RESEARCH ARTICLE

Awareness about Human Papillomavirus Vaccine and Its Uptake among Women from North India: Evidence from a Cross-Sectional Study

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Abstract

Objective: This study aims to estimate the prevalence of human papillomavirus (HPV) vaccine usage and determine the factors for awareness about HPV vaccine among women in reproductive age group. **Methods:** This is a cross-sectional survey under a cervical cancer prevention study. The sample size was 1020 women, aged 15-49 years [550 in Delhi and 470 in Rohtak]. Bivariate analysis and Fisher exact test along with binary logistic regression analysis were used to determine the factors for awareness. **Result:** About 18.0 % [Delhi: 24.2 % and Rohtak: 10.9 %] of the respondents had heard about the vaccine against cervical cancer. The women aged more than 30 years [AOR: 1.35; CI: 0.94, 1.94] were more likely to be aware of cervical cancer vaccine as compare to women of 30 years and less. However, the women from Rohtak [AOR: 0.90; CI: 0.48, 1.66] were less likely to be aware of vaccine against cervical cancer in reference to women aged 30 years and more [AOR: 1.61; CI: 1.01, 2.56] from Delhi. About 0.6 % [Delhi: 1.1 % and Rohtak: 0.0 %] of the respondents had received HPV vaccine. **Conclusion:** Women tend to have limited knowledge about cervical cancer vaccine and immunisation practices. The women's demographic makeup varied significantly between the two sites, i.e , Rohtak and Delhi, which had an impact on how well they understood and utilised the cervical cancer vaccination. It is worth mentioning that none of the women from Rohtak had received the immunisation. The awareness of the cervical cancer vaccine among women from the Rohtak was lower than the Delhi women.

Keywords: Cervical cancer- vaccination- human papillomavirus vaccines- vaccine awareness- India

Introduction

Cervical cancer is the fourth most prevalent cancer in the world (WHO, 2020), and the second most common cancer among women in India (Bruni et al., 2019). The infection of specific high-risk types of human papillomaviruses (HPVs) is the primary cause of cervical cancer. In India, two high-risk HPV strains, HPV 16 and HPV 18, account for more than 80 % of cervical cancer cases (Sontakke et al., 2019).

Cervical cancer has a significant morbidity and mortality rate, thus early identification and treatment are the only options. Since HPV infection is the leading cause of cervical cancer (Bosch and de Sanjosé, 2003), vaccination with the HPV vaccine offers protection against the disease (Indian Academy of Pediatrics Committee on Immunization (IAPCOI), 2008). Cervical cancer incidence and mortality are also reduced by screening for precancerous lesions. Although, Pap smear cytology-based screening programs have been demonstrated to be

beneficial in developed countries alternative screening approaches such as visual inspection with acetic acid (VIA) and visual inspection using Lugol's Iodine (VILI) can be more effective in low-resource settings.

Cervical cancer screening coverage in low-income countries is 11 % as compared to 84 % in high income countries, and ranges from 0.6 % in Benin to 68% in Singapore (Bruni et al., 2022). The rates of opportunistic screening in different parts of India ranged from 6.9 % in Kerala to 0.006 % and 0.002 % in the western state of Maharashtra and the southern state of Tamil Nadu, respectively (Sankaranarayanan et al., 2007, 2009). In a study of college students, 44 % of women and 31 % of boys knew about the HPV vaccine, but only 7 % of them had received it (Rashid et al., 2016). Similar results have been reported from another study conducted in a tertiary care teaching hospital in south India, with undergraduate students aged 18 years and above, belonging to medical, dental and nursing streams (Swarnapriya et al., 2016). In contrast to this research, a study conducted among

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women college students in Kolkata found a substantially lower level of knowledge, around 15 %. However, 75 % of the them wanted to be vaccinated for protection (Saha et al., 2010). Many socio-demographic indicators like gender, age, education, relationship status and income are all linked to general HPV knowledge (McBride and Singh, 2018).

There are discrepancies in survival, treatment, and screening due to the absence of a nationwide screening program in India. The success and benefit of cervical cancer control and prevention are largely reliant on public awareness and knowledge of many facets of the disease and the vaccine (Rashid et al., 2016). Furthermore, according to public health research, understanding and awareness of HPV are critical factors in vaccine acceptance and uptake (Beavis and Levinson, 2016; Galbraith et al., 2016). Therefore, the study aims to estimate the prevalence of HPV vaccine usage and determine the factors for knowledge about HPV vaccine among women in reproductive age group.

