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Articles

2701-2712

- PDF

- **Indigenous People Carrying Capacity; Consciousness of Protecting Nature**

  Ahmad Sopian Pamungkas

  2680-2688

  - PDF

- **Prevalence of Hyperemesis Gravidarum Based on Age, Parity, and Severity**

  Sarah Chaerani Salsa Bella, Syamsul Bahri M.S. Idris, Prita Aulia M. Selomo

  2514-2519

  - PDF

- **The Effect of Bladder (BL) 32 Acupressure Point on Reducing Labor Pain Intensity During Active Phase of First Stage in Laboring Women**

  Daris Yolanda Sari

  2520-2527

  - PDF

- **Characteristics of Infarct and Hemorrhagic Stroke Patients Who Died at RSUD Bayu Asih Purwakarta, JanuaryDecember 2024**

  Ahmad Zakki Komarudin, Taufan Putra Widodo, Murti Astuti, Zuhaira Syam, Ganda Septianda Hedwar

  2506-2513

  - PDF

- **Instagram Live as a Promotional Media for Inacraft Exhibitions**

  M Rizky Antasari

  2464-2653

  - PDF

- **The Effect of Implementing the 8p Digital Marketing Strategy on Purchase Intention for Bvlgari Luxury Perfumes: A Binary Logistic Regression Analysis**

  Yudi Nugraha, Ricki Threezardi, Retno Dwirahmawati, Jerry Heikal

  2615-2626

  - PDF

- **Implementation of Qur'anic Values in Educating Children (Interpretation of Surah Luqman Verses 13, 14, 16, 18, and 19)**

  Ahmad Wafi Nur Safaat

2567-2575

- PDF

- **Risk Analysis and Improvement of Information Systems on J&T Express Using the National Institute of Standards & Technology (NIST) 800-30 Framework**

  Alda Sagita, Sandfreni

  2689-2700

  - PDF

- **The Influence of Instagram and TikTok on E-commerce Purchase Decisions: Consumer Behavior Analysis using SEM-PLS**

  Sofyan Fathur Rahman, Ahmad Yasin, Faiza Renaldi, Tacbir Hendro Pudjiantoro

  2528-2540

  - PDF

- **Implementation of Field School Activities for Agricultural Technology Innovation in Klirong District, Kebumen Regency**

  Latifah Dwi Setiasih, Tyas Retno Wulan, Rili Windiasih, Masrukin, Lilik Kartika Sari

  2729-2745

  - PDF

- **Physiotherapy Management with Infrared, Transcutaneous Electrical Nerve Stimulation, and Nerve Tendon Gliding Exercise in Dextra Carpal Tunnel Syndrome Cases**

  Amanda Rilya Fressica, Suci Amanati

  2670-2679

  - PDF

- **The Effect of Efflurage Massage on Sleep Quality in Postpartum Women at Bayu Asih Hospital, Purwakarta Regency**

  Teti Yuli Handayani, Nita Oktiawati

  2560-2566

  - PDF

- **Learning Biography Text Writing Skills Using Canva Media for Class X TKR A Students of SMK Negeri 1 Gantiwarno (Case Study)**

  Indrastuti Budi Ristiyani, Basuki, Agus Yuliantoro

  2576-2585

  - PDF

- PDF

- **Effectiveness of Supportive Therapy in Reducing Anxiety in Adolescents in Sukamaju Village, Purwakarta**

  Shinny Ria Pratiwi

  2746-2754

  - PDF

- **Comparing the Relevance of the USE Questionnaire and Heatmap Analysis in Evaluating Usability and User Experience: A Case Study of the Unjani Information Systems Study Program Community Website**

  Meisya Putri Utami, Hasan Basri, Faiza Renaldi, Dea Destiani

  2541-2551

  - PDF

INTERNATIONAL INDEX

- **ADDITIONAL MENU**

- **EDITORIAL TEAM**
- **REVIEWERS**
- **FOCUS & SCOPE**
- **AUTHOR GUIDELINES**
- **PUBLICATION ETHICS & MISCONDUCTS**
- **PEER REVIEW PROCESS**
- **OPEN ACCESS STATEMENT & POLICY**
- **ARTICLE PROCESSING CHARGE**
- **PLAGIARISM POLICY**
- **INDEXING & ABSTRACTING**
- **COPYRIGHT AND LICENSE STATEMENT**

