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ORIGINAL ARTICLE

# The Study of the Prevalence of Knowledge and Vaccination Status of HPV Vaccine Among Healthcare Students at a Tertiary Healthcare Center in Western India

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## Abstract

**Background** Cervical cancer is one of the most common vaccine-preventable cancers. An amalgamation of timely screening and vaccination is an effective strategy to combat the prevalence of cervical cancer. We sought to assess knowledge, awareness, and practices regarding HPV cancer, screening, and vaccination as these are the bases for developing attitudes and practices which, in the long run, shall change the culture of the community for primary prevention.

**Methodology** This was a cross-sectional study with an anonymous questionnaire to check knowledge, attitude, and practice toward cervical cancer and HPV vaccination. The study was conducted for MBBS, physiotherapy, and nursing students aged between 17 and 24 years across all years at Bhaikaka University, irrespective of gender. Prior consent from the participants was taken while filling out the questionnaire.

**Results** Out of 868 students, 76% responded. Females were double than males, and there is no statistical difference between them. Overall knowledge regarding cancer was > 80%, but screening knowledge was < 10%, and that regarding vaccination was around 50%. There is a visible statistical difference between MBBS and non-MBBS students. More than > 80% have positive attitudes toward HPV vaccination, but only 7.72% are vaccinated. 42.7% had accepted a lack of knowledge as the reason for not getting vaccinated.

**Conclusion** Partial knowledge and poor vaccination, even in advanced age and healthcare communities, suggest a strong need for community intervention at the early adolescent age by a multispecialty and multidisciplinary team.

**Keywords** HPV—human papilloma virus · Cancer · Vaccination · Healthcare

## Introduction

Cancer has become one of the significant public health problems in India and worldwide because of its disease burden, mortality rate, and tendency toward increased incidence [1]. Among the most prevalent sexually transmitted infections, it affects both genders equally. [2] Cervical cancer accounted for 6.6% of all cancers in 2018, with 570,000 newly diagnosed cases. Cervical cancer is most prevalent in developing countries [3]. A significant public health concern among Indian women in their reproductive years is cervical cancer, which accounts for 17% of all cancer deaths. [4].

Human Papillomavirus (HPV) is a family of closely related, non-enveloped, double-stranded DNA viruses. HPV 16 and 18 strains are high-risk subtypes with oncogenic potential [1]. Cervical cancer risk in women can be altered by factors such as early marriage, multiple sexual partners, multiple pregnancies, poor genital hygiene, and poor nutritional status [5].

Cytology, visual inspection with acetic acid, and HPV DNA testing are the most used screening methods. The FIGO recommends screening at 21 years (regardless of sexual activity) and repeating the pap test every three years until

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30. Co-testing should be done every five years for women 30–65. HPV and Pap tests can also be performed simultaneously. CIN detection was highest with HPV, followed by Pap and VIA. Care HPV testing was, therefore, more effective than VIA or Pap tests at detecting high-grade CIN in rural areas [6].

Recent studies suggest that HPV vaccines can reduce the cervical cancer burden in India by 75% [7]. Furthermore, young women and adolescent girls who have not been vaccinated against HPV at 11–12 years of age should be assessed and encouraged to be vaccinated against HPV during the catch-up period (13–26 years of age). Cervical cancer can be prevented with HPV vaccination, especially before sexual activity [8].

According to the Indian Academy of Pediatrics Advisory Committee on Vaccination and Immunization Practices (IAP COVI), all females aged 9–26 should be offered the HPV vaccine (Category 2 of the IAP vaccine categorization). HPV vaccines are recommended for females aged 9 to 14 at six-month intervals. Girls and women older than 15 years and immunocompromised should receive three doses of the vaccine at 0, 2, and 6 months.

ACOG Committee has mentioned the following vaccination guidelines for certain special groups:

1. A pregnant woman should not receive this vaccination.
2. During an ongoing HPV vaccination, the vaccination must be halted if a female conceives.
3. The safety of breastfeeding is not compromised with HPV vaccination; thus, a breastfeeding female aged </=26 years can be and should be vaccinated.
4. Immunocompromised individuals can be safely vaccinated.
5. A child presenting with a history of sexual abuse or assault must be vaccinated as early as possible [9].

Vaccination programs in India are affected by many factors, including costs, health priorities, lack of awareness, vaccine safety concerns, and diverse cultural and sociological factors. Several strategies can be implemented to overcome these barriers to HPV vaccination, including active community involvement to increase community awareness and knowledge of vaccine benefits, safety, and effectiveness. [10].

Health Care Professionals play an integral role in cervical cancer prevention and awareness. Students of medicine, nursing, physiotherapy, and paramedics, who will soon be frontline health workers, must be aware of accurate facts and knowledge so that correct information reaches all individuals. [11].

## Objectives

1. To study knowledge of cervical cancer vaccination.
2. To study the attitudes of students toward HPV vaccination
3. To study the prevalence of HPV-vaccinated individuals and their 1st-degree relatives.

