International Journal of Nursing and Health Research
www.nursingjournal.in
Online ISSN: 2664-6420
Received: 27-03-2026, Accepted: 27-04-2026, Published: 12-05-2026
Volume 8, Issue 2, 2026, Page No. 56-58

Prevention of Human Papillomavirus infection and cervical cancer

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Abstract
Human papillomavirus (HPV) infection is one of the most common sexually transmitted infections worldwide and is strongly associated with the development of cervical cancer. Persistent infection with high-risk HPV types, especially HPV-16 and HPV-18, is responsible for the majority of cervical cancer cases. Cervical cancer remains a major public health problem, particularly in low- and middle-income countries where access to vaccination, screening, and treatment services is limited. However, cervical cancer is largely preventable through effective primary and secondary prevention strategies. HPV vaccination, regular cervical screening, safe sexual practices, early diagnosis, and timely treatment significantly reduce the incidence and mortality associated with cervical cancer. Public awareness, health education, and government-led screening programs play an important role in disease prevention. This article discusses HPV infection, its relationship with cervical cancer, risk factors, methods of prevention, screening techniques, vaccination strategies, and global initiatives aimed at eliminating cervical cancer as a public health problem. The article also highlights the importance of healthcare professionals in promoting awareness and preventive practices among women and adolescents.

Keywords: Cervical cancer, human papilloma virus

Introduction
Human papillomavirus (HPV) is a group of more than 200 related viruses, some of which are transmitted through sexual contact and can lead to various cancers. HPV infection is considered one of the most common sexually transmitted infections globally. Most sexually active individuals are infected with HPV at some point in their lives, often without symptoms. In many cases, the infection resolves spontaneously; however, persistent infection with high-risk HPV types can cause cervical cancer and other malignancies.
Cervical cancer develops in the cervix, the lower part of the uterus connecting to the vagina. It is the fourth most common cancer among women worldwide. According to the World Health Organization (WHO), approximately 660,000 new cases and 350,000 deaths due to cervical cancer occurred globally in 2022. The burden of disease is highest in low- and middle-income countries due to limited healthcare resources, inadequate screening, and low vaccination coverage.
The major cause of cervical cancer is persistent infection with oncogenic HPV types, especially HPV-16 and HPV-18, which account for nearly 70–76% of cases. The disease progresses slowly over many years, beginning with precancerous changes in cervical cells. Early detection and treatment of these changes can effectively prevent cancer development.

Human Papillomavirus Infection
HPV infects the epithelial cells of the skin and mucous membranes. It spreads mainly through sexual contact, including vaginal, anal, and oral sex. Skin-to-skin genital contact can also transmit the virus. HPV infection is usually asymptomatic, making it difficult to identify infected individuals.
HPV types are classified into low-risk and high-risk categories:

- Low-risk HPV types cause genital warts and benign lesions.
- High-risk HPV types are associated with cancers of the cervix, vagina, vulva, anus, penis, and oropharynx.

Persistent infection with high-risk HPV damages cervical epithelial cells, leading to cervical intraepithelial neoplasia (CIN), which may progress to invasive cervical cancer if untreated.

Risk Factors for HPV Infection and Cervical Cancer
Several factors increase the risk of acquiring HPV infection and developing cervical cancer. These include:

1. Early initiation of sexual activity
2. Multiple sexual partners
3. Unprotected sexual intercourse
4. Smoking and tobacco use
5. Long-term use of oral contraceptives
6. Poor genital hygiene
7. Weakened immune system, including HIV infection
8. Lack of regular cervical screening
9. High parity (multiple pregnancies)
10. Poor socioeconomic conditions and limited healthcare access

Women with HIV are at significantly higher risk of persistent HPV infection and cervical cancer due to reduced immunity.

Prevention of HPV Infection and Cervical Cancer
Prevention strategies are broadly divided into primary, secondary, and tertiary prevention.

Primary Prevention
Primary prevention aims to prevent HPV infection before it occurs.

1. HPV Vaccination

HPV vaccination is the most effective method for preventing HPV infection and cervical cancer. Vaccines protect against the high-risk HPV types responsible for most cervical cancer cases. WHO recommends vaccination for girls aged 9–14 years before the onset of sexual activity. Some countries also vaccinate boys to reduce transmission and protect against other HPV-related cancers.

