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Protective factors for reducing premalignant cervical lesions in women: systematic review for public management

Factores protectores para reducir lesiones premalignas de cérvix en mujeres: revisión sistemática para gestión pública

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Abstract

The objective of this systematic review was to identify protective factors for the public management of premalignant cervical lesions in women. The PRISMA methodology was applied to databases such as Scielo, Scopus, ProQuest, and ScienceDirect, including 53 studies published between 2018 and 2025, with quantitative, qualitative, or mixed designs. The findings are organized into three categories. First, biological prevention includes HPV vaccination (tetravalent and nonavalent), which is effective even after surgical procedures, as well as the presence of a cervicovaginal microbiome dominated by Lactobacillus. Second, in the behavioral sphere, prevention is related to delaying the onset of sexual activity, reducing the number of partners, using condoms, avoiding smoking, and adhering to health education programs. Finally, with regard to the health system, strategies should include organized screening, HPV testing, community support models, and provider training, which promotes early detection and reduces recurrence. These results contribute to strengthening public management through the integration of vaccination, education, and screening, in line with the WHO's cervical cancer elimination goals.

Keywords: health education, women's health, cancer.

Resumen

El objetivo de esta revisión sistemática fue identificar factores protectores para la gestión pública de lesiones premalignas de cérvix en mujeres. Se aplicó la metodología PRISMA en bases de datos como Scielo, Scopus, ProQuest y ScienceDirect, incluyendo 53 estudios publicados entre 2018 y 2025, con diseños cuantitativos, cualitativos o mixtos. Los hallazgos se organizan en tres categorías. En primer lugar, la prevención biológica incluye la vacunación contra el VPH (tetravalente y nonavalente), efectiva incluso después de procedimientos quirúrgicos, así como la presencia de un microbioma cervicovaginal dominado por Lactobacillus. En segundo lugar, en el ámbito conductual, la prevención se relaciona con la postergación del inicio de la actividad sexual, la reducción del número de parejas, el uso del condón, evitar el tabaquismo y la adherencia a programas educativos sanitarios. Finalmente, respecto al sistema de salud, las estrategias deben contemplar el tamizaje organizado, la prueba de VPH, los modelos comunitarios de acompañamiento y la capacitación de proveedores, lo cual favorece la detección temprana y reduce recurrencias. Estos resultados contribuyen a fortalecer la gestión pública mediante la integración de vacunación, educación y tamizaje, en línea con las metas de eliminación del cáncer cervical propuestas por la OMS.

Palabras clave: educación sanitaria, salud de la mujer, cáncer.

Introduction

Cervical dysplasia or neoplasia is a critical public health concern globally, ranking as the fourth most common neoplasm in women. Since 2020, it has affected over 600,000 individuals and resulted in approximately 350,000 deaths (Bogdanova et al., 2022). Notably, around 85% of these cases and fatalities occur predominantly

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in low- and middle-income countries (Bogdanova et al., 2022; Chidyaonga-Maseko et al., 2015), where it stands as the second leading cause of cancer and the third leading cause of cancer mortality among women (Pimple & Mishra, 2016).

Efforts to prevent abnormal cell growth on the cervix must prioritize timely detection and treatment, as such conditions can progress to invasive carcinoma. The most widely reported cause of dysplasia and cervical cancer is persistent infection with the human papillomavirus (HPV) (Alligood-Percoco & Kesterson, 2015; Morales, 2003). Therefore, addressing multifaceted risk factors is crucial (Priya et al., 2022). Consequently, identifying these factors is essential for developing preventive or protective strategies.

Cervical cancer prevention is known to encompass various strategies; however, implementation remains challenging, particularly in developing countries, due to financial constraints and limited awareness of the disease (Pimple & Mishra, 2016). HPV vaccination has marked a significant advance in primary prevention, with favorable outcomes anticipated as part of biological prevention efforts. Additionally, behavioral prevention strategies include safe sexual practices, avoidance of smoking, and adherence to healthy lifestyles (Priya et al., 2022). Supplements such as retinoids or vitamins may also exhibit chemopreventive effects (Arellano Ortiz et al., 2013). Furthermore, timely screening and diagnostic access within health systems are fundamental.

