

Knowledge and Awareness of Human Papillomavirus (HPV) Vaccine in Prevention of Cervical Cancer among Medical Students: A Cross-Sectional Study

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Abstract

Background: Cervical cancer remains a leading cause of cancer-related morbidity and mortality among women in low- and middle-income countries, particularly India, which accounts for a substantial share of the global burden. Persistent infection with high-risk Human Papillomavirus (HPV) is the primary etiological factor, and HPV vaccination provides effective primary prevention — yet vaccine uptake remains low even among healthcare trainees who are expected to serve as advocates for preventive health.

Objectives: To evaluate the knowledge, awareness, attitudes, and vaccination status related to HPV and its vaccine among final-year medical students and house surgeons, and to examine the association between awareness and willingness to recommend vaccination to others.

Methods: A descriptive, cross-sectional study was conducted among 100 final-year MBBS students and house surgeons at GIMSR Hospital, Visakhapatnam, using a structured, self-administered questionnaire covering knowledge, awareness, vaccination status, and attitudes. Data were analysed using descriptive statistics and the chi-square test, with $p < 0.05$ considered statistically significant. 117 (51.5%) reported knowing two or more danger signs.

Results: Awareness of HPV as a causative factor for cervical cancer was reported by 95% of students, and 85% were aware of the HPV vaccine; however, only 40% had actually received the vaccine. Among the 60 unvaccinated students, exactly half (50%) expressed willingness to be vaccinated. Awareness of the vaccine schedule (80%) and cost (74%), and willingness to recommend vaccination to others (88%), reflected generally positive attitudes despite low personal uptake. A statistically significant association was found between awareness of the HPV vaccine and willingness to recommend it ($p < 0.05$), while sex showed no significant association with vaccination status ($p > 0.05$).

Conclusion: Medical students demonstrate strong awareness of, and positive attitudes toward, HPV vaccination, but this has not translated into adequate personal uptake. Strengthening practical, vaccine-focused medical education, facilitating affordable on-campus access, and supporting national vaccination strategies — including India's newly available, lower-cost indigenous vaccine — are crucial to closing this gap.

Keywords

Cervical cancer; Human papillomavirus; HPV vaccine; Medical students; Awareness; Vaccination uptake; Preventive health; Cross-sectional study.

Introduction

Cervical cancer continues to pose a major threat to women's health worldwide despite being one of the most preventable and treatable malignancies when detected early. According to the most recent Global Cancer Observatory (GLOBOCAN) estimates, cervical cancer accounted for approximately 662,301 new cases and 348,874 deaths worldwide in 2022, making it the fourth most commonly diagnosed cancer and the fourth leading cause of cancer death among women globally [1]. Nearly 90% of these deaths occur in low- and middle-income countries (LMICs), reflecting profound global inequities in access to preventive screening, vaccination, and timely treatment [1].

India shares a disproportionate share of this global burden. GLOBOCAN 2022 data place India second only to China in absolute case numbers, with an estimated 127,356 new cervical cancer cases that year — nearly one-fifth of the global total [1]. Cervical cancer is the second most common cancer among Indian women after breast cancer, and government surveillance data from the Indian Council of Medical Research–National Cancer Registry Programme (ICMR-NCRP) indicate that annual cervical cancer deaths in the country have risen steadily in recent years, from an estimated 32,246 in 2019 to 35,691 in 2023 [2].

The near-universal cause of cervical cancer is persistent infection with high-risk, oncogenic genotypes of Human Papillomavirus (HPV). More than 200 HPV genotypes have been identified, of which approximately 12–14 are classified as high-risk; genotypes 16 and 18 alone are responsible for approximately 70% of cervical cancers worldwide [3]. HPV is transmitted predominantly through sexual contact and is the most common sexually transmitted infection among sexually active individuals. While most infections are transient and cleared spontaneously by the host immune system within one to two years, persistent infection with high-risk genotypes can progress through cervical intraepithelial neoplasia (CIN) to invasive carcinoma over a period of years to decades.