Materials and Methods

Study design and site

The survey utilised the data from the project titled "Increasing access to cervical cancer screening and care through the community-centric continuum of care initiative in India". The design was cross-sectional in nature. The survey was conducted in 2015-17 in close coordination with the Health Department of New Delhi and Rohtak, Haryana. The population of Palam and Rohtak as per census 2011 was 0.2 million and 1.06 million respectively. Rohtak is situated at about 70 kilometres away from national capital, New Delhi. The location was chosen based on its accessibility and closeness to the health care institution, allowing for fast screening and referrals. Second, the population of chosen places was taken into account in order to get an acceptable sample. The survey's goal was to examine women's understanding about cervical cancer. The semi-structured tool was used to collect the information.

Outcome variable

The outcome variable was dichotomous in nature. It was assessed using the question "Have you heard about vaccine against cervical cancer?" and was coded as no and yes.

Explanatory variables

The variable "vaccinated against HPV" was coded as no and yes. The variable was assessed using the question "Have you ever been vaccinated against HPV?". Age was recoded as 30 years and less and more than 30 years. Age at marriage was recoded as less than 18 years and 18 and above years. Educational status was recoded as not educated, primary, secondary and higher. Marital status was recoded as never married, married and widowed/divorced/separated. Employment status was recoded as not employed and employed. Income was recoded into five quintiles (in rupees) 5000 and less, 5000-8000, 8000-10,000, 10,000-15,000 and more than 15,000.

Sample estimation

We assume the prevalence of awareness to be 50% as there were no estimates available at the research locations. The calculation was based on the following assumptions: expected proportion: 0.5, non-response rate: 20% and a margin of error: 0.05, with the z value for the 95% confidence interval: 1.96. A total of around 480 samples were obtained for each study site (New Delhi and Rohtak) in the reproductive age group.

Data collection and management

Women were mobilised with the help of Anganwadi workers and Helper at Anganwadi Centres through home visits and data were collected using face to face interview in local language. Before the data collection from the respondent, the purpose and importance of the study was explained and written informed consent was obtained. Ethical clearance was obtained from the Institutional Ethics Committee. All the participants have provided their informed consent before the survey began, and proper measures were taken to ensure the data's confidentiality and to safeguard the rights of the participants.

Descriptive statistics, along with bivariate and multivariable analysis were opted to represent the results. Along with that Fisher exact test (Ghosh, 1988) was used to test the level of significance during bivariate analysis. The binary logistic regression analysis (Peng et al., 2002) was used to determine the factors for knowledge about cervical cancer vaccine among the respondents. The results were presented in the form of adjusted odds ratio (AOR) at 95 % confidence interval (CI). Variance inflation factor (VIF) (Miles, 2014) was used to check the multicollinearity and it was found that there was no evidence of multicollinearity among the variable used. STATA 14 was used for the analysis purpose.

Results

Only, 6 [0.6 %] of the respondents received HPV vaccine

Table 1 represents the socio-economic profile of the study population. It was revealed that about 57.0 % of the respondents were aged more than 30 years (Delhi: 61.3 % and Rohtak: 51.9 %). Almost 74 % of the respondents were those whose age at marriage was 18 years and above (Delhi: 65.6 % and Rohtak: 83.8 %). Respondents with higher educational levels were 54.1 % (Delhi: 58.2 % and Rohtak: 49.4 %). About 6.6 % of the respondents were never married (Delhi: 5.3 % and Rohtak: 8.1 %). Nearly 13.7 % of the respondents were employed (Delhi: 15.6 % and Rohtak: 11.5 %). About 22.1 % of the respondents had a family income of less than Rupees 5,000 (Delhi: 7.8 % and Rohtak: 38.7 %)

Table 2 represents the knowledge for a vaccine against cervical cancer. It was found that about 18.0 % [Delhi: 24.2 % and Rohtak: 10.9 %] of the respondents heard about the vaccine against cervical cancer. Nearly 65.8 % [Delhi: 69.9 % and Rohtak: 54.9 %] of the respondents (out of 18 % [Delhi: 24.2 % and Rohtak: 10.9 %] who heard about the vaccine against cervical cancer) think that the vaccine is available in India. Out of 18 % [Delhi: 24.2 % and Rohtak: 10.9 %] who heard about the vaccine against

