

Original research

Knowledge and willingness towards human Papillomavirus vaccination among the parents and school teachers of eligible girls in Dhaka, Bangladesh: A school-based cross-sectional study

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ABSTRACTS

Background: Cervical cancer ranks as the common prevalent cancer, among women worldwide especially impacting low-resource countries. In Bangladesh, this accounts for 12 % of all cancer cases. The development of cancer is closely linked to Human Papillomavirus (HPV) infection. Despite the availability of HPV vaccines, their uptake remains limited in Bangladesh. Thus, this research aims to assess the knowledge and willingness of parents and school teachers regarding HPV vaccination for eligible girls in Bangladesh.

Methodology: This study involved 406 parents and school teachers of girls aged 9–14 years from Dhaka city. A cross-sectional study design was used. Data collection was done through a questionnaire administered by interviewers after pre-testing and refinement for clarity and reliability. Analysis was carried out using Stata 17 software. Chi-square tests and logistic regression were used to uncover associations and predictors related to knowledge levels and willingness.

Results: Findings revealed that a majority of participants (64.04 %) exhibited an understanding of HPV and cervical cancer yet a high percentage (98.28 %) expressed willingness to engage in HPV vaccination initiatives. participants with primary (AOR = 3.306, $p < 0.005$), secondary (AOR = 8.806, $p < 0.001$), and higher education (AOR = 5.059, $p < 0.001$), as well as those from upper-middle-income groups (AOR = 3.038, $p < 0.001$), had significantly higher knowledge of HPV and cervical cancer.

Conclusion: The research emphasizes lack of knowledge regarding HPV and its vaccination among parents and educators in Bangladesh despite a willingness to vaccinate. These results emphasize the importance of tailored initiatives and better access, to health information to increase HPV vaccine acceptance and lower the incidence of cervical cancer.

1. Introduction

Cervical cancer ranks as the fourth most common cancer among women globally, with a significant burden in low-resource countries.¹ In 2022, 660,000 women were diagnosed and 350,000 died from this disease worldwide.¹ In Bangladesh, cervical cancer is the second most prevalent cancer among women, accounting for approximately 12 % of female cancers, following breast cancer (19 %).² In 2020, there were 8268 new cases and 4971 deaths in Bangladesh.² Infection with HPV, a non-enveloped, double-stranded DNA virus, is a critical cause of cervical cancer.² Among the approximately 100 fully sequenced HPV types,

high-risk types 16 and 18 are the main contributors to cervical cancer,^{3,4} with HPV type 16 responsible for over 50 % of squamous cell carcinomas and most adenocarcinoma cases.^{5–8}

HPV is primarily transmitted through sexual contact, making early vaccination crucial in preventing infection before exposure occurs. HPV infections typically occur in late teens or early 20s in unvaccinated populations.^{6,9} The Immature metaplastic cells in the cervix, especially during puberty and early pregnancy, are highly susceptible to HPV infection.¹⁰ However, the HPV vaccine played a major public health role in preventing HPV-related cancers.^{11,12} Prophylactic vaccines, such as bivalent, quadrivalent, and nonavalent, are produced using virus-like

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particle (VLP) technology,^{11,13,14} inducing type-specific antibodies that prevent persistent HPV infection and precancerous lesions.^{15,16}

In 2006, the US Food and Drug Administration approved the first HPV vaccine (Gardasil 4), which prevents 70 % of cervical cancers and other HPV-related diseases.¹⁷ By 2017, 71 countries had introduced the vaccine for girls aged 9–13 years.¹⁸ Bangladesh introduced the HPV vaccine in 2016, in the Gazipur district, funded by the Global Alliance for Vaccines and Immunization (GAVI).¹⁹ However, successful implementation requires addressing knowledge gaps and societal attitudes toward the vaccine.²⁰