It is imperative to verify the extent of protective factors in health management through a systematic review of global evidence. The research question posed was: What are the protective factors for the prevention of cervical premalignant lesions, compared to women without such interventions, between 2018 and 2025?

Methodology

Eligibility criteria

The principal criteria established were: a search period spanning the last seven years (2018–2025), the exclusive inclusion of scientific articles, and the consideration of studies from any part of the world relating to cervical dysplasia and its prevention from various perspectives. Both quantitative, qualitative, and mixed-methods studies on the topic were included. Sources such as opinions, books, editorials, theses of any type, and articles in languages other than Spanish, English, and Portuguese were excluded.

Information sources

Article records were obtained from ProQuest, Scopus, SciELO, and ScienceDirect. The final search was conducted in September 2025.

Search strategy

To identify studies, combinations of keywords in both English and Spanish were employed, including: "protective," "factors," "role," "cervical dysplasia," "cervical neoplasia," "prevent," "displasia cervical," "neoplasia cervical," and "prevención displasia cervical." No additional filters were applied beyond the publication period, nor was the search restricted by country.

Selection process

The articles were reviewed by the study authors. Initially, abstracts were read, followed by a thorough examination of the full texts, which facilitated the final inclusion of relevant studies. The Rayyan tool was utilized for screening, allowing for the selective identification of records most pertinent to the study variables, in addition to filtering out duplicates.

Presentation of results

To organize the data obtained, the information from the articles was systematically arranged into tables created using Excel. This tool facilitated a clear summary of the information, highlighting aspects such as authors, year of publication, methodology, country, findings, and study relevance.