- **INFORMATION**

  - **FOR READERS**
  - **FOR AUTHORS**
  - **FOR LIBRARIANS**

- **Indexing**

- **JOURNAL ISSN BARCODE**

- **Template Journal**

- **STATISTIC COUNTER**

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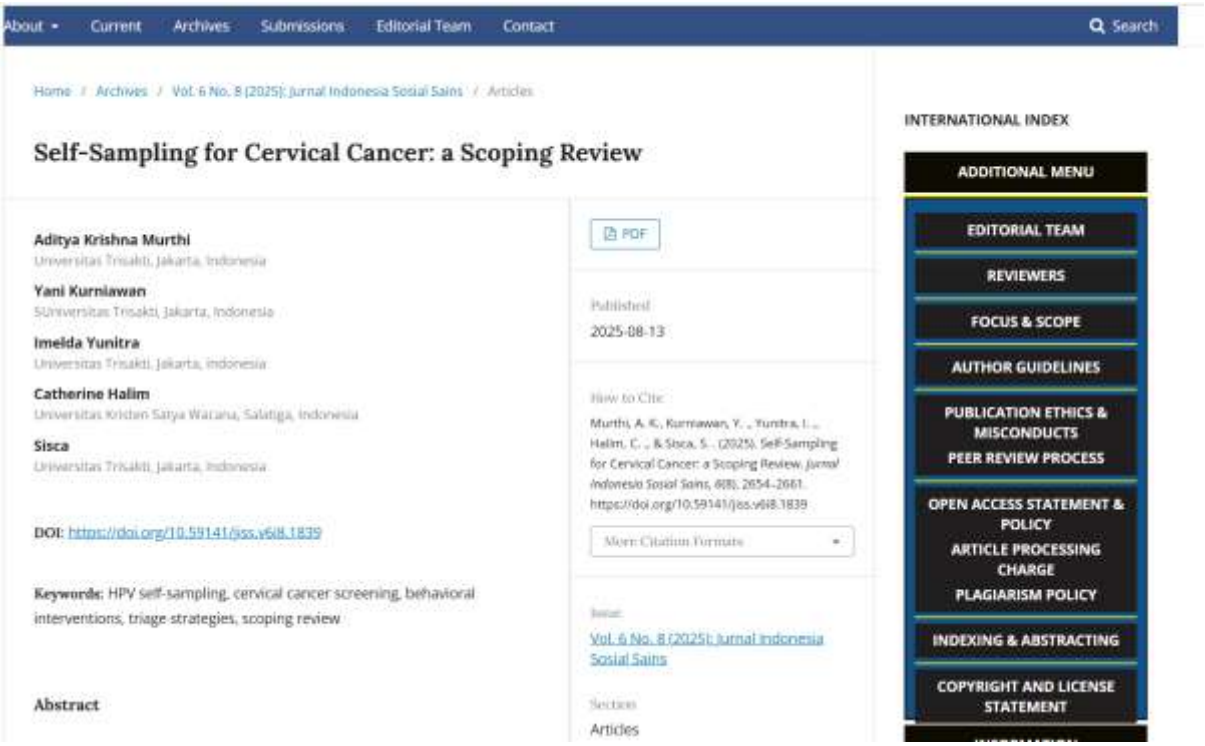

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Self-Sampling for Cervical Cancer: a Scoping Review

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KEYWORDS

HPV self-sampling; cervical cancer screening; behavioral interventions; triage strategies; scoping review.

ABSTRACT

Cervical cancer remains a major global health concern, particularly in low- and middle-income countries (*LMICs*), where barriers such as limited healthcare access, cultural stigma, and logistical challenges hinder routine screening. Human papillomavirus (*HPV*) self-sampling has emerged as a promising alternative to clinician-collected sampling, offering the potential to improve screening coverage and reduce the burden of cervical cancer. This scoping review aims to synthesize current evidence on the feasibility, effectiveness, and acceptability of *HPV* self- sampling, with a focus on its impact on screening uptake, psychological outcomes, and diagnostic accuracy. Following the *PRISMA-ScR* guidelines, a systematic search was conducted across PubMed, Google Scholar, and Scopus, resulting in the inclusion of five studies: four randomized controlled trials and one umbrella review. Findings indicate that self-sampling reduces anxiety associated with cervical screening, improves participation among underserved populations, and demonstrates high diagnostic concordance with clinician-collected samples. Behavioral interventions, such as *pay-it-forward* models, show potential to enhance sample return and feedback rates. However, challenges remain regarding effective triage strategies for *HPV*-positive cases, especially in resource-limited settings. The review supports the integration of self-sampling into national screening programs, emphasizing the need for culturally tailored approaches and continued research on cost-effective triage methods.

INTRODUCTION

Cervical cancer remains a significant global health challenge, ranking as the fourth most common cancer among women worldwide. According to the World Health Organization (*WHO*), approximately 600,000 new cases and over 340,000 deaths have been reported globally in recent years, with the highest burden in low- and middle-income countries (*WHO*, 2021). The primary etiological factor for cervical cancer is persistent infection with high-risk human papillomavirus (*HPV*) types, particularly *HPV*-16 and *HPV*-18, which are responsible for approximately 70% of cases (de Sanjosé et al., 2018).

Despite advances in screening and early detection, cervical cancer continues to cause substantial morbidity and mortality, underscoring the need for effective preventive and therapeutic strategies. Cancer vaccines have emerged as a promising approach to reduce the incidence and progression of cervical cancer. Prophylactic *HPV* vaccines, such as the bivalent, quadrivalent, and nonavalent vaccines, have demonstrated high efficacy in preventing infection with oncogenic *HPV* types and subsequent precancerous lesions (Garland et al., 2016). However, these vaccines are primarily preventive and have limited therapeutic effects on established infections or cervical cancer.

Therapeutic cancer vaccines, designed to stimulate the immune system to target and eliminate *HPV*-infected or transformed cells, represent a novel and evolving area of research. Various vaccine platforms, including peptide-based, viral vector-based, and *DNA/RNA*-based vaccines, are currently under investigation in clinical trials (Trimble et al., 2015; Melief et al., 2020). These vaccines aim to induce robust cellular immune responses against *HPV* oncoproteins E6 and E7, which are consistently expressed in cervical cancer cells. Current therapeutic vaccine development explores diverse platforms, including peptide-based, viral vector-based, and *DNA/RNA*-based vaccines, each with distinct advantages and limitations. Peptide vaccines, such as those targeting *HPV* oncoproteins E6 and E7, are safe and easy to produce but often exhibit limited immunogenicity. Viral vector-based vaccines (e.g., adenovirus or vaccinia vectors) induce robust immune responses but face challenges related to pre-existing immunity and safety concerns. *DNA/RNA* vaccines, exemplified by VGX-3100 in phase 2b trials, offer stability and scalability but require optimization for delivery and efficacy. Clinical trial results highlight varying success rates: while some *DNA* vaccines show promise in regressing precancerous lesions (e.g., 49.5% efficacy in CIN2/3 regression), others struggle with consistency. A critical gap remains in translating preclinical success into durable clinical outcomes, particularly in late-stage cancers.