Studies emphasize the critical need to evaluate vaccine-related knowledge among adolescents, parents, and school teachers, as knowledge deficits can significantly influence vaccination decisions. For instance, in Kampong Speu, Cambodia, while 35 % of women knew about cervical cancer prevention through vaccination and 62 % were willing to receive the vaccine, it remains unclear how their level of knowledge shaped their willingness.²¹ Similarly, another study showed high vaccine acceptance among urban and rural respondents, yet gaps in understanding HPV transmission, associated risks, and vaccine benefits persist. These gaps can fuel misinformation, leading to uncertainty and reduced vaccine uptake.^{22,23} Given that parents and teachers play a pivotal role in adolescent vaccination decisions, systematically assessing their knowledge is essential for designing effective awareness initiatives. Addressing these gaps through targeted educational interventions could enhance informed decision-making and ultimately improve HPV vaccine coverage.

Bangladesh's National Cervical Cancer Control Program aims to integrate the HPV vaccine into the Expanded Program on Immunization (EPI) and expand cervical cancer screening and treatment.²⁴ The high public health burden of cervical cancer in Bangladesh makes achieving widespread vaccination essential. The WHO's goal of vaccinating 90 % of girls under 15 by 2030 further underscores this necessity.²⁵ However, adolescents themselves cannot make vaccination decisions; this responsibility falls to their parents, with school teachers playing a crucial role in influencing awareness and dispelling myths about vaccination.^{26,27} Surveying teachers and parents is particularly relevant as they have a great influence on whether their daughters or students become vaccinated, especially since many of the HPV vaccination sites in Dhaka are in schools. Their involvement in vaccination awareness initiatives could help increase vaccine uptake and strengthen school-based immunization programs. While global studies have assessed HPV vaccine awareness, significant gaps remain, particularly in low-resource countries like Bangladesh. Therefore, this study aims to address these gaps by evaluating the knowledge and willingness of parents and school teachers towards HPV vaccination for adolescent girls in Bangladesh. This study helps to generate actionable insights that can inform future public health interventions, ultimately improving vaccine coverage and reducing cervical cancer incidence. The large sample size and focus on socio-demographic variations make this study highly relevant and generalizable.

2. Materials and methods

2.1. Study design

This study employed a cross-sectional design. The study involved quantitative data collection using a structured, interviewer-administered questionnaire. The structured questionnaire was designed based on a thorough review of existing literature and consultations with three experts in the field. It was pre-tested and refined to ensure clarity, reliability, and validity. In the questionnaire, there were 8 sets of questions for knowledge and 8 sets of questions for willingness. The reliability and internal consistency of the questions were assessed through Cronbach's alpha (α), which showed the coefficient value is higher than 0.80, indicating very strong internal consistency and reliability were present. Data were collected from a diverse sample of

parents and school teachers from different types of schools (public and private) and various geographical locations within Dhaka (urban and rural areas).

2.2. Study population and place of study

This study focused on parents and school teachers of adolescent girls aged 9–14 years attending primary and secondary schools in Dhaka, Bangladesh. Dhaka is the capital and largest city of Bangladesh, and more than 10 million people live here.²⁸ This provides a diverse demographic profile, which was one of the suitable sites for conducting the study. The research was conducted across various schools within this city to ensure a representative sample reflective of the broader population.

2.3. Study period and inclusion/exclusion criteria

The research was carried out over three months, from September 1, 2024 to December 1, 2024, following the approval of the research proposal. Participants included parents of adolescent girls aged 9–14 years and school teachers who directly interacted with girls within the same age range. To maintain the study's integrity and relevance, several exclusion criteria were applied: participants residing outside Dhaka, individuals with major psychological or psychiatric conditions, parents of non-school-going adolescent girls, and individuals unwilling to provide information. These criteria ensured the inclusion of a relevant and targeted participant pool.

