

Awareness And Knowledge Of Human Papillomavirus And Vaccination Among University Students: A Narrative Review

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ABSTRACT: Human papillomavirus (HPV) is the most common sexually transmitted infection worldwide and the cause of nearly all cervical cancers, as well as a significant portion of anogenital and oropharyngeal cancers. Despite the availability of highly effective vaccines and screening methods, coverage and acceptance remain low in many areas. University students are a key population, bridging adolescence and adulthood, with varying exposure to health education and independent health decisions. This narrative review summarizes recent evidence on HPV virology and disease impact; prevention methods, including vaccination, screening, and condom use; knowledge, attitudes, and practices (KAP) regarding HPV among university students; barriers to vaccination and screening participation; and evidence-based recommendations to increase knowledge and vaccination in higher-education settings. The literature consistently shows fragmented knowledge, misconceptions about how HPV is transmitted and its cancer risk, gendered misconceptions that vaccination is relevant only for women, and ongoing vaccine hesitancy fueled by safety concerns and social norms. Multi-faceted interventions, including integrating HPV prevention into curricula, peer-led education, digital prompts, and campus health services that provide easy, low-cost vaccination, along with WHO-endorsed single-dose schedules, can significantly increase uptake. A structured literature search was conducted in PubMed/MEDLINE, Scopus, Web of Science, and Google Scholar, covering publications from 2015 to 2025.

Keywords. Human papillomavirus; HPV vaccination; university students; knowledge, attitudes, and practices; vaccine hesitancy

INTRODUCTION

Human papillomaviruses (HPV) are a diverse group of DNA viruses with over 200 genotypes, of which high-risk types, most notably 16 and 18, cause oncogenic transformation in the anogenital tract and/or oropharynx (1). HPV is a necessary cause of cervical cancer and contributes substantially to cancers of the anus, penis, vulva, vagina, and oropharynx. Prophylactic L1 virus-like particle vaccines (bivalent, quadrivalent, and nonavalent) induce strong neutralizing antibodies and provide long-lasting protection against new and persistent infections, high-grade cervical intraepithelial neoplasia (CIN2+), and, at the population level, reductions in cervical cancer incidence (2).

The World Health Organization (WHO) Global Strategy to Eliminate Cervical Cancer as a Public Health Problem sets ambitious 90-70-90 targets, including 90% of girls fully vaccinated by age 15 years, 70% of women screened with a high-performance test at ages 35 and 45, and 90% of women diagnosed with cervical disease treated by 2030 (2,3). Despite these efforts, vaccine coverage and screening participation remain inconsistent across regions, while misinformation continues to undermine public trust in prevention programs.

University students, from both medical and non-medical fields, are a particularly important population to study and engage. They are at increased risk of HPV infection as they transition to independent health-related decision-making, and they may also serve as influential sources of knowledge within their peer groups and broader communities. To address these issues, we conducted a narrative review synthesizing current evidence on HPV biology and prevention, knowledge and attitudes among university students, barriers to vaccination and screening, and effective campus-based strategies to improve uptake.

METHODS

This narrative review was conducted to synthesize recent evidence on knowledge, attitudes, and practices (KAP) regarding HPV and HPV vaccination among university students, together with preventive strategies applicable in higher-education settings.

A structured literature search was performed in PubMed/MEDLINE, Scopus, Web of Science, and Google Scholar. Searches combined Medical Subject Headings (MeSH) and free-text terms including “human papillomavirus” or “HPV”, “vaccination”, “screening”, “knowledge”, “attitudes”, “awareness”, “university students”, “college students”, and “young adults”. The main search

covered publications from January 2015 to December 2025, with particular emphasis on studies published during the most recent five-year period to reflect current policies and vaccination strategies.

We included narrative and systematic reviews, cross-sectional surveys, cohort studies, qualitative studies, and interventional studies conducted among university or college students. International guidelines and policy documents from organizations such as the World Health Organization were also included because of their relevance to HPV prevention strategies and implementation in educational settings.

