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A Systematic Review of the Effectiveness of Health Education Programs for Cervical Cancer Prevention in Rural Communities: Implications for Promoting Health Equity

Ariel Washington¹, Lisa Smith², Georgia Anderson³, Jill Randall⁴, Karen Kayser⁵, Scott LaJoie⁶

¹Department of Oncology, Wayne State University School of Medicine, Detroit, MI, USA

²Grace Abbott School of Social Work, University of Nebraska Omaha, Omaha, NE, USA

³College of Allied Health Sciences, School of Social Work, University of Cincinnati, Cincinnati, OH, USA

⁴School of Nursing, University of Michigan, Ann Arbor, MI, USA

⁵Kent School of Social Work, University of Louisville, Louisville, KY, USA

⁶School of Public Health & Information Sciences, University of Louisville, Louisville, KY, USA

Abstract

Rural women face an increased risk of cervical cancer diagnosis in comparison to women living in metropolitan areas. This review synthesized and critically evaluated cervical cancer screening interventions that target women living in rural communities in the USA. EBSCO, JSTOR, Medline, PsychINFO, Psychology and Behavioral Sciences Collection, PubMed, and Cochrane Library were searched using keywords related to cervical cancer screening, rural communities, and prevention interventions. Study eligibility included randomized controlled trials or quasi-experimental designs, a psychosocial or educational intervention targeting cervical cancer prevention, and implementation in a rural setting. Eleven articles met criteria for the systematic review and 6 of those included information sufficient for meta-analysis. Cochrane guidelines, CONSORT-Equity 2017, and PROGRESS-Plus were used to assess included studies. The systematic review encompassed 9720 participants who were involved in a variety of intervention types: social media campaigns, faith-based, and patient navigation with lay health advisors. None of the studies met all criteria for the health equity assessment. The meta-analysis found that women in the intervention groups were more likely to participate in cervical cancer screening than women in control groups (OR: 2.43, 95% CI: 1.49 to 3.97). The type of intervention mattered in increasing cervical cancer screening participation for women living in

[✉] Ariel Washington, awashington@wayne.edu.

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rural communities. Educational interventions in combination with patient navigation saw the most success in promoting cervical cancer screening. Further, health inequities focus is lacking robust consideration. Our results highlight a continued need to develop multicomponent interventions with a health equity focus to address barriers to screening and prevention.

Keywords

Cervical cancer screening; Cervical cancer prevention; Health promotion; Health equity

Introduction

Women in rural America are more likely to be diagnosed with cervical cancer, at all stages of the disease, and to die from cervical cancer than their counterparts in urban America (SEER, 2010–2014). This excess disease burden has many explanations, from differences in attitudes towards prevention, to lack of providers and access to specialized care [1, 2]. Interventions to address these disparities have been developed and tested but to date, there has been no synthesis or meta-analysis of this literature. To address this gap, we conducted a meta-analysis of cervical cancer prevention efforts in rural communities and draw attention to promising interventions.

Cervical cancer is caused by specific types of the human papillomavirus (primarily, HPV 16/18). Because HPV is a common infection transmitted most often during sexual activity, efforts to reduce its spread through vaccination become entangled with conservative and religious beliefs [3–5]. Regular gynecological examinations, including the Pap smear, are effective at detecting pre-cancerous lesions and early-stage cancer but require that abnormal results be followed up with more specialized providers. Advancements in HPV DNA testing and home-based self-sampling for HPV allow for less frequent screening and easier access, but the rollout of these tests is unequal across the world [6].

The studies selected for this meta-analysis were conducted in small towns across the USA and reflect the diversity of what it means to be “rural.” The US Department of Agriculture Economic Research Service identifies more than two dozen definitions of “rural.”⁷ Common among the definitions is that rural communities tend to be smaller, often surrounded by farm and grazing lands, with populations with less formal education, and lower household incomes. Importantly, medical and health interventions are often received with mistrust and wariness by rural dwellers.^{7, 8} Further, there exist many cultural variations among rural communities. Small towns in the desert west, whose residents may not speak English as their primary language and who draw their cultural norms from south and central America, may differ starkly from the small towns in Appalachia, which tend to be populated mostly by Caucasian descendants of Scotch-Irish who hold beliefs consistent with their ancestors. Indigenous territories, managed by the Indian Health Services, are chronically underfunded and understaffed [7], resulting in disparities among Native Americans compared to White counterparts in cancer control [8].