2.4. Sampling technique and sample size

A convenience sampling technique was employed in this study due to practical considerations such as time constraints and accessibility of participants within the study period. This approach allowed for the efficient collection of data from readily available and willing participants, which was crucial given the logistical challenges of reaching a large and diverse population within Dhaka. To recruit participants, six schools were selected based on their willingness to participate and accessibility to the research team. The selected schools included Dhaka Collegiate School, Viqarunnisa Noon School and College, Government Laboratory High School, Dhamrai Hardinge High School, College, Karatia Pilot High School, and Kapasia Pilot High School. The research team directly contacted school administrators to seek permission for the study. Once schools agreed to participate, teachers and parents of adolescent girls (aged 9–14 years) were invited to take part in the study. Participants were approached through direct invitations and word-of-mouth referrals by school staff. While convenience sampling may limit the generalizability of the findings, efforts were made to reduce selection bias by including schools from diverse geographical areas, ensuring representation of different educational institutions. This strategy helped enhance the reliability of the collected data despite the limitations of the sampling method. Within these schools, parents and teachers who met the inclusion criteria and were willing to participate were approached.

The sample size was determined using a standard formula for prevalence studies:

$$N = z^2 y \frac{1-y}{w^2}$$

In this formula, N represents the desired sample size, Z the standard normal deviation at 5 % type-1 errors ($p < 0.05$) with a 95 % confidence interval, which is 1.96. The proportion of the population exhibiting the characteristic of interest, based on previous studies, was set at 59.2 % ($y = 0.592$).²⁹ The allowable error or precision (w) was set at 0.05. Substituting these values into the formula, the initial sample size calculated was 371.15. To account for a potential 5 % dropout rate, the minimum sample size was needed to 390 participants. In this study, a

total of 435 samples were collected. Upon applying exclusion criteria, removing missing values, and duplicate entries finally 406 samples were kept for the study.

2.5. Data collection

Data collection involved a structured, face-to-face, interviewer-administered questionnaire. Initially, the questionnaire was developed in English and then translated into Bengali to ensure comprehensibility among all participants. The development process of the questionnaire involved several steps: drafting an initial version based on a thorough literature review and expert consultations, translating the draft into Bengali by bilingual experts, pre-testing the questionnaire with a small group of parents and teachers to identify any language or comprehension issues, refining the questionnaire based on feedback from the pre-test, and conducting a field trial in two schools to finalize the questionnaire before the main data collection phase.

2.6. Ethical consideration

The study received approval from the Institutional Review Board (IRB) of North South University (IRB #2024/OR-NSU/IRB/0803), which was mandated by regulatory requirements. The ethical guidelines specified in the 1964 Declaration of Helsinki and its later amendments were adhered to wherever applicable. Prior to participation, all eligible respondents were provided with a detailed explanation of the study's purpose, procedures, potential risks, and benefits. Written informed consent was obtained from each participant. The respondents were assured that their privacy and confidentiality would be strictly protected, and no part of their responses would be disclosed to unauthorized individuals under any circumstances. This commitment to ethical standards ensured the protection and respect of all participants throughout the study.

2.7. Data analysis

The collected data were meticulously coded and entered into Stata version 17 for analysis. After applying inclusion and exclusion criteria and removal of any missing and duplicate data, the final dataset was prepared. This was checked by the supervisor as to see if the integrity and data quality were assured properly or not. Descriptive statistics were used initially to summarize the demographic characteristics of the study population, providing a clear overview of the study sample, including the distribution of demographics such as age, resident, educational level, and occupation.

For the knowledge assessment, eight specific questions were used, each with a binary response format of 'Yes' or 'No.' These questions covered key aspects of HPV and its vaccination. Participants were asked whether having multiple sexual partners is a risk factor for HPV infection, whether engaging in sexual activity at a young age increases the risk of HPV infection, whether being a smoker increases the risk of HPV infection, whether sexual contact is the primary route of transmission for HPV infection, whether the primary cause of cervical carcinoma is HPV infection, whether people can transmit HPV to their partners even without showing any symptoms, whether receiving the HPV vaccine before sexual intercourse can prevent cervical carcinoma, and whether the recommended age for receiving the HPV vaccine is nine to fourteen years old. Responses were coded as 1 for 'Yes' and 0 for 'No'. A composite knowledge score was calculated for each participant, ranging from 0 to 8. The cut point was set to 4 as if the participants scoring equal and less than 4 were categorized as having poor knowledge, while those scoring higher than 4 were categorized as having good knowledge.

