



Research article

Awareness of HPV vaccine and its socio-demographic determinants among the parents of eligible daughters in Bangladesh: A nationwide study

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ABSTRACT

Background: Vaccination against Human papillomavirus (HPV) is recommended to avoid HPV infections and its associated diseases, including cervical cancer. However, there is no awareness study among Bangladeshi population. Hence, this nationwide study was conducted to explore HPV vaccine awareness and its determinants among parents of eligible adolescent girls.

Methods: This study was conducted among the parents of daughters aged 9–15 years from 42 out of 64 randomly selected districts of Bangladesh between June 28 to August 2, 2023. A multistage sampling method was used to enroll 2151 study participants from all eight divisions of Bangladesh. A semi-structured questionnaire was used for face-to-face interviews in this study. The statistical software Stata (Version 17) was used for statistical analyses.

Results: The average age of the participants was 38.18 (± 5.86) years. Only 22.32 % of the participants were aware of the HPV vaccine. Every additional year of age increased the likelihood of being aware of the HPV vaccine by 3 % (AOR: 1.03; 95%CI: 1.00–1.06). Participants residing in the urban area had 3.56 times higher odds of awareness than rural and semi-urban people. Businessmen and housewives had 60 % (AOR: 0.40; 95 % CI: 0.22–0.69) and 77 % (AOR: 0.23; 95 % CI: 0.16–0.33) lower odds in comparison to job holders. The lower-income group exhibited significantly higher odds of awareness (AOR: 0.25, 95%CI: 0.16–0.39) compared to the middle and the higher-income group. Participants who never went through routine health check-ups had 77 % lower odds of being aware than those who availed of regular routine check-ups (AOR: 0.23; 95%CI: 0.16–0.34).

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Conclusion: Awareness of the HPV vaccine among the general population of Bangladesh is very low. Age, residence, occupation, monthly income, and routine medical check-ups were associated with HPV vaccine awareness. A nationwide awareness campaign would increase this awareness level among the Bangladeshi population, especially among the parents of daughters.

1. Introduction

Cervical cancer (CC), the greatest fear of women's health, is the fourth most prevalent cancer among women worldwide [1]. Every 2 min, one woman passes away of CC worldwide. Nine out of ten CC fatalities occur in developing nations [2]. Low- and middle-income countries accounted for almost 90 % of global new cases and fatalities in 2020 [3]. CC is the second most common cancer among women in Bangladesh, accounting for 12,000 new cases and more than 6000 yearly fatalities [4,5]. Infection with Human papillomavirus (HPV) is one of the most significant causes of CC. 99 % of female CC cases are caused by the sexually transmitted HPV [6]. According to the HPV Information Centre, HPV infection is responsible for about 500,000 cancer cases of cervical, vulvar, anal, penile, and oropharyngeal cancer each year [7]. Generally, sexually active adults are exposed to HPV. Interestingly, most new HPV infections occur in adolescents and young adults. Being a sexually transmitted infection, HPV occurs soon after the first sexual activity [8]. The lifetime probability of encountering HPV is as high as 80–90 % in many industrialized countries [9].

HPV vaccination is a revolutionary approach to the primary prevention of CC. Vaccination against HPV is recommended to avoid HPV infections and HPV-associated diseases, including CC [8]. The Advisory Committee on Immunization Practices (ACIP) suggests HPV vaccination at 11 or 12 years, though vaccination can start at nine years. Later catchup vaccinations were suggested till the age of 26, and they recommended the vaccine irrespective of gender [8]. There is no national HPV vaccine program in Bangladesh. A community-based cross-sectional study conducted among rural women found that only 5.3 % were vaccinated against HPV(4). One of the main reasons behind this poor uptake may be the lack of awareness and understanding of the benefits of vaccines among the beneficiaries. Raising awareness is essential for the higher uptake of the HPV vaccine. That means uptake relies predominantly on knowledge and understanding of cancer and its preventive measures, such as HPV vaccination and screening among the target population and their parents [10,11].

