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# Silent Threat, Limited Awareness: A Web-Based Assessment of Knowledge on Human Papillomavirus and Vaccination in Himachal Pradesh, India

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**Abstract** **Background:** Human Papillomavirus (HPV) infection is a major public health concern and a well-established cause of cervical cancer and other anogenital and oropharyngeal malignancies. Despite the availability of effective HPV vaccines, awareness and uptake remain suboptimal in many parts of India. Limited data are available regarding HPV-related knowledge among the general population in Himachal Pradesh. **Objectives:** To assess the level of knowledge regarding HPV infection and HPV vaccination among adults in Himachal Pradesh and to examine the association between socio-demographic characteristics and knowledge levels. **Methods:** A community-based cross-sectional study was conducted from October to December 2025 using a Google Form–based online survey. Adults aged 18 years and above residing in Himachal Pradesh were recruited through convenience sampling. A structured, self-administered questionnaire assessed socio-demographic characteristics and knowledge related to HPV infection and HPV vaccination. Knowledge scores ranged from 0 to 20 and were categorized as poor (≤6), moderate (7–13), or good (≥14). Data were analyzed using Epi Info version 7, and associations were tested using the chi-square test with a significance level set at $p < 0.05$. **Results:** A total of 800 participants were included in the analysis. Overall awareness of HPV was reported by 40.8% of participants. Knowledge regarding HPV transmission, associated cancers, and vaccination was generally low, with correct responses ranging from 17.6% to 44.8% across individual items. More than two-thirds of participants (68.1%) demonstrated poor knowledge, while only 17.4% had good knowledge. A statistically significant association was observed between age and knowledge level ($\chi^2 = 20.58$, $p = 0.002$), with younger participants showing better knowledge. No significant association was found between gender and knowledge level ($p = 0.999$). **Conclusion:** The study reveals considerable gaps in knowledge regarding HPV and HPV vaccination among adults in Himachal Pradesh. These findings highlight the urgent need for targeted awareness campaigns, strengthened health education initiatives, and improved dissemination of information to enhance HPV prevention efforts in the region

**Key Words** Human Papillomavirus, HPV vaccination, Knowledge assessment, Cervical cancer prevention, Himachal Pradesh, India

## INTRODUCTION

Human Papillomavirus (HPV) infection represents one of the most common sexually transmitted infections worldwide and is a well-established etiological factor for several malignancies, most notably cervical cancer [1,2]. Globally, cervical cancer remains a major public health concern, ranking as the fourth most common cancer among women, with a disproportionately high burden in low- and middle-income countries [3,4]. In India, cervical cancer constitutes a leading cause of cancer-related morbidity and mortality among women, underscoring the urgent need for effective preventive strategies, including HPV vaccination and regular screening [5,6].

Persistent infection with oncogenic HPV types is implicated not only in cervical cancer but also in cancers of the anogenital region, oropharynx, and other sites in both males and females. Prophylactic HPV vaccines have demonstrated high efficacy and safety in preventing infections with high-risk HPV types and related precancerous lesions, particularly when administered prior to sexual debut [7,8]. Consequently, the World Health Organization and national health authorities advocate for

early vaccination of adolescents, alongside continued cervical cancer screening even among vaccinated individuals. Despite these recommendations, HPV vaccination coverage remains suboptimal in many regions, largely due to limited awareness, misinformation, sociocultural barriers, and inadequate dissemination of public health information [2,9,10].

In India, although HPV vaccines have received regulatory approval and efforts are underway to introduce HPV vaccination through national immunization initiatives, public awareness and acceptance remain inconsistent across different regions and population groups. Knowledge regarding HPV transmission, associated health risks, vaccination schedules, and the continued need for screening is crucial for informed decision-making and successful implementation of prevention programs [11-13]. However, existing evidence suggests substantial gaps in HPV-related knowledge among the general population, particularly in semi-urban and rural settings.

Himachal Pradesh, a predominantly hilly state in northern India, presents unique public health challenges due to its geographical terrain, dispersed population, and variable access to healthcare and health education resources. Data on awareness and knowledge of HPV and HPV vaccination from this region are limited, highlighting the need for region-specific evidence to inform targeted health education and policy interventions. With increasing digital penetration and internet access, online survey platforms offer a feasible approach to assess health-related knowledge among diverse populations.