Public health interventions to reduce rural disparities in cervical cancer must be situated firmly within the communities where they are implemented and may not be effective

outside of those communities [9]. Therefore, the context of the rural community needs to be considered when assessing the effectiveness of public health interventions to reduce disparities in cervical cancer. Community-based research designs that incorporate local representation in the study planning, implementation, and evaluation often achieve better engagement and trust by the local population. In some rural areas, such as Appalachia, where churches play large roles in the lives of the residents, interventions succeed to the extent in which they are endorsed by the local ministers and pastors [10]. The Community Prevention Services Task Force's (CPSTF) Community Guide emphasizes the effectiveness of increasing cancer screening by involving patient navigation [11], community health workers [11], and multicomponent interventions [12]. The CPSTF proposes that effective client-oriented screening interventions use client reminders, one-on-one education, and small media campaigns. Provider-oriented interventions are effective when they use provider assessment and feedback strategies as well as provider reminder and recall systems. Multicomponent interventions consist of components that increase community demand, increase community access, and/or enhance provider delivery. Notably, these interventions are specifically designed to tackle structural barriers, contributing to their efficacy in promoting cancer screening and proving to be cost-effective.

Knowing that rural communities are hardly uniform, that several preventive methods exist, and that outcome measurements are imperfect, this study attempts to measure how successful recent efforts have been at increasing cervical cancer screening and prevention through pap smear screening adherence and HPV vaccination. In this paper, cervical cancer screening and prevention behavior include pap smear screening adherence and HPV vaccination initiation.

Research Aims

The overall purpose of the study is to systematically review health education and awareness interventions targeting cervical cancer prevention and detection efforts directed toward women living in rural communities. We have three aims: (1) to describe the characteristics of studies that evaluate effectiveness of health education programs for cervical cancer prevention in rural communities; (2) to compare the effectiveness of the interventions; and (3) to determine if the reporting of the studies adequately addressed health equity according to the CONSORT-Equity reporting standards.

Methods

This review was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Statement (PRISMA) [13].

Search Strategy

Eligible studies evaluated the impact of health education programs designed to promote cervical cancer screening and the HPV vaccination with women living in rural communities in the USA. Electronic databases (EBSCO, JSTOR, Medline, PsychINFO, Psychology and Behavioral Sciences Collection, PubMed, and The Cochrane Library) were searched using a combination of key terms: community-based intervention, HPV, cervical cancer,

screening, psychosocial, control trial, randomized control, quasi-experimental, prevention, community-based workers, community-based participatory research, CBPR, HPV vaccine, vaccination, community, education intervention, rural, and pap smear in the abstracts. References to articles related to psychoeducational cervical cancer interventions in other systematic reviews were also searched. The search was restricted to studies published in peer-reviewed journals between 2000 and January 2023.

Eligibility Criteria

To be included, studies had to meet the following criteria: (1) be a randomized controlled trial (RCT) or quasi-experimental design with a control group; (2) include a psychosocial or educational intervention focused on either cervical cancer screening or prevention; (3) include a sample of women above the age of 18 years old; (4) be implemented in a rural setting in the USA; and (5) be reported in a peer-reviewed journal. Since dissertations did not meet criterion 5, they were excluded. Intervention settings were determined by whether the articles' authors self-reported the location as being a part of the rural USA.

The potential list of articles was divided among team members. Each member independently selected potentially eligible studies. During the initial stage of the review, articles were assessed on their titles and abstracts, full-text articles were evaluated after having passed the initial stage of eligibility. The team discussed any studies that members questioned eligibility.

The search yielded 5788 articles. Fig. 1 shows the flow of the study identification, retrieval, and the number of eligible articles. Five investigators independently reviewed the records (title and abstract) of 212 articles that were identified by the search and excluded 115 abstracts that did not meet the eligibility criteria. The remaining 97 articles were reviewed in their entirety and 11 studies were included in the sample.

Data Extraction

A data extraction sheet was developed and internally validated by team members who pre-tested the sheet on randomly chosen articles. All reviewers showed consistency and accuracy in the use of the data extraction sheet. Data extracted from the studies were demographics of the participants, setting, focus of study, theoretical framework, inclusion criteria, sampling method (i.e., probabilistic or non-probabilistic), dropout, attrition, data collection (self-reported or medical review), design, intervention, interventionist, measures, health outcomes, effect size, validity, reliability, and limitations or weaknesses of the studies.

Items related to the risk of bias in the studies were also entered in the data extraction sheet. Following Cochrane guidelines,¹⁹ the items included biases related to selection, performance, detection, attrition, and reporting. An example of potential bias from the Cochrane guidelines being the use of random sequence generation in assigning intervention or control status to participants. They were assessed for having low risk, unclear risk, and high risk of bias.

The data extraction sheet also included items of health equity which were based on CONSORT-Equity 2017.²⁰ This guide builds on the original CONSORT 2010, which

provides guidelines for presenting results of systematic reviews and meta-analyses. CONSORT-Equity 2017 guides users to capture social and demographic characteristics of participants and disadvantaged populations and to assess the adequacy of randomized trials in addressing health inequities in these populations. Table S1 (supplemental) lists the CONSORT-Equity items that were included in the data extraction.