Preventive strategies against cervical cancer operate at two levels. Secondary prevention relies on the early detection of precancerous lesions through Papanicolaou (Pap) smear cytology, HPV DNA testing, and visual inspection with acetic acid (VIA). Primary prevention through HPV vaccination, however, has emerged as the single most effective long-term strategy, since it prevents infection before it can become

established. Three prophylactic vaccines have historically been available in India: Cervarix (bivalent, targeting HPV 16 and 18), Gardasil (quadrivalent, targeting HPV 6, 11, 16, and 18), and Gardasil-9 (nonavalent, additionally targeting HPV 31, 33, 45, 52, and 58). More recently, India has developed its own indigenous quadrivalent vaccine, Cervavac, manufactured by the Serum Institute of India in partnership with the Department of Biotechnology; a randomised, active-controlled phase 2/3 trial demonstrated that Cervavac produces antibody responses non-inferior to Gardasil, and it received market authorisation from the Drugs Controller General of India in 2022 [4]. Because Cervavac is priced substantially lower than the imported vaccines, it holds considerable promise for improving affordability and access in a cost-sensitive setting such as India.

Despite these advances, HPV vaccine uptake in India remains low. Recognised barriers include limited awareness, misconceptions about vaccine safety and fertility effects, social stigma associated with a sexually transmitted infection, and the historically high cost of imported vaccines. In 2020, the World Health Organization (WHO) launched the Global Strategy to Accelerate the Elimination of Cervical Cancer as a Public Health Problem, which set the “90–70–90” targets to be achieved by 2030: 90% of girls fully vaccinated against HPV by age 15 years, 70% of women screened using a high-performance test by age 35 and again by 45, and 90% of women with cervical disease receiving appropriate treatment [5]. Achieving these targets will require the active participation of healthcare professionals at every level of the health system.

Medical students occupy a unique position in this effort. As future physicians, they will be responsible for counselling patients, dispelling myths, and driving uptake of preventive interventions such as HPV vaccination within their communities. Their personal knowledge, attitudes, and vaccination status are therefore not merely a matter of This study was therefore undertaken among final-year MBBS students and house surgeons at GIMSR Hospital, Visakhapatnam, to assess their knowledge, awareness, attitudes, and vaccination status with respect to HPV and its vaccine.

Review of Literature

The causal link between persistent HPV infection and cervical carcinogenesis was firmly established through epidemiological and molecular virology studies during the 1980s and 1990s — work recognised by the award of the 2008 Nobel Prize in Physiology or Medicine to Harald zur Hausen — and this understanding directly informed the global burden estimates and prophylactic vaccine development efforts that followed in the early 2000s [6].

Global perspectives

Countries that achieved high, sustained HPV vaccination coverage have documented dramatic real-world reductions in HPV prevalence and cervical disease. In Australia, which became one of the first countries to introduce a national, school-based quadrivalent HPV vaccination programme in 2007, population-based surveillance found that the prevalence of vaccine-targeted HPV genotypes among women aged 18–24 years fell from 22.7% in 2005–2007 (pre-vaccine) to just 1.5% by 2015 — a relative reduction exceeding 90% — with similar declines and clear evidence of herd protection observed even among unvaccinated women [7]. In England, a population-based observational study linking vaccination, screening, and cancer

registry data found that women offered the bivalent vaccine at age 12–13 years had cervical cancer rates 87% lower than earlier, unvaccinated cohorts, with corresponding reductions of 62% and 34% among those vaccinated at ages 14–16 and 16–18 respectively [8]. A pooled systematic review and meta-analysis of vaccination programmes across multiple high-income countries has confirmed that these gains are consistent and reproducible wherever coverage is high and sustained, with clear population-level herd effects extending to unvaccinated individuals [9]. Together, these findings provide direct, population-level evidence that HPV vaccination — particularly when delivered before the onset of sexual activity — can dramatically curtail the future burden of cervical cancer.

Indian studies

Vaccination coverage in India, however, remains far below these benchmarks, even among healthcare trainees who might be expected to be better informed than the general population. Radhika et al. found that only 55% of medical students in Mangalore were aware of the HPV vaccine [10]. Pandey et al., studying students at a premier Indian medical school, similarly reported moderate awareness coupled with very low uptake [11]. Aparna et al. reported comparable findings, with reasonable baseline knowledge failing to translate into vaccine acceptance [12]. This pattern has persisted in more recent cohorts: a 2025 cross-sectional study among female undergraduate medical students in Nagpur found that despite generally adequate awareness of HPV, only around 10% of participants had actually been vaccinated [13]; a similarly recent study from a medical college in Amritsar found that while more than three-quarters of undergraduate medical students were aware of the HPV vaccine, only 7% had received it [14].