In this context, the present study was conducted in Himachal Pradesh using a Google Form–based survey to assess the level of knowledge regarding HPV infection and HPV vaccination among adults. The findings of this study aim to identify existing knowledge gaps and provide evidence to support the development of targeted awareness campaigns and public health strategies to improve HPV prevention efforts in the region.

## METHODS

### Study Design, Setting, and Duration

A community-based, cross-sectional study was conducted in the state of Himachal Pradesh, India, to assess knowledge regarding Human Papillomavirus (HPV) infection and HPV vaccination. The study was carried out over a three-month period from October to December 2025. Data were collected using an online survey administered through Google Forms, enabling participation from individuals across different geographical regions of the state.

### Study Population and Sample Size

The study population comprised adults aged 18 years and above who were residents of Himachal Pradesh at the time of the survey. A total of 800 participants who fulfilled the eligibility criteria and provided complete responses were included in the final analysis. Participation in the study was voluntary.

### Sampling Technique

A non-probability convenience sampling approach was adopted. The survey link was disseminated through commonly used digital platforms, including WhatsApp, Facebook, and email, to reach a broad and diverse population. Participants were also encouraged to share the survey link within their networks, thereby enhancing outreach across the state.

### Eligibility Criteria

Inclusion Criteria included individuals aged 18 years or older, residing in Himachal Pradesh, and willing to participate after providing informed electronic consent. Exclusion criteria were individuals below 18 years of age, those not residing in Himachal Pradesh, and respondents who submitted incomplete or duplicate questionnaires.

### Study Instrument and Data Collection

Data were collected using a structured, self-administered questionnaire developed after an extensive review of existing literature and previously validated HPV knowledge assessment tools. The questionnaire was prepared in English and administered via Google Forms. It consisted of two sections: the first section captured socio-demographic information such as age and gender, while the second section assessed knowledge related to HPV infection, modes of transmission, clinical manifestations, HPV-associated cancers, HPV vaccination, recommended age and dosage, vaccine effectiveness and safety, and awareness of governmental approval and initiatives in India. The knowledge section included 20 close-ended questions with predefined response options.

### Knowledge Scoring and Categorization

Each correct response in the knowledge section was awarded one point, while incorrect or "don't know" responses were scored zero. The total knowledge score ranged from 0 to 20. Based on the total score obtained, participants were categorized into three levels of knowledge: poor knowledge (≤6), moderate knowledge (7–13), and good knowledge (≥14).

### Ethical Considerations

Electronic informed consent was obtained from all participants before they accessed the questionnaire. Participation was entirely voluntary, and respondents were informed of their right to withdraw at any point. Confidentiality and anonymity were strictly maintained, and no personally identifiable information was collected.

### Statistical Analysis

Data collected through Google Forms were exported to Microsoft Excel and subsequently analysed using the Epi Info version-7 software. Descriptive statistics were used to summarize socio-demographic characteristics and knowledge responses, expressed as frequencies and percentages. The association between socio-demographic

variables and levels of knowledge was evaluated using the chi-square test. A p-value <0.05 was considered statistically significant.

## RESULTS

Among the 800 study participants, the majority were young adults, with 42.5% belonging to the 18–29-year age group and 39.9% aged 30–44 years, together accounting for more than four-fifths of the study population. Participants aged 45–59 years constituted 14.0%, while those aged 60 years and above represented only 3.6% of the sample. With regard to gender distribution, females comprised slightly more than half of the participants (55.4%), whereas males accounted for 44.6%, indicating a relatively balanced representation of both genders in the study population (Figure 1).

Overall, knowledge regarding HPV and HPV vaccination among participants was limited, with correct responses ranging from 17.6-44.8% across individual items. Awareness of HPV was reported by 40.8% of participants, and 44.8% correctly identified sexual contact as the primary mode of transmission. Knowledge related to HPV-associated diseases was low, with only 33.6% recognizing its link to cervical cancer and 26.8% acknowledging its role in causing cancers other than cervical cancer (Table 1). Awareness of HPV vaccination was suboptimal, as only 32.6% knew about vaccine availability, 31.9% correctly identified the recommended vaccination age of 9–14 years, and 29.0% knew the recommended two-dose schedule for adolescents. Important gaps and misconceptions were evident, with fewer than one-third of participants correctly understanding that