After developing and testing the data extraction sheet, the articles were divided among 4 reviewers; two reviewers were assigned to each article. The two reviewers would discuss any discrepancies in entering the data and reach a consensus. If consensus was not reached, the discrepancy was resolved by a third reviewer.

Data Analysis

Demographics were extracted from the studies to describe the participants' characteristics. For our meta-analysis, our primary outcomes of interest, as measured by self-report or medical record review, were cervical cancer screening adherence (yes or no) and HPV vaccination (yes or no). A meta-analysis of the outcomes was conducted when sufficient data could be extracted from the included studies, based on the number of women screened or vaccinated versus the control. We then entered the data into Review Manager (RevMan) software for meta-analysis [14].

Because of the dichotomous outcomes of screening or no screening, vaccination or no vaccination, odds ratio was deemed appropriate for interpreting the effect size of the interventions. Odds ratios allow for the interpretation of whether the intervention results in an increased likelihood of being screened or vaccinated versus the control groups. A random effects model was used when calculating and pooling the effect sizes of the included data. The random effects model was used for two reasons: based on the I^2 statistic showing heterogeneity between the studies and because there was an estimated clinical diversity among the included studies. The random effects model assumes that the included studies are estimating different but related intervention effects. Since each included study had a different intervention, using the random effects model was the more conservative option.

Results

Sample

Figure 1 displays the study flow of the literature search. A total of 5788 titles were initially retrieved, and 151 additional titles were identified through hand-searching reference lists and other cervical cancer systematic reviews. After removing duplicates, 5917 titles and abstracts were screened. From those 5917 titles, 212 abstracts were considered to either be a yes for further review or a maybe; conflicts were resolved between each reviewing team through discussion, with a third reviewer weighing in. Of the 212 abstracts that were reviewed, 115 were excluded for not meeting criteria, and 97 full articles were reviewed. Of the 97 full-text articles review, 86 were excluded for not meeting criteria leaving only 11 articles for our review.

Study Characteristics

Table 1 summarizes the characteristics of the 11 studies that met our eligibility criteria. There were 9720 participants in the studies. Participants' ages ranging from 22 to 65, with the majority choosing some high school education as their highest educational attainment, and most participants were low to middle income. Over half of the studies included Hispanic women as the majority of participants [15–20], while five of the studies had non-Hispanic White women as the majority [9, 21–23]. None of the studies had a majority of Black women or American Indian/Alaskan Native women in their samples. Three studies used probabilistic sampling [17, 21, 22], and seven used non-probabilistic [15, 16, 18, 20, 23–26].

Outcomes for the studies included cervical cancer screening behaviors [16–20, 26] and HPV vaccination awareness and knowledge, and HPV vaccination uptake [15, 22, 23]. Both cervical cancer screening and HPV vaccination uptake were measured by self-reported measures [9, 15–17, 19] or medical record review [18, 22, 23].

Types of Interventions—Types of interventions included social media campaigns [25], novella health education [15], education led by lay health advisors/promotoras [17, 19, 21], a faith-based intervention [26], and an educational DVD [23]. One study had a multi-level program that included educational sessions for providers and parents [16], and one had comprehensive activities at the level of small groups, individuals, and community organizations [22]. The largest RCT involved three arms: education only, education and patient navigation by lay health advisors, and patient navigation only [20].

The goals of the interventions were primarily to focus on improving HPV vaccination uptake [15, 22, 23, 25] and improving cervical cancer screening rates [16–21, 26]. One study included other cancer prevention behaviors such as smoking, eating patterns, healthcare access, and cancer screening (breast and colorectal cancers) [19].

There were a variety of theoretical frameworks for the interventions: extended parallel process model [22], transtheoretical model [21], health belief model [21, 22, 25, 26], theory of planned behavior [23,] theory of reasoned action [22], organizational developmental [22], precede-proceed [21, 26], community-based participatory research [15, 18, 19], and social cognitive theory [16–19, 21, 26]. Many of these theories attempt to explain how social interactions and experiences impact health behaviors; thus, suggesting that changing knowledge through education-based interventions will result in changed behavior.

Study Designs and Methods—Most of the studies randomized participants to either an intervention group or a control group/waitlist [15, 19, 21, 26] and one used a comparison intervention [18]. Two studies used randomized cluster designs in which counties or communities were matched and randomly assigned to an intervention or control arm [16, 22]. Another study allowed participants to choose which intervention arm they would participate in between education only, education and patient navigation by lay health advisors, and patient navigation only [20].

