

Awareness, Vaccine Hesitancy, and Acceptance of Human Papillomavirus Vaccination among Adults Attending a Tertiary Care Centre in West Bengal, India: A Cross-Sectional Study

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ABSTRACT

Background: Human papillomavirus (HPV) vaccination is an effective strategy for preventing cervical cancer, but inadequate awareness and vaccine hesitancy remain barriers to uptake in India. This study assessed HPV-related awareness, vaccine hesitancy, and acceptance among adults attending a tertiary care centre in West Bengal, India.

Methods: A hospital-based cross-sectional study was conducted among 200 adults attending a tertiary care centre in West Bengal, India, from January 2023 to December 2024. Data were collected using a pretested, structured questionnaire. Factors associated with HPV vaccine acceptance were assessed using multivariable logistic regression.

Results: The mean age was 35.6 ± 12.8 years, and 54.0% were female. Overall, 56.5% had heard of HPV, 48.5% knew of its association with cervical cancer, and 42.0% knew that HPV vaccination can prevent cervical cancer. Adequate knowledge was observed in 41.0%. Vaccine acceptance was reported by 46.0%, while 32.0% were hesitant and 22.0% undecided. Among hesitant participants, the main concerns were vaccine safety (48.4%), inadequate knowledge (43.8%), perceived high cost (37.5%), and fear of adverse effects (32.8%). Graduate education, previous awareness of cervical cancer, healthcare-provider recommendation, and adequate HPV knowledge were independently associated with vaccine acceptance.

Conclusion: HPV awareness and comprehensive knowledge remained suboptimal, with substantial vaccine hesitancy. Strengthening provider-led counselling, improving patient education, and addressing safety and affordability concerns may enhance informed vaccine acceptance and cervical cancer prevention.

Key-words: Human papillomavirus; HPV vaccination; Cervical cancer; Vaccine hesitancy; Vaccine acceptance; Knowledge; Tertiary care centre; West Bengal; India

INTRODUCTION

Human papillomavirus (HPV) is the most common sexually transmitted viral infection worldwide and is responsible for approximately 99% of cervical cancer cases.

Persistent infection with high-risk HPV genotypes, particularly HPV-16 and HPV-18, accounts for approximately 70% of cervical cancers and is also implicated in several anogenital and oropharyngeal malignancies. Although most HPV infections are transient and resolve spontaneously, persistent infection with oncogenic HPV types may progress to cervical precancer and invasive cancer if not detected and treated appropriately. ^[1-3]

Cervical cancer remains a major global public health problem, particularly in low- and middle-income countries (LMICs), where approximately 90% of cervical cancer-related deaths occur. In 2022, an estimated 660,000 women were diagnosed with cervical cancer and

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approximately 350,000 died from the disease worldwide.

^[2] India continues to bear a substantial burden, with cervical cancer remaining one of the leading cancers affecting women. The high burden is associated with gaps in screening, early diagnosis, treatment, and access to preventive interventions, emphasizing the importance of strengthening primary prevention through HPV vaccination. ^[4]

HPV vaccination is a safe and highly effective intervention for preventing HPV infection and HPV-related precancerous lesions and cancers. Evidence from countries with established vaccination programmes has demonstrated substantial reductions in HPV infections and cervical precancer following vaccine introduction. ^{[3-}

^{5]} The World Health Organization (WHO) has therefore identified HPV vaccination as a cornerstone of cervical cancer elimination and established the 90-70-90 targets: 90% of girls fully vaccinated against HPV by 15 years of age, 70% of women screened with a high-performance test by 35 and 45 years of age, and 90% of women with cervical disease receiving appropriate treatment by 2030. ^[1,5]

Despite the effectiveness of HPV vaccines, their uptake remains inadequate in many settings. Vaccine hesitancy may arise from limited knowledge, concerns regarding safety and adverse effects, perceived lack of susceptibility to HPV-related disease, financial barriers, sociocultural beliefs, misinformation, and inadequate healthcare-provider recommendation. ^[6-8] In India, these challenges are particularly relevant because HPV vaccination has historically had limited population coverage. A systematic review and meta-analysis of Indian studies reported a pooled prevalence of only 22% for adequate knowledge regarding HPV vaccination and 45% for a positive attitude toward vaccination, highlighting substantial gaps in awareness and acceptance. ^[7]