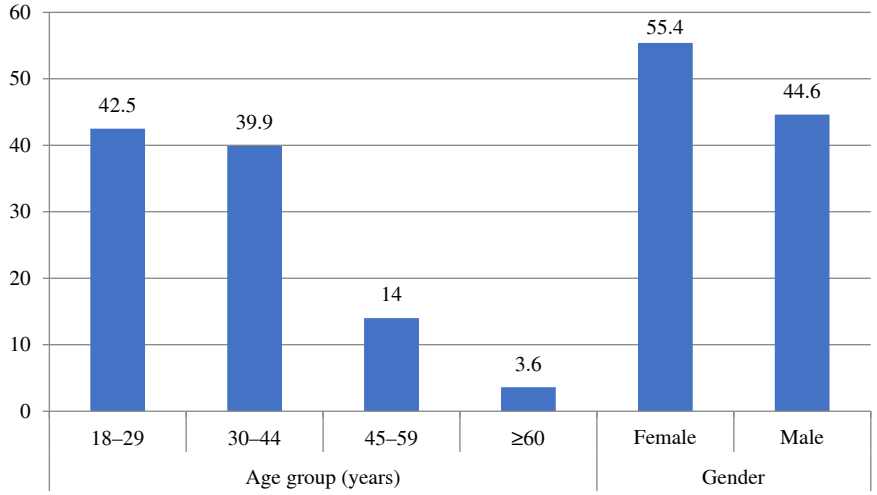


Figure 1: Socio-demographic characteristics of the study participants (N = 800)

Table 1: Item-wise distribution of correct responses to knowledge questions on Human Papillomavirus (HPV) and HPV vaccination among study participants (N = 800)

| Q. No. | Knowledge item assessed | Correct response | Correct responses n (%) |
|---|---|---|---|
| K1 | Self-reported awareness of Human Papillomavirus (HPV) | Yes | 326 (40.8) |
| K2 | Knowledge that HPV is mainly transmitted through sexual contact | Sexual contact | 358 (44.8) |
| K3 | Knowledge that HPV infection can affect genital area, oral cavity, and throat | Genital area, oral cavity and throat | 241 (30.1) |
| K4 | Knowledge that persistent HPV infection can lead to cervical cancer | Cervical cancer | 269 (33.6) |
| K5 | Knowledge that HPV can cause cancers other than cervical cancer | True | 214 (26.8) |
| K6 | Knowledge that HPV infection can occur in both males and females | True | 287 (35.9) |
| K7 | Knowledge that HPV vaccination is most effective when given at 9–14 years of age | 9–14 years | 255 (31.9) |
| K8 | Knowledge of recommended number of HPV vaccine doses for adolescents | Two doses | 232 (29.0) |
| K9 | Awareness of availability of a vaccine to prevent HPV infection | Yes | 261 (32.6) |
| K10 | Knowledge that HPV vaccine is more effective when given before sexual debut | True | 219 (27.4) |
| K11 | Knowledge that HPV vaccination is recommended for both males and females | Both males and females | 246 (30.8) |
| K12 | Knowledge that HPV vaccine does NOT protect against all HPV types | True | 203 (25.4) |
| K13 | Knowledge that cervical cancer screening is required even after HPV vaccination | True | 198 (24.8) |
| K14 | Knowledge that HPV vaccination can prevent most cases of cervical cancer | True | 225 (28.1) |
| K15 | Knowledge that HPV vaccination can be given after sexual debut | Yes | 209 (26.1) |
| K16 | Knowledge regarding safety and effectiveness of HPV vaccine | Safe and effective | 236 (29.5) |
| K17 | Knowledge that HPV infection does NOT always present with symptoms | True | 247 (30.9) |
| K18 | Knowledge that HPV vaccination has been included in immunization programs in several countries | True | 221 (27.6) |
| K19 | Knowledge that vaccines in India are approved by government health authorities | Government of India (MoHFW) | 141 (17.6) |
| K20 | Awareness of government initiatives in India to introduce HPV vaccination | Yes | 287 (35.9) |