Therapeutic options for existing *HPV* infections or cervical cancer are scarce, with conventional treatments such as surgery and chemoradiation often causing significant morbidity and failing to address recurrence. Therapeutic vaccines could fill this void by eliciting targeted immune responses, yet no such vaccine has achieved widespread clinical adoption. This review addresses this gap by synthesizing evidence from multiple vaccine platforms and clinical trials, offering a comparative analysis of their immunogenicity, safety, and efficacy across disease stages. By consolidating fragmented data, it aims to identify optimal strategies for vaccine design and highlight pathways for future research.

Given the rapid development and diverse approaches in cancer vaccine research for cervical cancer, a scoping review is warranted to synthesize the current evidence on their efficacy, safety, and immunogenicity. This review aims to provide a comprehensive assessment of cancer vaccines for cervical cancer, informing clinical practice and guiding future research directions. It offers significant benefits by synthesizing current evidence on therapeutic *HPV* vaccines, providing a valuable resource for researchers, clinicians, and policymakers. By comparing the efficacy, safety, and limitations of different vaccine platforms, it highlights the most promising candidates for clinical application, accelerating the development of effective treatments for existing *HPV* infections and cervical cancer. For healthcare providers, the review clarifies the potential of therapeutic vaccines as adjuncts or alternatives to conventional therapies, offering hope for improved patient outcomes, particularly in cases of advanced or recurrent disease. Additionally, the analysis of clinical trial data identifies gaps in current research, guiding future studies toward optimizing vaccine design and delivery. On a broader scale, this work supports public health efforts by informing policy decisions and funding priorities, ultimately contributing to the global goal of reducing cervical cancer incidence and mortality. Ultimately, this review bridges the gap between experimental research and real-world clinical practice, fostering progress toward accessible and equitable therapeutic solutions.

METHOD

This scoping review was conducted to comprehensively map the existing literature on *HPV* self-sampling for cervical cancer screening, with a focus on identifying key concepts, types of evidence, and research gaps. The methodology follows the framework outlined by

Levac, Colquhoun, and O'Brien (2010), as well as the *PRISMA-ScR* (*Preferred Reporting Items*

for Systematic Reviews and Meta-Analyses extension for Scoping Reviews) guidelines (Tricco

et al., 2018) to ensure methodological rigor and transparency, as shown in Figure 1.

A systematic search was carried out across three major electronic databases: PubMed, Google Scholar, and Scopus. The search aimed to capture peer-reviewed articles, clinical trial protocols, and relevant grey literature related to *HPV* self-sampling in cervical cancer screening. The following Boolean search string was used to maximize sensitivity while excluding irrelevant studies. Searches were adapted to the syntax and controlled vocabularies of each database, including the use of *Medical Subject Headings* (*MeSH*) in PubMed where applicable. No date or language restrictions were applied to capture the breadth of available evidence.

Eligibility Criteria

Given the exploratory nature of a scoping review, broad inclusion criteria were applied to encompass diverse study designs and contexts:

- Population: Women eligible for cervical cancer screening or diagnosed with cervical cancer, including underserved and minority populations.
- Concept: Studies examining *HPV* self-sampling methods, including behavioral interventions to improve uptake or feedback rates, diagnostic accuracy of self-sampling, psychological outcomes such as anxiety, and acceptability or feasibility.
- Context: Any healthcare setting globally, with no restrictions on geographic location or healthcare system.
- Types of Evidence: Randomized controlled trials (*RCTs*), observational studies, qualitative research, study protocols, systematic reviews, and meta-analyses.

Studies focusing exclusively on urine-based sampling were excluded to maintain focus on vaginal or cervical self-sampling methods.

Study Selection

All identified records were imported into reference management software, and duplicates were removed. Two independent reviewers screened titles and abstracts against the eligibility criteria. Full texts of potentially relevant studies were retrieved and assessed for inclusion. Discrepancies were resolved through consensus or, when necessary, consultation with a third reviewer.

Data Extraction

A standardized data extraction form was developed and pilot-tested. Extracted information included study characteristics (author, year, country, design), participant demographics, intervention and comparator details, outcomes measured (e.g., anxiety, screening uptake, feedback rates, diagnostic accuracy), and key findings. Both quantitative and qualitative data were captured to allow for a comprehensive overview.

Data Synthesis and Presentation

Given the heterogeneity of study designs and outcomes, a narrative synthesis approach was employed. Studies were grouped thematically according to major topics such as psychological impact, behavioral interventions, diagnostic accuracy, and acceptability. Descriptive tables were used to summarize study characteristics and findings. This approach facilitated the identification of research gaps and informed recommendations for future studies.

Quality Assessment

Consistent with scoping review methodology, formal risk of bias or quality appraisal of included studies was not conducted, as the primary aim was to map the evidence rather than critically appraise it.

Ethical Considerations

This review used publicly available data and did not involve human subjects; therefore, ethical approval was not required.