Table 1. Socio-Economic Profile of the Study Population

Background Characteristics	Total		Delhi		Rohtak	
	Sample	Percentage	Sample	Percentage	Sample	Percentage
Age (in years)						
30 years and less	439	43	213	38.7	226	48.1
More than 30 years	581	57	337	61.3	244	51.9
Age at marriage (in years)						
Less than 18	265	26	189	34.4	76	16.2
18 and above	755	74	361	65.6	394	83.8
Educational status						
Not Educated	131	12.8	45	8.2	86	18.3
Primary	166	16.3	99	18	67	14.3
Secondary	171	16.8	86	15.6	85	18.1
Higher	552	54.1	320	58.2	232	49.4
Marital status						
Never married	67	6.6	29	5.3	38	8.1
Married	905	88.7	492	89.5	413	87.9
Widowed/Divorced/Separated	48	4.7	29	5.3	19	4
Employment Status						
Not employed	880	86.3	464	84.4	416	88.5
Employed	140	13.7	86	15.6	54	11.5
Income (in Rupees)						
5,000 and less	225	22.1	43	7.8	182	38.7
5,000-8,000	238	23.3	90	16.4	148	31.5
8,000-10,000	236	23.1	166	30.2	70	14.9
10,000-15,000	164	16.1	140	25.5	24	5.1
More than 15,000	157	15.4	111	20.2	46	9.8
Cities						
Delhi	550	53.9				
Rohtak	470	46.1				
Total	1020	100	550	100.0	470	100.0

Source, Authors' calculation

cervical cancer, about 47.3 % [Delhi: 58.7 % and Rohtak: 17.7 %] feel that it is protective against cervical cancer.

Table 3 represents the percentage of women who had heard about vaccine against cervical cancer. It was found that higher percentage of women aged more than 30 years heard about vaccine against cervical cancer (20.7 % vs 14.6 %; p-value: 0.012). Higher percentage of women who had higher educational status heard about vaccine against cervical cancer (19.9 %). Higher percentage of women who were employed heard about vaccine against cervical cancer (25.7 % vs 16.8 %; p-value: <0.001). It was further found that income was directly proportional

to the knowledge about vaccine among women. Higher percentage of women from Delhi heard about vaccine against cervical cancer (24.2 %; p-value: <0.001).

Table 4 represents the logistic regression estimates for women who had heard about vaccine against cervical cancer. The regression analysis was adjusted for all the background characteristics. It was found that women aged more than 30 years had higher likelihood to have heard about vaccine against cervical cancer in reference to women aged 30 years and less [AOR: 1.35; CI: 0.94, 1.94]. The odds were significantly high in case of Delhi [AOR: 1.61; CI: 1.01, 2.56]. Women who were educated

Table 2. Knowledge for Vaccine against Cervical Cancer, (n=1020)

Variables	Total		Delhi		Rohtak	
	n	%	n	%	n	%
Heard about vaccine against cervical cancer	184	18	133	24.2	51	10.9
Do you think, it is available in India*	121	65.8	93	69.9	28	54.9
Is it protective against cervical cancer?*	87	47.3	78	58.7	9	17.7

*the sample will be 184, 133 and 51 from the respective variables respectively; Source, Authors' calculation

Table 3. Percentage of Women who had Heard about Vaccine against Cervical Cancer, (n=1020)

Background characteristics	Total		Delhi		Rohtak	
	%	p-value	%	p-value	%	p-value
Age (in years)		0.012		0.019		0.877
30 years and less	14.6		18.8		10.6	
More than 30 years	20.7		27.6		11.1	
Age at marriage (in years)		0.553		0.883		0.365
Less than 18	19.3		23.8		7.9	
18 and above	17.6		24.4		11.4	
Educational status		0.174		0.423		0.194
Not educated	12.2		20		8.1	
Primary	18.7		19.2		17.9	
Secondary	15.8		23.3		8.2	
Higher	19.9		26.6		10.8	
Marital status		0.706		0.815		0.51
Never Married	14.9		27.6		5.3	
Married	18.1		23.8		11.4	
Widowed/Divorced/Separated	20.8		27.6		10.5	
Employment Status		<0.001		0.048		0.32
Not Employed	16.8		22.6		10.3	
Employed	25.7		32.6		14.8	
Income (in Rupees)		<0.001		0.002		0.401
5,000 and less	12.9		23.3		10.4	
5,000-8,000	12.6		13.3		12.2	
8,000-10,000	16.5		19.9		8.6	
10,000-15,000	26.2		27.1		20.8	
More than 15,000	27.4		36		6.5	
Cities		<0.001				
Delhi	24.2					
Rohtak	10.9					

