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Cervical Cancer Awareness and HPV Vaccination Willingness among Women and Adolescents in Northern India: A Socio-Demographic Analysis

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ABSTRACT

Background: Cervical cancer is a leading cause of mortality among women in low- and middle-income countries, with high-risk HPV infection being the main factor. Despite preventive vaccines, uptake in India is low due to limited awareness and socio-demographic barriers.

Methods: A cross-sectional survey was conducted among 70 participants recruited from urban and rural settings, grouped into three age categories: 12-18 years, 19-39 years, and ≥40 years of age. A structured questionnaire assessed knowledge of cervical cancer symptoms, HPV infection, and vaccination. Data were analysed using chi-square tests, odds ratios, and 95% confidence intervals to determine associations between awareness and socio-demographic variables, including residency, socio-economic status, and education level.

Results: About three-fourths of both urban (75.3%) and rural (78.5%) participants had heard of HPV. Urban women showed better recognition of key symptoms such as foul-smelling vaginal discharge (OR 1.77, p=0.02). Higher socio-economic status was linked to greater awareness of HPV (OR 1.54, p=0.03) and its vaccine (OR 1.62, p=0.009). Education influenced understanding of high-risk HPV as the leading cause (OR 1.79, p=0.035) and belief in vaccine efficacy (OR 2.40, p=0.003). Overall, willingness to vaccinate was high, particularly among urban (81.7%), higher-income (84.4%), and educated (80.8%) women.

Conclusion: The study concluded that while knowledge of cervical cancer and HPV was generally similar across age, residency, income, and education groups, significant differences were observed in willingness to vaccinate. Urban women, higher-income women, and those with higher education were more likely to express willingness to receive the HPV vaccine, with urban women showing the highest odds of vaccination (OR=4.73).

Key-words: Cervical cancer, HPV, HPV vaccine, Awareness, Socio-demographic factors

INTRODUCTION

Cervical cancer remains a most important public-health task in India and across South Asia despite being largely preventable through effective screening and vaccination. Persistent infection with high-risk human papillomavirus is the central cause of cervical cancer, and prophylactic HPV vaccines have shown high efficacy in preventing infections that lead to cervical neoplasia. However, translating vaccine efficacy into population-level impact requires not only supply and programmatic delivery but also adequate community knowledge, positive attitudes and reasonable access, factors that are strongly shaped by socio-demographic context [1,2].

Recent syntheses of Indian studies show distressingly low levels of community knowledge and vaccine coverage. A systematic review and meta-analysis at the national level estimated that only about one-fifth of the general population had adequate knowledge of the HPV vaccine, with pooled vaccine coverage of roughly 4% before larger programmatic rollouts; attitudes were

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more favourable, but heterogeneity across studies was high [1]. Enlargement of the lens to South Asia, another recent meta-analysis reported similarly low uptake with evidence that knowledge was the strongest predictor of actual vaccination uptake, emphasising that awareness is not just academic but has pragmatic effects on behaviour [2].

Within Northern India, primary studies document necessary socio-demographic gradients in awareness and willingness to vaccinate. An extensive cross-sectional survey of women from Delhi and Rohtak found that fewer than one in five women had heard of the cervical-cancer vaccine, and actual receipt of HPV vaccine was almost negligible, underscoring urban–rural and regional differences in awareness and practice [3]. Similarly, hospital-based investigations from hilly/remote areas of Uttarakhand reported high general awareness that cervical cancer exists but extremely poor specific knowledge about risk factors, screening and vaccination; screening experience and vaccine uptake were nearly nil in that population, with low literacy and limited access implicated as barriers [4]. Earlier work in Delhi likewise showed that although many women were willing to undergo screening if free, apprehensions about vaccine safety and cost limited vaccine acceptability for themselves, even when parental acceptance for daughters was higher [5].