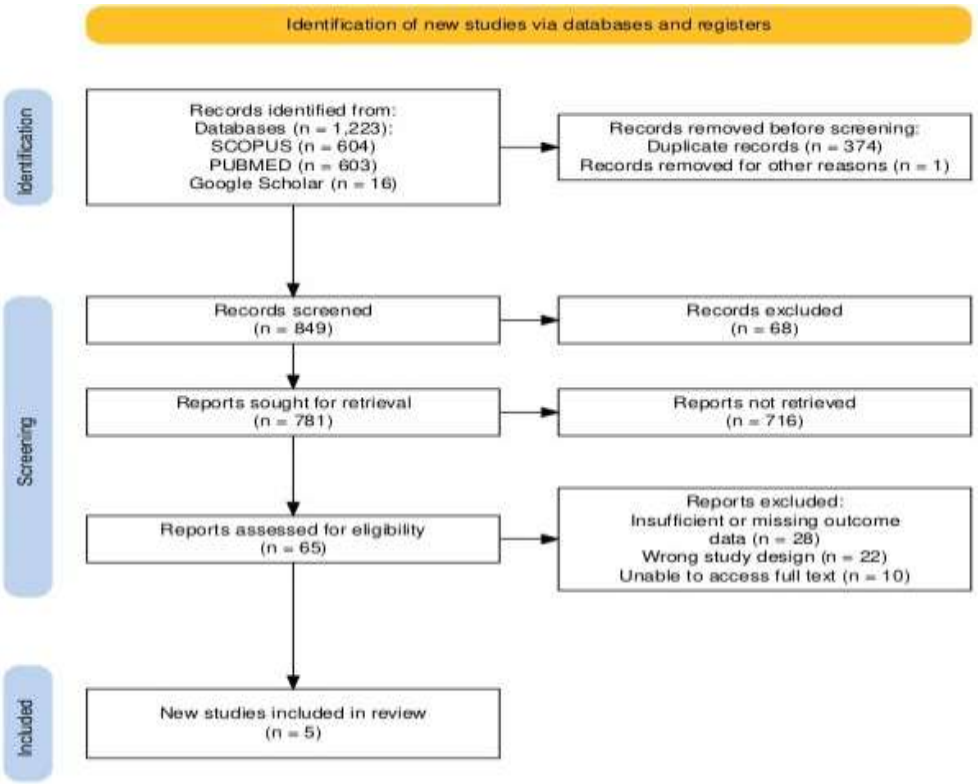

Figure 1. PRISMA flow diagram illustrating the selection process of studies for systematic review, resulting in 5 studies included from an initial 1,223 records identified Source: PRISMA guidelines (2021)

RESULTS AND DISCUSSIONS

The systematic review included four randomized controlled trials (RCTs) and one umbrella review focusing on HPV self-sampling for cervical cancer screening, as shown in table 1.The growing body of evidence from recent randomized controlled trials and qualitative investigations strongly supports the integration of HPV self-sampling as a feasible, acceptable, and effective strategy to improve cervical cancer screening coverage and outcomes. This approach addresses multiple barriers inherent in clinician-based sampling—such as anxiety, privacy concerns, logistical challenges, and cultural sensitivities—and thus holds promise for increasing participation especially among under screened and marginalized populations.

Table 1. Summary of Included Studies on HPV Self-Sampling for Cervical Cancer Screening

Authors	Year	Title	Participants / Subjects	Intervention/ Comparator	Outcome
Sen & Yilmaz	2025	The Effect of Self-Sampling or Clinician-Based Sampling on Anxiety in Cervical Cancer Screening	110 Turkish women aged 30–65, no prior screening in 5 years	Self-sampling vs Clinician-collected sampling	Self-sampling significantly reduced post-procedure anxiety (30.3 vs 41.5; $p<0.001$)

Zhou et al.	2025	A Pay-It-Forward Approach to Improve Feedback Rate of	108 ethnic minority women in Inner	Pay-it-forward self-sampling kits vs Free distribution	Primary: Feedback rate; Secondary: HPV positivity, adherence,

Authors	Year	Title	Participants / Subjects	Intervention/ Comparator	Outcome
		HPV-Based Self-Sampling...	Mongolia, China		psychological impact
Mekuria et al.	2024	Comparing VIA with/without Lugol's Iodine for Triage of HPV Positive Women in Ethiopia	878 screened; 197 HPV+ women	VIA + Lugol's iodine vs VIA only	Higher sensitivity with iodine (50% vs 25%), specificity ~84%
Zehbe et al.	2017	Self- vs Provider-Directed Sampling in Anishinaabek Cervical Cancer Screening Study	834 First Nations women in Canada + 69 qualitative participants	Self-sampling vs Pap cytology	Self-sampling preferred; doubled screening uptake
Arbyn et al.	2022	Meta-Analysis of Agreement in HPV Self- vs Clinician-Collected Samples	26 diagnostic test accuracy studies	Self-collected HPV tests vs Clinician-collected	High agreement: 84.6% (positive), 91.7% (negative)

In a Turkish RCT with 110 women aged 30–65 years, anxiety levels were measured using the State Anxiety Inventory before and after sampling. There was no significant difference in pre-test anxiety between the self-sampling group and clinician-collected group ($p > 0.05$). However, post-test anxiety was significantly lower in the self-sampling group (mean score 30.3) compared to the clinician-sampled group (mean score 41.5, $p < 0.001$). All HPV DNA tests were negative, and sample adequacy was confirmed by detection of the β-globin gene in all samples. The study provides compelling evidence that self-sampling significantly reduces anxiety compared to clinician-collected sampling.

Anxiety related to cervical cancer screening is a well-documented barrier, often driven by discomfort with pelvic examinations, embarrassment, fear of pain, and concerns about privacy (Sen and Yilmaz, 2025; Polman et al., 2019; Chaw et al., 2022). Their study found that while pre-test anxiety levels were similar, post-test anxiety scores were significantly lower in the self-sampling group (mean 30.3 vs 41.5, $p < 0.001$). This reduction in anxiety is critical because it may encourage women who otherwise avoid screening due to psychological distress to participate. The study also demonstrated that self-collected samples were adequate for HPV DNA testing, with all samples testing negative in this cohort, highlighting the technical feasibility and reliability of self-sampling. These findings align with international literature showing high acceptability and preference for self-sampling, including studies in Spain (Ibanez et al., 2023).

Building on acceptability, Zhou et al. (2025) introduced an innovative behavioral economic intervention—the Pay-It-Forward model—in ethnic minority regions of Inner Mongolia, China. This randomized controlled trial protocol aims to improve the feedback rate of HPV self-sampling results by requiring participants to pay a refundable deposit before receiving the self-sampling kit. This ongoing RCT protocol in Inner Mongolia, China, plans to enroll 108 women aged ≥24 years, randomized to either a pay-it-forward prepayment group or a free kit distribution group. The pay-it-forward group pays a refundable 20 RMB deposit to encourage timely feedback of self-sampling results. The primary outcome is the feedback rate of HPV self-sampling results within one month. Secondary outcomes include HPV positivity rate, treatment adherence, psychological status, and knowledge.