Results

Figure 1.
PRISMA flow diagram of selected articles

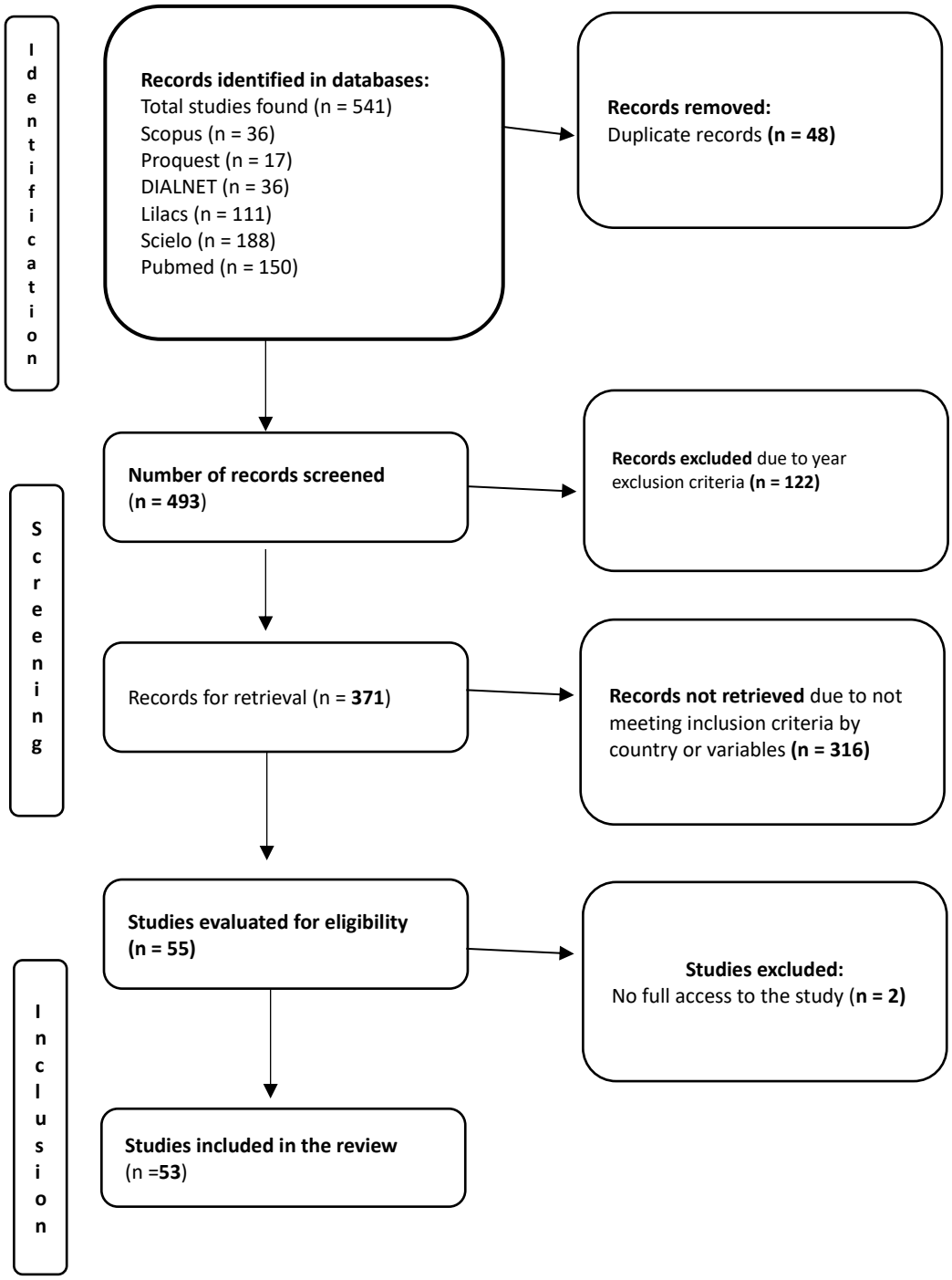


Table 1

Matrix on preventive aspects of cervical dysplasia

N	Author and Year	Findings
1	Adhikari et al. (2018)	Oral contraceptives (for over one year) reduced the risk of cervical intraepithelial neoplasia grade 1.
2	Alcántara-Quintana et al. 2022	Exosomes used for early diagnosis of cervical cancer (CC), monitoring, and potential treatment.
3	Almeida et al. 2019	Risk factors: non-white ethnicity, early sexual debut, unprotected intercourse.
4	Anaya Rodríguez, 2024	Nonavalent vaccine effective against HPV, including cervical intraepithelial neoplasias (CIN) and cervical cancer.
5	Banila et al. (2025)	Specific microbial strains associated with the development and resolution of CIN3.
6	Bao et al. (2018)	Combinations of HLA and KIR alleles associated with risk or protection against cervical neoplasia.
7	Bogani et al. (2020)	Vaccination was beneficial for women with persistent HPV.
8	Bogani et al., 2024	HPV vaccination after hysterectomy would protect against dysplasia.
9	Bruera et al. 2024	STIs and partner sexual violence: key predictors of gynecological proliferative lesions.
10	Butorac et al. (2022)	Physicians have a positive attitude toward HPV vaccination, with no contraindications for tertiary prevention.
11	Chen et al. 2023	Prophylactic quadrivalent HPV vaccination after LEEP was protective; non-vaccination increased risk.
12	Cohen et al. 2019	Postcoital bleeding (PCB) is a significant risk factor.
13	Donkoh et al. 2022	Vaccine-preventable genotypes, with HPV-52 as the most prevalent high-risk genotype, and HPV-16 as low-risk.
14	Escobar et al. 2023	Educational intervention increased knowledge and intention for self-care.
15	Galdos Kajatt 2018	Quadrivalent vaccination: primary prevention strategy that should be complemented with secondary screening.
16	Giovannetti et al. 2023	LEEP surgery reverses microenvironments to a healthy state, reducing microbial dysbiosis associated with dysplasia.
17	Hurtado-Salgado et al. 2018	High-risk HPV and cytology testing detected twice as many CIN2+ lesions compared to conventional cytology.
18	Kjaer et al. 2020	The quadrivalent vaccine (qHPV) demonstrated sustained efficacy.
19	Lalinde et al. 2022	Early diagnosis of cervical cancer is crucial to avoid diagnosis at metastatic stages.
20	Lieb et al. (2023)	Endocervical resection as a protective factor against recurrence.
21	Long et al., 2023	Bacterial vaginosis (BV) is a protective factor against cytological abnormalities and HPV infections.
22	Lugović-Mihić et al., 2021	Coping with stress helps reduce immunity; psychosomatic interventions can alleviate the impact of chronic stress.
23	Maria et al., (2018)	Nonavalent vaccination: significant reduction in morbidity and mortality from cervical cancer. Screening for various STIs is important.
24	Melo et al. (2019)	Fewer years of sexual activity correlate with lower likelihood of an atypical Pap smear. Emphasizing counseling at various ages is recommended.
25	Montero Lora et al., 2018	Pap test, sexual and reproductive education, and reduced promiscuity are protective factors.
26	Nascimento et al., 2018	Early detection programs for HPV and health education are required; employing more efficient therapeutic strategies.
27	Ngu et al., 2024	HPV vaccination and secondary cervical screening (cytology/HPV testing) are preventive measures.
28	Novais et al., 2023	Cytological screening showed a protective effect. HPV vaccination is a primary prevention measure.
29	Pecinato et al., 2022	Pap testing for early diagnosis and treatment is an effective preventive measure.