Several studies have found different levels of awareness in varied populations. Developed countries like Italy had higher levels of awareness about the HPV vaccine; on the contrary, developing countries like China and least developed countries like Senegal had lower levels of awareness of HPV vaccination [12] [–] [14]. Low awareness status of the HPV vaccine was also found in the U.S. ethnic minorities [15]. A study in India on medical students revealed that one-fourth of medical students are unaware of HPV vaccination. This study also revealed that 74.4 percent of students didn't know about the need for men to be vaccinated [16].

Similarly, poor awareness of the HPV vaccine and CC was reported in several small sample studies in Bangladesh [4,17]. Many factors may influence the awareness status and, consequently, the acceptance of HPV vaccines [4]. The Ministry of Family and Health Welfare of Bangladesh (MoHFW) plans to integrate the HPV vaccine into the Expanded Program on Immunization (EPI), launching its initial phase of vaccination targeting adolescent girls aged 10–15 years in educational institutions [18]. Considering the influence of awareness on the decision to take the vaccine, and the fact that parents make decisions regarding healthcare for their children in the country, this nationwide survey of HPV vaccine awareness and its determinants was conducted among parents of eligible adolescent girls.

2. Methodology

2.1. Study site

This nationwide study was conducted across Bangladesh, a South Asian nation known for its cultural richness and diversity. With its geographical complexity, Bangladesh is divided into eight administrative divisions, featuring 64 districts, 495 Upazilas, and 4571 unions [19]. Researchers used a two-stage sampling method. First, for practicality and convenience, this research used a convenient sampling method while selecting 42 out of 64 districts that collectively constitute the study site, encompassing a broad cross-section of Bangladesh's geographic and cultural landscape while in the second stage, participants from 42 districts were also selected using convenient sampling.

2.2. Study design and participants

We conducted a cross-sectional study among self-identified parents of daughters aged 9–15 years in Bangladesh. To gather data, a convenience sampling method was employed, covering all eight divisions of Bangladesh, including Dhaka, Mymensingh, Chattogram, Sylhet, Rajshahi, Khulna, Rangpur, and Barishal. Data collection occurred over the period from June 28 to August 2, 2023. The study specifically included individuals who were permanent residents of Bangladesh and had daughters within the specified age range. Excluded from the list were parents with foreign nationality and/or those affected by mental illness.

In this study, the sample size was determined using a standard formula: $n = \frac{Z^2 pq}{d^2}$, where n represents the sample size, p is the expected proportion of desired events (set at 0.80), $q = 1-p$, Z is the critical value of standard normal distribution (at 95 % level of

significance, $Z = 1.96$), $d = 0.05$ denotes acceptance level of errors (5 %). Based on this calculation, the sample size for each division was determined to be 245. Consequently, with eight divisions considered, the total sample size was estimated at approximately 2160, accounting for a 10 % non-response rate, ensuring a proportionate distribution across divisions as per the Population and Housing Census [20]. After data cleaning, the final sample consisted of 2151 parents who met the criteria of having eligible daughters in Bangladesh.

Instead of conducting long open-ended interviews, a survey questionnaire was used for face-to-face interviews of participants. This allowed for the standardization of questions and response options, ensuring consistency across all participants. The data collectors were public health graduates and were trained on the questionnaire before initiation, thus reducing bias and ensuring data quality. Moreover, the format of the survey questionnaire facilitated quantitative analysis, enabling the application of statistical methods to disclose patterns, correlations, and determinants of parental awareness regarding the HPV vaccine. This analytical approach provides a robust foundation for comprehensively understanding the issue at a population level, offering insights that may inform targeted interventions and policies.

2.3. Data collection instrument

A semi-structured questionnaire was used to conduct face-to-face interviews among study participants to assess their status of awareness of the HPV vaccine. An English draft questionnaire was created based on earlier research after a thorough literature review [21]–[23]. We changed the way the questions were phrased and framed to better represent Bangladesh's sociocultural and healthcare environments. After that, the questionnaire was translated into Bangla. The versions that were translated were verified by consensus among the researchers and numerous modifications. Due to the time-sensitive nature of the study, certified translators' forward-background translation and relevant experts' assessments were not included in the inquiry. However, the questionnaire's face validity was guaranteed in two ways; opinions from the experts and pre-testing the questionnaires. Some items were changed or clarified to increase face-to-face and construct validity and to make the questionnaire easier for the participants to grasp. We selected individuals for the pilot research from a variety of socioeconomic backgrounds. Participant modifications were taken into consideration and implemented into the survey to maintain consistency with contemporary research. The questionnaire (32 items) was finalized by the authors. The supplementary file contains the completed questionnaire.

