI [5.29, 5.57]) women screened were VIA positive. Of those, 3,735 (95% CI [66.96, 69.43]) were treated with cryotherapy. Cryotherapy rates increased from 66.8% during the pilot phase to 76.7% during the scale-up phase ($p < 0.0001$). Loss to follow-up decreased from 31.3% to 17.9% ($p < 0.0001$).	The dataset lacked certain demographic information for women who underwent screening.
Tavasoli et al., 2016	A cohort study that evaluated the impact of invitations and reminders on 9-month uptake of CC screening among women aged 30–69 years ($n = 99,278$ in the intervention group and $n = 130,181$ in the control group) who had not been screened in the past 3 years in Ontario, Canada	An invitation letter with information on CC screening was mailed to women in the intervention group. The historical cohort included women who were eligible for a screening letter but did not receive one because it was prior to the intervention. A reminder letter was sent 4 months after the initial letter to women who had not yet received a Pap test.	14.1% of women in the intervention group and 8.5% of women in the historical cohort were screened within 9 months. Being mailed an invitation letter was associated with greater likelihood of screening (OR = 1.8, 95% CI [1.7, 1.8]). The intervention had a positive effect, but innovation is required to supplement mailed invitations for nonresponders.	Because of the inability to perform a randomized control trial, there is a possibility of unknown systematic differences between groups. Some women may have had difficulty reading and/or understanding the invitation letters.

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TABLE 1. Selected Studies (N = 35) (Continued)

Study	Design, Purpose, and Sample	Methods or Intervention	Results	Limitations
Tchounga et al., 2019	A cross-sectional survey of 1,991 women aged 25–55 years who were living with HIV in Côte d'Ivoire and had been followed in HIV clinics for at least 1 year to estimate uptake of CC screening and associated factors	A standardized questionnaire was administered to participants by trained nurses, midwives, or social workers.	CC screening uptake was 59.7% (95% CI [57.6, 62]) among women living with HIV. 1,444 participants were offered CC screening, most in the follow-up HIV clinic (88.9%). The association between screening uptake and offering CC screening in the HIV clinic emphasized the positive effect of service integration.	Data were collected through face-to-face interviews with possible memory and social desirability bias.
Téguété et al., 2021	An operational research study that determined the effect of the Weekend70 program on participation in CC screening among 289,924 Malian adolescents and women aged 20 years or older attending health facilities in Bamako	Awareness-raising activities, strengthening of screening practices in healthcare facilities, free CC screening on weekends, text messaging, and mass campaigns focused on CC screening were used. Leaders of female associations were trained to be key informants. HCWs received educational presentations and refresher training.	The number of women screened increased significantly, with 4,100 screenings in week 46. CC screening uptake was 42.3% at the end of phase 2 and 47.3% at the end of phase 4. In low-resource and low-literacy settings, combining the use of text messaging, broadcasting media, and other strategies may improve participation.	Awareness-raising methods may reach some women more than others. Communication strategies may not have been appropriate for older women.
Thompson et al., 2017	A 3-armed RCT that examined the effect and cost-effectiveness of an intervention targeting the use of Pap testing and adherence to recommended follow-up among 443 Latina women aged 21–64 years in a rural, agricultural region of the state of Washington in the United States	Women were randomized to the control arm (usual care), low-intensity intervention (a Spanish-language video sent to the participants' homes that informed them of the importance of CC screening), or high-intensity intervention (the same video plus a home visit by a <i>promotora</i> who presented information to participants on the importance of screening).	More women in the high-intensity arm (n = 578) underwent Pap testing within 7 months than in the usual care (n = 550, p < 0.001) or low-intensity arms (n = 558, p < 0.01). The cost-effectiveness ratio per additional woman screened in the high-intensity arm versus the usual care arm was \$4.24. 1-on-1 educational interventions can motivate women to seek CC screening.	Some women may have undergone a Pap test elsewhere and would not have been captured by the medical record review. This study had limited generalizability because it was designed for a population of rural Latina women.
Trapero-Bertran et al., 2017	An RCT and cost-effectiveness analysis of 3 active interventions to promote the uptake of CC screening in 15,965 women aged 30–70 years who were receiving primary healthcare services in Barcelona, Spain	Interventions included a personalized invitation letter signed by a primary care physician (group 1), the same letter with an informative leaflet on prevalent CC screening (group 2), and the same intervention as group 2 with a reminder telephone call 3 days before the appointment indicated in the letter (group 3). Interventions were compared to an opportunistic screening group.	The intervention acceptance rate was highest in group 3 (23%), followed by group 1 (18.6%) and group 2 (17.4%). The group 2 intervention was more expensive and less effective than group 1. Compared to opportunistic screening, the group 1 intervention cost €2.78 and the group 3 intervention cost €13.73 per 1% increase in coverage. Sending a letter was the most cost-effective intervention for all women.	None reported

