pISSN:2349-5707 Volume:13,Issue 5, May -2026 eISSN:2349-5715

CERVICAL CANCER SCREENING IN THE MODERN ERA: TECHNIQUES, GLOBAL BURDEN, AND IMPLEMENTATION CHALLENGES IN UZBEKISTAN

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https://doi.org/10.5281/zenodo.20279684

Abstract: Cervical cancer is one of the leading causes of cancer-related morbidity and mortality among women worldwide, particularly in low- and middle-income countries. Persistent infection with high-risk human papillomavirus (HPV) plays a central role in cervical carcinogenesis. Modern screening techniques including Papanicolaou (Pap) smear cytology, HPV DNA testing, visual inspection with acetic acid (VIA), and co-testing have significantly improved early detection and prevention of cervical cancer. Despite global advances in screening and HPV vaccination, disparities remain in developing regions due to inadequate healthcare infrastructure, low awareness, and limited access to organized screening programs. Uzbekistan is gradually strengthening national cervical cancer prevention strategies; however, challenges related to screening coverage, diagnostic facilities, trained personnel, and public awareness continue to affect effective implementation. This review discusses contemporary cervical cancer screening methods, evaluates the global burden of disease, and analyzes the current status and implementation challenges of cervical cancer screening programs in Uzbekistan.

Keywords: Cervical cancer, HPV, Pap smear, HPV DNA testing, screening, Uzbekistan, public health

Introduction

Cervical cancer remains a major public health challenge globally and is the fourth most common cancer among women worldwide [1]. According to GLOBOCAN 2020 estimates, approximately 604,000 new cases and 342,000 deaths were reported globally, with nearly 90% of deaths occurring in low- and middle-income countries [2]. Persistent infection with high-risk human papillomavirus (HPV), particularly HPV-16 and HPV-18, is recognized as the principal etiological factor responsible for cervical carcinogenesis [3]. HPVpersistent→CIN→Cervical Cancer

Over the past several decades, implementation of organized cervical cancer screening programs has substantially reduced disease incidence and mortality in many developed countries [4]. Screening enables early detection of precancerous lesions, allowing timely treatment before progression to invasive carcinoma. screening modalities include conventional cytology (Pap smear), HPV DNA testing, visual inspection with acetic acid (VIA), and co-testing approaches [5]. The World Health Organization (WHO) currently recommends HPV DNA testing as the preferred primary screening method because of its superior sensitivity compared with cytology-based screening [6]. In 2020, WHO launched the global strategy for elimination of cervical cancer, targeting 90% HPV vaccination coverage, 70% screening coverage, and 90% access to treatment by 2030 [7]. However, implementation remains difficult in resource-limited settings where healthcare systems face financial, infrastructural, and sociocultural barriers.

Uzbekistan has increasingly recognized cervical cancer prevention as an important component of women's health services. Although screening initiatives and reproductive healthcare programs are expanding, nationwide implementation of organized HPV-based

pISSN:2349-5707 Volume:13,Issue 5, May -2026 eISSN:2349-5715

screening remains limited [8]. This review aims to discuss current cervical cancer screening techniques, global epidemiological trends, and implementation challenges in Uzbekistan.

Pathogenesis and Role of Human Papillomavirus (HPV)

Human papillomavirus is a sexually transmitted DNA virus affecting epithelial tissues of the cervix. Persistent infection with high-risk HPV genotypes contributes to cervical intraepithelial neoplasia (CIN), which may progress to invasive cervical carcinoma if untreated [3].

The oncogenic proteins E6 and E7 produced by high-risk HPV strains inactivate tumor suppressor proteins p53 and retinoblastoma (Rb), resulting in uncontrolled cellular proliferation and malignant transformation [9].