The intervention of this study aims to enhance psychological commitment and improve screening effectiveness, particularly in ethnic minority regions. This strategy leverages

psychological commitment and the sunk cost effect to motivate timely sample submission and feedback, addressing a major challenge in self-sampling programs: low return rates of samples and results (Zhou et al., 2025). Given the sociocultural and economic barriers in rural and minority populations, this approach may enhance adherence to screening and follow-up care, ultimately improving early detection and treatment. The study's design, incorporating urban-rural stratification and comprehensive psychosocial assessments, promises valuable insights into scalable interventions to increase screening participation in resource-limited settings.

From a diagnostic and triage perspective, Mekuria et al. (2024) evaluated visual inspection with acetic acid (VIA), with and without Lugols iodine, as triage tests for HPV-positive women identified through self-sampling in Ethiopia. Approximately 878women were screened, with 197 (22.4%) testing hrHPV positive via self-sampling. HPV-positive women were randomized to visual inspection with acetic acid (VIA) alone or VIA combined with Lugols iodine. The study concluded that VIA with iodine improved detection but was not significantly better than VIA alone for triage of HPV-positive women. While VIA with iodine demonstrated higher sensitivity (50%) and specificity (84.6%) for detecting cervical intraepithelial neoplasia grade 2 or higher (CIN2+) compared to VIA alone (sensitivity 25%, specificity 82.7%), the difference was not statistically significant (p=0.5). Importantly, HIV-positive women had a significantly higher risk of CIN2+ (odds ratio 5.1), underscoring the need for tailored triage and treatment strategies in high HIV prevalence areas (Mekuria et al., 2024). The study highlights the limitations of VIA-based triage due to its subjective nature and variable accuracy, emphasizing the urgent need for more sensitive, affordable, and scalable triage methods such as DNA methylation markers or HPV genotyping, particularly in low-resource settings (Manley et al., 2022; World Health Organization, 2021).

The Anishinaabek Cervical Cancer Screening Study (ACCSS) by Zehbe et al. (2017) provides crucial qualitative and quantitative insights into the acceptability of HPV self-sampling among Indigenous First Nations women in Canada. It used a mixed-methods approach including qualitative interviews, focus groups, and a cluster RCT involving 834 First Nations women in Canada. Women strongly preferred HPV self-sampling over clinician-administered Pap tests due to greater accessibility, privacy, personal control, and less physical and emotional discomfort. Self-sampling doubled screening uptake compared to Pap screening. Participants emphasized the need for culturally sensitive education, including de-stigmatization of HPV and involvement of men in awareness efforts.

The study demonstrated that self-sampling was strongly preferred over Pap tests due to enhanced privacy, personal control, and less physical and emotional discomfort. These factors contributed to a doubling of screening uptake, addressing persistent health disparities in cervical cancer incidence and mortality faced by Indigenous populations (Zehbe et al., 2017). This study emphasized the necessity of culturally sensitive education programs that include men and address HPV-related stigma to foster community-wide acceptance. These findings resonate globally, as self-sampling has been shown to overcome structural barriers such as transportation, childcare, and clinic accessibility, particularly in rural and underserved communities (Nelson et al., 2017).

Supporting the clinical validity of self-sampling, the umbrella review by Arbyn et al. (2014) synthesized data from 26 diagnostic accuracy studies and found high concordance between HPV testing on self-collected and clinician-collected samples, with agreement rates of 84.6% for positive and 91.7% for negative results. There was no significant difference in test positivity ratios between methods, supporting self-sampling as a reliable alternative to clinician sampling to increase screening coverage. This meta-analysis confirms that self-sampling is a reliable alternative to clinician sampling, capable of maintaining diagnostic accuracy while

expanding screening reach (Arbyn et al., 2014). Such evidence is critical to inform policy and guideline development for incorporating self-sampling into national screening programs.

CONCLUSION

HPV self-sampling is a feasible, acceptable, and effective approach to cervical cancer screening that reduces anxiety and overcomes numerous barriers. Supported by robust diagnostic accuracy data, it empowers women and improves screening participation, particularly among underserved groups. Innovative *behavioral economics* interventions and culturally tailored education can further enhance outcomes. Integrating self-sampling into public health programs represents a pivotal step toward achieving equitable cervical cancer prevention and, ultimately, its elimination.

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Self-Sampling for Cervical Cancer: a Scoping Review

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Self-Sampling for Cervical Cancer: a Scoping Review

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KEYWORDS

HPV self-sampling; cervical cancer screening; behavioral interventions; triage strategies; scoping review.

ABSTRACT

Cervical cancer remains a major global health concern, particularly in low- and middle-income countries (*LMICs*), where barriers such as limited healthcare access, cultural stigma, and logistical challenges hinder routine screening. Human papillomavirus (*HPV*) self-sampling has emerged as a promising alternative to clinician-collected sampling, offering the potential to improve screening coverage and reduce the burden of cervical cancer. This scoping review aims to synthesize current evidence on the feasibility, effectiveness, and acceptability of *HPV* self-sampling, with a focus on its impact on screening uptake, psychological outcomes, and diagnostic accuracy. Following the *PRISMA-ScR* guidelines, a systematic search was conducted across PubMed, Google Scholar, and Scopus, resulting in the inclusion of five studies: four randomized controlled trials and one umbrella review. Findings indicate that self-sampling reduces anxiety associated with cervical screening, improves participation among underserved populations, and demonstrates high diagnostic concordance with clinician-collected samples. Behavioral interventions, such as *pay-it-forward* models, show potential to enhance sample return and feedback rates. However, challenges remain regarding effective triage strategies for *HPV*-positive cases, especially in resource-limited settings. The review supports the integration of self-sampling into national screening programs, emphasizing the need for culturally tailored approaches and continued research on cost-effective triage methods.