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TABLE 1. Selected Studies (N = 35) (Continued)

Study	Design, Purpose, and Sample	Methods or Intervention	Results	Limitations
Tsoa et al., 2017	A cohort historical control study that assessed whether letters contribute to an increase in recall to CC screening in 9,405 women aged 21–69 years in Ontario, Canada	The intervention group consisted of women who were sent a recall letter. If women did not have a screening test within a 4-month time period, a reminder letter was sent. The historical control group consisted of women who did not receive a letter.	In the intervention group, 43% of women completed a Pap test compared to 28.4% in the historical control group. Women who were sent a recall letter were 1.9 times more likely to receive a Pap test. Reminder letters recalling women to screening had a beneficial effect on recruitment and recall.	The use of a historical control group design meant that comparing the groups concurrently and ensuring random allocation to the intervention was not possible.
Vu et al., 2018	A pre-experimental study that piloted a community-based model for CC screening in 1,945 Vietnamese women aged 30–65 years who attended community health centers in 2 provinces (rural and urban settings)	The following 6 phases were implemented: develop a formal procedure for VIA, train midwives and assistant physicians, evaluate the capacity of midwives and assistant physicians, implement screening for CC under the supervision of specialized physicians, compare VIA with Pap testing, and provide appropriate treatment or follow-up to individuals testing positive.	36 HCWs were trained. Of 2,100 women contacted, 1,945 responded (nonresponse rate of 7.4%), and 157 tested VIA positive (8.1%). CC screening using VIA had high diagnostic value. The sensitivity of VIA was comparable to that of a Pap test but required far fewer resources. The average cost for VIA at a community health center was \$1–\$2 per screening.	None reported
Wong et al., 2019	A pilot waitlist RCT that investigated the feasibility and preliminary effects of a multimedia intervention for CC screening in 42 women of South Asian origin aged 25 years or older who were attending community centers or organizations in Hong Kong	The intervention included a 30-minute multimedia educational program aimed at augmenting CC knowledge, monthly telephone follow-up for 3 months, and provision of navigation assistance in accessing screening services. A booklet containing information about CC was provided to participants. Participants allocated to the control arm received the intervention after data collection was complete.	A statistically significant improvement in the perceived benefit of CC screening ($p = 0.001$) and a reduction in perceived barriers to screening ($p = 0.02$) were observed in the intervention arm. No significant difference in CC screening uptake ($p = 0.739$) or intention ($p = 0.999$) was observed. The intervention was potentially effective in increasing CC screening in an underprivileged group.	The number of clusters available for randomization was small and could have led to bias. The outcomes were assessed immediately after the 3-month intervention without a long follow-up period.
CC—cervical cancer; CI—confidence interval; GP—general practitioner; HCW—healthcare worker; HPV—human papillomavirus; LHA—lay health advisor; LHW—lay health worker; LMIC—low- and middle-income country; OR—odds ratio; Pap—Papanicolaou; PCSAR—Primary Care Screening Activity Report; RCT—randomized controlled trial; VIA—visual inspection with acetic acid				

to 78.7% (Eghbal et al., 2020), 72.2% to 82% (Emerson et al., 2020), and 42.3% to 47.3% (Téguété et al., 2021). The mean difference in uptake across all experimental studies was 24.4%. Other outcomes included positive rates of acceptance to complete screening among participants in the intervention without a comparison group or baseline data (Asgary et al., 2017; DeGregorio et al., 2017; Magnani et al., 2016; Romero et al., 2017),