Effectiveness of Interventions

Six studies reported enough information for odds ratios to be calculated, comparing their intervention strategy against a control group. For some studies, there was not a clear definition of usual care, while one study used a waitlisting design which allowed participants to eventually receive the intervention [26]. Overall, when comparing the health education intervention with usual care, women in the intervention group were twice as likely to report engaging in screening practices (OR: 2.43, 95% CI: 1.49 to 3.97; $I^2=94\%$). Fig. 2 shows the studies that had enough information to calculate effectiveness. One study [19] analyzed Hispanic/Latina and Caucasian participants separately. Hispanic/Latina women in a multi-level intervention were more likely to participate in pap smear screening than the usual care group (OR: 4.86, 95% CI: 2.80 to 8.42) [19]. Faith-based health navigation intervention was effective at increasing cervical cancer screening participation when compared with a wait-listed control group (OR: 2.26, 95% CI: 0.45 to 1.2) [26]. In Falk, Foley (20), the women who received both patient navigation and education were more likely to be screened than those participants who only received the education intervention (OR: 6.16, 95% CI: 5.22 to 7.27).

Only two studies had sufficient information to compare the effectiveness of a prevention intervention, on HPV vaccine uptake among rural residents. However, neither study had significant findings.

Risk of Bias

Figure. 2 shows the risk of bias for each study, with green indicating minimal risk and red indicating high risk. Studies were generally low risk for bias, except for selection bias. Most studies did not randomly assign intervention or control groups which makes them susceptible to selection bias [27].

Reporting of Health Equity Factors

Table 2 presents the 22 items that were used to assess the reporting of health equity factors in the review articles. Most articles (90–100%) covered 9 of the 22 items in the reporting of the studies. These items included (1) a rationale for focusing on health equity, (2) an objective with reference to health equity, (3) a proposed trial design to answer equality questions, (4) the context and relationship to health equity, (5) details of partnerships with populations and communities, (6) methods of recruitment to reach populations across relevant PROGRESS-Plus characteristics, (7) limitations related to assessing effects on health equity, (8) applicability related to the population of interest across PROGRESS-Plus characteristics, and (9) details of partnerships with populations and communities. Less than half of the studies (0–36%) reported (1) how the intervention compared to the best standard of care, (2) outcomes relevant and important to population(s) across PROGRESS-Plus, (3) whether the sample size was powered to detect statistical differences between groups, (4) whether randomization was stratified by geographical region and quality of care, (5) an analysis of losses and exclusions after randomization, (6) details of implementation in each trial arm relevant to the PROGRESS-Plus characteristics, and (7) whether there were any unintended inequities caused by the intervention.

Discussion

Our goal was to systematically review studies on psychosocial and educational interventions for promoting cervical cancer screening and HPV prevention among women living in rural communities. Eleven research articles from 2000 through 2023 met our inclusion criteria of using an RCT or quasi-experimental design and implementing an educational intervention with a sample of adult women living in rural communities. Most studies were successful in recruiting samples of women with low to middle incomes and/or women of color, especially Hispanic/Latinas. The interventions were primarily educational using a variety of methods such as social media, novella, lay health advisors, patient navigators, and educational DVDs. None used mobile technology (e.g., mHealth) which includes using apps or text messaging with smart phones as an intervention delivery method. Nor did they use self-sampling kits which are a growing avenue in cervical cancer screening intervention. Although self-sampling kits have yet to be widely adopted in clinical practice and our currently not FDA approved, promising results have shown that self-sampling can positively impact the screening rates for under screened and hard to reach populations [28–32]. Both self-sampling and mHealth are newer intervention strategies that can potentially address the access issues encountered in rural healthcare.

Our findings suggest that educational interventions are effective in encouraging cervical cancer screening and prevention behavior. When paired with patient navigation services or lay health advisors, educational interventions are even more effective in promoting cervical cancer screening and prevention behavior as evidenced by two of the more successful studies [20, 26]. While there were improvements in women's knowledge and beliefs about cervical cancer screening, screening and prevention behaviors (pap smear adherence and vaccination) did not produce comparable results. There may be practical barriers that are preventing access to screening. For example, transportation and costs are practical barriers that women in rural settings have been previously reported [9]. Between 2010 and 2021, 136 rural hospitals have closed. With the closure of rural medical centers and increasing shortage in qualified medical providers in rural areas, transportation and access to care issues become further exacerbated [33]. Transportation issues have been a consistent barrier to care for rural residents [34–37].

The relationship between patient and provider is both a barrier and facilitator to cervical cancer screening and HPV vaccination. While lack of recommendation by a healthcare provider is a known barrier to HPV vaccination [38], only one study in this review addressed provider recommendation. Additionally, the lack of regular healthcare provider, the lack of insurance and the lack of knowledge about cervical cancer tests have also been found to be barriers to cervical cancer screening [39].