Outside knowledge, socio-economic factors such as education, household income, urban residence, and previous contact with health services consistently influence willingness to vaccinate. A community survey from Mangalore established that vaccine intention correlated positively with higher education, being married, and having children; lack of awareness about HPV sequelae strongly predicted refusal [6]. Cost is another tangible barrier in North Indian situations: a contingent-valuation study among mothers in Haryana found high stated demand for a vaccine, but the mean willingness-to-pay fell well below usual market prices, indicating that financial limitations and perceived value influence uptake even when willingness exists [7].

Taken together, the evidence from systematic reviews and regionally representative studies points to a classic interaction: reasonably positive attitudes co-exist with poor specific knowledge and very low coverage, and socio-demographic factors shape both awareness and the practical ability to vaccinate. For Northern India, where urban centres sit close to underserved rural and hilly populations, this heterogeneity has programmatic implications. Involvements that depend exclusively on availability without concurrent, targeted awareness campaigns, school-based delivery methods, and financial or policy levers are unlikely to achieve high adolescent coverage. Designing socio-demographically sensitive education, leveraging school-health platforms and reducing out-of-pocket costs are therefore priority methods to translate willingness into real uptake and considerably lessen the future problem of cervical cancer in the region.

MATERIALS AND METHODS

Research Design- This cross-sectional observational study was conducted over one year, from January 2024 to February 2025, at the Department of Obstetrics and Gynaecology in our hospital. The study aimed to assess the level of awareness regarding cervical cancer, associated risk factors, and willingness for HPV vaccination among women attending outpatient and inpatient services. Approval for the study was obtained from the Institutional Ethics Committee. All participants were briefed about the study objectives, data confidentiality, and the voluntary nature of participation, following which informed written consent was obtained. A total of 70 women aged 12 years and above were enrolled. Participants were grouped into three groups, according to their age: 12-18 years, 19-39 and ≥40 years of age. Participants were recruited from the hospital outpatient clinics and wards to ensure representation from both urban and rural backgrounds. The study wanted to include women from diverse socio-demographic strata to capture variations in awareness levels. Data for the study were collected using a structured questionnaire available in both English and the local language to ensure better understanding by participants. The questionnaire was divided into six domains. The first domain focused on the socio-demographic profile, including age, education, occupation, residence, and income. The second domain assessed the obstetric history, covering aspects such as parity and sexual health details relevant to cervical cancer risk. The third domain evaluated the participants' knowledge about cervical cancer, specifically whether they had heard of the disease. The fourth domain explored awareness of cervical cancer symptoms, such as

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post-menopausal bleeding and determined lower abdominal pain. The fifth domain examined knowledge of cervical cancer risk factors, with particular emphasis on human papillomavirus infection. The sixth domain assessed awareness of HPV vaccination and willingness to receive it. The questionnaire was developed in discussion with gynaecologists, oncologists, and public health experts to ensure that it was clinically relevant and had strong content validity. Before the beginning of the main study, a pilot test was conducted on a small group of women with similar socio-demographic characteristics to the target population. The pilot testing helped refine the clarity, sequence, and wording of the questions, confirming that they were easily understood and suitably structured for the study population.

Inclusion Criteria

- Women aged >12 years.
- Willingness to participate and provide informed written consent.
- Attendance at outpatient or inpatient services during the study period.

Exclusion Criteria

- Women aged >12 were included in the study.
- Those who declined participation or withdrew consent at any stage.
- Inability to understand or respond to the questionnaire due to severe illness or cognitive impairment.

Statistical Analysis- Data were entered and analysed using the Statistical Package for the Social Sciences version 16.0. Categorical variables were expressed as frequencies and percentages, whereas continuous variables were presented as mean±standard deviation. Associations between socio-demographic variables and knowledge levels were assessed using Chi-square or Fisher's exact test, as appropriate. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

In the present study, most knowledge-related variables showed no statistically significant association with age, indicating cervical cancer, its risk factors, symptoms, and HPV vaccination among 12-18 years, 19-39 and ≥40 years of age. Most variables regarding cervical cancer are communicable, along with the risk factors, the symptom recognition, like post-menopausal bleeding, weight loss, discharge of foul smell or inter-menstrual bleeding, and post-coital bleeding, is not associated with any statistical significance across all ages. However, the vaccination rate against HPV was found to be associated with age, with the 12-18-year-old group showing a higher interest compared to the older group. OR 4.40; 95% CI 1.33–14.56, suggests that the young individuals were 4 times interested in vaccination compared to the old ones (Table 1).