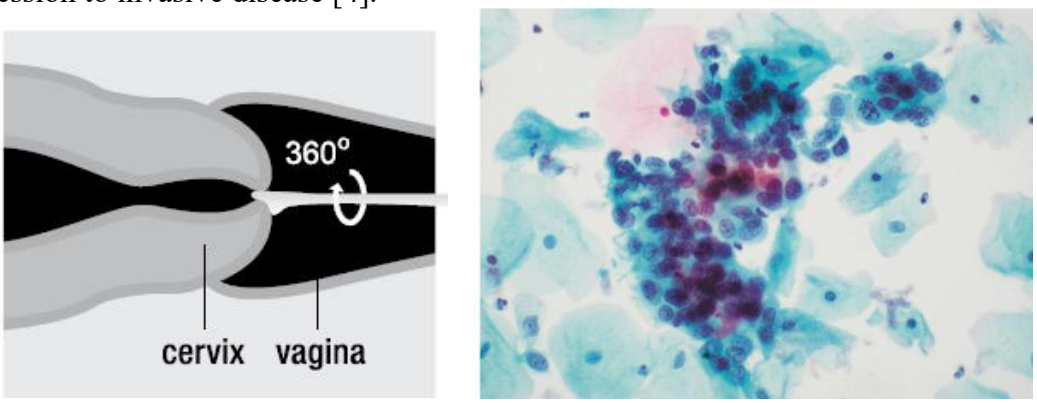
Risk factors associated with cervical cancer include: Early onset of sexual activity , Multiple sexual partners, Smoking , Immunosuppression ,, Long-term oral contraceptive use , Poor genital hygiene Lack of regular screening

HPV-16 and HPV-18 account for approximately 70% of cervical cancer cases globally [10].

Modern Cervical Cancer Screening Techniques

Pap Smear Cytology

The Papanicolaou (Pap) smear is one of the oldest and most widely utilized screening methods for cervical cancer detection. It identifies abnormal epithelial cellular changes before progression to invasive disease [4].



Fig; Liquid-based cytology – severe dyskaryosis.

Advantages ; Cost-effective , Widely established , Effective in organized screening programs

Limitations; Moderate sensitivity , Requires laboratory infrastructure , Observer-dependent interpretatio.

Countries with effective cytology-based screening programs have demonstrated significant reductions in cervical cancer incidence and mortality [11].

HPV DNA Testing

HPV DNA testing detects high-risk HPV genotypes associated with cervical carcinogenesis and is currently considered the preferred primary screening modality by WHO [6]. Sensitivity; HPV DNA> Pap Smear> VIA

Advantages

- Higher sensitivity than cytology , Early identification of high-risk infection , Longer screening intervals , Potential for self-sampling

Limitations

- Higher cost , Need for molecular laboratory facilities , Limited availability in low-resource settings

HPV-based screening has demonstrated improved detection rates of precancerous lesions compared with conventional cytology [12].

pISSN:2349-5707 Volume:13,Issue 5, May -2026 eISSN:2349-5715

Visual Inspection with Acetic Acid (VIA)

Visual inspection with acetic acid is a low-cost screening technique commonly used in resource-limited settings. Application of dilute acetic acid to the cervix produces acetowhite lesions in abnormal epithelial areas.

Advantages; Immediate results , Inexpensive , Suitable for rural healthcare settings

Limitations; Lower specificity , Operator dependence , Reduced reproducibility

Despite its limitations, VIA remains important where cytology and HPV testing are unavailable [5].

Co-testing

Co-testing combines Pap smear cytology with HPV DNA testing, increasing diagnostic sensitivity and specificity in women older than 30 years [11].

Although co-testing improves diagnostic accuracy, it also increases healthcare costs and laboratory requirements.

Global Burden of Cervical Cancer

Cervical cancer continues to disproportionately affect women in developing countries due to inadequate screening coverage and limited healthcare accessibility [2]. Approximately 94% of cervical cancer deaths occur in low-resource settings [7].

Sub-Saharan Africa, South Asia, and parts of Central Asia report relatively high incidence and mortality rates. In contrast, countries with organized HPV vaccination and screening programs have experienced marked reductions in disease burden [1].

Major contributing factors include: Lack of organized screening programs , Limited HPV vaccination coverage , Poor healthcare accessibility , Sociocultural barriers , Low public awareness

WHO estimates that widespread implementation of HPV vaccination and effective screening could prevent millions of cervical cancer deaths in the coming decades [6].

Cervical Cancer Screening in Uzbekistan

Uzbekistan has increasingly prioritized women's reproductive health and cancer prevention strategies in recent years [8]. Efforts have been made to strengthen gynecological healthcare services and improve early detection of cervical malignancies. However, cervical cancer screening coverage remains inconsistent, especially in rural and underserved regions. Opportunistic rather than population-based screening continues to predominate.

Major Challenges in Uzbekistan

Limited Public Awareness; Many women remain unaware of HPV infection, cervical cancer risk factors, and the importance of routine screening.