A large multi-institutional survey of 1,210 health science undergraduates in central India found that fewer than 28% correctly identified vaccination as a preventive measure for cervical cancer, although medical students performed somewhat better on most parameters than students of other health science disciplines [15]. Taken together, these studies — spanning more than a decade and multiple regions of India — consistently demonstrate a persistent gap between awareness and actual vaccine utilisation among Indian medical trainees.

Barriers identified

Across these studies, recurring barriers to HPV vaccine uptake include the absence of a strong recommendation from healthcare providers or institutions, persistent myths linking the vaccine to infertility or the promotion of premarital sexual activity, the historically high cost of imported vaccines, and — until 2024 — the exclusion of HPV vaccination from India's Universal Immunization Programme [10–15]. Notably, even where knowledge and awareness are adequate, translation into actual vaccine uptake remains poor, mirroring the broader global observation that population-level impact is realised only where sustained, structured programmatic delivery — not awareness alone — drives high coverage [8,9].

Medical students as advocates

As future physicians, medical students are expected to act as both educators and vaccine advocates for their patients and communities. Consistent with this expectation, the present study found a statistically significant association between students' awareness of the HPV vaccine and their willingness to

recommend it to others (see Results), reinforcing the notion that informed, personally engaged medical trainees are best placed to serve as credible advocates for vaccination — and underscoring the importance of addressing knowledge gaps and personal vaccine hesitancy at the trainee level.

Thus, the literature consistently demonstrates a paradox of high awareness but poor uptake, highlighting the urgent need for comprehensive, practically-oriented education, supportive institutional policy, and accessible vaccination programmes targeting medical trainees specifically.

Materials and Methods

Study design

This was a descriptive, observational, cross-sectional study designed to evaluate knowledge, awareness, attitudes, and vaccination status regarding HPV and cervical cancer among medical students.

Study setting and duration

The study was conducted in the Department of Obstetrics and Gynaecology, GIMSR Hospital, Visakhapatnam — a tertiary care teaching institution with an annual intake of approximately 150 MBBS students, providing a representative cross-section of young medical trainees in coastal Andhra Pradesh. [Study period: to be inserted by authors, e.g., Month Year to Month Year.]

Study population

Participants comprised final-year MBBS students and house surgeons who had completed their core clinical rotations, including postings in Obstetrics and Gynaecology. This group was selected because sufficient clinical exposure was considered necessary to meaningfully evaluate awareness of, and attitudes toward, a clinically relevant preventive intervention. Students in the first, second, and third years of the MBBS programme were excluded on account of limited clinical exposure at the time of the study.

Sample size

The minimum required sample size was estimated using the standard formula for a single-proportion prevalence study:

$$n = Z^2pq / d^2$$

where $Z = 1.96$ (the standard normal deviate corresponding to a 95% confidence level), $p = 0.5$ (an expected awareness prevalence of 50%, used in the absence of prior local data to yield the most conservative, maximum sample-size estimate), $q = (1 - p) = 0.5$, and $d = 0.1$ (an acceptable margin of error of 10%). This calculation yielded a minimum required sample size of $n = (1.96)^2 \times 0.5 \times 0.5 / (0.1)^2 \approx 96.04$, i.e., approximately 96 participants, which was rounded up to 100 to allow a margin for incomplete or non-usable responses.

Sampling technique and study tool

All eligible final-year MBBS students and house surgeons who were available and willing to participate during the study period were approached, and enrolment continued until the calculated sample size of 100 was reached. Data were collected using a structured, pretested, self-administered questionnaire comprising 10 multiple-choice questions, framed in simple language after review of the existing literature

on HPV vaccine-related knowledge, attitudes, and practice. The questionnaire covered five principal domains:

1. Awareness of HPV infection as a causative agent of cervical cancer.
2. Knowledge of HPV vaccines and their availability.
3. Awareness of the recommended HPV vaccine schedule and cost.
4. Personal vaccination status of participants.
5. Attitudes toward HPV vaccination and willingness to recommend it to others.