2.4. Data collection procedure

The data collection was managed by a group of trained public health graduates and students. The interviewers were directed to speak with as many parents as they could, regardless of their origins. Interviewers were assigned based on their location to prevent linguistic barriers. In public places such as hospitals, schools, pharmacies, food markets, streets, workplaces, and homes, participants were contacted. The researchers also spoke with their family members, friends, neighbors, and co-workers, in addition to the broader public. Our interviewers explained key questions to the participants as they completed the questionnaire to help them comprehend them. Before enrolling in the study, written informed consent was collected from all participants, who gave their consent voluntarily.

2.5. Variables of interest

Participants were divided into two categories: mothers (i.e., females) and fathers (i.e., males), with detailed personal information collected, including their address, age, marital status, religion, place of residence, educational background, occupation, average monthly family income, family size, the number of children, and the ages of their daughters. To determine healthcare worker status and daughters' educational enrollment, yes/no questions were employed. The childhood vaccination status of the daughters was divided into two categories: those that were confirmed as "received," and those indicated as "yes all" or "yes some" for other recommended vaccines were collectively labelled as "yes," while responses of "no" or "not sure" were grouped under "others." The types of academic institutions (government, private, madrasa) and the geographical locations (rural, semi-urban, urban) were evaluated as ordinal variables. The health check-up frequency was assessed and categorized into three main groups: "regular," "irregular," and "never," with specific time intervals such as "<1 year," "1–2 years," "2–5 years," and ">5 years," providing a comprehensive overview of participants' health monitoring practices. Respondents' awareness was measured through the question "Have you ever heard about HPV Vaccination?" There were two possible answers for that, such as Yes and No. Sources of information were also inquired if the response was positive regarding awareness-related questions.

2.6. Data analysis

Before analysis, all data were examined for completeness, outliers, and assumption violations. To describe the socio-demographic data of the research participants and their awareness and source of information regarding the HPV vaccine, descriptive statistics were employed. Pearson's Chi-squared test, Welch Two Sample t -test, Fisher's exact test and Wilcoxon rank sum test were used to analyze the association of characteristics of the respondents with HPV vaccine awareness. To investigate the relationship between parental awareness of HPV vaccination and socio-demographic variables, health checkup frequency, knowledge, and beliefs about HPV and CC, we conducted a multivariable binary logistic regression analysis. Adjusted odds ratios (AOR) and their accompanying 95 % confidence intervals (CI) were expressed. A p -value of <0.05 was considered significant for all tests. The statistical software STATA (Version 17) was used for statistical analyses.

2.7. Ethical considerations

All procedures were carried out in compliance with the ethical guidelines of North South University's Institutional Review Board's (IRB)/Ethical Review Committee's (ERC) ethical standards (approval number: 2023/OR-NSU/IRB/0507). The ethical principles specified in the 1964 Helsinki Declaration and its subsequent revisions, or analogous ethical principles, were observed when appropriate [24]. We received written informed consent from each participant in the study during the face-to-face interviews. All participants were made aware that their participation was completely optional and that they might revoke it at any point before delivering their signed consent. They were also told that only the researchers would have access to the data and that it would all be provided on a group level.

3. Result

Among the 2151 participants, the respondents had an average age of approximately 38.18 (± 5.86) years, with a majority being female (81.40 %) and primarily living with their spouse (93.86 %). The dominant religion among the respondents was Islam (82.94 %), and participants came from diverse residential backgrounds, with 51.60 % residing in urban areas. On average, participants had 11.37 (± 4.51) years of education. The majority of the participants were housewives (63.41 %), while only 8.51 % were healthcare workers. About 27.98 % of households had a monthly income of 35,001–50,000 BDT compared to other lower income categories. Joint families (57.12 %) were more common among the study population. About 31.19 % of respondents had done regular health check-ups. While a significant portion of the population was aware of CC (80.15 %), only 22.55 % of respondents were aware of Human papillomavirus. Only 22.32 % of participants were aware of the HPV vaccine, compared to around 48.72 % who were aware of the CC vaccination (Table 1).