Willingness to vaccinate was assessed using eight Likert-scale questions, with responses scored from 1 (Strongly Disagree) to 5 (Strongly Agree). The specific statements used in the survey are presented in Table 1 to avoid redundancy. Data was obtained directly from

Table 1

Demographic characteristics of the participants and their responses to knowledge- and willingness-related questions on HPV vaccination.

Characteristics	Frequency (N)	Percentage (%)
Age group		
20-30 y	65	16.01
31-40 y	215	52.96
41-50 y	114	28.08
Above 50 y	12	2.96
Participant type		
Parents	281	69.21
School Teacher	125	30.79
Resident		
Urban	201	49.51
Rural	205	50.49
Education Level		
No Education	55	13.55
Primary	64	15.76
Secondary	93	22.91
Higher	194	47.78
Socio Economic Status		
Lower Middle Income	204	50.25
Upper Middle Income	202	49.75
Knowledge Related		
Multiple sexual partners increase HPV infection risk		
No	159	39.16
Yes	247	60.84
Early sexual activity increases HPV infection risk		
No	330	81.28
Yes	76	18.72
Smoking increases HPV infection risk		
No	202	49.75
Yes	204	50.25
Sexual contact is the primary HPV transmission route		
No	219	53.94
Yes	187	46.06
HPV infection is the primary cause of cervical carcinoma		
No	260	64.04
Yes	146	35.96
HPV can be transmitted without symptoms		
No	269	66.26
Yes	137	33.74
HPV vaccine before sex prevents cervical carcinoma		
No	182	44.83
Yes	224	55.17
The recommended age for the HPV vaccine is 9–14 years		
No	235	57.88
Yes	171	42.12
Willingness Related		
I believe having only one sexual partner reduces the risk of HPV		
Strongly Disagree	10	2.46
Disagree	14	3.45
Neutral	56	13.79
Agree	190	46.8
Strongly Agree	136	33.5
I support including education about the HPV vaccine in school curriculums		
Strongly Disagree	1	0.25
Disagree	11	2.71
Neutral	19	4.68
Agree	133	32.76
Strongly Agree	242	59.61
I believe cervical cancer is a significant health issue for women		
Strongly Disagree	1	0.25
Disagree	2	0.49
Neutral	14	3.45
Agree	140	34.48
Strongly Agree	249	61.33
I believe cervical cancer can lead to death		
Strongly Disagree	2	0.49
Disagree	5	1.23
Neutral	10	2.46
Agree	154	37.93
Strongly Agree	235	57.88
I believe men's involvement is important for cervical cancer prevention		
Strongly Disagree	1	0.25
Disagree	10	2.46

(continued on next page)

Table 1 (continued)

Characteristics	Frequency (N)	Percentage (%)
Neutral	43	10.59
Agree	169	41.63
Strongly Agree	183	45.07
I support vaccinating girls against HPV before their first sexual activity		
Strongly Disagree	2	0.49
Disagree	7	1.72
Neutral	48	11.82
Agree	199	49.01
Strongly Agree	150	36.95
I believe it is necessary to provide information about the HPV vaccine to adolescents		
Strongly Disagree	0	0
Disagree	4	0.99
Neutral	10	2.46
Agree	187	46.06
Strongly Agree	205	50.49
I agree that the HPV vaccine helps prevent cervical cancer		
Strongly Disagree	3	0.74
Disagree	5	1.23
Neutral	32	7.88
Agree	196	48.28
Strongly Agree	170	41.87

participant survey responses, which included self-reported demographic characteristics and HPV-related knowledge and willingness. All the data in this study were collected through direct interviews, where trained interviewers asked the participants the questions and recorded their responses. This approach ensured clarity in participant understanding and minimized response bias.