Articles were limited to English-language publications in peer-reviewed journals. Studies focusing exclusively on adolescent populations outside higher-education environments or on healthcare workers not enrolled as students were excluded unless they provided transferable insights relevant to campus-based interventions.

Titles and abstracts were independently screened for relevance by the authors, followed by full-text assessment of potentially eligible articles. Disagreements were resolved by discussion and consensus. From eligible studies, information was extracted on country and income setting, study design, participant characteristics, academic field, measures of HPV-related knowledge and attitudes, vaccination uptake, reported barriers and facilitators, and evaluated interventions. Findings were synthesized thematically across predefined domains: baseline knowledge, gender differences, vaccine perceptions, structural and sociocultural barriers, screening behaviors, and effectiveness of educational or service-delivery strategies.

Because this was a narrative rather than a systematic review, no formal meta-analysis was conducted. Priority was given to large-scale studies, recent systematic reviews, and authoritative guideline documents to ensure an evidence-based synthesis. A formal risk-of-bias assessment was not conducted; this limitation is acknowledged and considered in the interpretation of the findings.

DISCUSSION

HPV Virology and Disease Burden (Brief Overview)

Human papillomavirus is primarily transmitted through skin-to-skin sexual contact, including genital contact that does not involve penetrative intercourse. Although consistent condom use reduces the risk of transmission and may facilitate viral clearance, it does not provide complete protection because viral exposure can occur through uncovered genital skin (4).

Most HPV infections are transient and resolve spontaneously within 1–2 years as a result of host immune responses. In contrast, persistent infection with high-risk oncogenic genotypes, particularly HPV16 and HPV18, is the central biological mechanism driving the development of cervical intraepithelial neoplasia and progression to invasive carcinoma (5). The likelihood of persistence is influenced by viral type, host immunity, smoking, and other behavioral or biological cofactors (6).

Globally, HPV is responsible for virtually all cases of cervical cancer and contributes substantially to cancers of the anus, vulva, vagina, penis, and oropharynx (7). The introduction of prophylactic vaccination programs has already produced measurable population-level benefits, including marked declines in vaccine-type HPV prevalence, genital warts, high-grade cervical lesions, and, in countries with long-standing high coverage, reductions in cervical cancer incidence.

Taken together, these virological characteristics and epidemiological data underscore why prevention through vaccination and early detection strategies remains central to HPV control and why assessing awareness and knowledge among university students is particularly relevant. These biological features and the substantial cancer burden attributable to HPV provide a compelling rationale for comprehensive prevention strategies that combine vaccination, screening, and behavioral risk-reduction measures, particularly in young adult populations such as university students.

Prevention strategies

Effective prevention of HPV infection and its associated malignancies requires a multi-layered approach that extends beyond vaccination alone. While immunization remains the cornerstone of primary prevention, complementary strategies such as organized screening programs, timely treatment of precancerous lesions, risk-reduction behaviors, and accurate health education are essential to achieving sustained population-level impact. A thorough understanding of HPV transmission dynamics, the limitations of barrier protection methods, and the role of early detection is therefore critical to empowering young adults to make informed health decisions and engage proactively with preventive services (8).

In university settings, where individuals are often navigating independent healthcare choices for the first time, integrating clear information about vaccination, screening eligibility, and safer sexual practices into campus health systems and educational initiatives is particularly important (9). Together, these coordinated measures form the foundation for effective HPV control strategies.

Vaccination

Currently available HPV vaccines include the bivalent (HPV16/18), quadrivalent (HPV6/11/16/18), and nonavalent formulations, the latter also protecting HPV types 31, 33, 45, 52, and 58 (10,11). Across randomized trials and real-world effectiveness studies, all three vaccines have demonstrated greater than 90% efficacy against vaccine-type infections and high-grade precancerous lesions

in HPV-naïve individuals (12,13). The World Health Organization now endorses both one- and two-dose schedules for girls and boys, including a single-dose option, particularly for those aged 9 to 14 years, to facilitate programmatic feasibility and expand population coverage (14). At the population level, sustained high vaccination uptake has been associated with substantial herd protection, reflected in marked declines in genital warts, vaccine-type HPV prevalence, and high-grade cervical lesions, even among unvaccinated individuals (13,15).