Table 1
Characteristics of the respondents (n = 2151).

Characteristic	n (%)
Age (years)	38.18 \pm 5.86
Sex	
Female	1751 (81.40)
Male	400 (18.60)
Marital Status	
Living with spouse	2019 (93.86)
Living without spouse	76 (3.53)
Others	56 (2.60)
Religion	
Islam	1784 (82.94)
Hindu	337 (15.67)
Buddhist	4 (0.19)
Christian	26 (1.21)
Residence	
Rural	783 (36.40)
Semi-urban	258 (11.99)
Urban	1110 (51.60)
Years of Education	11.37 \pm 4.51
Occupation	
Job	511 (23.76)
Business	186 (8.65)
Housewife	1364 (63.41)
Others	90 (4.18)
Health Care Worker	183 (8.51)
Monthly household income (BDT)	
<20000	547 (25.47)
20001-35000	569 (26.49)
35001-50000	601 (27.98)
>50000	431 (20.07)
Number of family members	5.00 (4.00, 6.00)
Family Type	
Nuclear	922 (42.88)
Joint	1228 (57.12)
Routine Health Checkup	
Regular	671 (31.19)
Irregular	890 (41.38)
Never	590 (27.43)
Heard about Human Papilloma Virus	485 (22.55)
Heard about Cervical Cancer	1724 (80.15)
Heard about Cervical Cancer Vaccination	1048 (48.72)
Heard about HPV Vaccine	480 (22.32)

Continuous data was expressed as Mean \pm SD and Median (IQR).

Fig. 1 illustrates the status of awareness regarding the HPV vaccine among the study participants. Approximately 22.32 % of the participants were aware of the HPV vaccine.

According to Table 2, among those who were aware of the HPV vaccine, healthcare workers (HCWs) were the most common source of information, with 80.45 % of respondents learning about the vaccine from them. Training sessions (33.72 %), friends (30.52 %), and advertisements (27.43 %) also played significant roles in disseminating information about the HPV vaccine. Social media platforms were a prominent source, with 61.41 % of respondents citing it. Mass media (46.69 %) and pharmacies (46.69 %) also contributed substantially to awareness, while schools were less influential, with 20.00 % of respondents hearing about the vaccine from this source.

The association between various characteristics of respondents and their awareness of the HPV vaccine is reported in Table 3. The average age of those who were aware of the HPV vaccine (39.21 years) was slightly higher than those who were not familiar (37.89 years), and this difference was statistically significant ($p < 0.001$). A significant association exists between residence and HPV vaccine awareness ($p < 0.001$). Urban residents (30.63 %) were more aware than rural residents (11.49 %). Those with more years of education tend to have higher awareness of the HPV vaccine ($p < 0.001$). There was a significant association between occupation and awareness of the HPV vaccine ($p < 0.001$), with healthcare workers having the highest awareness rate (88.52 %) while housewives had a relatively lower rate (13.86 %). Higher-income groups had more awareness than lower-income groups ($p < 0.001$). There was a significant association between family type and awareness ($p = 0.022$). Joint families had a higher awareness (24.10 %) than nuclear families (19.96 %). Those who received regular health check-ups (35.77 %) were more aware of the HPV vaccine compared to those who received irregular check-ups (21.24 %) or never received them (8.64 %). CC awareness was significantly associated with HPV vaccine awareness ($p < 0.001$). Those who were aware of CC vaccination (27.73 %) was significantly associated with HPV vaccine awareness ($p < 0.001$). Similar to CC awareness, awareness of CC vaccination was significantly associated with HPV vaccine awareness ($p < 0.001$). Awareness of HPV itself was strongly associated with awareness of the HPV vaccine ($p < 0.001$).