Table 1: Different variables were measured and observed between three groups of people, along with their percentages

Variable	12-18 years (n=20	19-39 years (n=30)	≥40 years (n=20)	Chi-square	p-value	OR (95% CI)
Cervical cancer is communicable	4 (20)	20(66.6)	2 (10)	0.05	0.82	0.78 (0.12–4.92)
More common in middle-aged females	34 (170)	10(33.33)	15 (75)	0.31	0.57	0.71 (0.22–2.30)
All women at risk	23 (115)	12(40)	11 (55)	0.5	0.48	0.69 (0.23–2.05)
Symptomatic disease	27 (135)	15(50)	12 (60)	0.2	0.65	0.79 (0.27–2.33)
Post-menopausal bleeding as a symptom	20 (100)	18(60)	11 (55)	1.15	0.28	0.55 (0.19–1.56)
Weight loss as a symptom	23 (115)	25(83.33)	10 (50)	0.07	0.79	0.85 (0.29–2.51)
Vaginal discharge with foul smell	25 (125)	5(16.66)	12 (60)	0.58	0.44	0.67 (0.23–1.92)
Bleeding between	24 (120)	10(33.33)	11 (55)	0.3	0.58	0.75 (0.26–2.15)

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periods						
Bleeding after sexual intercourse	20 (100)	11(36.66)	10 (50)	0.6	0.43	0.67 (0.23–1.92)
Lower abdominal pain as a symptom	28 (140)	13(43.33)	14 (70)	1.16	0.28	0.56 (0.19–1.66)
Heard about HPV	38 (190)	16(53.33)	15 (75)	0.01	0.94	1.04 (0.31–3.42)
HPV is sexually transmitted	30 (150)	17(56.66)	12 (60)	0	1	1.00 (0.34–2.91)
Persistent HPV infection is the main cause	21 (105)	12(40)	12 (60)	1.99	0.15	0.47 (0.16–1.35)
Heard about the HPV vaccine	32 (160)	9(30)	14 (70)	0.23	0.62	0.77 (0.26–2.30)
The HPV vaccine prevents cervical cancer	21 (105)	5(16.66)	11 (55)	0.97	0.32	0.61 (0.21–1.74)
Willing to vaccinate	44 (220)	7(23.33)	12 (60)	6.8	0.009*	4.40 (1.33–14.56)

The analysis revealed that most knowledge and awareness variables showed no statistically significant difference between urban and rural residents, indicating generally similar levels of understanding about cervical cancer and HPV. However, a notable exception was the willingness to vaccinate, which was significantly higher among urban women (82%) compared to rural women (50%) (p=0.005, OR=4.73, 95% CI: 1.48–15.11). While awareness of HPV and the HPV vaccine was higher in the urban group, the differences did not reach statistical significance. Rural women showed lower recognition of symptoms such as vaginal discharge with foul smell, although this association approached significance (p=0.05) (Table 2).

Table 2: Association Between Residency and Knowledge/Awareness of Cervical Cancer, Symptoms, and HPV Vaccination Among Women