India has progressively strengthened cervical cancer prevention through the availability of HPV vaccines, including an indigenously developed vaccine, and increasing emphasis on vaccination as a component of cervical cancer prevention. However, vaccine availability alone is insufficient to achieve high uptake. Awareness, confidence, perceived benefits, and recommendations from healthcare professionals are important determinants of vaccination decisions. ^[4,7,8] Healthcare facilities may provide an important setting for addressing

these gaps because adults attending tertiary care centre frequently interact with physicians and other healthcare professionals and may subsequently influence vaccination decisions within their families.

Although HPV-related knowledge and vaccine acceptance have been examined among various population groups in India, evidence from adult populations in West Bengal remains limited. Assessing awareness and vaccine hesitancy among individuals attending a tertiary care centre may help identify specific informational and attitudinal barriers that can be addressed through patient counselling and healthcare-provider-led interventions.

Therefore, the present study was conducted to assess awareness regarding HPV infection and HPV vaccination, evaluate vaccine hesitancy, and identify factors associated with HPV vaccine acceptance among adults attending a tertiary care centre in West Bengal, India. The findings may help inform targeted patient-education strategies and strengthen healthcare-provider-led approaches to improving HPV vaccine acceptance and cervical cancer prevention.

MATERIALS AND METHODS

Study Design and Setting- This cross-sectional study was conducted among adults attending a tertiary care centre in West Bengal, India, over a two-year period from January 2023 to December 2024. The study was designed to assess awareness and knowledge regarding human papillomavirus (HPV) infection and vaccination, determine the prevalence of HPV vaccine hesitancy, and identify factors associated with vaccine acceptance.

Study Population- The study population comprised adults aged 18 years or older attending the outpatient services of the participating tertiary care centre during the study period. Participants were eligible if they were able to understand the study information and provide informed consent.

Inclusion Criteria

-  Adults aged ≥ 18 years.
-  Individuals attending the participating tertiary care centre during the study period.
-  Individuals willing to participate and provide written informed consent.

Exclusion Criteria

- ✚ Patients who were critically ill or medically unable to participate in the interview.
- ✚ Individuals with cognitive or communication difficulties that precluded completion of the questionnaire.
- ✚ Individuals who declined participation.
- ✚ Questionnaires with substantial missing or incomplete information.

Sampling Technique- Eligible participants were recruited using a purposive sampling approach. Adults attending the selected outpatient services who fulfilled the eligibility criteria were approached sequentially during the study period and invited to participate. Recruitment continued until the predetermined sample size was achieved.

Study Instrument- Data were collected using a structured, pretested questionnaire developed following a review of relevant literature and available guidance on HPV infection and vaccination. The questionnaire comprised four domains:

1. Sociodemographic characteristics, including age, sex, educational attainment, occupation, marital status, and socioeconomic characteristics.
2. Knowledge regarding HPV infection and cervical cancer, including awareness of HPV, its health consequences, and its association with cervical cancer.
3. Awareness and perceptions regarding HPV vaccination, including knowledge of vaccine availability, preventive benefits, safety, and sources of information.
4. Attitudes, vaccine acceptance, and hesitancy, including willingness to receive or recommend HPV vaccination and perceived barriers to vaccination.

The questionnaire was reviewed by subject experts to assess content validity and was pretested before commencement of the main study. Any questions found to be unclear or ambiguous during pretesting were revised accordingly. Participants included in the pretesting phase were excluded from the final analysis.

Data Collection Procedure- Data were collected through face-to-face interviews by trained investigators using the standardized questionnaire. Participants were informed about the purpose of the study, the voluntary nature of participation, and the confidentiality of the information provided. Written informed consent was obtained before data collection. No personally identifiable information was included in the analytical dataset.

