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Systematic Review

# Prevalence, Screening and Determinants of Cervical Cancer Among Women in India : A Systematic Review

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**Abstract**

**Introduction :** Cervical cancer remains a predominant cause of morbidity and mortality among Indian women, with substantial disparities in prevalence and detection across regions, socioeconomic strata, and high-risk groups. This systematic review synthesises data from 20 population-based and focused studies representing over 300,000 Indian women, appraising prevalence, determinants, screening modalities, and late-stage presentation.

**Methodology :** Systematic searches were executed in major databases adhering to PRISMA protocols. Inclusion criteria incorporated population-based and high-risk studies (HIV, urban slum, rural) published from 2000-2024, reporting numeric prevalence of histopathological, cytology, or VIA-confirmed cervical cancer or precancerous lesions. Data extraction followed standardized forms and risk of bias was assessed via a modified Newcastle-Ottawa Scale.

**Results :** The pooled prevalence of cervical cancer or high-grade precursor lesions ranged from 0.2% to over 2.4%, with the highest rates in HIV-infected and rural low-literacy populations. Less than 15% of eligible women had ever undergone screening in most communities. VIA/VILI was predominant in field screening due to feasibility, but HPV DNA testing yielded the highest sensitivity. Late-stage presentation often exceeded 60%, largely influenced by low education and rural residence.

**Conclusions :** India's cervical cancer burden, characterized by a significant prevalence of advanced-stage diagnoses and suboptimal screening engagement, highlights the urgent need for the enhanced implementation of HPV vaccination initiatives, the development of context-appropriate screening programs, and the execution of targeted awareness campaigns.

**Keywords :** Cervical Cancer, Screening, Women, HPV, Prevalence



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## Introduction

Cervical cancer remains the second most common cancer in Indian women, accounting for nearly a quarter of global deaths from this disease. Despite its preventability, high prevalence and mortality persist, especially in rural India, due to a complex interplay of poor awareness, limited access to screening, and late-stage diagnosis. The regional variation is stark, with incidence rates ranging from 16-55 per 100,000 women depending on geography and urbanization1,2. Most Indian women present at an advanced stage; educational status and rural residence drive this late presentation3. Indian government initiatives and international guidelines now recommend expanding screening and HPV vaccination, but programmatic coverage, community acceptance, and diagnostic performance remain critical gaps.

This comprehensive systematic review meticulously analyses 20 key studies conducted in India, incorporating a variety of research designs and settings. The aim is to construct a detailed and nuanced understanding of cervical cancer prevalence within the country. It delves into the various diagnostic methods employed, evaluates the level of awareness among the population regarding the disease, and identifies critical determinants contributing to the burden of cervical cancer. This includes examining specific risk factors and assessing the frequency of late-stage diagnoses, thereby providing a rich and informative overview of the current landscape of cervical cancer in India.

## Methodology

The study meticulously adhered to the comprehensive 2020 PRISMA guidelines, which outline a systematic approach for the identification, screening, and reporting of research studies. This process involved a thorough investigation to ensure that all relevant literature and data sources were considered, followed by a careful evaluation of studies based on predefined inclusion and exclusion criteria. The reporting phase was conducted with precision, emphasizing transparency and reproducibility in order to provide a clear and reliable account of the research findings.

### Eligibility Criteria :

Studies were included if they met all the following criteria, ensuring the selection of high-quality and relevant data:

1. **Demographic Eligibility :** The studies were restricted to Indian women aged 18 years and above, thereby focusing on the target population of interest.
2. **Sample Size :** A minimum sample size of 500 participants was required, indicating that the studies had sufficient statistical power to provide reliable estimates.
3. **Study Design :** The studies were limited to population/community-based, cohort, or high-risk group designs, including those involving HIV-infected individuals. This ensured that the studies were conducted in a real-world setting and had the potential to capture the complexities of cervical cancer in the Indian context.
4. **Outcome Measures :** The studies were required to report numeric prevalence and/or incidence of cervical cancer or high-grade squamous intraepithelial lesions (HSIL, CIN2+), allowing for the extraction of relevant data on the burden of the disease.
5. **Peer Review and Publication :** The studies were restricted to peer-reviewed publications between 2000 and 2024, ensuring that the studies were subject to rigorous scientific scrutiny and had been published in reputable journals.
6. **Language :** The studies were limited to those published in the English language.