Screening and Early Detection

Primary HPV DNA testing, supported by numerous large-scale studies and meta-analyses, is substantially more sensitive than cytology (Pap smear) for detecting high-grade cervical intraepithelial neoplasia (CIN2+) (16). Accordingly, the World Health Organization now recommends primary HPV DNA testing as the preferred modality for cervical cancer screening where feasible (14). Because persistent infection with high-risk HPV types is the necessary cause of cervical cancer, HPV-based screening enables earlier identification of women at risk compared with cytology, which detects morphological cellular changes that typically arise later in the disease process (3).

Owing to its superior sensitivity and high negative predictive value, individuals who test negative for HPV DNA can safely undergo screening at longer intervals, commonly every 5 to 10 years in contemporary guidelines, compared with the shorter intervals recommended for cytology-based programs (17). These extended intervals may improve acceptability and adherence, particularly among young adults who otherwise engage irregularly with preventive healthcare services.

Offering self-collected vaginal samples for HPV testing has emerged as a particularly promising strategy to increase screening participation, especially among individuals who are underscreened or face access barriers. Self-sampling can mitigate obstacles related to embarrassment, cultural stigma, geographic distance, time constraints, or limited clinic availability, thereby promoting greater equity in cervical cancer prevention (18). In multiple settings, HPV testing on self-collected samples has demonstrated accuracy comparable to clinician-collected specimens for the detection of high-risk HPV genotypes (19). On the other hand, using condoms lowers HPV transmission and helps promote clearance, but does not provide complete protection. Quitting smoking, limiting the number of partners, and getting vaccinated before sexual debut further lowers the risk (4,6,8).

In university and other young-adult populations, incorporating self-sampling options within campus health services or outreach programs may further enhance screening uptake once age eligibility is reached, complementing vaccination initiatives and strengthening comprehensive HPV prevention efforts.

Knowledge, attitudes, and practices among university students

Narrative and systematic reviews consistently report moderate overall awareness of HPV, but persistent gaps in core concepts among university students (20). Confusion remains regarding transmission routes, the asymptomatic nature of infection, and the association between HPV and non-cervical cancers, particularly oropharyngeal and anal malignancies (21). Misperceptions that HPV vaccination is only relevant for women are widely described, with male students demonstrating significantly lower knowledge and weaker intentions to vaccinate (22). Overestimation of condom effectiveness and the belief that monogamy alone provides complete protection also continue to be reported across diverse settings.

Safety concerns and fear of side effects are frequently cited as drivers of vaccine hesitancy, along with low perceived personal risk and logistical or financial barriers (21). Importantly, recommendations from healthcare professionals are among the strongest and most consistent predictors of vaccine uptake or intention to vaccinate, even among students enrolled in health-related programs. Social norms, parental attitudes, and peer approval further shape intentions, while stigma surrounding sexually transmitted infections may reduce willingness to seek information or to be vaccinated (21,22).

Medical and nursing students typically demonstrate higher baseline knowledge than their non-medical peers; however, misconceptions persist, including uncertainty about vaccination indications for males, evolving dose schedules, and catch-up eligibility (23). Non-medical students show greater heterogeneity in awareness and frequently rely on social media as a primary information source, where misinformation remains common and may reinforce hesitancy (23).

Digital exposure increasingly shapes students' knowledge and attitudes. Short educational videos, infographics, and university-sponsored online campaigns can increase awareness and motivation to vaccinate, whereas misinformation about fertility, long-term safety, or moral implications continues to undermine trust (24). Preventive strategies that proactively counter false narratives before they spread, such as "prebunking" and inoculation messaging, are being explored as promising tools for campus-based interventions (24,25).