Representative items included:

- “Do you know that HPV is a causative factor for cervical cancer?” (Yes/No)
- “Are you aware of vaccines available for HPV?” (Yes/No)
- “Have you received the HPV vaccine?” (Yes/No)
- “Would you recommend HPV vaccination to others?” (Yes/No)

Data collection

The objectives of the study were explained to all eligible participants prior to enrolment, and written informed consent was obtained. Questionnaires were distributed in classroom settings and collected immediately upon completion; responses were anonymised at the point of collection to protect participant confidentiality and encourage candid responses.

Ethical considerations

Ethical clearance was obtained from the Institutional Ethics Committee of GIMSR prior to commencement of data collection (Approval No.: [to be inserted by authors]). Participation was entirely voluntary, and participants were free to withdraw at any stage without any effect on their academic standing. Confidentiality of individual responses was maintained throughout data collection, entry, and analysis.

Statistical analysis

Completed questionnaires were coded and entered into Microsoft Excel for analysis. Descriptive statistics — frequencies and percentages — were calculated for all study variables. Associations between categorical variables (for example, awareness of the HPV vaccine and willingness to recommend it, and sex and vaccination status) were tested using the chi-square test, with a p-value <0.05 considered statistically significant.

Results

A total of 100 medical students — comprising final-year MBBS students and house surgeons — completed and returned the questionnaire. The study population was evenly split by sex, with 50 (50%) male and 50 (50%) female participants, and ages ranging from 21 to 25 years.

Knowledge and awareness (Table 1, Table 2; Figures 1, 2, 6, 7)

Awareness that persistent HPV infection is the causative agent of cervical cancer was high, reported by 95 of 100 students (95%) (Table 1; Figures 1 and 6). Eighty-five students (85%) were aware that vaccines against HPV are available (Table 2; Figures 2 and 7). Somewhat fewer — 70 students (70%) — were aware

that HPV vaccination also protects against other HPV-associated malignancies, such as anal, penile, and oropharyngeal cancers.

Response	Number (n=100)	Percentage
Yes	95	95%
No	5	5%

Table 1: Awareness about HPV being the causative agent of cervical cancer (n=100).

Response	Number (n=100)	Percentage
Yes	85	85%
No	15	15%

Table 2: Awareness of HPV vaccine availability (n=100).

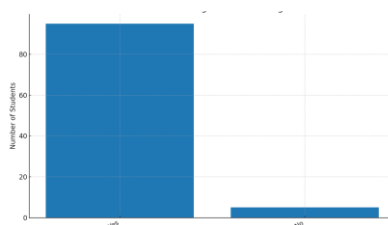


Figure 1: Awareness about HPV being the causative agent of cervical cancer.

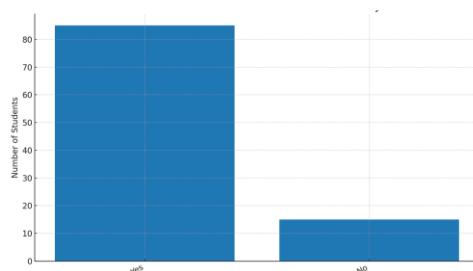


Figure 2: Awareness of HPV vaccine availability.

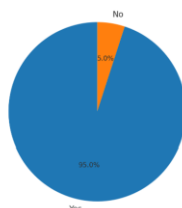


Figure 6: Awareness about HPV being the causative agent of cervical cancer (pie chart).

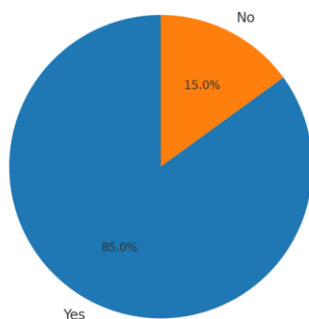


Figure 7: Awareness of HPV vaccine availability (pie chart).

Despite this generally high level of awareness, only 40 of 100 students (40%) had actually received the HPV vaccine (**Table 3; Figures 3 and 8**). Among the 60 unvaccinated students, willingness to be vaccinated was evenly divided: 30 (50% of the unvaccinated group) expressed willingness to receive the vaccine in future, while the remaining 30 (50%) were unwilling (**Table 4; Figures 4 and 9**).

Response	Number (n=100)	Percentage
Vaccinated	40	40%
Not Vaccinated	60	60%

Table 3: Vaccination status among students (n=100).