INTRODUCTION

Cervical cancer remains a significant global health challenge, ranking as the fourth most common cancer among women worldwide. According to the World Health Organization (*WHO*), approximately 600,000 new cases and over 340,000 deaths have been reported globally in recent years, with the highest burden in low- and middle-income countries (*WHO*, 2021). The primary etiological factor for cervical cancer is persistent infection with high-risk human papillomavirus (*HPV*) types, particularly *HPV*-16 and *HPV*-18, which are responsible for approximately 70% of cases (de Sanjosé et al., 2018).

Despite advances in screening and early detection, cervical cancer continues to cause substantial morbidity and mortality, underscoring the need for effective preventive and therapeutic strategies. Cancer vaccines have emerged as a promising approach to reduce the incidence and progression of cervical cancer. Prophylactic *HPV* vaccines, such as the bivalent, quadrivalent, and nonavalent vaccines, have demonstrated high efficacy in preventing infection with oncogenic *HPV* types and subsequent precancerous lesions (Garland et al., 2016). However, these vaccines are primarily preventive and have limited therapeutic effects on established infections or cervical cancer.

Therapeutic cancer vaccines, designed to stimulate the immune system to target and eliminate *HPV*-infected or transformed cells, represent a novel and evolving area of research. Various vaccine platforms, including peptide-based, viral vector-based, and *DNA/RNA*-based vaccines, are currently under investigation in clinical trials (Trimble et al., 2015; Melief et al., 2020). These vaccines aim to induce robust cellular immune responses against *HPV* oncoproteins E6 and E7, which are consistently expressed in cervical cancer cells. Current therapeutic vaccine development explores diverse platforms, including peptide-based, viral vector-based, and *DNA/RNA*-based vaccines, each with distinct advantages and limitations. Peptide vaccines, such as those targeting *HPV* oncoproteins E6 and E7, are safe and easy to produce but often exhibit limited immunogenicity. Viral vector-based vaccines (e.g., adenovirus or vaccinia vectors) induce robust immune responses but face challenges related to pre-existing immunity and safety concerns. *DNA/RNA* vaccines, exemplified by VGX-3100 in phase 2b trials, offer stability and scalability but require optimization for delivery and efficacy. Clinical trial results highlight varying success rates: while some *DNA* vaccines show promise in regressing precancerous lesions (e.g., 49.5% efficacy in CIN2/3 regression), others struggle with consistency. A critical gap remains in translating preclinical success into durable clinical outcomes, particularly in late-stage cancers.

Therapeutic options for existing *HPV* infections or cervical cancer are scarce, with conventional treatments such as surgery and chemoradiation often causing significant morbidity and failing to address recurrence. Therapeutic vaccines could fill this void by eliciting targeted immune responses, yet no such vaccine has achieved widespread clinical adoption. This review addresses this gap by synthesizing evidence from multiple vaccine platforms and clinical trials, offering a comparative analysis of their immunogenicity, safety, and efficacy across disease stages. By consolidating fragmented data, it aims to identify optimal strategies for vaccine design and highlight pathways for future research.

Given the rapid development and diverse approaches in cancer vaccine research for cervical cancer, a scoping review is warranted to synthesize the current evidence on their efficacy, safety, and immunogenicity. This review aims to provide a comprehensive assessment of cancer vaccines for cervical cancer, informing clinical practice and guiding future research directions. It offers significant benefits by synthesizing current evidence on therapeutic *HPV* vaccines, providing a valuable resource for researchers, clinicians, and policymakers. By comparing the efficacy, safety, and limitations of different vaccine platforms, it highlights the most promising candidates for clinical application, accelerating the development of effective treatments for existing *HPV* infections and cervical cancer. For healthcare providers, the review clarifies the potential of therapeutic vaccines as adjuncts or alternatives to conventional therapies, offering hope for improved patient outcomes, particularly in cases of advanced or recurrent disease. Additionally, the analysis of clinical trial data identifies gaps in current research, guiding future studies toward optimizing vaccine design and delivery. On a broader scale, this work supports public health efforts by informing policy decisions and funding priorities, ultimately contributing to the global goal of reducing cervical cancer incidence and mortality. Ultimately, this review bridges the gap between experimental research and real-world clinical practice, fostering progress toward accessible and equitable therapeutic solutions.

METHOD

This scoping review was conducted to comprehensively map the existing literature on *HPV* self-sampling for cervical cancer screening, with a focus on identifying key concepts, types of evidence, and research gaps. The methodology follows the framework outlined by Levac, Colquhoun, and O'Brien (2010), as well as the *PRISMA-ScR* (*Preferred Reporting Items*

for Systematic Reviews and Meta-Analyses extension for Scoping Reviews) guidelines (Tricco et al., 2018) to ensure methodological rigor and transparency, as shown in Figure 1.

A systematic search was carried out across three major electronic databases: PubMed, Google Scholar, and Scopus. The search aimed to capture peer-reviewed articles, clinical trial protocols, and relevant grey literature related to *HPV* self-sampling in cervical cancer screening. The following Boolean search string was used to maximize sensitivity while excluding irrelevant studies. Searches were adapted to the syntax and controlled vocabularies of each database, including the use of *Medical Subject Headings* (*MeSH*) in PubMed where applicable. No date or language restrictions were applied to capture the breadth of available evidence.

Eligibility Criteria

Given the exploratory nature of a scoping review, broad inclusion criteria were applied to encompass diverse study designs and contexts:

- Population: Women eligible for cervical cancer screening or diagnosed with cervical cancer, including underserved and minority populations.
- Concept: Studies examining *HPV* self-sampling methods, including behavioral interventions to improve uptake or feedback rates, diagnostic accuracy of self-sampling, psychological outcomes such as anxiety, and acceptability or feasibility.
- Context: Any healthcare setting globally, with no restrictions on geographic location or healthcare system.
- Types of Evidence: Randomized controlled trials (*RCTs*), observational studies, qualitative research, study protocols, systematic reviews, and meta-analyses.