The logistic regression table (Table 4) explores the determinants of awareness of the HPV vaccine using binary logistic regression analysis. Every additional year of age increased the likelihood of being aware of the HPV vaccine by 3 % (AOR: 1.03; 95%CI: 1.00–1.06). Participants residing in the urban area (AOR: 3.56; 95%CI: 2.37–5.40) had 3.56-times higher odds of awareness than rural and semi-urban people after adjusting with other determinants. Businessmen and housewives, respectively, were 60 % (AOR: 0.40; 95 % CI: 0.22–0.69) and 77 % (AOR: 0.23; 95 % CI: 0.16–0.33) lower odds to be aware of the HPV vaccine compared to job holders. The lower-income group exhibited significantly higher odds of awareness (AOR: 0.25, 95%CI: 0.16–0.39) compared to the middle-income group (AOR: 0.19, 95%CI: 0.12–0.32) and the higher-income group (AOR: 0.23, 95%CI: 0.13–0.39), emphasizing a consistent trend of decreasing awareness as income levels increase. Participants who never went through routine health check-ups were having 77 % lower odds to be aware than the participants who availed regular routine check-ups (AOR: 0.23; 95%CI: 0.16–0.34). People who heard about CC had 17.90 times higher odds of awareness about HPV than those who never heard about CC (AOR: 17.90, 95%CI: 5.38–111). Similarly, participants who heard about CC vaccination were found 9.71 times higher odds of aware compared to the participants who hadn't heard about the vaccine (AOR: 9.71, 95%CI: 6.64–14.60).

4. Discussion

The HPV is a pervasive viral infection that poses a significant global public health concern due to its association with CC, among other malignancies [25]. Vaccination against HPV has proven to be a powerful preventive measure against these potentially life-threatening diseases [26]. However, adequate awareness and understanding of the HPV vaccine, particularly among parents with daughters, are paramount for the successful implementation and uptake of the vaccine. This nationwide study in Bangladesh delves into the critical issue of HPV vaccine awareness among parents, unravelling the intricate socio-demographic determinants that influence awareness and perceptions surrounding this vital immunization program.

One of the notable findings from this study is the limited awareness of the HPV vaccine among the study population, which aligns with findings from prior research conducted in developing countries [27] [–] [30]. A mere 22.32 % of respondents demonstrated familiarity with the HPV vaccine, while nearly 49 % were aware of CC vaccination. In contrast, data from developed countries, such as

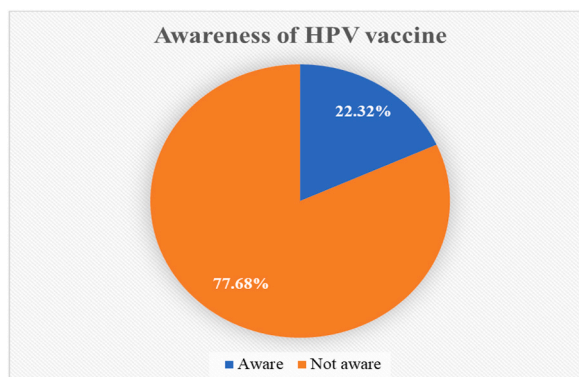


Fig. 1. Awareness of HPV vaccine.

Table 2
Source of information regarding HPV vaccine (n = 2151).

Characteristic	n (%)
Heard about the HPV vaccine from HCW	358 (80.45)
Heard about the HPV Vaccine from training	87 (33.72)
Heard about the HPV Vaccine from friends	76 (30.52)
Heard about the HPV Vaccine from advertisements	65 (27.43)
Heard about the HPV Vaccine from social media	183 (61.41)
Heard about the HPV Vaccine from the mass media	141 (46.69)
Heard about the HPV Vaccine from the pharmacy	141 (46.69)
Heard about the HPV Vaccine from the school	47 (20.00)

Table 3
Association of characteristics of the respondents with HPV vaccine awareness.