improvement in baseline knowledge and perceived benefits of CC screening for patients and healthcare providers (Awolude et al., 2018; Azlina et al., 2021; Cooper et al., 2021; Mendes et al., 2018; Vu et al., 2018; Wong et al., 2019), high proportion of treatment with cryotherapy (Bernstein et al., 2018; Ouedraogo et al., 2018; Shikha et al., 2020), acceptance of an educational approach (Colón-López et al., 2017), and

a greater chance of eligible women participating in screening because of improvements in motivation or state of change for Pap testing (Gyulai et al., 2018; Krok-Schoen et al., 2016).

Some studies emphasized the low cost of the screening method or intervention implemented. VIA was described as a simple, low-cost option that required limited technology and training, which is an advantage in low-resource settings (Awolude et al., 2018; Bernstein et al., 2018; Ouedraogo et al., 2018; Shikha et al., 2020; Vu et al., 2018). Text messages,

automated telephone calls, audiovisual media, and good practices at healthcare centers (e.g., implementing actions to organize CC screening, actively seeking patients in need of screening) were described as low-cost accessible interventions (Adler et al., 2019; Cooper et al., 2021; Firmino-Machado et al., 2018, 2019; Maia et al., 2018). Organized screening was cited as cost-effective (Paulauskiene et al., 2019). Lay HCWs played a role in informing their community about reduced-cost or free CC screening services (Colón-López et al., 2017; Krok-Schoen et al., 2016).

TABLE 2. Study Interventions by Focus and Content

Focus and Content	Studies
Patients	
Education and counseling sessions	Azlina et al., 2021; DeGregorio et al., 2017; Eghbal et al., 2020; Emerson et al., 2020; Mbachu et al., 2017; Mendes et al., 2018; Ouedraogo et al., 2018
Email	Peitzmeier et al., 2016
Face-to-face interviews	Firmino-Machado et al., 2019
Leaflets, booklets, and pamphlets	Azlina et al., 2021; Eghbal et al., 2020; Paulauskiene et al., 2019; Trapero-Bertran et al., 2017; Wong et al., 2019
Letters	Gyulai et al., 2018; Hamers et al., 2018; Lönnberg et al., 2016; Paulauskiene et al., 2019; Peitzmeier et al., 2016; Tavasoli et al., 2016; Trapero-Bertran et al., 2017; Tsoa et al., 2017
Mass communication	Bernstein et al., 2018; Cooper et al., 2021; Tégouéti et al., 2021
Telephone calls	Eghbal et al., 2020; Firmino-Machado et al., 2018, 2019; Peitzmeier et al., 2016; Trapero-Bertran et al., 2017; Wong et al., 2019
Text messages	Adler et al., 2019; Eghbal et al., 2020; Firmino-Machado et al., 2018, 2019; Tégouéti et al., 2021
Video and multimedia	Azlina et al., 2021; Cooper et al., 2021; Mendes et al., 2018; Thompson et al., 2017; Wong et al., 2019
Healthcare providers	
Access to patient information	Gyulai et al., 2018; Jonah et al., 2017
Involvement	DeGregorio et al., 2017; Gyulai et al., 2018; Maia et al., 2018; Ouedraogo et al., 2018; Romero et al., 2017
Training	Awolude et al., 2018; Bernstein et al., 2018; Mbachu et al., 2017; Ouedraogo et al., 2018; Romero et al., 2017; Shikha et al., 2020; Tégouéti et al., 2021; Vu et al., 2018
Use of navigators, lay healthcare workers, <i>promotoras</i> , and informants	Asgary et al., 2017; Colón-López et al., 2017; Krok-Schoen et al., 2016; Savas et al., 2021; Tégouéti et al., 2021; Thompson et al., 2017
Services	
Appointment scheduling	Firmino-Machado et al., 2018; Lönnberg et al., 2016; Paulauskiene et al., 2019; Trapero-Bertran et al., 2017
Cost-free screening on weekends	Tégouéti et al., 2021
Integration with other health services	DeGregorio et al., 2017; Tchounga et al., 2019
Single-day screening and treatment	Bernstein et al., 2018; Magnani et al., 2016; Shikha et al., 2020

Thompson et al. (2017) found that a *promotora* intervention conducted by a lay health worker had an incremental cost-effectiveness ratio per additional woman screened of \$4.24.