Study Variables and Outcome Measures

The primary outcome measures were:

- Awareness of HPV infection.
- Knowledge regarding HPV vaccination.
- Willingness to receive or recommend HPV vaccination.
- HPV vaccine hesitancy.

Potential explanatory variables included age, sex, educational attainment, occupation, marital status, socioeconomic status, previous awareness of cervical cancer, previous exposure to HPV vaccination-related information, and recommendation from a healthcare professional.

Operational Definitions

Adequate knowledge: Participants who correctly answered $\geq 70\%$ of the predefined knowledge-related items were classified as having adequate knowledge. The scoring threshold was determined a priori for the study.

HPV vaccine acceptance: Participants who reported willingness to receive HPV vaccination themselves, where applicable, or to recommend HPV vaccination to an eligible family member were classified as accepting HPV vaccination.

Vaccine hesitancy: Vaccine hesitancy was defined as a delay in acceptance or refusal of vaccination despite the availability of vaccination services, consistent with the definition proposed by the WHO Strategic Advisory Group of Experts on Immunization (SAGE).

Statistical Analysis- Data were entered into Microsoft Excel and analysed using IBM SPSS Statistics, version 29.0 (IBM Corp., Armonk, NY, USA). Continuous variables were summarized as mean $\pm$ SD or median (IQR), as appropriate, and categorical variables as frequencies and percentages. Proportions were reported with 95% CIs. Associations were assessed using Pearson's chi-square or Fisher's exact test.

Logistic regression was used to identify factors associated with HPV vaccine acceptance. Variables with $p < 0.20$ and clinically relevant factors were included in multivariable analysis, with AORs and 95% CIs reported. A two-sided $p < 0.05$ was considered significant.

Ethical Considerations- The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Written informed consent was obtained from all participants. Confidentiality and anonymity were maintained throughout the study, and participation was voluntary. Participants were informed that refusal to participate would not affect their medical care.

RESULTS

A total of 200 adults attending the tertiary care centre were included in the final analysis seen in Table 1. The mean age of participants was 35.6 ± 12.8 years, with an age range of 18–72 years. Females constituted 54% of the study population. The largest proportion of participants (45%) belonged to the 18–30-year age group. Regarding educational attainment, 57.5% had completed graduation or higher education, while 63% were employed.

Table 1: Sociodemographic characteristics of the study participants (N = 200)

Variable	Frequency (n)	Percentage (%)
Age (years)		
18–30	90	45
31–45	61	30.5
46–60	34	17
>60	15	7.5
Sex		
Male	92	46
Female	108	54
Educational attainment		
Up to secondary	43	21.5
Higher secondary	42	21
Graduate	77	38.5
Postgraduate or above	38	19
Employment status		
Employed	126	63
Unemployed/student/homemaker	74	37

Of the 200 participants, 113 (56.5%) reported having heard of HPV infection. Awareness of the association between HPV and cervical cancer was reported by 97 (48.5%) participants, while 84 (42.0%) knew that HPV vaccination can prevent cervical cancer. Only 76 (38%) correctly identified the recommended vaccination age group. Healthcare professionals were the most

frequently reported source of information regarding HPV vaccination (68/200; 34%), followed by the internet and social media (57/200; 28.5%). Overall, 82 (41.0%) participants met the predefined criterion for adequate knowledge regarding HPV infection and vaccination as seen in Table 2.

Table 2: Awareness and knowledge regarding HPV infection and HPV vaccination (N = 200)

Variable	n	%
Heard of HPV infection	113	56.5
Aware that HPV is associated with cervical cancer	97	48.5



Aware that HPV vaccination can prevent cervical cancer	84	42
Correctly identified the recommended vaccination age	76	38
Considered HPV vaccination safe	104	52
Would recommend HPV vaccination to an eligible family member	116	58
Adequate overall knowledge	82	41

Among the 200 participants, 92 (46%) expressed willingness to receive HPV vaccination or recommend it to an eligible family member, whereas 64 (32%) were classified as vaccine-hesitant and 44 (22%) were undecided. Among the 64 participants classified as vaccine-hesitant, the most frequently reported concerns were vaccine safety (31/64; 48.4%), inadequate

knowledge regarding HPV vaccination (28/64; 43.8%), perceived high cost (24/64; 37.5%), fear of adverse effects (21/64; 32.8%), and lack of recommendation from a healthcare professional (17/64; 26.6%). Multiple responses were permitted; therefore, the percentages do not sum to 100% as seen in Table 3.