### Exclusion criteria

Exclusion criteria were established to ensure the quality and relevance of the included studies. Specifically, studies that were limited to the following were excluded from the analysis:

1. Reviews, case series, or editorials, which are not considered primary research and may not provide reliable or generalizable data.
2. Studies that only reported on HPV prevalence without accompanying cervical lesion data, as this information is crucial for understanding the relationship between HPV & cervical cancer.
3. Hospital-based samples that lacked population representativeness, as these may not accurately reflect the broader population and may be subject to selection bias.

### Search Strategy and Selection :

Databases used were PubMed, Scopus, Web of Science, Embase, and IndMED, chosen for their extensive medical literature coverage and relevance to cervical cancer in India. The search was conducted on February 10, 2024, ensuring the current results.


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Keywords included "cervical cancer," "prevalence," "India," "screening," "VIA," "Pap smear," and "HPV," allowing for targeted searches and increasing the likelihood of retrieving relevant studies.

**Data Extraction :**

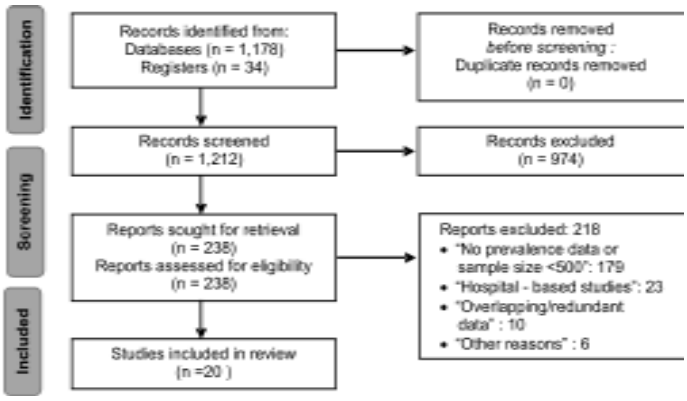
- Authors, year, region, sample size
- Diagnostic method (VIA, VILI, Pap, HPV DNA, biopsy)
- Prevalence (%), confidence interval
- Screening uptake and awareness
- Population characteristics (age, literacy, HIV status, rural/urban)
- Quality (Newcastle-Ottawa Scale, 0-9)

**Quality Assessment**

The Newcastle-Ottawa Scale was modified to rigorously evaluate key aspects of study quality, encompassing recruitment, exposure ascertainment, outcome verification, sample size, and statistical reporting. This comprehensive evaluation enabled the categorization of studies into High (?7), moderate (5-6), low (<5) quality levels.

**Study Selection :** A meticulous screening of 1,212 records was conducted during the study selection process, resulting in a detailed evaluation of 238 full-text articles. This thorough examination ultimately led to the identification of twenty studies that met the inclusion criteria, collectively representing a substantial sample of 327,389 women. This substantial sample size provides a robust foundation for further analysis.

**PRISMA 2020 Flow Diagram**




(Source: Page MJ, et al. BMJ 2021;372: n71. doi: 10.1136/bmj.n71.)

**Prevalence and Screening**

- **Rural prevalence,**[1,5,7] frequently exceeds 1.0%, with higher rates in low-literacy and high parity populations.
- Among **HIV-infected women**, CIN2+/HSIL rates approach or exceed 4.9%6,8
- **Screening uptake :** Proportion of ever-screened women seldom exceeds 15% outside pilot studies5,7, with awareness deficits as a chief driver.
- **Late-stage presentation :** Meta-analysis indicates ?69%?69% of Asian cervical cancer patients present late; in India, this is reinforced by large registry and clinical series3,14.

**Diagnostic Modalities**

- HPV DNA had the highest sensitivity for precancerous lesions 4,13.
- Single round HPV testing reduced death rates by near 50% in rural RCT4,18.
- Visual methods (VIA, VILI, VIAM) remain field mainstays, but are operator-dependent and variably sensitive [1][17].