p-value based on chi-square test; Source, Authors' calculation

either primary [AOR: 1.38; CI: 0.71, 2.70], secondary [AOR: 1.16; CI: 0.58, 2.31] or higher [AOR: 1.32; CI: 0.71, 2.46] had higher odds to have heard about vaccine against cervical cancer in reference to those who were not educated. Employed women had significantly higher odds to have heard about vaccine against cervical cancer in reference to women who were not employed [AOR: 1.49; CI: 1.04, 2.32]. Women from household with income more than 15000 rupees per month had higher odds to have heard about vaccine against cervical cancer in comparison to women who had family income of less than 5000 rupees per month [AOR: 1.55; CI: 0.86, 2.79].

Discussion

The purpose of this study was to investigate about the knowledge and uptake of HPV vaccine against cervical cancer among the women in two different cities (metropolitan and non-metropolitan) from Northern part of India, and specifically, about their knowledge on vaccine's availability in India and vaccine's protective effect against the cervical cancer. The study found poor knowledge and uptake of HPV vaccine by the women in

both the cities, however, Delhi, a metropolis outperformed Rohtak. The level of awareness found in the present study is similar to other study from India (Hussain et al., 2014). However, it is important to mention that most of these studies are among school, university and medical college students and there is lack of evidence from the general communities (Ramavath and Olyai, 2013; Rashid et al., 2016). Several other studies have shown inter-state/urban-rural differences and have found lower levels in women from rural areas that their urban counterparts. For instance, a population-based cross-sectional survey in Bangladesh found that only 21% of urban women and three percent of rural women had heard of a vaccine to prevent cervical cancer (Islam et al., 2018). This can be corroborated with the results of the present study where Delhi (28.2%), a metropolitan city, outperformed Rohtak (10.9%). The overall level of awareness about HPV vaccination is much lower than many other developing countries such as Nepal at 32% (Johnson et al., 2014), Indonesia at 64% (Endarti et al., 2018) and Bangladesh at 56 % (Beavis et al., 2018)

The study also found that among those who had heard about HPV vaccine, only two-third knew that HPV vaccine is available in India and only half of them

Table 4. Logistic Regression Estimates for Women who had Heard about Vaccine against Cervical Cancer, (n=1020)

Background characteristics	Total AOR (95 % CI)	Delhi AOR (95 % CI)	Rohtak AOR (95 % CI)
Age (in years)			
30 years and less	Ref.	Ref.	Ref.
More than 30 years	1.35 (0.94,1.94)	1.61* (1.01,2.56)	0.90 (0.48,1.66)
Age at marriage (in years)			
Less than 18	Ref.	Ref.	Ref.
18 and above	1.00 (0.63,1.57)	0.91 (0.54,1.54)	1.16 (0.37,3.59)
Educational Status			
Not educated	Ref.	Ref.	Ref.
Primary	1.38 (0.71,2.70)	1.04 (0.42,2.59)	2.56 (0.94,6.96)
Secondary	1.16 (0.58,2.31)	1.28 (0.51,3.2)	0.98 (0.32,2.97)
Higher	1.32 (0.71,2.46)	1.28 (0.54,3.03)	1.38 (0.54,3.52)
Marital Status			
Never Married	Ref.	Ref.	Ref.
Married	1.13 (0.47,2.7)	0.81 (0.28,2.29)	2.13 (0.33,13.92)
Widowed/Divorced/Separated	1.24 (0.40,3.83)	0.97 (0.25,3.7)	1.81 (0.16,20.28)
Employment Status			
Not Employed	Ref.	Ref.	Ref.
Employed	1.49* (1.04,2.32)	1.44 (0.85,2.45)	1.61 (0.69,3.76)
Income (in Rupees)			
5,000 and less	Ref.	Ref.	Ref.
5,000-8,000	0.83 (0.47,1.46)	0.57 (0.22,1.48)	1.26 (0.61,2.59)
8,000-10,000	0.87 (0.49,1.55)	0.88 (0.39,2.01)	0.84 (0.30,2.31)
10,000-15,000	1.34 (0.74,2.44)	1.20 (0.53,2.72)	0.61 (0.16,2.26)
More than 15,000	1.55 (0.86,2.79)	1.76 (0.77,4.02)	2.49 (0.79,7.90)