Types of HPV vaccines include:

- Bivalent vaccine
- Quadrivalent vaccine
- Nonavalent vaccine

The vaccines are highly safe and effective. Studies have shown a major reduction in HPV infections and precancerous cervical lesions following widespread vaccination programs.

2. Safe Sexual Practices

Practicing safe sex reduces the risk of HPV transmission. Preventive measures include:

- Consistent condom use
- Limiting the number of sexual partners
- Delaying onset of sexual activity
- Mutual monogamy
- Maintaining genital hygiene

Although condoms do not provide complete protection, they significantly lower the risk of HPV infection and other sexually transmitted infections.

3. Health Education and Awareness

Public awareness regarding HPV infection, vaccination, cervical cancer screening, and healthy lifestyle practices is essential. Health education programs in schools, colleges, and communities can improve knowledge and promote preventive behaviors.

4. Smoking Cessation

Smoking weakens local immune defenses and increases the risk of cervical cancer progression. Avoiding tobacco products helps reduce cancer risk.

Secondary Prevention

Secondary prevention focuses on early detection and treatment of precancerous lesions.

1. Cervical Cancer Screening

Regular screening helps identify abnormal cervical changes before cancer develops. WHO recommends screening women beginning at age 30 years, or earlier in women with HIV infection.

Common Screening Methods

a. Pap Smear Test

The Pap smear detects abnormal cervical cells. It is a simple and effective method for early detection of precancerous lesions.

b. HPV DNA Testing

HPV DNA testing identifies high-risk HPV strains associated with cervical cancer. It is more sensitive than cytology-based screening.

c. Visual Inspection with Acetic Acid (VIA)

VIA is a low-cost screening method commonly used in resource-limited settings. Acetic acid is applied to the cervix, and abnormal areas appear white during examination.

2. Early Treatment of Precancerous Lesions

Timely management of cervical abnormalities prevents progression to invasive cancer. Common treatment methods include:

- Cryotherapy
- Loop electrosurgical excision procedure (LEEP)
- Laser therapy
- Surgical excision

Tertiary Prevention

Tertiary prevention aims to reduce complications and mortality in women diagnosed with cervical cancer.

1. Early Diagnosis and Treatment

Early-stage cervical cancer can often be cured with surgery, radiotherapy, chemotherapy, or combined treatment approaches. Early diagnosis improves survival rates and quality of life.

2. Palliative Care

For advanced cancer cases, palliative care helps manage pain, symptoms, and psychological distress while improving quality of life.

Global Strategies for Cervical Cancer Elimination

The WHO launched a global strategy to eliminate cervical cancer as a public health problem. The strategy focuses on the "90–70–90" targets:

- 90% of girls fully vaccinated against HPV by age 15
- 70% of women screened by ages 35 and 45
- 90% of women with precancer or cervical cancer receiving appropriate treatment

Achieving these targets can significantly reduce cervical cancer incidence and mortality worldwide.

Many countries, including India, are strengthening HPV vaccination and cervical screening programs to reduce disease burden.

Role of Nurses and Healthcare Professionals

Healthcare professionals play a critical role in preventing HPV infection and cervical cancer. Their responsibilities include:

- Providing health education regarding HPV and cervical cancer
- Promoting HPV vaccination among adolescents
- Encouraging women to undergo regular screening
- Counseling patients regarding safe sexual practices
- Assisting in early detection and referral
- Supporting women emotionally and psychologically during treatment

Nurses serve as educators, counselors, advocates, and caregivers in cervical cancer prevention programs.

Conclusion

Human papillomavirus infection is the leading cause of cervical cancer, a preventable disease that continues to affect millions of women worldwide. Persistent infection with high-risk HPV types can lead to precancerous lesions and invasive cervical cancer if left untreated. Prevention through HPV vaccination, safe sexual behavior, regular cervical screening, and early treatment remains the most effective strategy for reducing the burden of disease.

Public awareness, government initiatives, and healthcare professional involvement are essential for successful prevention and control programs. Widespread implementation of HPV vaccination and cervical screening services can help achieve the global goal of eliminating cervical cancer as a public health problem. Strengthening healthcare systems, improving access to preventive services, and promoting health education are vital steps toward protecting women's health and reducing cervical cancer-related mortality.

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