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30	Petrillo et al., 2020	HPV vaccination after LEEP surgery is a protective factor against severe cervical lesions.
31	Phoolcharoen et al., 2021	Training in procedures like colposcopy, cervical biopsy, thermal ablation, and LEEP increases preventive health providers' capabilities.
32	Punchoo et al., 2025	Potential role of vitamin D in primary prevention.
33	Montero Lora et al. - 2018	Pap test as the best preventive method; stability in relationships and avoidance of early sexual activity are also important.
34	Ramachandran et al. 2021	Certain genetic changes (allelic variants rs10175462) seem to provide protection against cervical cancer, reducing risk.
35	Rantshabeng et al. - 2024	Screening programs and linking participants with lesions reduces the disease burden.
36	Reynolds et al. 2024	Community educators' assistance model enables immediate identification and treatment, preventing progression to cancer.
37	Rippinger et al. 2019	Gynecological check-ups are the primary preventive measure.
38	Rosa et al. 2021	Regular check-ups and health education for early detection; high educational level is an indirect social protective factor.
39	Rosas Salinas et al. 2024	Local Hormone Replacement Therapy as a cost-effective alternative that allows for a more accurate diagnosis by eliminating changes due to cervical atrophy.
40	Rourke et al. 2024	HPV vaccination may reduce cervical cancer and disease decline.
41	Rozario et al. 2019	Screening and treatment programs decrease the incidence and mortality of squamous cell carcinoma. Never having smoked is a preventive aspect.
42	Salcedo et al. 2023	Education by community health promoters is key to protection; training of providers ensures sustainability.
43	Sladič et al. 2022	HPV vaccination is preventive, although not for all genotypes; follow-up in young patients is necessary.
44	Soto-Fuenzalida et al. 2020	Local high-prevalence HPV vaccination for primary prevention; Pap tests allow for timely identification of precursor lesions.
45	Staples et al. 2018	Formal education increases knowledge about Pap tests, which can detect cervical changes; promotes condom use and HPV vaccination.
46	Swiecki-Sikora et al. 2024	Vaccination after treatment can reduce recurrent cervical dysplasia.
47	Tasić et al. 2018	Condom use demonstrated a protective role in women infected with HPV; promoting HPV vaccination is critical.
48	Tossas et al. 2023	An optimal vaginal microbiome (Lactobacillus) was protective for women, though not all according to ethnicity.
49	Wang et al. 2024	Treating vaginal lesions during LEEP decreases the risk of residual issues.
50	Ybaseta-Medina, 2024	Health education on sexual practices and early detection; high educational level and use of injectable contraceptives or IUDs were inversely associated with cervical dysplasia.
51	Zeng et al. 2025	Vaginal environment dominated by Lactobacillus is protective, maintaining normal pH levels (≤ 4.5).
52	Zhang et al. 2025	Expanding health coverage is essential for prevention in health education campaigns.
53	Zhu et al. 2025	Genetically identified gut microbiota have a protective effect against high-risk HPV infection; dietary interventions or probiotics may be a strategy.

Frequency of studies

The systematic review of 53 articles reveals a broad geographical distribution of research. The most represented countries include Brazil (7 studies), Mexico (6), China (6), Colombia (4), Cuba (3), Germany (3), and the United States (4). Other nations, such as Peru, Argentina, Ghana, South Africa, Burkina Faso, Serbia, Ireland, Slovenia, Botswana, Liberia, and regions like Europe and Hong Kong, contribute between one and two studies each. Methodologically, epidemiological and cross-sectional observational studies predominate, accounting for approximately 40% of the articles, followed by prospective or longitudinal cohort studies (25%), literature reviews

(10%), educational intervention studies (10%), and case reports along with genetic or molecular studies (15%). In terms of publication years, 60% of the studies are concentrated from 2020 onward, with an increase noted in 2023 and 2024, reflecting the current relevance of this topic in scientific literature.