Characteristic	Aware of the HPV Vaccine		p-value
	No, (n = 1671)	Yes, (n = 480)	
Age (years)	37.89 ± 5.85	39.21 ± 5.78	<0.001 ^b
Sex			0.067 ^c
Female	1374 (78.47)	377 (21.53)	
Male	297 (74.25)	103 (25.75)	
Marital Status			0.835 ^c
Living with spouse	1571 (77.81)	448 (22.19)	
Living without spouse	57 (75.00)	19 (25.00)	
Others	43 (76.79)	13 (23.21)	
Religion			0.025 ^d
Islam	1405 (78.76)	379 (21.24)	
Hindu	245 (72.70)	92 (27.30)	
Buddhist	4 (100.00)	0 (0.00)	
Christian	17 (65.38)	9 (34.62)	
Residence			<0.001 ^c
Rural	693 (88.51)	90 (11.49)	
Semi-urban	208 (80.62)	50 (19.38)	
Urban	770 (69.37)	340 (30.63)	
Years of Education	10.92 ± 4.49	12.94 ± 4.22	<0.001 ^b
Occupation			<0.001 ^c
Job	274 (53.62)	237 (46.38)	
Business	157 (84.41)	29 (15.59)	
Housewife	1175 (86.14)	189 (13.86)	
Others	65 (72.22)	25 (27.78)	
Health Care Worker	21 (11.48)	162 (88.52)	<0.001 ^c
Monthly household income (BDT)			<0.001 ^c
≤20000	416 (76.05)	131 (23.95)	
20001-35000	512 (89.98)	57 (10.02)	
35000-50000	452 (75.21)	149 (24.79)	
>50000	289 (67.05)	142 (32.95)	
Family Type			0.022 ^c
Nuclear	738 (80.04)	184 (19.96)	
Joint	932 (75.90)	296 (24.10)	
Routine Health Checkup			<0.001 ^c
Regular	431 (64.23)	240 (35.77)	
Irregular	701 (78.76)	189 (21.24)	
Never	539 (91.36)	51 (8.64)	
Heard about Cervical Cancer	1246 (72.27)	478 (27.73)	<0.001 ^c
Heard about Cervical Cancer Vaccination	606 (57.82)	442 (42.18)	<0.001 ^c
Heard about the Human Papilloma Virus	40 (8.25)	445 (91.75)	<0.001 ^c

Mean ± SD; n (%); Median (IQR).

^bWelch Two Sample t-test.

^cPearson's Chi-squared test.

^dFisher's exact test.

the USA (87.70 % for HPV and 91.80 % for HPV vaccine), the UK (61.60 % for HPV and 80.70 % for HPV vaccine), and Australia (71.80 % for HPV and 81.30 % for HPV vaccine), reveal significantly higher awareness levels [31]. This substantial variation in awareness levels underscores the necessity for tailored awareness campaigns that focus on HPV and its vaccine, especially in the context of developing countries, where awareness lags behind that of developed nations.

The study reveals several sociodemographic determinants that are notably associated with awareness levels regarding the HPV vaccine. Age, for instance, emerges as a significant factor, with older participants demonstrating higher levels of awareness. This aligns

Table 4
Determinants of HPV vaccine awareness.

Characteristic	Univariate Models			Multivariate Model		
	OR	95 % CI	p-value	OR	95 % CI	p-value
Age (years)	1.04	1.02 to 1.06	<0.001	1.03	1.00 to 1.06	0.044
Sex						
Female	–	–	–	–	–	–
Male	1.26	0.98 to 1.62	0.068	0.65	0.42 to 1.00	0.047
Marital Status						
Living with spouse	–	–	–	–	–	–
Living without spouse	1.17	0.67 to 1.95	0.564	4.61	1.92 to 11.0	<0.001
Others	1.06	0.54 to 1.93	0.856	0.75	0.31 to 1.76	0.509
Residence						
Rural	–	–	–	–	–	–
Semi-urban	1.85	1.26 to 2.69	0.001	1.58	0.98 to 2.55	0.061
Urban	3.40	2.65 to 4.40	<0.001	3.56	2.37 to 5.40	<0.001
Years of Education	1.11	1.09 to 1.14	<0.001	1.00	0.95 to 1.05	0.943
Occupation						
Job	–	–	–	–	–	–
Business	0.21	0.14 to 0.32	<0.001	0.40	0.22 to 0.69	0.001
Housewife	0.19	0.15 to 0.23	<0.001	0.23	0.16 to 0.33	<0.001
Others	0.44	0.27 to 0.72	0.001	0.88	0.45 to 1.72	0.703
Health Care Worker						
No	–	–	–	–	–	–
Yes	40.0	25.6 to 65.8	<0.001	–	–	–
Monthly household income (BDT)						
≤20000	–	–	–	–	–	–
20001-35000	0.35	0.25 to 0.49	<0.001	0.25	0.16 to 0.39	<0.001
35001-50000	1.05	0.80 to 1.37	0.740	0.19	0.12 to 0.32	<0.001
>50000	1.56	1.18 to 2.07	0.002	0.23	0.13 to 0.39	<0.001
Family Type						
Nuclear	–	–	–	–	–	–
Joint	1.27	1.04 to 1.57	0.022	1.56	1.18 to 2.08	0.002
Routine Health Checkup						
Regular	–	–	–	–	–	–
Irregular	0.48	0.39 to 0.61	<0.001	0.71	0.53 to 0.95	0.022
Never	0.17	0.12 to 0.23	<0.001	0.23	0.16 to 0.34	<0.001
Heard about Cervical Cancer						
No	–	–	–	–	–	–
Yes	81.5	26.13 to 492.50	<0.001	17.9	5.38 to 111.20	<0.001
Heard about Cervical Cancer Vaccination						
No	–	–	–	–	–	–
Yes	20.4	14.66 to 29.33	<0.001	9.71	6.64 to 14.57	<0.001