Studies focusing exclusively on urine-based sampling were excluded to maintain focus on vaginal or cervical self-sampling methods.

Study Selection

All identified records were imported into reference management software, and duplicates were removed. Two independent reviewers screened titles and abstracts against the eligibility criteria. Full texts of potentially relevant studies were retrieved and assessed for inclusion. Discrepancies were resolved through consensus or, when necessary, consultation with a third reviewer.

Data Extraction

A standardized data extraction form was developed and pilot-tested. Extracted information included study characteristics (author, year, country, design), participant demographics, intervention and comparator details, outcomes measured (e.g., anxiety, screening uptake, feedback rates, diagnostic accuracy), and key findings. Both quantitative and qualitative data were captured to allow for a comprehensive overview.

Data Synthesis and Presentation

Given the heterogeneity of study designs and outcomes, a narrative synthesis approach was employed. Studies were grouped thematically according to major topics such as psychological impact, behavioral interventions, diagnostic accuracy, and acceptability. Descriptive tables were used to summarize study characteristics and findings. This approach facilitated the identification of research gaps and informed recommendations for future studies.

Quality Assessment

Consistent with scoping review methodology, formal risk of bias or quality appraisal of included studies was not conducted, as the primary aim was to map the evidence rather than critically appraise it.

Ethical Considerations

This review used publicly available data and did not involve human subjects; therefore, ethical approval was not required.

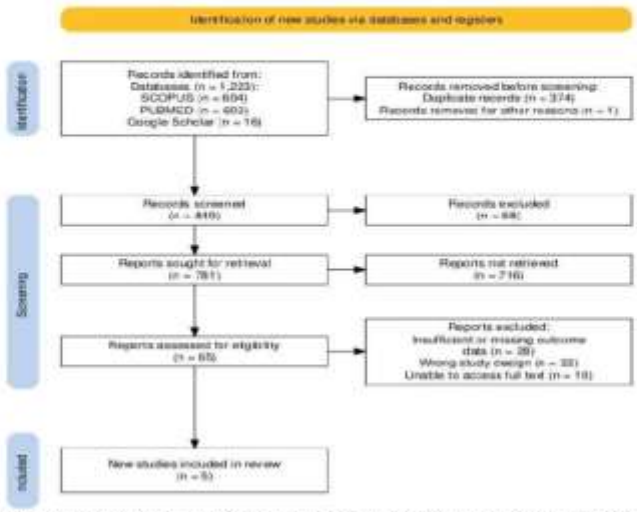

Figure 1. PRISMA flow diagram illustrating the selection process of studies for systematic review, resulting in 5 studies included from an initial 1,223 records identified
Source: PRISMA guidelines (2021)

RESULTS AND DISCUSSIONS

The systematic review included four randomized controlled trials (RCTs) and one umbrella review focusing on HPV self-sampling for cervical cancer screening, as shown in table 1.The growing body of evidence from recent randomized controlled trials and qualitative investigations strongly supports the integration of HPV self-sampling as a feasible, acceptable, and effective strategy to improve cervical cancer screening coverage and outcomes. This approach addresses multiple barriers inherent in clinician-based sampling—such as anxiety, privacy concerns, logistical challenges, and cultural sensitivities—and thus holds promise for increasing participation especially among under screened and marginalized populations.

Table 1. Summary of Included Studies on HPV Self-Sampling for Cervical Cancer Screening

Authors	Year	Title	Participants / Subjects	Intervention/ Comparator	Outcome
Sen & Yilmaz	2025	The Effect of Self-Sampling or Clinician-Based Sampling on Anxiety in Cervical Cancer Screening	110 Turkish women aged 30–65, no prior screening in 5 years	Self-sampling vs Clinician-collected sampling	Self-sampling significantly reduced post-procedure anxiety (30.3 vs 41.5; p<0.001)
Zhou et al.	2025	A Pay-It-Forward Approach to Improve Feedback Rate of	108 ethnic minority women in Inner	Pay-it-forward self-sampling kits vs Free distribution	Primary: Feedback rate; Secondary: HPV positivity, adherence,

Authors	Year	Title	Participants / Subjects	Intervention/ Comparator	Outcome
		HPV-Based Self-Sampling...	Mongolia, China		psychological impact
Mekuria et al.	2024	Comparing VIA with/without Lugol's Iodine for Triage of HPV Positive Women in Ethiopia	878 screened; 197 HPV+ women	VIA − Lugol's iodine vs VIA only	Higher sensitivity with iodine (50% vs 25%), specificity ~84%
Zehbe et al.	2017	Self- vs Provider-Directed Sampling in Anishinaabek Cervical Cancer Screening Study	834 First Nations women in Canada + 69 qualitative participants	Self-sampling vs Pap cytology	Self-sampling preferred; doubled screening uptake
Arbyn et al.	2022	Meta-Analysis of Agreement in HPV Self- vs Clinician-Collected Samples	26 diagnostic test accuracy studies	Self-collected HPV tests vs Clinician-collected	High agreement: 84.6% (positive), 91.7% (negative)

In a Turkish RCT with 110 women aged 30–65 years, anxiety levels were measured using the State Anxiety Inventory before and after sampling. There was no significant difference in pre-test anxiety between the self-sampling group and clinician-collected group ($p > 0.05$). However, post-test anxiety was significantly lower in the self-sampling group (mean score 30.3) compared to the clinician-sampled group (mean score 41.5, $p < 0.001$). All HPV DNA tests were negative, and sample adequacy was confirmed by detection of the β-globin gene in all samples. The study provides compelling evidence that self-sampling significantly reduces anxiety compared to clinician-collected sampling.