The measurement of willingness to vaccinate follows established frameworks, including the WHO Behavioral and Social Drivers (BeSD) model and the Parent Attitudes about Childhood Vaccines (PACV) scale, both of which emphasize that vaccine acceptance is shaped by perceptions, trust, risk awareness, and behavioral readiness.^{30,31} Since willingness to vaccinate is influenced by multiple factors beyond a simple intent statement, using a composite score provides a more accurate and meaningful assessment. This approach ensures a well-rounded understanding of vaccine acceptance, capturing not just intent but also the key attitudes and beliefs that drive vaccination decisions. While analyzing individual questions separately may offer additional insights, composite scoring allows for greater consistency and comparability with previous vaccine hesitancy research, making it a strong and reliable approach for assessing willingness to vaccinate. A total willingness score was calculated for each participant, ranging from 8 to 40, based on responses to eight Likert-scale questions. Since a neutral response (score of 3) on all eight questions would result in a total score of 24 ($3 \times 8 = 24$), this threshold was used to distinguish willingness. Participants with a score above 24 were classified as willing to vaccinate, indicating a positive inclination toward vaccination, while those with a score of 24 or below were classified as not willing, reflecting neutrality or hesitancy.

Bivariate analysis was performed to explore the association between demographic variables and the categorized knowledge and willingness level. Chi-square tests were used to identify significant associations between categorical variables. Variables with a p-value ≤ 0.2 in the bivariate analysis were included in the logistic regression model to ensure that potentially relevant factors were not excluded prematurely.

To adjust for potential confounders and to determine the independent effect of each variable on the outcomes of interest, multivariate logistic regression was employed. In this step, all independent variables that showed a p-value ≤ 0.2 in the chi-square were included in the multivariate model. The final model was refined by sequentially removing non-significant variables and reassessing the fit of the model. The significance level was shown as the level of strength as ψ for a p-value less than 0.05, $\psi\psi$ for a p-value less than 0.01, and $\psi\psi\psi$ for a p-value less than 0.001. Adjusted odds ratios (AOR) with 95 % confidence intervals (CI) were also shown to identify significant predictors. The

results of the analysis were presented using text, tables, and figures to provide a comprehensive depiction of the findings.

3. Results

In this study, a total of 406 respondents were included encompassing a diverse population in terms of age, participant type, residence, education level, and socioeconomic status. Table 1 shows the demographic characteristics of the participants along with their knowledge and willingness to vaccinate. The majority were aged 31–40 years (52.96 %), with 48.31 % of parents and 52.63 % of teachers in this age group. The sample was nearly evenly split between urban (49.51 %) and rural (50.49 %) residents. Education levels varied, with 92.98 % of teachers having higher education, compared to 41.57 % of parents, while 13.48 % of parents had only primary education. Socioeconomic status was balanced, with 50.25 % lower-middle-income and 49.75 % upper-middle-income participants. In terms of willingness to vaccinate, 56.88 % of parents and 45.53 % of teachers aged 31–40 years expressed willingness. Additionally, 96.75 % of teachers with higher education were willing to vaccinate, compared to 25.72 % of parents with the same education level.

However, There were a significant proportion of respondents (60.84 %) recognized that having multiple sexual partners increases the risk of HPV infection, and (55.17 %) understood that receiving the HPV vaccine before sexual intercourse can prevent cervical carcinoma. Additionally, a substantial majority (87.37 %) believed that providing HPV vaccine education in schools is essential, and (83.98 %) agreed that men's involvement is important for the prevention of cervical carcinoma.

Table 2 shows that among the participants, a majority (72.17 %) had heard about cervical cancer, and (88.42 %) had no history of cervical cancer in their family. Most respondents (92.12 %) indicated no history of sexual activity among their girls, and (67.00 %) did not express fear of sexual transmission of HPV. Regarding HPV vaccination, (29.56 %) had received the vaccine. These findings highlight a high level of awareness about cervical cancer and a substantial portion of participants taking preventive measures such as HPV vaccination.

After properly scoring and labeling the knowledge and willingness category, Fig. 1 illustrates that while knowledge about HPV and cervical cancer remains limited, with 68.3 % of parents and 54.4 % of teachers exhibiting poor knowledge, the overall willingness to vaccinate is remarkably high. Despite these knowledge gaps, 98.2 % of parents and 98.4 % of teachers expressed a positive attitude toward supporting HPV vaccination.