OR = Odds Ratio, CI = Confidence Interval.

with findings from previous research, including the study by Cinar et al. (2019), which suggested that awareness tends to increase with age and accumulated knowledge [32]. Similarly, the study conducted by Jimenez Garcia et al. found that knowledge deepened with age within their study population [33]. Moreover, Adejuyigbe et al.'s research indicated a significant difference in knowledge about HPV and HPV vaccination among students, stratified by age group [34]. These collective findings underscore the influence of age as a determinant of HPV vaccine awareness. As part of efforts to enhance public health awareness and improve health metrics, it becomes crucial to instill knowledge about HPV infection and vaccination at an early stage within the educational curriculum [35].

Urban residents exhibited significantly higher awareness than their rural counterparts, as noted in previous research [36,37], indicating that geographic location is a critical factor. In the study by Mohammed et al. (2018), urban residents consistently exhibited significantly higher awareness of HPV and the vaccine compared to rural residents. Adjusted models in their research supported this disparity [36]. Similarly, Degarege et al. (2018) found that parents in urban areas were more likely to perceive HPV and CC as serious health threats compared to rural parents [37]. This urban-rural divide emphasizes the necessity for tailored awareness strategies to reach rural communities effectively.

Education emerges as a powerful determinant of awareness, with individuals who had more years of education exhibiting higher awareness levels, consistent with the findings of Yu and colleagues (2016) [38]. This finding underscores the importance of educational interventions to raise awareness about HPV and its vaccine, particularly among less educated populations. Moreover, socio-economic status exhibits an interesting trend, where lower-income groups exhibit higher awareness, which contrasts with the findings of several previous studies that linked higher monthly income with greater awareness of HPV and the HPV vaccine [28,30,39,40]. This counterintuitive result may reflect the targeted efforts of public health campaigns in reaching lower-income communities. However, further research is needed to fully understand this dynamic.

Occupation holds notable importance, with healthcare professionals exhibiting the highest level of awareness, as observed in similar previous studies [41,42]. Most of the analyzed studies demonstrate that health professionals possess a commendable level of

knowledge concerning HPV infection and its impact on human health, although there is a noticeable knowledge deficit in crucial specifics concerning the virus and HPV vaccination [43]. This suggests that healthcare professionals can serve as crucial advocates for HPV vaccination, given their influence and credibility in healthcare settings. Furthermore, regular health check-ups are positively associated with HPV vaccine awareness, consistent with the observations made by Grandahl et al. (2018)(21), highlighting the potential for healthcare providers to educate individuals during routine healthcare visits.

The study reveals a strong association between awareness of CC and awareness of the HPV vaccine, although we noticed a remarkable lack of awareness among the respondents regarding HPV's clinical implications, the HPV vaccine, and its importance and availability in previous studies [44] [-] [46]. Individuals who were aware of CC or CC vaccination were significantly more likely to be aware of the HPV vaccine. This connection underscores the interrelatedness of these topics and suggests that HPV vaccine awareness can benefit from existing knowledge about CC, highlighting the importance of comprehensive education on both CC and HPV vaccination.