Table 2: Association between socio-demographic characteristics and level of knowledge regarding Human Papillomavirus (HPV) among study participants (N = 800)

| Variable | Category | Poor knowledge n (%) | Moderate knowledge n (%) | Good knowledge n (%) | Total n (%) | $\chi^2$ (df) | p-value |
|---|---|---|---|---|---|---|---|
| Age group (years) | 18–29 | 208 (26.0) | 55 (6.9) | 77 (9.6) | 340 (42.5) | 20.58 (6) | 0.002* |
| | 30–44 | 220 (27.5) | 46 (5.8) | 53 (6.6) | 319 (39.9) | | |
| | 45–59 | 84 (10.5) | 12 (1.5) | 16 (2.0) | 112 (14.0) | | |
| | ≥60 | 33 (4.1) | 3 (0.4) | 0 (0.0) | 29 (3.6) | | |
| Gender | Female | 302 (37.8) | 64 (8.0) | 77 (9.6) | 443 (55.4) | 0.002 (2) | 0.999 |
| | Male | 243 (30.4) | 52 (6.5) | 62 (7.8) | 357 (44.6) | | |
| Total | - | 545 (68.1) | 116 (14.5) | 139 (17.4) | 800 (100.0) | | |

*Statistically significant at p<0.05

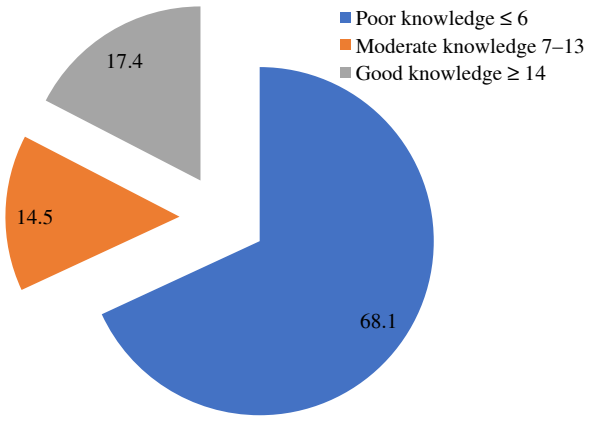


Figure 2: Distribution of overall knowledge score and knowledge categories regarding Human Papillomavirus (HPV) among study participants (N = 800)

the vaccine does not protect against all HPV types, that cervical cancer screening remains necessary after vaccination, and that HPV infection may be asymptomatic. Knowledge regarding government approval of vaccines in India (17.6%) and awareness of governmental initiatives to introduce HPV vaccination (35.9%) were particularly low.

Assessment of overall knowledge scores revealed that a substantial majority of participants (68.1%) had poor knowledge regarding HPV, while 14.5% demonstrated moderate knowledge and only 17.4% exhibited good knowledge. This distribution indicates that fewer than one-fifth of the study population possessed adequate comprehensive knowledge about HPV and HPV vaccination, highlighting a considerable overall deficit in awareness and understanding among participants (Figure 2).

A statistically significant association was observed between age group and level of HPV knowledge ($\chi^2 = 20.58$, df = 6, p = 0.002), with younger participants, particularly those aged 18–29 years, demonstrating a higher proportion of good knowledge compared to older age groups. Notably, none of the participants aged 60 years or above exhibited good knowledge. In contrast, no significant association was found between gender and knowledge level ($\chi^2 = 0.002$, df = 2, p = 0.999), as both males and females showed similarly high proportions of poor knowledge. These findings suggest that age, but not gender, plays a significant role in influencing HPV-related knowledge among the study participants (Table 2).

## DISCUSSION

The present cross-sectional study assessed knowledge regarding Human Papillomavirus (HPV) infection and HPV vaccination among adults in Himachal Pradesh using an online survey platform. The findings reveal substantial gaps in awareness and understanding of HPV, its modes of transmission, associated health risks, and preventive measures, despite the availability of effective vaccines and increasing national and global emphasis on cervical cancer prevention. Overall, the study highlights an unsatisfactory level of HPV-related knowledge among the study population, underscoring the need for targeted health education interventions in the region.

In this study, awareness of HPV was reported by less than half of the participants, and knowledge regarding its sexual transmission and association with cervical cancer was similarly limited. These findings are consistent with previous studies conducted in various parts of India, which have documented low levels of HPV awareness among the general population [14-17]. Limited understanding of the broader disease burden of HPV, including its role in non-cervical cancers and infections in males, further reflects persistent misconceptions that HPV is a women-specific issue. Such misconceptions may hinder vaccine acceptance among males and reduce the overall effectiveness of population-level prevention strategies.