Interventions that were most effective in our review were those who worked with community members or community health workers to educate and encourage screening. Community health workers and community engagement models have been effective in other populations for increasing cervical cancer screening participation and have been recommended by CPSTF [11]. Our findings reiterate their importance. In addition, the use of self-sampling kits was an effective strategy in increasing cervical cancer screening participation, reflecting

similar findings in other priority populations as well [40, 41]. In fact, self-sampling kits have been recently promoted as a cost-effective measure for addressing under screened women [29, 42]. Self-sampling kits are one cost-effective way to address the barriers of access and health provider availability that rural women have encountered.

Unique to this review is the use of the health equity assessment, CONSORT-Equity 2017 PROGRESS-Plus. Most of the reviewed studies addressed health equity in their introductions, aims, population eligibility criteria, and recruitment of participants. However, few used rigorous analyses to address health equity objectives and outcomes. This is an area for improvement in future intervention research focused on addressing health inequities. Given that most of the studies did not report rigorous methods and may have had numerous risks of bias, we cannot reach any definitive conclusions about whether inequities were reduced.

Limitations

Our review has limitations, primarily due to problematic definitions of outcomes. For studies with outcomes that include adherence to Pap smear guidelines, adherence over the past 3 years is often self-recalled; errors in memory and knowledge for which gynecological procedures were conducted can lead to inaccuracies in reporting [43]. A more reliable but costly approach is to rely on reviews of medical charts [44]. Evaluation of vaccination is challenged by the number of doses needed (2 or 3) and time frame (up to 1 year from initiation). Many studies report the numbers of persons who *intend* to vaccinate rather than the number of those who have initiated or finished the vaccine series. The intention-behavior gap is problematic for estimating vaccination rates [45].

A common concern for the meta-analysis process is publication bias. Studies with non-significant findings are often excluded from the literature. Our study catchment excluded “gray literature” — studies that have not been published in peer-review journals. We intentionally left out gray literature, with the belief that the peer-review process, including revise and resubmit, leads to higher quality articles. However, this is an assumption that may need further empirical validation. We feel a strength of this review and our methodology is the use of the risk of bias assessment which provided details on the biases of each article reviewed.

Lastly, narrow definitions of geographic location and intervention strategy limit the generalization of our findings. However, the rigor of the inclusion/exclusion criteria and evaluation methods allow for insights to be drawn that can help future interventionists.

Future Research

The landscape for cervical cancer and HPV interventions continues to change and there are several future directions in which research and intervention development can expand. In 2022, American Indian/Alaskan Native women replaced Hispanic/Latina women in having the highest incidence of cervical cancer [46]. None of the studies in our review focused on this population, nor did they focus on African American/Black women who have the highest mortality rate, while being third for incidence [47]. In recent years, rural America has seen growing racial/ethnic diversity in their population, which could translate to an

increased need to address cervical cancer health disparities in this population and setting. As we mentioned previously, education alone did not lead to higher likelihood of women being screened. Practical barriers (e.g., access to care) and strong recommendations from providers may be more important than knowledge and awareness for this setting. Future research and interventions can address accessibility barriers by using self-sampling kits. With the decreasing accessibility of healthcare services in rural America, self-sampling kits could increase women's access to screening. Access to HPV vaccination could be improved by allowing pharmacists, school nurses, and other health professionals outside of primary care providers to administer the vaccines.