Two studies described fees for VIA between \$1 and \$3 (Téguété et al., 2021; Vu et al., 2018). Firmino-Machado et al. (2018) expected that their intervention based on automated text messaging and telephone calls costs as much as €0.10 per woman invited at the national level in Portugal. The most cost-effective intervention identified was based on an invitation letter costing €2.78 per 1% increase in screening uptake (Trapero-Bertran et al., 2017). Reduced-fee or cost-free services were observed to improve participation among women (Ouedraogo et al., 2018; Téguété et al., 2021). DeGregorio et al. (2017) found that charging a small fee for service was acceptable and important to making a screening program self-sustaining. In addition, Maia et al. (2018) suggested that low-cost Pap tests might not be sufficient because improving contact among women and HCWs would also be necessary to increase participation.

Discussion

Characteristics of Interventions

The diversity of the interventions suggests a large range of possibilities to improve CC screening and reflects a need to implement specific or a combination of strategies to the target population based on available resources and demographic characteristics. Invitation letters were the most common intervention described and were associated with an increase in screening uptake, particularly letters that contained notifications of scheduled appointments (Gyulai et al., 2018; Hamers et al., 2018; Lönnberg et al., 2016; Paulauskiene et al., 2019; Peitzmeier et al., 2016; Tavasoli et al., 2016; Trapero-Bertran et al., 2017; Tsoa et al., 2017). Conducting education and counseling sessions with the eligible population was also well described and associated with improvements in knowledge about CC, increases in screening uptake, and more women agreeing to complete the screening (Azlina et al., 2021; DeGregorio et al., 2017; Eghbal et al., 2020; Emerson et al., 2020; Mbachu et al., 2017; Mendes et al., 2018; Ouedraogo et al., 2018).

According to Staley et al. (2021), invitation letters and educational interventions are the most effective methods for increasing the absolute uptake of CC screening. Antinyan et al. (2021) found that invitation letters substantially increased CC screening participation in LMICs. Although these studies reinforce this review's findings about the success of invitation

letters, it is not feasible to assume that this type of intervention is the most effective in all conditions. All interventions provided some advantage to CC screening, with the target population benefiting in different ways independently of the type of intervention used.

Using mobile telephones to invite people to CC screening has the potential to spread knowledge and incentivize participation in LMICs. In a systematic review of eight studies, Zhang et al. (2020) found that mobile technologies, particularly telephone reminders or messages, contributed to an increase in Pap test uptake. These findings reinforce the results of studies conducted by Adler et al. (2019) and Firmino-Machado et al. (2018, 2019), which found that text messaging and automated telephone calls improved adherence to screening.

Providers can influence patients' clinical behaviors and attitudes toward CC screening (O'Connor et al., 2021). Some studies engaged healthcare providers with educational training and access to information about patients' screening status to help them become more active in promoting CC screening. Such actions were successful in improving knowledge among HCWs and patients, motivating eligible women, and increasing screening uptake in many studies (Awolude et al., 2018; Bernstein et al., 2018; DeGregorio et al., 2017; Gyulai et al., 2018; Jonah et al., 2017; Maia et al., 2018; Ouedraogo et al., 2018; Romero et al., 2017; Shikha et al., 2020; Téguété et al., 2021; Vu et al., 2018).

Community HCWs play a role in CC screening education, outreach, and awareness activities. Shikha et al. (2020) approached local community HCWs and trained them to counsel women, and Wong et al. (2019) led a multimedia outreach intervention for ethnically underrepresented individuals. Other studies relying on cultural legitimacy trained navigators, lay HCWs, *promotoras*, and key informants to improve CC screening rates through one-on-one education and promotion of screening awareness (Asgary et al., 2017; Colón-López et al., 2017; Krok-Schoen et al., 2016; Savas et al., 2021; Téguété et al., 2021; Thompson et al., 2017). These types of HCWs carry cultural legitimacy, trustworthiness, and acceptability for their communities, and they appear feasible and acceptable in LMICs (O'Donovan et al., 2019).