Despite moderate awareness, preventive practices often lag behind knowledge. Many students delay vaccination, fail to complete recommended schedules, or do not engage in screening once eligible, reflecting the combined influence of informational, attitudinal, and structural barriers. These findings underscore the need for comprehensive sexual health education that frames HPV prevention primarily as cancer prevention and integrates vaccination and screening into broader student well-being initiatives (20,22,23).

Barriers to Vaccination and Screening in University Settings

Barriers to HPV vaccination exist across multiple domains and interact to shape student behavior. Programmatic challenges often include limited availability of vaccination services on campus, out-of-pocket costs, inconvenient clinic hours, appointment scheduling difficulties, and the absence of reminder or recall systems (26). For students transitioning from pediatric to adult healthcare, uncertainty about where to obtain vaccines and how to navigate insurance coverage can further delay uptake.

Informational barriers remain prominent and are closely linked to the knowledge gaps described above. Persistent myths regarding vaccine safety, fertility impairment, and sexual disinhibition continue to circulate in student communities, alongside low awareness of male eligibility and the protective benefits of vaccination against oropharyngeal and anal cancers (26, 27). A weak understanding of the link between HPV infection and cancer risk also contributes to the underestimation of personal susceptibility.

Sociocultural obstacles constitute another major category of barriers. Stigma associated with sexually transmitted infections may discourage students from seeking information or accessing preventive services, while gender norms often place disproportionate responsibility for HPV prevention on women and minimize perceived risk among men (28). Cultural taboos surrounding discussions of sexual health can further suppress open communication and reduce participation in vaccination or screening programs.

Structural and administrative barriers also play a significant role in university populations. International students may encounter documentation or insurance-related hurdles, language barriers, or uncertainty about eligibility for national vaccination programs. Fragmentation between campus health services and external healthcare providers, along with concerns about confidentiality, may further impede engagement with preventive care (29).

Taken together, these overlapping barriers underscore the need for multi-level strategies that go beyond information provision alone. Effective responses must simultaneously address service accessibility, affordability, culturally sensitive communication, gender-inclusive messaging, and smooth transitions into adult healthcare systems if HPV prevention programs in higher-education settings are to achieve sustained and equitable impact.

Interventions That Work

Various interventions have been shown to increase HPV vaccination and screening rates among young adults. Including HPV-related modules in first-year courses across both health and non-health faculties improves knowledge and vaccination intentions, while case-based learning and OSCE-style training enhance counseling skills and their practical application (30). Peer-led and ambassador programs boost credibility and outreach, especially in non-medical faculties. Digital reminders via SMS, email, electronic health portals, and campus apps are effective in increasing series initiation and completion. Short, evidence-based micro-videos help combat misinformation. On-site, accessible vaccination options such as walk-in clinics near lecture halls, extended hours during peak academic times, and free or subsidized vaccines address access barriers, with smooth consent processes ensuring privacy and efficiency. Following WHO guidelines, adopting single-dose schedules can simplify logistics, lower costs, and expand coverage without losing effectiveness for targeted age groups (15). Male-focused messages emphasizing protection against oropharyngeal and anal cancers have been shown to increase engagement, while self-sampling for HPV testing on campus provides an additional way to boost participation among eligible students and staff (31).

Research Gaps and Future Directions

Future research and program development should focus on several critical areas. A clearer understanding of male student perspectives remains essential to identify gender-specific barriers and to design strategies that more effectively promote HPV vaccination among men (22, 32). Despite growing recognition of male susceptibility to HPV-associated cancers, many existing studies continue to center primarily on female populations, limiting the generalizability of campus-based interventions.

Long-term follow-up data are notably scarce. Most interventional studies assess short-term changes in knowledge, attitudes, or initial vaccine uptake, while few track sustained completion of vaccination schedules or screening participation over multiple years (25). Evaluating the durability of effects is particularly important as students transition out of university settings and into community-based healthcare systems.