Conclusion

Cervical cancer continues to be a source of morbidity and mortality. This review assesses the current landscape of psychosocial and educational interventions to promote cervical cancer screening and HPV vaccination. We show that education-only interventions are not as effective as multi-level interventions. Patient navigators plus education, for example, increases the number of women screened and the frequency of screening. Rural and minority women who are at higher risk of not receiving timely healthcare require additional supports to allow them to receive the life-saving benefits afforded by regular cancer screening and HPV vaccination.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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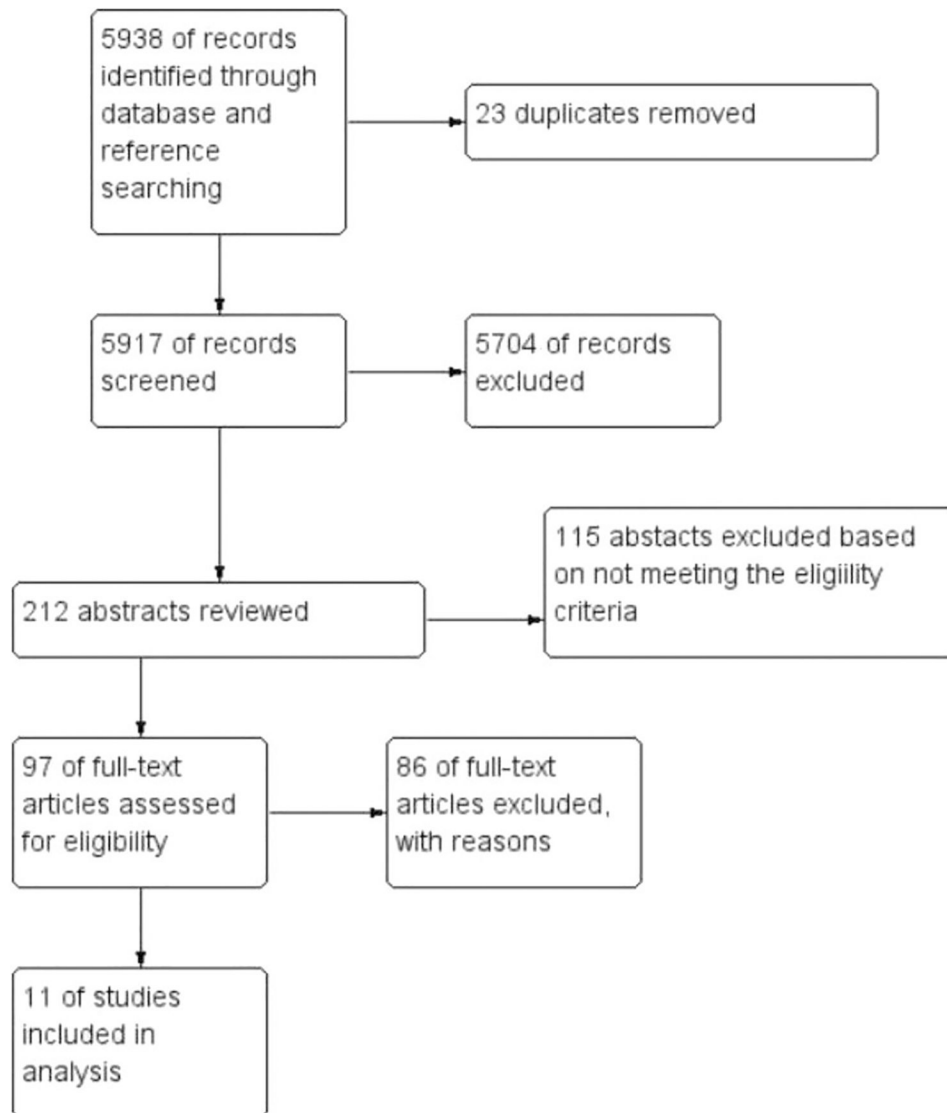


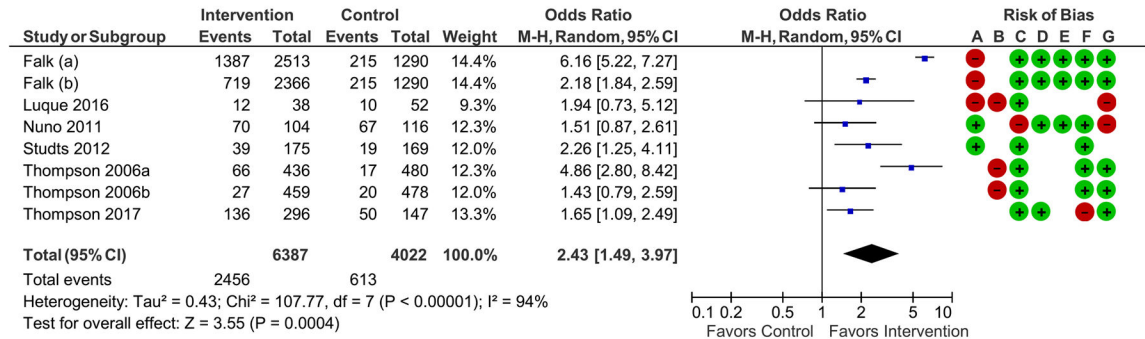
Fig. 1.
Study flow diagram of the 11 studies reviewed

Psychosocial Interventions for Cervical Cancer in Rural America

16-Feb-2023

1 Cervical Cancer Screening or Prevention

1.1 Screening



Risk of bias legend

- (A) Random sequence generation (selection bias)
- (B) Allocation concealment (selection bias)
- (C) Blinding of participants and personnel (performance bias)
- (D) Blinding of outcome assessment (detection bias)
- (E) Incomplete outcome data (attrition bias)
- (F) Selective reporting (reporting bias)
- (G) Other bias