Anxiety related to cervical cancer screening is a well-documented barrier, often driven by discomfort with pelvic examinations, embarrassment, fear of pain, and concerns about privacy (Sen and Yilmaz, 2025; Polman et al., 2019; Chaw et al., 2022). Their study found that while pre-test anxiety levels were similar, post-test anxiety scores were significantly lower in the self-sampling group (mean 30.3 vs 41.5, $p < 0.001$). This reduction in anxiety is critical because it may encourage women who otherwise avoid screening due to psychological distress to participate. The study also demonstrated that self-collected samples were adequate for HPV DNA testing, with all samples testing negative in this cohort, highlighting the technical feasibility and reliability of self-sampling. These findings align with international literature showing high acceptability and preference for self-sampling, including studies in Spain (Ibanez et al., 2023).

Building on acceptability, Zhou et al. (2025) introduced an innovative behavioral economic intervention—the Pay-It-Forward model—in ethnic minority regions of Inner Mongolia, China. This randomized controlled trial protocol aims to improve the feedback rate of HPV self-sampling results by requiring participants to pay a refundable deposit before receiving the self-sampling kit. This ongoing RCT protocol in Inner Mongolia, China, plans to enroll 108 women aged ≥24 years, randomized to either a pay-it-forward prepayment group or a free kit distribution group. The pay-it-forward group pays a refundable 20 RMB deposit to encourage timely feedback of self-sampling results. The primary outcome is the feedback rate of HPV self-sampling results within one month. Secondary outcomes include HPV positivity rate, treatment adherence, psychological status, and knowledge.

The intervention of this study aims to enhance psychological commitment and improve screening effectiveness, particularly in ethnic minority regions. This strategy leverages

psychological commitment and the sunk cost effect to motivate timely sample submission and feedback, addressing a major challenge in self-sampling programs: low return rates of samples and results (Zhou et al., 2025). Given the sociocultural and economic barriers in rural and minority populations, this approach may enhance adherence to screening and follow-up care, ultimately improving early detection and treatment. The study's design, incorporating urban-rural stratification and comprehensive psychosocial assessments, promises valuable insights into scalable interventions to increase screening participation in resource-limited settings.

From a diagnostic and triage perspective, Mekuria et al. (2024) evaluated visual inspection with acetic acid (VIA), with and without Lugols iodine, as triage tests for HPV-positive women identified through self-sampling in Ethiopia. Approximately 878women were screened, with 197 (22.4%) testing hrHPV positive via self-sampling. HPV-positive women were randomized to visual inspection with acetic acid (VIA) alone or VIA combined with Lugols iodine. The study concluded that VIA with iodine improved detection but was not significantly better than VIA alone for triage of HPV-positive women. While VIA with iodine demonstrated higher sensitivity (50%) and specificity (84.6%) for detecting cervical intraepithelial neoplasia grade 2 or higher (CIN2+) compared to VIA alone (sensitivity 25%, specificity 82.7%), the difference was not statistically significant (p=0.5). Importantly, HIV-positive women had a significantly higher risk of CIN2+ (odds ratio 5.1), underscoring the need for tailored triage and treatment strategies in high HIV prevalence areas (Mekuria et al., 2024). The study highlights the limitations of VIA-based triage due to its subjective nature and variable accuracy, emphasizing the urgent need for more sensitive, affordable, and scalable triage methods such as DNA methylation markers or HPV genotyping, particularly in low-resource settings (Manley et al., 2022; World Health Organization, 2021).

The Anishinaabek Cervical Cancer Screening Study (ACCSS) by Zehbe et al. (2017) provides crucial qualitative and quantitative insights into the acceptability of HPV self-sampling among Indigenous First Nations women in Canada. It used a mixed-methods approach including qualitative interviews, focus groups, and a cluster RCT involving 834 First Nations women in Canada. Women strongly preferred HPV self-sampling over clinician-administered Pap tests due to greater accessibility, privacy, personal control, and less physical and emotional discomfort. Self-sampling doubled screening uptake compared to Pap screening. Participants emphasized the need for culturally sensitive education, including de-stigmatization of HPV and involvement of men in awareness efforts.

The study demonstrated that self-sampling was strongly preferred over Pap tests due to enhanced privacy, personal control, and less physical and emotional discomfort. These factors contributed to a doubling of screening uptake, addressing persistent health disparities in cervical cancer incidence and mortality faced by Indigenous populations (Zehbe et al., 2017). This study emphasized the necessity of culturally sensitive education programs that include men and address HPV-related stigma to foster community-wide acceptance. These findings resonate globally, as self-sampling has been shown to overcome structural barriers such as transportation, childcare, and clinic accessibility, particularly in rural and underserved communities (Nelson et al., 2017).

Supporting the clinical validity of self-sampling, the umbrella review by Arbyn et al. (2014) synthesized data from 26 diagnostic accuracy studies and found high concordance between HPV testing on self-collected and clinician-collected samples, with agreement rates of 84.6% for positive and 91.7% for negative results. There was no significant difference in test positivity ratios between methods, supporting self-sampling as a reliable alternative to clinician sampling to increase screening coverage. This meta-analysis confirms that self-sampling is a reliable alternative to clinician sampling, capable of maintaining diagnostic accuracy while

expanding screening reach (Arbyn et al., 2014). Such evidence is critical to inform policy and guideline development for incorporating self-sampling into national screening programs.

CONCLUSION

HPV self-sampling is a feasible, acceptable, and effective approach to cervical cancer screening that reduces anxiety and overcomes numerous barriers. Supported by robust diagnostic accuracy data, it empowers women and improves screening participation, particularly among underserved groups. Innovative *behavioral economics* interventions and culturally tailored education can further enhance outcomes. Integrating self-sampling into public health programs represents a pivotal step toward achieving equitable cervical cancer prevention and, ultimately, its elimination.

Self-Sampling for Cervical Cancer: a Scoping Review

Self-Sampling for Cervical Cancer: a Scoping

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