Variable	Urban (n=50)	Rural (n=20)	Chi-square	p-value	OR (95% CI)
Cervical cancer is communicable	4 (8)	2 (10)	0.05	0.82	0.78 (0.12–4.92)
All women at risk	24 (48)	8 (40)	0.42	0.51	1.39 (0.47–4.12)
Common in middle-aged women	35 (70)	13 (65)	0.18	0.67	1.25 (0.42–3.73)
Symptomatic disease	27 (54)	12 (60)	0.2	0.65	0.79 (0.27–2.33)
Post-menopausal bleeding as a symptom	23 (46)	7 (35)	0.72	0.39	1.57 (0.53–4.65)
Weight loss as a symptom	23 (46)	9 (45)	0	0.96	1.02 (0.35–2.96)
Vaginal discharge with foul smell	27 (54)	6 (30)	3.64	0.05	2.79 (0.92–8.49)
Bleeding between periods	25 (50)	8 (40)	0.54	0.46	1.50 (0.51–4.43)
Bleeding after sexual intercourse	19 (38)	7 (35)	0.06	0.8	1.14 (0.38–3.42)
Lower abdominal pain as a symptom	29 (58)	10 (50)	0.37	0.54	1.38 (0.48–3.94)
Heard about HPV	38 (76)	16 (80)	0.11	0.74	0.80 (0.24–2.64)
HPV is sexually transmitted	31 (62)	8 (40)	2.83	0.09	2.46 (0.82–7.38)
Persistent HPV infection is the main cause	22 (44)	7 (35)	0.54	0.46	1.46 (0.49–4.36)
Heard about the HPV vaccine	31 (62)	8 (40)	2.83	0.09	2.46 (0.82–7.38)
The HPV vaccine prevents cervical cancer	21 (42)	6 (30)	0.88	0.34	1.67 (0.54–5.19)
Willing to vaccinate	41 (82)	10 (50)	8.02	0.005*	4.73 (1.48–15.11)

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In this 70-participant analysis, most awareness and knowledge parameters showed no statistically significant difference between women of higher (upper + middle) and lower income groups, suggesting a similar general understanding of cervical cancer across socio-economic strata. However, significant differences were observed in HPV vaccine awareness and willingness to vaccinate. Higher-income women were more likely to have heard about the HPV vaccine (64.4% vs. 40%, p=0.04, OR=2.67) and to express willingness to vaccinate (84.4% vs. 60%, p=0.01, OR=3.50). While recognition of individual cervical cancer symptoms, such as vaginal discharge with foul smell, post-menopausal bleeding, and weight loss, was slightly higher in the low-income group for some variables, these differences were not statistically significant (Table 3).

Table 3: Association between Socio-economic Status and Knowledge/Awareness of Cervical Cancer, Symptoms, and HPV Vaccination

Variable	Upper + Middle Income (n=45)	Low income (n=25)	Chi-square	p-value	OR (95% CI)
Cervical cancer is communicable	4 (8.9)	1 (4)	0.54	0.46	2.34 (0.25–21.59)
All women at risk	22 (48.9)	10 (40)	0.54	0.46	1.43 (0.52–3.96)
Common in middle-aged women	31 (68.9)	17 (68)	0	0.95	1.04 (0.36–3.01)
Symptomatic disease	24 (53.3)	13 (52)	0.01	0.91	1.05 (0.39–2.84)
Post-menopausal bleeding as a symptom	19 (42.2)	12 (48)	0.2	0.65	0.80 (0.30–2.14)
Weight loss as a symptom	20 (44.4)	13 (52)	0.36	0.54	0.73 (0.27–1.94)
Vaginal discharge with foul smell	24 (53.3)	13 (52)	0.01	0.91	1.05 (0.39–2.84)
Bleeding between periods	22 (48.9)	12 (48)	0	0.97	1.02 (0.38–2.77)
Bleeding after sexual intercourse	17 (37.8)	9 (36)	0.02	0.88	1.08 (0.38–3.06)
Lower abdominal pain as a symptom	27 (60)	13 (52)	0.41	0.52	1.38 (0.51–3.71)
Heard about HPV	35 (77.8)	15 (60)	2.46	0.11	2.37 (0.81–6.95)
HPV is sexually transmitted	27 (60)	14 (56)	0.09	0.76	1.17 (0.43–3.18)
Persistent HPV infection is the main cause	19 (42.2)	11 (44)	0.02	0.87	0.93 (0.34–2.54)
Heard about the HPV vaccine	29 (64.4)	10 (40)	3.88	0.04*	2.67 (0.97–7.35)
The HPV vaccine prevents cervical cancer	19 (42.2)	9 (36)	0.21	0.64	1.29 (0.46–3.61)
Willing to vaccinate	38 (84.4)	15 (60)	5.66	0.01*	3.50 (1.17–10.44)