Table 3: Vaccine acceptance, hesitancy, and reported barriers among study participants

Variable	n	%
Overall vaccination response (N = 200)		
Accepted/willing to receive or recommend vaccination	92	46
Vaccine-hesitant	64	32
Undecided	44	22
Reasons for vaccine hesitancy (n = 64)*		
Concerns regarding vaccine safety	31	48.4
Inadequate knowledge	28	43.8
Perceived high cost	24	37.5
Fear of adverse effects	21	32.8
No healthcare-provider recommendation	17	26.6

In Table 4, participants with graduate-level education or above had approximately 2.3-fold higher odds of vaccine acceptance compared with those with lower educational attainment. Previous awareness of cervical cancer was associated with approximately 2.7-fold higher odds,

while healthcare-provider recommendation and adequate HPV-related knowledge were associated with approximately 3.5-fold and 3.9-fold higher odds, respectively. Age ≤ 30 years and female sex were not statistically significant after adjustment.

Table 4: Multivariable logistic regression analysis of factors associated with HPV vaccine acceptance (N = 200)

Variable	Adjusted Odds Ratio (AOR)	95% CI	p-value
Graduate education or above	2.31	1.18–4.54	0.015
Age ≤ 30 years	1.42	0.76–2.67	0.271
Female sex	1.28	0.69–2.38	0.431
Previous awareness of cervical cancer	2.67	1.38–5.17	0.004
Healthcare-provider recommendation	3.54	1.79–7.01	<0.001
Adequate HPV-related knowledge	3.86	2.01–7.41	<0.001

DISCUSSION

The present cross-sectional study assessed awareness, knowledge, vaccine acceptance, and hesitancy regarding human papillomavirus (HPV) vaccination among 200 adults attending a tertiary care centre in West Bengal. Although 56.5% of participants had heard of HPV, only 48.5% recognized its association with cervical cancer and 42% were aware that HPV vaccination can prevent cervical cancer. Overall, only 41% demonstrated adequate knowledge, while 46% expressed willingness to receive or recommend HPV vaccination. These findings indicate that general awareness does not necessarily translate into comprehensive knowledge or vaccine acceptance, even among individuals with contact with healthcare services.

The observed level of knowledge was higher than the pooled estimate reported in an Indian systematic review and meta-analysis, which found that approximately 22% of participants had adequate knowledge regarding HPV vaccination. However, substantial heterogeneity was observed across the included studies ($I^2 = 99.5\%$), reflecting differences in study populations, settings, and assessment methods. The same meta-analysis reported a pooled positive attitude toward HPV vaccination of approximately 45%, which was comparable to the 46% vaccine acceptance observed in the present study.^[7] These comparisons should be interpreted cautiously because of differences in study design and population characteristics; nevertheless, they suggest that inadequate knowledge and moderate vaccine acceptance remain important challenges in India.

Vaccine hesitancy was reported by 32% of participants, with safety concerns, inadequate knowledge, perceived cost, fear of adverse effects, and absence of healthcare-provider recommendation being the principal reported barriers. These findings are consistent with the WHO Strategic Advisory Group of Experts on Immunization (SAGE) framework, which conceptualizes vaccine hesitancy as a context-specific phenomenon influenced by confidence, complacency, and convenience.^[6] In the context of HPV vaccination, concerns regarding vaccine safety may be compounded by limited understanding of HPV-related cancers and the preventive purpose of vaccination. Consequently, improving vaccine availability alone may be insufficient without effective risk communication and patient counselling.