In Table 3, the association analysis revealed significant relationships between knowledge levels and various demographic characteristics. The age group was significantly associated with knowledge levels ($X^2 = 10.721$, $p = 0.013$), with the highest knowledge observed in the 31–40 years age group. Urban residents have higher knowledge levels than rural residents and resident is associated with knowledge level ($X^2 = 18.367$, $p < 0.001$). Moreover, Education level ($X^2 = 37.068$, $p < 0.001$) and socioeconomic status ($X^2 = 42.073$, $p < 0.001$) were both

Table 2

Reproductive health factors associated with HPV and related beliefs of study participants.

Characteristics	Response	Frequency	Percent
Have you ever heard about cervical cancer	Yes	293	72.17
	No	113	27.83
Do you or any close family member have a history of cervical cancer	No	359	88.42
	Yes	47	11.58
Do you believe HPV infection is related to sexual activity	No	374	92.12
	Yes	32	7.88
Do you believe HPV can be transmitted through sexual contact	No	272	67.00
	Yes	134	33.00
Have your child or student received the HPV vaccine	No	286	70.44
	Yes	120	29.56

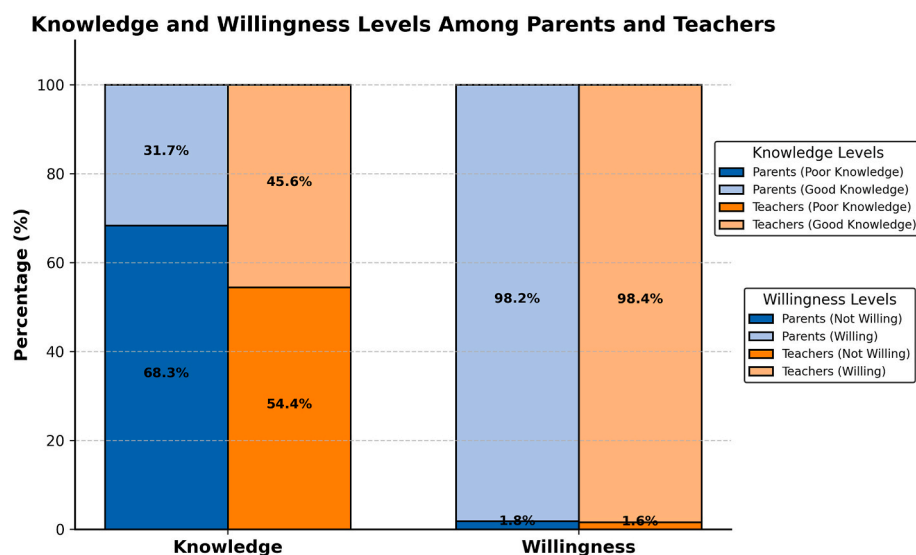


Fig. 1. A grouped bar chart showing the prevalence (%) of knowledge and willingness levels among parents and teachers. Parents' responses are shown in blue shades, while teachers' responses are in orange shades, with each bar summing to 100 % within the Knowledge (Poor vs. Good) and Willingness (Not Willing vs. Willing) categories.

Table 3

Association between knowledge and willingness levels across demographic characteristics.