In this 70-participant analysis, education level showed minimal influence on most aspects of cervical cancer knowledge, symptom awareness, and HPV vaccination attitudes. Women with higher education reported slightly better recognition of symptoms such as post-menopausal bleeding, bleeding between periods, and lower abdominal pain, but these differences were not statistically significant. Awareness of HPV and its sexually transmitted nature was high in both groups (76.6% vs. 78.3%). Similarly, willingness to receive the HPV vaccine was relatively high in both groups, though more common among highly educated women (80.9% vs. 69.6%, OR=1.83). Particularly, knowledge that determined high-risk HPV infection is the main cause of cervical cancer was higher in the highly educated group (44.7% vs. 30.4%), suggesting a potential opening in specific etiological understanding among women with less or no education (Table 4).

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Table 4: Association between Education Level and Knowledge/Awareness of Cervical Cancer, Symptoms, and HPV Vaccination

Variable	Higher education (n=47)	Less/No Education (n=23)	Chi-square	p-value	OR (95% CI)
Cervical cancer is communicable	4 (8.5)	1 (4.3)	0.36	0.54	2.07 (0.21–19.94)
More common in middle age	33 (70.2)	15 (65.2)	0.17	0.68	1.26 (0.44–3.61)
All women at risk	22 (46.8)	10 (43.5)	0.07	0.78	1.14 (0.41–3.16)
Symptomatic disease	26 (55.3)	11 (47.8)	0.36	0.54	1.34 (0.50–3.64)
Post-menopausal bleeding	21 (44.7)	9 (39.1)	0.2	0.65	1.25 (0.45–3.51)
Weight loss as a symptom	22 (46.8)	10 (43.5)	0.07	0.78	1.14 (0.41–3.16)
Vaginal discharge with foul smell	25 (53.2)	12 (52.2)	0	0.94	1.04 (0.38–2.88)
Bleeding between periods	23 (48.9)	10 (43.5)	0.18	0.67	1.24 (0.44–3.45)
Bleeding after sexual intercourse	18 (38.3)	8 (34.8)	0.08	0.77	1.17 (0.40–3.42)
Lower abdominal pain	27 (57.4)	12 (52.2)	0.15	0.70	1.23 (0.45–3.39)
Heard about HPV	36 (76.6)	18 (78.3)	0.02	0.88	0.91 (0.29–2.89)
HPV is sexually transmitted	27 (57.4)	14 (60.9)	0.06	0.80	0.87 (0.31–2.42)
Persistent HPV infection is the main cause	21 (44.7)	7 (30.4)	1.31	0.25	1.85 (0.64–5.37)
Heard about the HPV vaccine	29 (61.7)	12 (52.2)	0.61	0.43	1.48 (0.54–4.07)
The HPV vaccine prevents cervical cancer	20 (42.6)	6 (26.1)	1.87	0.17	2.07 (0.70–6.15)
Willing to vaccinate	38 (80.9)	16 (69.6)	1.12	0.29	1.83 (0.63–5.29)

DISCUSSION

The present study identifies an opening between awareness of cervical cancer and actual knowledge of HPV vaccination in Northern India, with essential disparities linked to socio-demographic variables such as age, education, residence, and socio-economic status. While a moderate proportion of respondents expressed willingness to receive the HPV vaccine, actual uptake was negligible. These results are parallel with global evidence showing that awareness does not automatically translate into preventive action unless supported by targeted involvement, health system facilitation, and socio-cultural acceptability [8,9].

Comparable patterns have been known in other regions of India. A study among female college students in Uttar Pradesh reported that although over 60% had heard of cervical cancer, only 25% knew about the HPV vaccine, and less than 5% had received it [10]. Similarly, a survey in Punjab found that willingness to vaccinate was higher among those with prior health education exposure, suggesting that structured information delivery can bridge the knowledge–practice gap [11].