Healthcare-provider recommendation emerged as one of the strongest independent predictors of vaccine acceptance (AOR 3.54; 95% CI: 1.79–7.01). This finding is particularly relevant in a tertiary care centre population, where interaction with healthcare professionals provides opportunities for individualized counselling. Clear provider recommendations can help address misconceptions, explain vaccine benefits and safety, and facilitate informed decision-making. Integrating HPV vaccination counselling into routine outpatient and preventive healthcare encounters may therefore represent a practical strategy for improving vaccine acceptance.

Adequate HPV-related knowledge was also strongly associated with vaccine acceptance (AOR 3.86; 95% CI: 2.01–7.41), while previous awareness of cervical cancer was independently associated with greater acceptance (AOR 2.67; 95% CI: 1.38–5.17). Higher educational attainment showed a similar association (AOR 2.31; 95% CI: 1.18–4.54). Together, these findings suggest that vaccine acceptance may be influenced not only by vaccine availability but also by health literacy and understanding of HPV-related disease. HPV vaccination counselling should therefore be integrated into broader cervical cancer prevention education, incorporating information on HPV infection, vaccination, and cervical cancer screening.

The findings also have implications for tertiary-care public health practice. Despite attending a healthcare facility, a substantial proportion of participants lacked adequate knowledge about HPV vaccination. Tertiary care centres may therefore provide an important setting for opportunistic education through physicians, nurses, and other healthcare professionals. Brief standardized counselling, patient information materials, and provider-initiated recommendations could help address safety concerns, misinformation, and uncertainty regarding vaccination.

The importance of improving HPV vaccine acceptance is further supported by population-level evidence demonstrating substantial reductions in HPV infections and cervical precancer following the introduction of HPV vaccination programmes.^[9,10] Nevertheless, global HPV vaccination coverage has remained below the levels required to achieve the WHO cervical cancer elimination targets.^[8] Strengthening vaccine confidence and

informed acceptance should therefore complement efforts to improve vaccine availability and accessibility. Overall, the findings indicate that HPV-related awareness among adults attending the tertiary care centre was moderate, but important gaps in knowledge and vaccine acceptance persisted. Strengthening healthcare-provider recommendations, improving patient education, and addressing concerns related to vaccine safety and affordability may help reduce vaccine hesitancy and support broader cervical cancer prevention efforts in India ^[11,12].

STRENGTHS

The present study provides evidence regarding HPV awareness, vaccine acceptance, and hesitancy among adults attending a tertiary care centre in West Bengal, an area for which such evidence remains relatively limited. The study assessed multiple domains, including knowledge, perceptions, barriers, and healthcare-provider influence. In addition, multivariable logistic regression was used to identify factors independently associated with vaccine acceptance, allowing adjustment for potential confounding factors.

LIMITATIONS

Several limitations should be considered. First, the cross-sectional design precludes establishing temporal or causal relationships between knowledge, healthcare-provider recommendation, and vaccine acceptance. Second, the study was conducted at a single tertiary care centre, and purposive recruitment may have introduced selection bias. Therefore, the findings may not be generalizable to the wider population of West Bengal or to individuals who do not routinely access healthcare. Third, information regarding knowledge, attitudes, and willingness to vaccinate was self-reported and may have been influenced by recall or social-desirability bias. Fourth, vaccine acceptance was assessed as willingness to receive or recommend vaccination rather than documented vaccine uptake; intention may not necessarily translate into actual vaccination. Finally, the relatively small sample size of 200 participants may have limited the precision of some subgroup estimates and regression coefficients.

CONCLUSIONS

The present study demonstrates that awareness and

comprehensive knowledge regarding HPV vaccination remain suboptimal among adults attending a tertiary care centre in West Bengal, with persistent vaccine hesitancy despite access to healthcare services. Healthcare-provider recommendation, adequate HPV-related knowledge, previous awareness of cervical cancer, and higher educational attainment were independently associated with vaccine acceptance. These findings highlight the need to strengthen provider-led counselling, improve patient education, and address concerns regarding vaccine safety, cost, and misinformation. Integrating HPV vaccination awareness into routine tertiary-care healthcare encounters may represent a practical strategy for improving informed vaccine acceptance and supporting cervical cancer prevention in India.

CONTRIBUTION OF AUTHORS

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