4.1. Strengths and limitations

The strength of this study lies in its comprehensive analysis of socio-demographic determinants impacting HPV vaccine awareness. The study was conducted across various socio-demographic and geographical contexts and included a diverse range of parents of different beliefs and socioeconomic statuses. Another major strength was the inclusion of a representative study population from across Bangladesh, which enhances the generalizability of findings to similar contexts. Moreover, the study's nationwide survey design enables the collection of robust data, while its comparison with developed countries highlights global disparities in HPV vaccine awareness. These strengths collectively provide valuable insights for crafting targeted public health campaigns and interventions related to HPV vaccination, making the study applicable not only in Bangladesh but also in analogous socio-demographic settings.

The study's limitations include its cross-sectional design, which provides a snapshot of HPV vaccine awareness but lacks the ability to establish causal relationships or track changes over time. Convenience sampling may introduce selection bias, potentially impacting the study's representativeness. The absence of longitudinal data prevents the examination of awareness trends. Additionally, the study primarily offers quantitative insights, with limited depth in qualitative data, to explore the underlying reasons for socio-demographic determinants of HPV vaccine awareness. These factors should be considered when interpreting the findings.

5. Conclusion

Awareness of the HPV vaccine among the general population of Bangladesh is very low. Age, residence, occupation, monthly income, and routine medical check-ups were associated with HPV vaccine awareness. People who heard about CC had a higher level of awareness about HPV than those who had never heard of it. The findings of this nationwide study reveal the significance of improving HPV vaccine awareness, not only in Bangladesh but also in comparable settings worldwide. To succeed, strategies must be tailored to diverse age groups, urban-rural disparities, and educational levels. Engaging healthcare workers as trusted advocates is crucial for disseminating information and promoting vaccination. Targeting lower-income communities, despite higher awareness levels, remains essential for achieving desired outcomes. Fine-tuning public health campaigns to these determinants can maximize the potential of HPV vaccination, contributing significantly to the prevention of HPV-related diseases and advancing overall public health outcomes.

Approval of the research protocol

Approval was received from the Institutional Review Board (IRB)/Ethical Review Committee (ERC) of North South University (2023/OR-NSU/IRB/0507).

Informed consent

Consent was implied by survey completion.

Registry and the registration no. of the study/trial

Approval was received from the Institutional Review Board (IRB)/Ethical Review Committee (ERC) of North South University (2023/OR-NSU/IRB/0507).

Animal studies

N/A.

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Availability of data and materials

The data underlying the results presented in this study will be provided on reasonable request to Dr. Delwer H. Hawlader. Email: mohammad.hawlader@northsouth.edu.

CRediT authorship contribution statement

Fahima Nasrin Eva: Writing – review & editing, Writing – original draft, Validation, Resources, Project administration, Methodology, Investigation, Conceptualization. **Md Abdullah Saeed Khan:** Writing – review & editing, Software, Project administration, Methodology, Formal analysis, Data curation. **Tarifful Islam:** Validation, Software, Resources, Investigation, Formal analysis, Data curation. **Umme Kulsum Monisha:** Validation, Resources, Methodology, Investigation. **Nur-E-Safa Meem:** Writing – original draft, Validation, Software, Resources, Investigation, Formal analysis, Data curation. **Mohammad Ali Hossain:** Writing – original draft, Validation, Resources, Investigation. **Arpita Goutam:** Writing – original draft, Validation, Resources, Investigation. **Tahmina Zerine:** Validation, Resources, Investigation. **Nishat Alam:** Writing – original draft, Validation, Resources, Investigation. **Rima Nath:** Validation, Resources, Investigation. **Shamma Sifat:** Validation, Resources, Investigation. **Sayla Sultana:** Validation, Resources, Investigation. **Mosammat Sadeka Sultana:** Validation, Resources, Investigation. **Sumit Kumar Saha:** Validation, Resources, Investigation. **Naifa Enam Sarker:** Validation, Resources, Investigation. **Mohammad Lutfor Rahman:** Visualization, Supervision, Methodology. **Mohammad Hayatun Nabi:** Visualization, Supervision. **Mohammad Delwer Hossain Hawlader:** Visualization, Validation, Supervision, Resources, Investigation, Conceptualization.

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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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.heliyon.2024.e30897>.

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