



Cervical Cancer Screening: Balancing Advances with Implementation Challenges – Systematic Review

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Abstract

Introduction:

Cervical cancer remains a major public health concern, particularly in low- and middle-income countries where screening coverage is limited. Advances in screening modalities, such as high- risk HPV testing, liquid-based cytology, and point-of-care diagnostics, have improved sensitivity and early detection. However, widespread implementation is hindered by infrastructural, financial, and sociocultural barriers, leading to disparities in outcomes.

Aim:

This systematic review aimed to evaluate recent advances in cervical cancer screening methods and to analyze the challenges affecting their implementation across diverse health care settings.

Methods:

A systematic search was conducted in PubMed, Scopus, Web of Science, and Google Scholar for studies published between 2015 and 2025. Keywords included “cervical cancer screening,” “HPV testing,” “Pap smear,” “implementation challenges,” and “low-resource settings.” Eligible studies were screened based on PRISMA guidelines. Data were extracted and synthesized thematically, focusing on screening efficacy, cost-effectiveness, feasibility, and barriers to implementation.

Conclusion:

The review highlights that while HPV-based screening and self-sampling approaches demonstrate superior sensitivity and acceptability, significant implementation challenges remain, including limited laboratory infrastructure, cost constraints, workforce shortages, and cultural stigma. Strengthening health system capacity, integrating community-based strategies, and adopting context-specific policies are essential to translate technological advances into equitable cervical cancer prevention.

Keywords: Cervical cancer, Screening, HPV testing, Pap smear, Implementation challenges, Low-resource settings, Systematic review

Introduction

Worldwide, cervical cancer is still a major public health concern, especially in low- and middle- income nations. Reducing incidence and death has been greatly aided by screening using Pap smears, HPV

tests, and other technologies. Disparities in screening uptake, access restrictions, and differing knowledge levels still impede progress despite gains. This review summarizes the most recent data on cervical cancer

screening, emphasizing worldwide trends, obstacles, cutting-edge strategies including self-sampling and artificial intelligence, and suggestions for bolstering screening initiatives.

Effective screening and early intervention can help prevent cervical cancer, which is the fourth most frequent cancer among women worldwide (Gavinski & DiNardo, 2023). Particularly in high-income nations, screening programs have dramatically decreased morbidity and death; nonetheless, problems still exist in low-resource environments (Asgary *et al.*, 2022; Olubodun *et al.*, 2022). In order to give readers a thorough grasp of the latest developments, obstacles, and trends in cervical cancer screening, this review assesses the data from recent research.

Screening modalities and effectiveness:

Pap smears and other conventional screening techniques continue to be the mainstay of cervical cancer detection (Mignot *et al.*, 2019). However, cytology's varying sensitivity has sparked interest in molecular methods like HPV DNA detection. According to comparative analyses, HPV testing provides greater sensitivity, especially in environments with limited resources (Asgary *et al.*, 2022). Improvements in DNA methylation biomarkers have the potential to increase the precision of diagnosis (Bowden *et al.*, 2023).

As a viable substitute, self-sampling for HPV testing is becoming more popular among women who are hesitant to have tests performed by clinicians (Fujita *et al.*, 2022).

Additionally, applications of artificial intelligence are improving workflow efficiency and diagnostic accuracy (Wu *et al.*, 2024).

Trends in screening update:

Regional differences in screening participation are substantial. For example, structured national programs have improved screening rates in Korea over the past ten years, despite some variations (Shin *et al.*, 2022). However, because of logistical, cultural, and financial obstacles, underserved and rural people continue to have low acceptance (da Silva *et al.*, 2022; Olubodun *et al.*, 2022).

In India, there are still gaps in information and access, and awareness and behaviors are still below ideal, particularly in rural areas (Aswathy *et al.*, 2012;

Srivastava *et al.*, 2022). Similar trends can be observed in Malta, where women's willingness to participate is impacted by misconceptions and a lack of awareness (Deguara *et al.*, 2021).