Inadequate Organized Screening Programs; Lack of nationwide organized screening systems limits effective population coverage.

pISSN:2349-5707 Volume:13,Issue 5, May -2026 eISSN:2349-5715

Resource and Infrastructure Constraint; Several healthcare facilities lack: Cytology laboratories ,HPV testing facilities , Trained cytotechnologists , Colposcopy services

Sociocultural Barriers; Fear, stigma, and misconceptions surrounding gynecological examinations may reduce participation in screening programs.

Financial Challenges; Implementation of HPV DNA testing and vaccination programs requires substantial healthcare investment.

Strategies for Improvement

Expansion of HPV-Based Screening

Nationwide implementation of HPV DNA testing aligned with WHO recommendations could significantly improve early detection rates.

Public Awareness Programs

Community education campaigns targeting women and healthcare workers are essential for improving screening uptake.

Integration into Primary Healthcare

Cervical cancer screening should be integrated into maternal and reproductive healthcare services.

Training Healthcare Professionals

Specialized training in cytology, colposcopy, and molecular diagnostics is necessary to improve screening quality.

HPV Vaccination Programs

Increasing HPV vaccination coverage among adolescent girls can substantially reduce future disease burden.

Prevention=HPV Vaccination+Screening+Early TreatmentPrevention=HPV\ Vaccination+Screening+Early\
TreatmentPrevention=HPV Vaccination+Screening+Early Treatmen

Conclusion

Cervical cancer remains a preventable yet significant global health problem, particularly in low- and middle-income countries. Modern screening methods, especially HPV DNA testing, have transformed early detection and prevention strategies. Although Uzbekistan has made progress in strengthening women's healthcare services, major challenges persist regarding awareness, infrastructure, organized screening, and healthcare accessibility. Comprehensive national strategies involving HPV vaccination, organized screening programs, public awareness campaigns, and healthcare capacity building are essential to reduce cervical cancer burden and improve women's health outcomes in Uzbekistan.

References

1. World Health Organization. Cervical cancer [Internet]. Geneva: WHO; 2024 [cited 2026 May 18]. Available from: https://www.who.int/health-topics/cervical-cancer

2. Sung H, Ferlay J, Siegel RL, et al. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2021;71(3):209-249.

3. Bosch FX, Lorincz A, Muñoz N, et al. The causal relation between human papillomavirus and cervical cancer. J Clin Pathol. 2002;55(4):244-265.

4. Schiffman M, Castle PE. The promise of global cervical-cancer prevention. N Engl J Med. 2005;353(20):2101-2104.

pISSN:2349-5707 Volume:13,Issue 5, May -2026 eISSN:2349-5715

5. IARC Working Group on the Evaluation of Cancer-Preventive Interventions. Cervical Cancer Screening. Lyon (FR): International Agency for Research on Cancer; 2022.

6. World Health Organization. New recommendations for screening and treatment to prevent cervical cancer [Internet]. Geneva: WHO; 2021 [cited 2026 May 18]. Available from: https://www.who.int/news/item/06-07-2021-new-recommendations-for-screening-and-treatment-to-prevent-cervical-cancer

7. World Health Organization. Global strategy to accelerate the elimination of cervical cancer as a public health problem. Geneva: WHO; 2020.

8. Aniyozova D. National Programme on cervical cancer screening in the Republic of Uzbekistan: introduction of HPV based screening [Internet]. 2025 [cited 2026 May 18]. Available from: https://www.researchgate.net/publication/396245534_National_Programme_on_cervical_cancer_screening_in_the_Republic_of_Uzbekistan_introduction_of_HPV_based_screening

9. Doorbar J. Molecular biology of human papillomavirus infection and cervical cancer. Clin Sci (Lond). 2006;110(5):525-541.

10. International Agency for Research on Cancer. Worldwide burden of cancer attributable to HPV by site, country and HPV type [Internet]. Lyon: IARC; 2024 [cited 2026 May 18]. Available from: https://www.iarc.who.int/reference/worldwide-burden-of-cancer-attributable-to-hpv-by-site-country-and-hpv-type

11. Perkins RB, Guido RS, Castle PE, et al. 2019 ASCCP risk-based management consensus guidelines. J Low Genit Tract Dis. 2020;24(2):102-131.

12. Arbyn M, Weiderpass E, Bruni L, et al. Estimates of incidence and mortality of cervical cancer in 2018: a worldwide analysis. Lancet Glob Health. 2020;8(2):e191-e203.