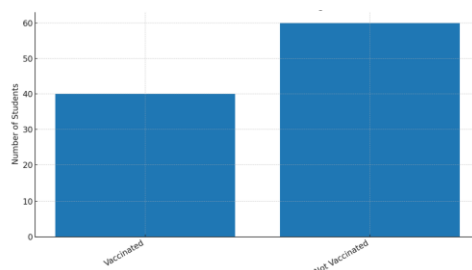


Figure 3: Vaccination status among students (bar chart).

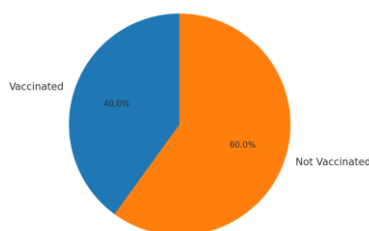


Figure 8: Vaccination status among students (pie chart).

Response	Number (n=60)	Percentage
Willing	30	50%

Response	Number (n=60)	Percentage
Unwilling	30	50%

Table 4: Willingness to vaccinate among unvaccinated students (n=60).

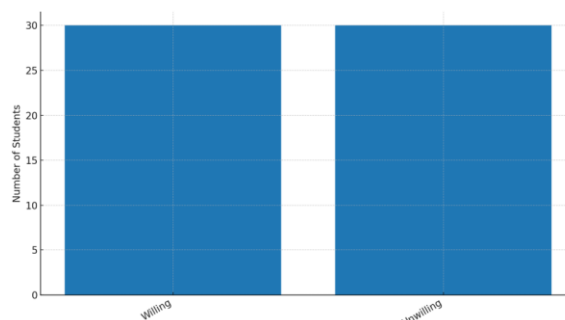


Figure 4: Willingness to vaccinate among unvaccinated students (bar chart).

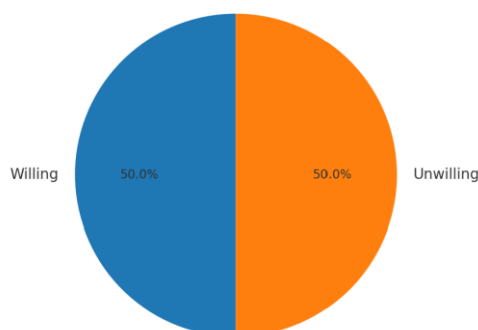


Figure 9: Willingness to vaccinate among unvaccinated students (pie chart).

Knowledge of vaccine schedule and cost

Among all participants, 80 (80%) correctly identified the recommended HPV vaccination schedule, and 74 (74%) reported awareness of the approximate cost of the vaccine.

Attitudes toward vaccination (Table 5; Figures 5, 10)

A large majority — 88 students (88%) — indicated that they would recommend HPV vaccination to others, including patients, friends, and family members (Table 5; Figures 5 and 10), reflecting generally positive attitudes toward the vaccine even among students who had not themselves been vaccinated.

Response	Number (n=100)	Percentage
Yes	88	88%
No	12	12%

Table 5: Recommendation of HPV vaccination to others (n=100).

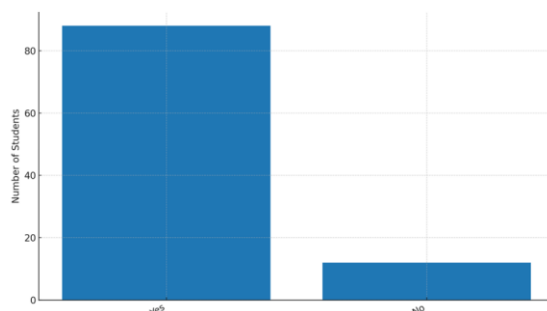


Figure 5: Recommendation of HPV vaccination to others (bar chart).

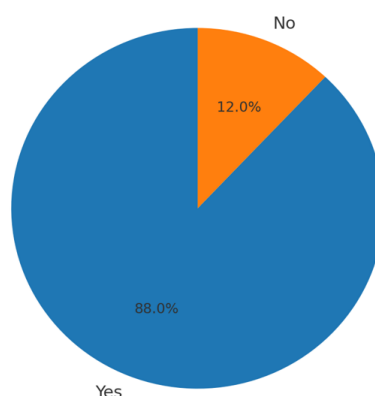


Figure 10: Recommendation of HPV vaccination to others (pie chart).