Knowledge related to HPV vaccination was found to be particularly inadequate. Only about one-third of participants were aware of the availability of the HPV vaccine, the recommended age for vaccination, and the correct dosing schedule. Moreover, critical gaps were observed in understanding vaccine effectiveness, including the misconception that vaccination eliminates the need for cervical cancer screening and that the vaccine protects against all HPV types. These findings are concerning, as such misunderstandings may lead to inappropriate health behaviors, reduced screening uptake, and misplaced confidence following vaccination. Similar gaps have been reported in earlier Indian and international studies, emphasizing the global challenge of translating vaccine availability into informed public acceptance [17-20].

The overall knowledge score analysis further reinforces these concerns, with more than two-thirds of participants categorized as having poor knowledge and fewer than one-fifth demonstrating good knowledge. This pattern suggests that even when individuals have partial awareness of HPV, their understanding is often fragmented and insufficient for

informed decision-making. The predominance of poor knowledge among a largely young adult population who represent a key target group for HPV vaccination highlights missed opportunities for early prevention and health promotion.

A significant association was observed between age and level of HPV knowledge, with younger participants demonstrating relatively better knowledge compared to older age groups. This finding may be attributed to greater exposure of younger individuals to digital media, educational content, and health information through online platforms. In contrast, the absence of good knowledge among participants aged 60 years and above indicates a critical gap in health communication reaching older adults. Gender, however, was not significantly associated with knowledge levels, suggesting that inadequate awareness of HPV is a widespread issue affecting both males and females equally. This underscores the importance of adopting gender-neutral educational approaches in HPV prevention campaigns.

The findings of this study have important public health implications. Strengthening HPV awareness through school-based education, community outreach programs, and integration of HPV information into existing reproductive and adolescent health initiatives is essential. Additionally, clear communication regarding government approval, safety, and ongoing initiatives related to HPV vaccination may improve public trust and vaccine acceptance. Healthcare providers play a crucial role in disseminating accurate information and addressing misconceptions, and their involvement should be emphasized in future interventions.

## CONCLUSION

The present study highlights substantial gaps in knowledge regarding Human Papillomavirus (HPV) infection and HPV vaccination among adults in Himachal Pradesh. Despite the availability of safe and effective vaccines and increasing national focus on cervical cancer prevention, the majority of participants demonstrated poor overall knowledge, with limited awareness of HPV transmission, associated cancers, vaccination schedules, and the continued need for screening after vaccination. Younger participants exhibited relatively better knowledge compared to older age groups, while no significant gender-based differences were observed, indicating that inadequate HPV awareness is a widespread issue across the population. These findings underscore the urgent need for comprehensive, region-specific health education initiatives to improve understanding of HPV and enhance acceptance of preventive strategies.

## Recommendations

Based on the findings of the study, it is recommended that targeted HPV awareness and education programs be implemented at the community level, with a focus on adolescents, young adults, and parents. Integration of HPV-related education into school and college curricula, as well as into existing reproductive and adolescent health programs, may help address early knowledge gaps. Public health campaigns should emphasize accurate information regarding HPV transmission, vaccine safety and effectiveness, recommended vaccination age, and the importance of continued cervical cancer screening even after vaccination. Additionally, strengthening the role of healthcare providers in counseling and disseminating HPV-related information, along with clear communication about government approval and immunization initiatives, may enhance public trust and vaccine uptake. Leveraging digital platforms and social media could further expand outreach, particularly in geographically challenging regions such as Himachal Pradesh.

## Strengths and Limitations

A key strength of this study is its relatively large sample size and inclusion of participants from across Himachal Pradesh, providing valuable region-specific insights into HPV-related knowledge. The use of an online Google Form facilitated efficient data collection and enabled participation from geographically dispersed areas. However, the study also has certain limitations. The use of a non-probability convenience sampling technique and online survey methodology may limit the generalizability of findings, as individuals without internet access or adequate digital literacy may have been underrepresented. Additionally, self-reported responses are subject to recall and social desirability bias. Despite these limitations, the study provides important baseline data that can inform future research and public health interventions aimed at improving HPV awareness and prevention.

## Informed Consent

Electronic informed consent was obtained from all participants before participation in the study. Participants were informed about the purpose of the study, and confidentiality and anonymity were ensured.

## Conflict of Interest

The authors declare that there are no conflicts of interest related to this study.

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