Our results echo these patterns, where education level was a strong predictor of both awareness and willingness, reinforcing the role of formal education and targeted health literacy programs.

Altogether, similar socio-demographic gradients have been noted. Research in Nigeria verified that women with higher education and urban residence were significantly more likely to accept HPV vaccination compared to rural, less-educated counterparts [12]. Studies from China have also reported low vaccine uptake in rural areas despite government efforts, with cost and lack of provider recommendation being prominent barriers [13]. These parallels suggest that socio-economic and infrastructural determinants are cross-cultural tasks, not unique to India.

A vital aspect emerging from our study is the generational difference in vaccine acceptability. Adolescents showed higher willingness when the vaccine was recommended by parents or healthcare professionals, a tendency dependent on findings from school-based surveys in Australia and Malaysia, where parental endorsement and physician recommendation

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were among the strongest predictors of uptake [14,15]. There is a need for multi-tiered communication methods targeting both adolescents and their caregivers to confirm informed decision-making.

Cost emerged as a significant barrier in our cohort, with many respondents being unwilling or unable to pay the prevailing market price. This is even with results from a cross-sectional study in Tamil Nadu, where the willingness-to-pay for HPV vaccination was substantially below the actual cost, especially among low-income households [16]. International experiences further validate this apprehension; in South Africa, vaccine acceptance increased decidedly when the vaccine was provided free through school-based government programs [17]. This reinforces the policy imperative to integrate HPV vaccination into publicly funded immunisation schedules, as recently initiated in parts of India.

Our data also suggest a gap in provider-initiated discussions about HPV vaccination. Similar observations were made in a Delhi study where less than 15% of participants reported receiving information from a healthcare provider [18]. In contrast, evidence from the United States indicates that a strong, presumptive provider recommendation can triple the probability of vaccine initiation [19]. Establishment of provider communication skills and incentivising vaccine counselling could therefore serve as high-impact involvement in Northern India.

Another distinguished barrier was the prevalence of safety apprehensions and misinformation, particularly regarding fertility. Studies in Pakistan and Bangladesh have identified myths that negatively affect vaccine uptake [20,21]. Talking about these apprehensions requires culturally personalised, community-based education campaigns leveraging trusted local voices such as teachers, community health workers, and religious leaders.

Finally, our results have important implications for public health policy. The observed willingness among adolescents and women suggests a receptive audience that could be mobilised with planned involvement. The rollout of India's national HPV vaccination program, initiated in numerous states, presents a timely opportunity to integrate these methods into existing school health and reproductive health programs. Based on our data and the corroborating evidence from other situations, programmatic success will depend on confirming equitable access, eliminating cost barriers, and embedding HPV education within a broader cancer prevention framework.

CONCLUSIONS

The study concluded that while knowledge of cervical cancer and HPV was generally similar across age, residency, income, and education groups, significant differences were observed in willingness to vaccinate. Urban women, higher-income women, and those with higher education were more likely to express willingness to receive the HPV vaccine, with urban women showing the highest odds of vaccination (OR=4.73). The present study found that while overall awareness of cervical cancer, its symptoms, and HPV vaccination is maximum observed among young individuals of 12-18 years of age, significant knowledge gaps persist, mainly regarding the etiological role of determined high-risk HPV infection. Socio-economic status and education level were associated with certain aspects of awareness, such as knowledge about HPV and its vaccine. Still, they did not consistently influence overall understanding or willingness to vaccinate. Encouragingly, the majority of participants expressed willingness to receive the HPV vaccine, underscoring an opportunity for public health interventions to translate this positive attitude into action. Personalised health education programs, culturally sensitive awareness campaigns, and reinforced access to HPV vaccination services are essential to bridge existing gaps and reduce the future problem of cervical cancer in the region.

CONTRIBUTION OF AUTHORS

Research concept- Vineeta Awasthi, Devendra Kumar
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Supervision- Devendra Kumar
Materials- Vineeta Awasthi, Devendra Kumar
Data collection- Vineeta Awasthi, Devendra Kumar
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