Statistical associations

On chi-square testing, a statistically significant association was observed between awareness of the HPV vaccine and willingness to recommend it to others ($p < 0.05$), suggesting that better-informed students were more likely to advocate for vaccination. No statistically significant association was found between sex and actual vaccination status ($p > 0.05$), indicating that male and female students were comparably likely to have been vaccinated.

A summary of key findings is presented in (Tables 1-5), with the corresponding bar- and pie-chart representations in (Figures 1-10).

Discussion

This study set out to characterise knowledge, awareness, attitudes, and vaccination status regarding HPV and cervical cancer among final-year medical students and house surgeons — a population poised to enter independent clinical practice within months of graduation. The central finding is a striking paradox: although awareness of HPV as the cause of cervical cancer (95%) and of the existence of a preventive vaccine (85%) was high, actual vaccine uptake (40%) lagged far behind, and even among unvaccinated students who were aware of the vaccine, willingness to be vaccinated was split evenly. This awareness–uptake gap is consistent with, and adds further weight to, a substantial body of Indian and international literature.

Comparison with indian studies

The 85% vaccine-awareness level observed here is appreciably higher than the 55% reported over a decade ago by Radhika et al. among medical students in Mangalore [10], and is broadly consistent with — or exceeds — awareness levels reported in more recent single-centre Indian studies, including cohorts from Nagpur [13] and Amritsar [14]. However, uptake in our cohort (40%) was, if anything, considerably higher than the 7–10% vaccination rates reported in these more recent studies [13,14], even though those studies included younger, more heterogeneous cohorts spanning all years of the MBBS programme. A plausible explanation is that our participants — being exclusively final-year students and house surgeons with several additional years of clinical exposure, and often closer to independent decision-making about their own health — had more opportunity, agency, and clinical context in which to access vaccination than the first- to fourth-year students sampled elsewhere. Pandey et al., studying a premier Indian medical school, similarly found moderate awareness accompanied by very low uptake [11], and Aparna et al. reported a comparable knowledge–practice gap [12]. That this pattern recurs across studies conducted more than a decade apart, in different regions of India, and using different sampling frames, suggests it reflects a genuine, structural feature of HPV vaccine delivery in India rather than an artefact of any single study population.

Comparison with global studies

The contrast with countries that have implemented sustained, structured national immunisation programmes is instructive. Australia's school-based quadrivalent vaccination programme, introduced in 2007, reduced the prevalence of vaccine-targeted HPV genotypes among young women by more than 90% within less than a decade, with evidence of herd protection extending even to unvaccinated women [7]. England's bivalent vaccination programme has been shown, using linked national registry data, to reduce actual cervical cancer incidence by 87% among women vaccinated at age 12–13 years, with smaller but still substantial reductions among those vaccinated later in adolescence [8]. A pooled analysis of multiple national vaccination programmes confirms that these gains are consistent and reproducible wherever coverage is high and sustained [9]. The key distinction between these settings and India is not scientific — the vaccines themselves are highly efficacious wherever they are used — but programmatic: high, population-level coverage in Australia and the UK was achieved through school-based, publicly funded delivery, whereas HPV vaccination in India has, until very recently, remained an opportunistic, out-of-pocket purchase for most families.

Barriers to uptake

Consistent with prior work, the barriers underlying low uptake in our setting are likely to include the historically high cost of imported vaccines, persistent myths linking vaccination to infertility or the promotion of premarital sexual activity, the absence of a strong, consistent recommendation from healthcare providers and institutions, and — until 2024 — the exclusion of HPV vaccination from India's Universal Immunization Programme. Medical students, despite their clinical training, are not immune to these same social and cultural pressures, and may also underestimate their personal risk of HPV exposure.

Emerging opportunities

Several developments since this study was conducted offer grounds for cautious optimism. India's own

indigenously developed quadrivalent vaccine, Cervavac, manufactured by the Serum Institute of India, has demonstrated antibody responses non-inferior to Gardasil in a large phase 2/3 trial [4] and is priced substantially below imported alternatives, directly addressing the cost barrier repeatedly identified in this and other Indian studies [10–15]. As domestic manufacturing scales up and HPV vaccination moves toward inclusion within national immunisation policy, the principal remaining barriers are likely to shift from cost and availability toward awareness, provider recommendation, and the dismantling of persistent myths — precisely the domains in which medical students, as future physicians, are best placed to lead.