Equity-focused approaches also remain underdeveloped. International students, LGBTQ+ populations, and socioeconomically disadvantaged groups are frequently underrepresented in research samples, despite facing distinct structural, cultural, and healthcare-access barriers. Future investigations should adopt inclusive recruitment strategies and disaggregated analyses to better understand how gender identity, sexual orientation, migration status, and financial constraints intersect with vaccination behaviors and access to preventive services (33).

Another emerging area requiring closer scrutiny is the rapidly evolving digital information environment. While several studies highlight the promise of social-media-based educational interventions, far fewer systematically evaluate real-time misinformation dynamics, platform-specific rumor diffusion, or the effectiveness of rapid-response counter-messaging deployed by campus health

units (24). Developing standardized monitoring frameworks and toolkits for university health services could substantially strengthen future prevention efforts.

Finally, there is limited comparative research examining the cost-effectiveness, scalability, and acceptability of different campus-based delivery models, such as pop-up vaccination clinics, bundled immunization events, or self-sampling programs for HPV testing. Rigorous economic evaluations and implementation-science approaches would provide policymakers and university administrators with critical evidence to guide sustainable, large-scale prevention strategies.

Practical Recommendations for Universities and Policymakers

A comprehensive campus-wide HPV strategy should begin with the adoption of institutional policies aligned with national immunization programs and World Health Organization guidance on single-dose options, coupled with reliable procurement systems that allow vaccines to be consistently available in on-site clinics (3,11). Clear governance structures and collaboration between university administrations, public health authorities, and student health services are essential to ensure sustainability.

To improve accessibility, vaccination opportunities should be designed to be as seamless as possible through default appointments, pop-up clinics, and combined immunization events, such as offering HPV vaccination alongside influenza campaigns, scheduled during high-traffic academic periods, including orientation weeks or examination seasons. Simplified booking systems, extended clinic hours, and transparent communication about eligibility and costs can further reduce logistical barriers.

Efforts to normalize and destigmatize vaccination are equally important. Framing HPV immunization primarily as cancer prevention rather than as a marker of sexual activity and using inclusive imagery and non-judgmental language in campus communications can enhance acceptability across diverse student populations. Targeted outreach to male students and culturally sensitive messaging for international or minority groups may further increase engagement.

Training for campus physicians, nurses, and counselors should emphasize delivering strong, presumptive vaccine recommendations supported by brief motivational interviewing techniques, enabling providers to confidently address safety concerns and misconceptions. At the same time, integrating HPV-related content into curricula across faculties, supported by pre- and post-intervention assessments, can reinforce knowledge and encourage informed decision-making beyond health-related disciplines.

Peer-led initiatives, student ambassador programs, and university-approved digital platforms should be leveraged to disseminate verified information and rapidly counter misinformation circulating online. Finally, ongoing monitoring and evaluation of program outcomes, including vaccine initiation and completion rates, improvements in HPV-related knowledge, and equity indicators across demographic groups, should be embedded within continuous quality improvement cycles to ensure that campus-based strategies achieve durable and measurable public health impact.

CONCLUSION

HPV vaccination and screening remain cornerstone strategies for cancer prevention, yet substantial knowledge gaps and persistent vaccine hesitancy persist among university students across diverse settings. Evidence synthesized in this narrative review highlights the multifactorial nature of these challenges, encompassing informational deficits, attitudinal concerns, sociocultural influences, and structural barriers within higher-education environments. Targeted, multi-layered interventions, including integrating HPV-related content into university curricula, peer-led education, digitally delivered reminders and counter-misinformation strategies, and convenient access to on-campus vaccination services, have demonstrated potential to substantially improve uptake and preventive engagement among students. Importantly, aligning institutional policies with World Health Organization recommendations, such as adopting single-dose vaccination schedules where appropriate, represents a pragmatic approach to expanding coverage while maintaining effectiveness.

Together, these coordinated campus-based strategies can contribute meaningfully to broader national and global efforts to reduce HPV-related cancer burden and to advance progress toward cervical cancer elimination goals, while also fostering a more informed and empowered generation of young adults.

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