Discussion

This review synthesizes evidence regarding preventive factors against cervical cancer, necessitating biological, behavioral, and health system-strengthening strategies. The aspects with the most consistent evidence relate to HPV vaccination (Bogani et al., 2020; Chen et al., 2023; Swiecki-Sikora et al., 2024; Petrillo et al., 2020) and the rigorous implementation of secondary screening (Hurtado-Salgado et al., 2018; Montero Lora et al., 2018; Ybaseta-Medina, 2024). Additional biological protective factors encompass genetic, immunological, and microbiological characteristics; for instance, a vaginal environment dominated by Lactobacillus spp. is considered protective (Wang et al., 2019; Zeng et al., 2025; Tossas et al., 2023). Genetically, certain allelic variants (such as rs10175462) have been identified as protective against cervical cancer and high-grade dysplasia, associated with approximately a two-thirds risk reduction (Ramachandran et al., 2021).

Concerning health systems evidence, the management of HPV vaccination stands out. The quadrivalent vaccine has demonstrated sustained efficacy of 98% over 14 years against lesions related to this virus in previously unexposed women (Kjaer et al., 2020), whereas the nonavalent vaccine protects against multiple genotypes and reduces the incidence of invasive cancer (Anaya Rodríguez, 2024). Moreover, health systems can implement tertiary prevention measures through surgical optimization; for example, additional endocervical resection during LEEP offers protection against recurrence (Lieb et al., 2023). Models such as "Screen-Triage-Treat" (Reynolds et al., 2024), supported by community health promoters, have proven effective in ensuring follow-up for women in low-resource areas (Reynolds et al., 2024; Salcedo et al., 2023).

In terms of behavioral and social prevention, educational level gaps are emphasized, as lower educational attainment is associated with diagnoses at advanced stages. Regarding sexual behaviors, reducing the number of partners and avoiding early sexual initiation are critical factors; furthermore, condom use showed a protective role even in women already infected with high-risk HPV (Tasić et al., 2018; Zhang et al., 2025). Regular gynecological check-ups are also a key preventive measure (Montero Lora et al., 2018; Rippinger et al., 2019). Notably, never having smoked was inversely associated with squamous cell carcinoma (Rozario et al., 2019). Educational interventions improve knowledge, awareness, and self-care, promoting regular cytology screenings (Escobar et al., 2023; Staples et al., 2018). Lastly, nutritional factors such as adequate levels of vitamin D were inversely related to high-grade squamous intraepithelial lesions (HSIL) in uninfected women, suggesting potential protective actions (Punchoo et al., 2025).

The findings are complemented by other reviews. Luvián-Morales et al. (2024) identified risks such as coinfections, smoking, microbiota, and the use of hormonal contraceptives; however, this review incorporates both clinical and public health environments. While causality regarding microbiota and comorbidities has been noted, this study adds specificity by identifying strains and environments, such as Lactobacillus, with a clear protective role (Wang et al., 2019; Zeng et al., 2025). The pattern of results concerning tertiary prevention through post-LEEP vaccination (Bogani et al., 2020; Petrillo et al., 2020) offers a clinically relevant contribution that supports active strategies following treatment.

Conclusions

The results of this review may contribute to achieving the World Health Organization's (WHO) targets for cervical cancer elimination by 2030, particularly concerning the 90-70-90 strategy (Organización Mundial de la Salud, 2020). In relation to the goal of vaccinating 90% of girls by age 15, the findings emphasize the urgent need to strengthen promotion and prevention programs (Luvián-Morales et al., 2024). With regards to the objective of 70% of women screened using high-precision tests (Organización Mundial de la Salud, 2020), there is a recommendation to utilize and expand screening coverage for high-risk HPV (Hurtado-Salgado et al., 2018; Ngu et al., 2024).

Finally, to ensure access to timely treatment, community care models, such as "Screen-Triage-Treat," along with postoperative vaccination (Chen et al., 2023; Petrillo et al., 2020), represent cost-effective strategies that can enhance therapeutic adherence and respond more efficiently to this public health issue.

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