Characteristics	Good Knowledge			X ² Value	P-value	Have Willingness			X ² Value	P-value
	Parents (N %)	School Teachers (N%)	Total (N%)			Parents (N %)	School Teachers (N%)	Total (N%)		
Age Group				10.721	0.013 ^Ψ				4.461	0.216
20-30 y	12 (13.48)	3 (5.26)	15 (10.27)			46 (16.67)	18 (14.63)	64 (16.04)		
31-40 y	43 (48.31)	30 (52.63)	73 (50.00)			157 (56.88)	56 (45.53)	213 (53.38)		
41-50 y	31 (34.83)	22 (38.60)	53 (36.30)			64 (23.19)	47 (38.21)	111 (27.82)		
Above 50 y	3 (3.37)	2 (3.51)	5 (3.42)			9 (3.26)	2 (1.63)	11 (2.76)		
Residence				18.367	<0.001 ^{ΨΨΨ}				1.369	0.242
Urban	61 (68.54)	22 (56.14)	93 (63.70)			136 (49.28)	60 (48.78)	196 (49.12)		
Rural	28 (31.46)	25 (43.86)	53 (36.30)			140 (50.72)	63 (51.22)	203 (50.88)		
Education Level				37.068	<0.001 ^{ΨΨΨ}				2.959	0.398
No Education	4 (4.49)	0 (0.00)	4 (2.74)			53 (19.20)	0 (0.00)	53 (13.28)		
Primary	12 (13.48)	0 (0.00)	12 (8.21)			62 (22.46)	1 (0.81)	63 (15.79)		
Secondary	36 (40.45)	4 (7.01)	40 (27.39)			90 (32.61)	3 (2.44)	93 (23.31)		
Higher	37 (41.57)	53 (92.98)	90 (61.64)			71 (25.72)	119 (96.75)	190 (47.62)		
Socioeconomic Status				42.073	<0.001 ^{ΨΨΨ}				1.338	0.247
Lower Middle Income	28 (31.46)	14 (24.56)	42 (28.77)			161 (58.33)	41 (33.33)	202 (50.63)		
Upper Middle Income	61 (68.54)	43 (75.44)	104 (71.23)			115 (41.67)	82 (66.67)	197 (49.37)		

Denote: (Chi² significance: ^Ψ = p-value<0.05, ^{ΨΨ} = p-value=<0.01, ^{ΨΨΨ} = p-value<0.001).

significantly associated with knowledge levels, highlighting that higher education and better socioeconomic status correlate with better knowledge about HPV vaccine and cervical cancer.

However, willingness to participate in HPV vaccination programs didn't show any significant association.

In Table 4, through the logistic regression model, the study analyzed the demographic factors influencing knowledge levels about HPV and cervical cancer. Significant findings indicated that participants with primary education (AOR = 3.306, $p < 0.005$), secondary education (AOR = 8.806, $p < 0.001$) and higher education (AOR = 5.059, $p < 0.001$) had considerably higher likelihood of knowledge levels compared to those with no education. Additionally, individuals from upper-middle-income groups were significantly more knowledgeable than those from lower-middle-income groups (AOR = 3.038, $p < 0.001$). These results highlight the critical role of higher education and better socioeconomic status in enhancing awareness and knowledge about

HPV and cervical cancer.

4. Discussion

The results of this study highlight several important aspects regarding the knowledge and willingness of parents and school teachers of adolescent girls toward the HPV vaccination in Bangladesh. The demographic characteristics revealed that the majority of participants were aged between 31 and 40 years, with a significant proportion being parents rather than school teachers. This demographic distribution is important as it suggests that the primary caregivers, who are directly responsible for the health decisions of adolescent girls, form the bulk of the respondents.

The knowledge-related findings showed that a significant portion of respondents recognized that having multiple sexual partners increases the risk of HPV infection and that receiving the HPV vaccine before

Table 4

Demographic factors associated with the Knowledge level.

Characteristics	AOR	St. Error	[95 % Conf. Interval]
Age Group			
20-30 y	Ref		
31-40 y	1.598	0.602	0.763–3.346
41-50 y	1.615	0.649	0.735–3.549
Above 50 y	2.548	1.883	0.598–10.847
Participant Type			
Parents	Ref		
School Teachers	1.278	0.396	0.697–2.344
Residence			
Urban	Ref		
Rural	0.674	0.180	0.400–1.138
Education Level			
No Education	Ref		
Primary	3.306*	2.032	0.991–11.030
Secondary	8.806***	5.186	2.776–27.928
Higher	5.059***	3.082	1.533–16.698
Monthly Income			
Lower Middle Income	Ref		
Upper Middle Income	3.038***	0.838	1.769–5.217

Denote: (P-value indication: * = P-value<0.05, ** = P-value=<0.01, *** = P-value<0.001, AOR = adjusted odds ratio).