Several interventions that provided education and counseling sessions for patients succeeded in improving baseline knowledge about CC, which is essential to increasing screening uptake (Azlina et al., 2021; DeGregorio et al., 2017; Eghbal et al., 2020; Emerson et al., 2020; Mbachu et al., 2017; Mendes et al., 2018; Ouedraogo et al., 2018). Based on the effectiveness of

education and counseling in screening uptake, health-care professionals—including nurses and community HCWs—are integral in leading and performing CC prevention interventions.

Vulnerable Populations

When analyzing inequities in CC, about one half of cases occur in women who have never been screened. Many of those women are poor, live in rural areas, and have limited access to HCWs and infrastructure (Zug et al., 2014). Compared to women living in urban areas, women living in rural areas experience a 13% higher mortality rate (Blake et al., 2017). However, few studies in this review described interventions approaching vulnerable populations of women. Eghbal et al. (2020) demonstrated an improvement in Pap testing rates and CC knowledge after an educational intervention for women living in rural areas. A personal invitation letter was found to significantly increase CC screening uptake more so in rural regions than in urban regions (Paulauskiene et al., 2019). An educational video intervention was associated with a greater change in knowledge scores of women in urban areas than women in rural areas (Cooper et al., 2021). Interventions may not result in the same outcomes in all populations. Rural populations face transportation challenges, ill-equipped health facilities, lack of information, and fewer highly trained HCWs, all of which need to be considered when choosing an intervention (Ndejjo et al., 2016). In addition, HCWs must be trained to promote culturally competent patient-provider communication (Fuzzell et al., 2021; Johnson et al., 2008).

Women who are ethnically diverse, marginalized, underserved, part of sex and gender minorities, or immigrants are also vulnerable to disparities in screening. The included studies described solutions, such as mobile screening by community HCWs, education sessions, and patient navigators or *promotoras*, which could potentially improve adherence to screening and follow-up (Asgary et al., 2017; Emerson et al., 2020; Magnani et al., 2016; Thompson et al., 2017; Wong et al., 2019). In a study by Asgary et al. (2017), opt-out patient navigation was effective in mitigating barriers to cancer screening among unhoused women. The See, Test and Treat program was designed to reduce barriers for ethnic populations by providing care that addresses cultural and financial issues (Magnani et al., 2016). Wong et al. (2019) suggested that a multimedia intervention led by community HCWs was crucial to enhancing CC screening beliefs for a group of underprivileged South Asian women. A

randomized controlled trial to increase CC screening among Latina women in rural areas concluded that one-on-one education provided by a *promotora* motivates women to seek screening (Thompson et al., 2017). Lastly, Emerson et al. (2020) found that cervical health literacy empowerment delivered to women during a jail detention decreased health disparities. These studies highlighted the range of possible interventions that can be applied to decrease health disparities in underserved patient populations. Given the expertise of healthcare providers, particularly nurses and community HCWs, they are essential in selecting, planning, and conducting the best intervention according to the target population.

CC Screening Settings in LMICs

The highest rates of CC mortality are observed in Africa, Latin America, the Caribbean, and Asia (Gossa & Fetters, 2020; Sung et al., 2021). However, fewer than half of the studies included in this review were conducted in LMICs (Awolude et al., 2018; Bernstein et al., 2018; Colón-López et al., 2017; Cooper et al., 2021; DeGregorio et al., 2017; Eghbal et al., 2020; Maia et al., 2018; Mbachu et al., 2017; Mendes et al., 2018; Ouedraogo et al., 2018; Romero et al., 2017; Shikha et al., 2020; Tchounga et al., 2019; Téguété et al., 2021; Vu et al., 2018). In these studies, the main outcomes demonstrated after the interventions were improvements in technical knowledge among healthcare providers, high acceptance rates for VIA screening, an increase in baseline knowledge about CC among eligible women, and greater screening uptake.