Fig. 2.
 Psychosocial Interventions for Cervical Cancer in Rural America

Table 1

Summary table of studies reviewed

Study (references)	Study type sample/location	Theoretical framework	Intervention	Primary outcomes and measures	Intervention effectiveness
Cates, Shafer, Diehl, Deal (2011)	2-arm cluster; mothers with daughters ages 11–12 ($n=225$); North Carolina	Ecological Model	Social marketing campaign about HPV vaccination targeting mothers and healthcare practices	Campaign awareness; website traffic, hotline calls, media placement, and HPV immunization rates; cross-sectional survey	82% of mothers heard or saw campaign messages or materials; 94% of providers used campaign brochures; HPV vaccination rates rose in 2 of the 4 intervention counties compared to 9 non-intervention counties; mothers who reported some campaign awareness were more likely to take action than mothers who were unaware (71% vs. 22%, $p < .001$)
Falk, Foley, Weaver, Jones, Cubbin (2022)	3-arm Quasi-experimental; women ages 21–64 ($n=6169$); Texas	Psycho-educational; Not clearly identified	Education only; PN only; Both PN and education; PN included navigating participant barriers to screening such as cost and transportation	Self-reported receipt of pap test	Education only: English speaking Latina women had an 18% probability of receiving a Pap test; non-Latina White women had a 50% probability. Education and PN: Spanish speaking Latina women had the highest probability (70%) followed by non-Latina White (62%), non-Latina Black (60%), and English-speaking Latina women (50%). Women aged 21–39 had higher odds of screening (OR: 1.40, CI: 1.23–1.59) compared to older women; English-speaking Latina women (OR:0.51, CI 0.40–0.64) had lower odds compared to non-Latina White women
Kepka, Coronado, Rodriguez, Thompson (2011)	RCT; Hispanic parents of daughters aged 9–17 ($n=88$); Washington	Community-based participatory research approach	Culturally tailored Spanish <i>radionovela</i> about HPV vaccine	Knowledge of HPV, cervical cancer, and HPV vaccine; attitudes, decision-making, and intention to receive HPV vaccine. Pre- and posttest participant questionnaire	Parents who listened to the HPV <i>radionovela</i> scored higher on 6 knowledge and belief items than control group parents. The HPV vaccine <i>radionovela</i> improved HPV and vaccine knowledge and attitudes. Less acculturated parents in intervention arm improved in relation to self-efficacy for vaccine uptake ($p < .05$)
Krok-Schoen, Oliveri, Young, Katz, Tatum, Paskett (2016)	RCT; 90 women in need of Pap test randomized to lay health advisor (intervention arm) or usual care (control arm)—letter from physician & brochure). 96.7% Caucasian Appalachia counties in Ohio	Translational Model	10-month lay health advisor (LHA) intervention with in-person visits, phone calls, and mailed postcards tailored to participant's stage of change	Receipt of Pap test; self-report and medical record review; barriers to cervical cancer screening were measured by an author developed survey using eleven items based on previously reported barriers; stages of change for Pap testing was measured by participants' self-reported responses to intention to receive a pap test	
Luque, Tarasenko, Reyes-Garcia, Alfonso, Suazo, Rebling, Ferris (2016)	2-arm quasi-experimental feasibility study; Hispanic or Latina immigrant women aged 21–65 years and overdue for Pap test ($n=90$); Southeast Georgia	Social Cognitive Theory	Spanish language educational group session on cervical cancer led by <i>promotoras</i> ; group activities included watching video, dialog about barriers to healthcare, resources, etc.	Cancer screening knowledge, cervical cancer beliefs, sources of health information, and self-efficacy. pre- and posttest surveys. Receipt of Pap test was self-reported	Twelve (32%) intervention group participants received Pap test compared to 10 (19%) control group participants ($p = 0.178$). Intervention participants were higher on both cervical cancer knowledge recall and retention than control group ($p < 0.001$)
Nuno, Martinez, Harris, Garcia (2011)	RCT; Hispanic women 50 or older, medically	Social Cognitive Theory	Trained <i>promotoras</i> led classes about breast and cervical cancer	Self-reported mammogram and Pap smear screening	Women in intervention group were 1.5 times more likely to report having a Pap smear within the last year when compared with usual care group (although