sexual intercourse can prevent cervical carcinoma. However, there were notable gaps in knowledge, such as the misunderstanding that HPV infection is not the primary cause of cervical carcinoma and the lack of awareness that HPV can be transmitted without symptoms. These findings align with previous studies where awareness about HPV and its link to cervical cancer is generally low. For instance, similar gaps in knowledge, suggest that the lack of comprehensive sexual health education and cultural taboos surrounding discussions of sexual health contribute to these misconceptions.^{32,33}

Furthermore, the study found that urban residents and those with higher education levels had significantly better knowledge about HPV and cervical cancer. Urban residents typically have better access to health information and services, which likely contributes to their higher knowledge levels.³⁴ Additionally, higher education is often correlated with improved health literacy, enabling individuals to better understand and utilize health information.³⁵

Despite the gaps in knowledge, the study revealed a high willingness among respondents to participate in HPV vaccination programs. The overwhelming majority of participants expressed support for providing HPV vaccine education in schools and recognized the importance of men's involvement in preventing cervical carcinoma. This high level of willingness can be attributed to the general recognition of cervical cancer as a significant health issue and the perceived benefits of vaccination. Previous research supports this finding, indicating that when individuals are aware of the benefits of vaccination, they are more likely to support and participate in vaccination programs.³⁶

The logistic regression analysis provided further insights into the key factors influencing knowledge levels about HPV and cervical cancer. Participants with primary, secondary, and higher education had a significantly higher likelihood of having better knowledge levels compared to those with no education. Additionally, individuals from upper-middle-income groups were more knowledgeable than those from lower-middle-income groups. These results emphasize the critical role of education and socioeconomic status in enhancing awareness and knowledge about HPV. Education equips individuals with the necessary skills to seek out, understand, and apply health information, while higher socioeconomic status provides better access to healthcare resources and information.³⁷

5. Limitation

Although every research has limitations, one issue could be that this

research relies on information provided by the participants themselves, which could lead to biases like wanting to appear as memory-related biases. People might exaggerate behaviors that are seen positively or downplay those that are not affecting the accuracy of the results. Moreover, because the study only captures a moment in time through its cross-sectional design, it can't fully establish cause-and-effect relationships or track changes over time. Additionally, although the research involves individuals from both urban and rural areas, using a convenience sampling method might limit how broadly we can apply the findings to the population. Finally, even though steps were taken to make sure the survey was reliable and valid differences in culture and language might still influence how participants interpret questions and provide responses, potentially impacting what conclusions we draw from the study.

6. Conclusion

The findings reveal significant knowledge gaps about HPV and its vaccination among parents and school teachers in Bangladesh despite a strong willingness to support vaccination programs. Factors such as education level and socioeconomic status were found to significantly influence knowledge levels. The high willingness to participate in HPV vaccination programs highlights the potential for targeted educational interventions and improved vaccine access, driven by a general awareness of cervical cancer as a major health issue and the perceived benefits of vaccination. Enhancing access to accurate health information and making vaccines more available, especially in rural and lower socioeconomic areas, can substantially reduce HPV-related cervical cancer in Bangladesh. These efforts are crucial for improving the health outcomes of adolescent girls and supporting the broader public health objectives of the country.

CRediT authorship contribution statement

Samina Sultana: Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **MD Nahid Hassan:** Writing – review & editing, Writing – original draft, Software, Methodology, Formal analysis, Data curation, Conceptualization. **Aklima Akter:** Writing – review & editing, Writing – original draft. **Dalia Rahman:** Writing – review & editing, Writing – original draft. **Fowzia Yasmin:** Writing – review & editing, Writing – original draft. **Mohammad Delwer Hossain Hawlader:** Writing – review & editing, Writing – original draft, Supervision.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Abbreviation

Abbreviation	Full Term
AOR	Adjusted Odds Ratio
CI	Confidence Interval
EPI	Expanded Program on Immunization
GAVI	Global Alliance for Vaccines and Immunization
HPV	Human Papillomavirus
P-value	Probability Value
VLP	Virus-Like Particle
WHO	World Health Organization
χ^2	Chi-Square
α	Cronbach's Alpha

Data availability

Data will be made available on request.

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