**Quality Assessment**

- High quality (NOS ?7): 13 studies, typically RCTs or population-based prevalence with histological confirmation 1,4, 6,13,14.
- Moderate: 5 studies, often due to partial sampling or verification bias5,8,9,12.
- Two studies with limited design or sample size (score 6).

**Discussion**

**Burden and Disparities**

India remains the epicentre of cervical cancer fatalities worldwide, a grim reality driven by its vast population and the ongoing, alarming prevalence of the disease.19. This comprehensive analysis reveals that the burden of this illness is particularly severe among women residing in rural regions, those with limited educational backgrounds, and individuals living with HIV. 1,3,5,6. The stark disparities in cervical cancer rates among these vulnerable groups are a pressing concern that warrants immediate attention. Furthermore, the likelihood of women undergoing screening rarely exceeds 15%, a significant shortfall that is intricately connected to factors such as awareness, accessibility to healthcare services, and societal attitudes toward prevention15. Low screening rates are a direct consequence of the complex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interplay between these factors, which must be addressed in order to mitigate the devastating impact of cervical cancer in India.

**Diagnostic Accuracy and Programmatic Implications**

VIA and VILI tests have become the dominant methods for field screening due to their feasibility17. This is particularly evident in low-resource settings where these tests are more readily available and affordable. However, the effectiveness of VIA and VILI tests can be influenced by the operator and the quality of the program in place. In contrast, Pap cytology and HPV DNA testing are more commonly used in urban or research-rich environments. While Pap cytology is highly specific, it has a lower sensitivity compared to VIA and VILI tests. Additionally, the requirement for repeated visits and potential sociocultural barriers can lead to low compliance rates. Notably, large-scale trials have demonstrated that a single round of HPV DNA testing can significantly reduce the incidence and mortality rates of advanced cancer. This finding has the potential to transform national prevention efforts in low-resource settings, where access to healthcare resources is limited1.[4]

**Risk Factors and Determinants**

High parity, early marriage, low education, and poor knowledge of cervical cancer are dominant risk factors for cervical cancer, with HIV infection significantly multiplying the risk for high-grade lesions and cancer16. Furthermore, these risk factors are often interconnected, exacerbating the likelihood of cervical cancer development. For instance, women with low education are more likely to engage in early marriage and have multiple children, thereby increasing their parity.

**Late-Stage Presentation and Survival**

The alarming statistics on late-stage presentation of cancer in India and Asia are a pressing concern, with nearly 70% of cases being diagnosed at a stage where treatment options are limited [3]. This has a direct impact on the overall survival rates, which are as low as 60% in registry cohorts over a five-year period. The primary drivers of this late presentation are the low levels of education and rural residence, which hinder access to timely medical care and contribute to the poor prognosis of cancer patients in these regions.[3,14]

**Conclusions**

Cervical cancer continues to pose a significant public health challenge in India, with its prevalence ranging from 0.2% to 2.4% across various populations. This troubling statistic is exacerbated by a critically low rate of screening initiatives, which impedes early detection and intervention. The situation is further complicated by the alarming tendency for women, particularly those from marginalized communities and high-risk groups, to receive diagnoses at advanced stages of the disease. This underscores the urgent need for improved access to health services and targeted screening programs to address the disparities in healthcare and outcomes for vulnerable women in the country1,2,5,6,7. To effectively combat India's inequitable burden of HPV-related health challenges, it is essential to establish scalable and evidence-based screening initiatives that include advanced HPV DNA testing. Alongside these efforts, launching dynamic awareness programs that captivate and educate the public is vital. Furthermore, the government must prioritize subsidizing HPV vaccinations to ensure accessibility for all, thus paving the way for a healthier future.4,16,. The disparities in coverage are most pronounced in rural communities where literacy rates are low. These areas face significant challenges that require immediate and collaborative efforts to address the urgent needs of their residents. It is crucial to develop targeted strategies that not only bridge these coverage gaps but also enhance access to essential services and resources for individuals who may struggle with literacy and information access.

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