Ref, Reference; *if p<0.05; AOR, Adjusted Odds Ratio; CI, Confidence Interval; Source, Authors' calculation

believed that HPV vaccine is protective against cervical cancer. This is lower than other studies from India where the knowledge about availability was higher among the students (76%) (Pandey et al., 2012) and a study from South India where 66% women opined that vaccines are effective against the HPV infection (Montgomery et al., 2015).

Women's age, employment status, and income status acted as predictors of HPV vaccine knowledge. Women with age over 30, who are employed, and who had a high income have higher odds of knowledge about HPV vaccine than those under the age of 30, who were unemployed, and who had a low income. Evidence worldwide show that being woman, having a higher education, and having a high income are significant predictors of general HPV and HPV vaccine knowledge (McBride and Singh, 2018; Iliyasu et al., 2021). These studies have, however, found that young women (below 30 years) are more likely to be aware about the HPV vaccine. However, in our study higher age (above 30) were a predictor for higher HPV knowledge. The finding is in line with a study from Bangladesh where the knowledge was higher among women aged 25 and above (Islam et al., 2018).

Further, the awareness about HPV vaccination also determines the uptake of vaccination by the community. In addition to the poor awareness about the HPV vaccination,

uptake of HPV vaccination was found to be critically low in the present study. Only 0.6 % (n=6) of the women were vaccinated and all were from Delhi. None of the women from Rohtak had got themselves vaccinated. Moreover, only three women out of six, had received complete three doses of the vaccine. There is sparse evidence on the uptake of the vaccination in general communities in the country. A hospital-based study from South India among medical undergraduate students, reported a 6.8 % uptake of HPV vaccination. The study stated that low uptake was due to lack of knowledge, as well as doubts about the vaccine's efficacy, fear of side effects, cost, and a lower perceived risk of carcinoma of cervix. (Swarnapriya et al., 2016). This is in agreement with the observations in the present study where the level of awareness was very low and this might be the reason for the low uptake of the vaccine among the women in our study. The uptake of vaccination in the present study is even lower than studies from other developing countries such as Nigeria (Oluwole et al., 2019) and far lower than those from developed countries such as Germany (Remschmidt et al., 2014) and United States (Liu et al., 2016).

Statistically reasonable sample size and inclusion of women from the general community that contribute to fair representation of the women from the general population are among the strengths of the study. However, a few

limitations include a cross-sectional study design that limits the causality, and samples drawn from only two cities that limits the generalisability of the findings to other settings.

In conclusion, to the best of our knowledge, this is a first-of-its-kind community-based survey, conducted to study the awareness and uptake of HPV vaccine and their predictors in two diverse geographic regions of India, a metropolitan area (Delhi) and a non-metropolitan city (Rohtak). There is a considerable lack of knowledge about cervical cancer vaccine and practices towards vaccination among the women in these regions. There were significant differences between the two cities in terms of the demographic profile of the women that influenced the knowledge and uptake of cervical cancer vaccination among these women. It is noteworthy that none of the women in Rohtak had got the vaccination and the awareness was also lower among these women than the women from Delhi. This calls for designing appropriate tailored-interventions and awareness campaigns to improve awareness and correct knowledge about HPV vaccine which augments HPV immunisation programmes for prevention and control of cervical cancer in India. Developing countries like India should consider subsidising the cost for HPV vaccination also.

Author Contributions Statement

SM was the overall project administrator and obtained grant funding. AR, SKR, RG and KK designed the initial draft of the survey. KK, SS (1), PRG and RG edited and formatted the original manuscript. Revising and finalizing the draft manuscript by SS (2), SKR, and PRG. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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