Screening programs vary between low-resource and high-income areas. In most high-income countries, Pap tests, which require a well-funded healthcare system, are offered as the main screening method. Although HPV testing is recommended by the WHO because of its better sensitivity compared to cytology and VIA, the cost and infrastructure requirements can make widespread implementation difficult (Vale, Silva, et al., 2021). VIA is more feasible in LMICs and has been implemented as an alternative to cytology because it is a low-cost screening technology. VIA does not require laboratory analysis, and trained nonphysician clinicians can perform it in clinics, producing immediate results (Huchko et al., 2015; Sohn, 2020). Among the 15 studies that were conducted in LMICs, 9 described VIA as the preferred screening method.

Studies exploring CC screening in LMICs are important for proposing alternative strategies to improve screening uptake because resources for CC

prevention are limited in these countries. In addition, HPV testing is rarely offered. Social and cultural factors, such as a lack of awareness and knowledge about preventive services, limited accessibility, socioeconomic status, and cultural and religious beliefs, also influence the use of screening programs (Chidyaonga-Maseko et al., 2015). However, independently of the type of screening method, CC screening effectiveness can improve by increasing examination coverage, which can be done through the organization of the healthcare services.

Limitations

Of the 35 studies included, only 9 were randomized controlled or clinical trials, which limited the quality of the evidence. The remaining 26 studies used mixed-methods, experimental, or pre-/postintervention or questionnaire-based designs, or were pilot studies, retrospective reviews, or cross-sectional observations. Most studies described some limitations, most commonly an inability to generalize the outcomes, biases in participant selection, small sample sizes, and availability of medical records. More trials are needed to understand how to approach underrepresented populations and evaluate long-term and secondary outcomes, particularly in LMICs where fewer studies have been conducted. In addition, the study was limited by its focus on studies published during a five-year period and the choice to exclude interventions focused on HPV testing.

Implications for Practice

The interventions described in the selected studies were diverse, and the synthesized evidence is valuable for healthcare providers and decision-makers in improving CC screening uptake. Adherence to CC screening depends on many factors (e.g., culture-related behavior, service availability, social and economic status), and healthcare providers play a complex role. In addition to choosing a method to identify cancer or precancerous lesions, defining the screening method can motivate eligible women to participate. Nurses, physicians, and community HCWs comprise an interprofessional team that is responsible for planning and implementing the intervention that is most relevant to local conditions. Nurses and community HCWs at primary healthcare centers can build relationships and engage with the community in cancer screening initiatives while providing health education. They can also influence patients to adopt healthy behaviors by applying the strategies from some of the interventions described. Helping healthcare

KNOWLEDGE TRANSLATION

- Nurses and community healthcare workers at primary healthcare centers can engage the community in cancer screening initiatives while providing health education.
 - Invitation letters, telephone calls, and education and/or counseling sessions were the approaches most often used with patients to improve cervical cancer screening.
 - Implementing multiple low-cost interventions led by healthcare professionals in accordance with local conditions can improve cervical cancer screening uptake, particularly in low- and middle-income countries.
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providers to understand population demands is crucial to the design of more effective interventions and efforts to overcome barriers to screening, particularly in LMICs with limited resources. The findings of this review, which provided examples of interventions that successfully improved CC screening, can be used to guide future health practices.

Conclusion

This integrative review synthesized data from low-cost interventions to improve CC screening. Most studies achieved positive outcomes, including increases in adherence and uptake, improvements in baseline knowledge for patients and healthcare providers and in the best use of healthcare staff, and delivery of treatment to a high proportion of patients with a positive screen result. CC screening program assessments are complex and depend on local conditions. Screening test performance is easily defined in terms of specificity or sensitivity, but early cancer detection cannot be offered until the logistics of screening are defined. Any approach must be adapted to the local cultural and socioeconomic settings and available resources, particularly in LMICs, where programs are often underfunded. Financial implications of CC screening should be investigated, and adequate funding and services for women who need specialist management are needed. Implementing multiple low-cost interventions and involving healthcare providers and the community seem to be the best approaches to improving CC screening uptake.

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