Study (references)	Study type sample/location	Theoretical framework	Intervention	Primary outcomes and measures	Intervention effectiveness
Paskett, Krok-Schoen, Pennell, et al. (2016)	Group-randomized trial; parents of daughters age 9–17 who had not received HPV vaccine ($n=337$), providers ($n=119$); Appalachian Ohio	Health Belief Model; Theory of Planned Behavior; Organizational Developmental Theory	Multi-level: clinic educational information; educational session for providers; packet with brochure and DVD video mailed to parents	Baseline survey identified barriers Primary outcome: Medical record-confirmed receipt of first HPV dose 3 months after intervention. Secondary outcomes: receipt of first HPV vaccine dose by 6 months and changes in provider knowledge	this was not statistically significant). Secondary analysis indicated a stronger effect on women who had not had a Pap smear within the past year at baseline Ten (7.7%) daughters of intervention participants received first dose of HPV vaccine within 3 months compared to 4 (3.2%) daughters of comparison group ($p = 0.061$). By 6 months, 17 (13.1%) daughters in intervention group received first HPV vaccine compared to 8 (6.5%) daughters in comparison group ($p = 0.002$). Provider knowledge about HPV increased ($p = 0.001$)
Studs, Tarasenko, Schoenberg, Shelton, Hatcher-Keller, Dignan (2012)	RCT; women aged 40–64 and overdue for screening ($N = 345$); Appalachian Kentucky	Precede-Proceed	Luncheon with educational program on cervical cancer screening and prevention; LHAs home visits; newsletters addressing barriers to screening.	Primary outcome: Self-reported receipt of Pap test	Treatment group participants (17.6% screened) had over twice the odds of wait-list controls (11.2% screened) of reporting Pap test receipt post-intervention. Regardless of group, recently screened participants (1–5 years ago) had significantly higher odds of obtaining screening than rarely or never screened participants
Thompson, Coronado, Chen, Islas (2006)	Randomized group design ($N=1962$), Eastern Washington	Community-based Participatory Research (CBPR)	Comprehensive: community activities, organizational, small group and individual levels; health fairs, block parties, festivals, fun runs, education presentations; schools, religious organizations, worksites; wellness van; local clinics; home health parties	Cross-sectional surveys and in-person interviews measured: healthcare access, smoking behavior, eating patterns, cancer screening behavior, awareness of cancer events, questions about screening, acculturation	Few significant changes in use of Pap test between intervention and control communities; more awareness of and participation in intervention activities in the treatment communities than control communities
Thompson, Carosso, Jhingan, et al. (2017)	RCT; 443 Latina women ($n=443$); Yakima Valley in Washington State	CBPR	Two arms: (1) Spanish-language educational session in home; watching video with <i>promotora</i> , making commitment and appointment for Pap test; sheet of resources for overcoming barriers; reminder magnet, appointment card	Knowledge and attitudes towards cervical cancer screening and risk factors assessed pre- and post-intervention; receipt of cervical cancer screening assessed by review of electronic medical records. Cost-effectiveness was measured by ratio comparing additional cost per participant screened with usual-care group	Seven months after randomization, significantly more women in the promotora intervention received a Pap test (53.4%) compared to the video group (38.7%); $p < .001$ and usual care arm (34% ; $p < .01$)
Vanderpool, Cohen, Crosby, Jones, Bates, Casey, Collins (2013)	RCT; women ages 18–26, not previously vaccinated against HPV ($n=344$); Appalachian Kentucky	Theory of Planned Behavior; Motivation, behavioral skills model	After receiving first dose of HPV vaccine, participants in intervention group watched 13-minute educational DVD	Intent to complete vaccination series measured by questionnaire; Vaccine series completion rate measured by medical record review	Participants assigned to the intervention were 2.44 times more likely than women in the usual care group to complete the series. Women's beliefs that all 3 doses reduced cancer risk predicted intent and completion. Intention predicted completion

Percentage of studies reporting health equity factors according to CONSORT-Equity 2017

Extension for health equity relevant trials		% (n=11)
1	Rationale for focus on health equity	100
2	Methods of recruitment to reach populations across relevant PROGRESS-Plus characteristics	100
3	Objective with reference to health equity	91
4	Report any limitations related to assessing effects on health equity	91
5	Applicability related to population of interest across PROGRESS-Plus characteristics	91
6	Trial design to answer equity questions	91
7	Population eligibility criteria across relevant PROGRESS-Plus / characteristics	91
8	Context and relationship to health inequity	91
9	Details of partnerships with populations and communities	91
10	Participants who were assigned, received, and who were analyzed across relevant PROGRESS-Plus characteristics	63
11	Numbers of participants randomly assigned, received, and were analyzed across relevant PROGRESS-Plus characteristics	63
12	Baseline characteristics across relevant PROGRESS-Plus characteristics	63
13	Details of ethical clearance and informed consent	54
14	Additional analyses focused on health equity	45
15	Additional analytic approaches related to equity objectives distinguishing pre-specified from exploratory	45
16	Outcomes relevant and important to population(s) across PROGRESS-Plus	36
17	Losses and exclusions after randomization across relevant PROGRESS-Plus characteristics with reasons	36
18	Randomization was stratified by geographical region and quality of care	36
19	Details of implementation (coverage, intensity) in each trial arm across relevant PROGRESS-Plus characteristics	27
20	Analyses focused on health equity objectives are powered to detect differences	18
21	Comparator intervention as standard of care and whether it has equity implications	0
22	Whether inequities caused by the intervention (such as unintended effects) were assessed	0

/ PROGRESS-Plus characteristics are place of residence, race/ethnicity/culture/language, occupation, gender/sex, religion, education, socioeconomic status, personal characteristics associated with discrimination, features of relationships, and time-dependent relationships