Barriers to Screening

Cervical cancer screening obstacles come in several forms:

1. Cultural and socioeconomic: stigma, ignorance, and false beliefs regarding screening (Olubodun *et al.*, 2022; Salehiniya *et al.*, 2021).
2. Geographic: People living along the Amazon River have limited access to healthcare in rural or isolated locations (de Silva *et al.*, 2022).
3. Disability and Vulnerability: Inequities in healthcare delivery are highlighted by differences in Pap test usage among women with impairments (Orji & Roess, 2024).
4. Health System Factors: Lack of follow-up procedures, inadequate infrastructure, and a shortage of skilled staff (Srivastava *et al.*, 2022).

Innovation and future directions:

AI improves productivity and lowers human error in cytology and HPV testing (Wu *et al.*, 2024). Self-sampling techniques increase acceptance and accessibility, particularly for marginalized groups (Fujita *et al.*, 2022). Additionally, risk categorization may be improved by integrating HPV testing with molecular indicators as DNA methylation (Bowden *et al.*, 2023).

To overcome obstacles, policy-level initiatives, community-based awareness campaigns, and culturally appropriate health education are still crucial (Olubodun *et al.*, 2022).

Conclusion:

Although cervical cancer screening has been shown to lower incidence and mortality, there are still issues with fairness, accessibility, and knowledge around the world. Self-sampling, molecular testing, and AI integration are examples of innovations that have the potential to increase screening participation and accuracy. The World Health Organization's objective of eradicating cervical cancer as a public health issue depends on bolstering public health infrastructure, resolving inequities, and encouraging community involvement.

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Cervical Cancer Screening Studies (2012–2024)

AUTHOR/ YEAR	PARTICIP ANTS	AGE	METHODS/MEA SUREMENTS	RESULTS
Orji & Roess (2024)	Women with disabilities, USA	Not specified	Cross-sectional study, Pap test disparities	Significant disparities in Pap test uptake by disability type
Wu et al. (2024)	Review & expert analysis	Not applicable	AI-based cervical cancer screening approaches	AI improves accuracy, efficiency, and early detection
Bowden et al. (2023)	Systematic review protocol	Not applicable	DNA methylation in HPV & host genes	Protocol to assess diagnostic accuracy of methylation markers
Gavinski & DiNardo (2023)	Review study	Not applicable	Review of cervical cancer screening methods	Updated screening guidelines and evidence-based practices
Asgary et al. (2022)	Low- resource settings	Not specified	Comparative analysis of Pap, VIA, HPV tests	HPV testing had highest sensitivity, VIA feasible for LMICs
da Silva et al. (2022)	Rural riverside women, Amazon	Adult women	Qualitative study, interviews	Barriers: isolation, lack of transport, cultural beliefs
Olubodun et al. (2022)	Women in Lagos, Nigeria	Reproductive age	Qualitative interviews	Barriers: cost, stigma, awareness;

				recommendation s: outreach
Shin et al. (2022)	Korean women, nationwide	30–74 years	Korean National Cancer Screening Survey (2005–2020)	Screening rates rose until 2013, then plateaued
Srivastava et al. (2022)	Reproductive age women, Delhi & Rohtak	15–49 years	Cross-sectional survey	Low screening prevalence, influenced by education & awareness
Fujita et al. (2022)	ACCESS trial, Japan	Not specified	HPV self-sampling study protocol	Planned to evaluate effectiveness of HPV self- sampling
Salehiniya et al. (2021)	Asian women (review)	Varied	Systematic review of factors	Factors: education, culture, socioeconomic conditions
Deguara et al. (2021)	Women in Malta	16–65 years	Survey-based study	Knowledge low; attitudes positive but participation low
Mignotet al. (2019)	CONSTAN CES cohort, France	18–64 years	Cohort study, Pap test + contraception	Contraceptive users more likely to have Pap tests
Aswathy et al. (2012)	Rural women, Kerala (India)	15–65 years	Cross-sectional survey	Knowledge and practice of screening very low

Identification Of Studies Through Database