Implications for medical education

As the findings of this and other studies illustrate, high knowledge does not automatically translate into personal vaccination or confident advocacy. Medical curricula should therefore move beyond simply imparting factual knowledge of HPV virology and epidemiology to actively facilitating vaccination — for example, by offering the vaccine on campus at subsidised or no cost, incorporating structured discussion of vaccine hesitancy and communication skills into the Obstetrics and Gynaecology and Community Medicine curricula, and ensuring that faculty and senior residents model positive vaccination behaviour. A medical student who has personally received the vaccine, and who has been trained to address common patient concerns, is likely to be a far more credible advocate than one who has not.

Policy implications

At the health-system level, the findings support continued efforts to integrate HPV vaccination fully into India's national immunisation programme, to expand subsidised or free access — particularly now that a substantially cheaper indigenous vaccine is available — and to run sustained public awareness campaigns that explicitly target healthcare trainees alongside the general public. Achieving the WHO's 90–70–90 elimination targets by 2030 [5] will not be possible without the active engagement of the medical profession, beginning at the undergraduate level.

Strengths and limitations

This study adds to a growing body of Indian literature on HPV vaccine-related knowledge, attitudes, and practice by focusing specifically on final-year students and house surgeons — the medical trainees closest to independent clinical practice — and by directly examining the association between vaccine awareness and willingness to recommend the vaccine to others, an outcome of particular relevance to their future role as advocates. Several limitations should nonetheless be noted. The cross-sectional, single-centre design limits both causal inference and generalisability to medical students elsewhere in India. The convenience sample of 100 students, while adequate for the descriptive objectives of the study, restricts the precision of subgroup comparisons. Vaccination status and other responses were self-reported and could not be independently verified against vaccination records, introducing the possibility of recall or social-desirability bias. Finally, the structured questionnaire, while covering the core domains of interest, did not capture more granular information — such as specific reasons for vaccine refusal or the influence of family and peer attitudes — that could further explain the observed awareness–uptake gap.

Future Research

Larger, multi-centre studies across different regions and types of medical colleges in India would help

establish how generalisable these findings are, and would allow more robust subgroup analyses (for example, by year of study, sex, or urban versus rural background). Qualitative or mixed-methods research exploring the specific reasons behind vaccine refusal — beyond simple willingness/unwillingness — would help design more targeted interventions. Longitudinal or interventional studies evaluating whether structured educational interventions, on-campus vaccination drives, or the availability of Cervavac measurably improve uptake among medical students would provide direct evidence to guide institutional policy.

Conclusion

This study demonstrates that final-year medical students and house surgeons at a tertiary teaching hospital in India possess high awareness of HPV as a cause of cervical cancer and largely positive attitudes toward vaccination, yet translate this knowledge into personal vaccination at a rate of only 40% — leaving the majority inadequately protected against a largely preventable cancer. As the physicians who will soon be responsible for recommending preventive interventions to their own patients, medical students carry a dual responsibility: safeguarding their own health and modelling the preventive behaviour they will be expected to promote. Bridging the awareness–uptake gap will require coordinated action — curricular integration of practical, vaccine-focused education; institutional facilitation of affordable or free vaccination; and sustained public health messaging — supported by emerging developments such as the availability of a lower-cost indigenous vaccine. Such measures, implemented at the medical-student level and scaled nationally, will be essential if India is to make meaningful progress toward the WHO's goal of cervical cancer elimination by 2030.

Declarations

Ethical approval: This study was approved by the Institutional Ethics Committee, GIMSR, Visakhapatnam (Approval No.: [to be inserted by authors]; dated [to be inserted by authors]). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

Consent to participate: Written informed consent was obtained from all participants prior to enrolment. Participation was voluntary, and responses were collected and analysed anonymously to protect participant confidentiality.

Consent for publication: Not applicable (no identifying individual data are reported).

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Conflict of interest: [Authors to confirm — e.g., “The authors declare that they have no conflict of interest.”]

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Author contributions: [To be completed by authors, following ICMJE authorship criteria; suggested framework below.]

- AB: conceptualisation, data collection, data analysis, manuscript drafting.
- GI: supervision, study design, critical revision of the manuscript.
- KSKD, M, K: data collection / analysis / manuscript review — roles to be specified.
- All authors reviewed and approved the final manuscript.

Data availability: The datasets generated and/or analysed during the current study are available from the corresponding author on reasonable request.

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