## Material and Methodology

*Data Source* University students of Pramukhswami Medical College and Shree Krishna Hospital, including MBBS, Nursing, and Physiotherapy

*Inclusion Criteria* Students from MBBS, Nursing, and Physiotherapy programs, both females and males, were included in the study (17–24 years of age).

*Exclusion Criteria* This study excluded postgraduate students.

*Study Period* The research was conducted from April 2022 to September 2022 (six months). The data were collected over two months, and the manuscript was compiled, analyzed, and written over four months.

*Study Type* Cross-sectional study.

*Study Design* The research was conducted with prior permission from the university & ethics committee approval. Participants were required to provide implicit consent to participate in the study. Consenting participants were sent an anonymous online questionnaire before the study. Following that, participants were sent a Google form with sets of questions. This is a self-constructed questionnaire that was influenced by questions from various studies (Fig. 1). As part of the current study, each participant was asked to complete 30 questions divided into two sections, i.e., "About the Virus" and "About the Vaccine," each with multiple options. The complete set of questionnaires used in this study is provided in supplementary dataset 1. After evaluating the collected responses, we evaluated the score based on cumulative proportions for each category, including MBBS, Physiotherapy, Nursing and Total, which were calculated (Tables 1, 2 and 3). The descriptive statistical analysis was calculated using Origin 2022b (Fig. 2).

## Results

### Demography

The total eligible participants were 868 students at university across MBBS, Physiotherapy, and Nursing, out of which 76% (660) students have responded to the questionnaire comprising 66.5% (438) females and 33.5% (222) males.

**Table 1** Assessment of knowledge concerning cervical cancer, HPV vaccine and screening

| Questions | Total (660) | MBBS (479) | Nursing (115) | Physiotherapy(66) |
|---|---|---|---|---|
| Knowledge about cervical cancer | | | | |
| 1.Causative agent | 87.12% | 88.51% | 79.13% | 90.90% |
| **2. Harmful strain** | 52.72% | **49.06%*** | **48.69%*** | **86.36%*** |
| 3. Vaccine preventable cancer? | 82.12% | 83.29% | 80% | 77.27% |
| 1. *Methods to prevent cancer cervix* | | | | |
| a. Regular screening | 7.57% | 7.51% | 8.69% | 9.09% |
| b. Personal hygiene | 1.51% | 1.67% | 0.86% | 1.51% |
| c. Barrier method | 1.66% | 1.67% | 2.60% | 0 |
| d. Single sexual partner | 0.9% | 0.83% | 1.73% | 0 |
| e. Good nutrition | 0.15% | 0.20% | 0 | 0 |
| f. All of the above | 88.18% | 88.51% | 86.08% | 89.39% |
| Knowledge about HPV vaccine | | | | |
| 2. *Eligibility Criteria* | | | | |
| a. Gender-neutral vaccine | 49.84% | 54.27% | 27.82% | 56.06% |
| b. Doses for < 15 years of age | 38.48% | 41.54% | 34.78% | 22.72% |
| c. Doses for > 15 years of age | 34.24% | 36.74% | 24.34% | 28.78% |
| 6. Appropriate age group for vaccination? | 64.69% | 67.01% | 57.39% | 60.60% |
| 7 Part of which immunisation schedule? | 45% | 54.07% | 26.08% | 12.12% |
| 8. Vaccines available in India? | 93% | 92.2% | 93.04% | 98.48% |
| 9. How many Types of vaccines are available in India? | 17% | 17.75% | 9.56% | 24.24% |
| Knowledge of screening | | | | |
| **10. Age to begin screening **** | 37.72% | **39.24%**** | **60.86%**** | **54.54%**** |
| 11. Screening Modalities | | | | |
| a. Single Correct Answer | 26.06% | 20.04% | 38.26% | 48.48% |
| b. Two Correct Answer | 12.57% | 14.19% | 11.30% | 3.03% |
| c. Three Correct Answer | 10% | 12.73% | 3.47% | 1.57% |
| d. All Correct Answers | 5.15% | 7.09% | 0 | 0 |
| **E. Defaulters ^** | **53.78% ^** | 45.92% | 46.95% | 46.96% |
| **12. Method of screening used in Rural set-up ***** | 25.30% | **33.40%***** | **4.34%***** | **3.03%***** |
| 13. Screening interval as per FIGO guidelines | 23.78% | 24% | 17.39% | 24,24% |

*There is a statistically significant difference between MBBS and Non−MBBS regarding knowledge of harmful strain; the chi−square statistic is 9.4213. The $p$−value is 0.002145, and the result is significant at $p < 0.05$

^defaulters—Those students who had to choose blood culture as an option along with the other correct options)

**Statistical difference between MBBS and NON_MBBS regarding the age of beginning vaccination, the chi−square statistic is 19.8392. The $p$−value is 0.00001; the result is significant at $p < 0.05$

***statistical difference was noticed between MBBS and NON−MBBS regarding knowledge of screening methods in rural setups. The chi−square statistic is 60.6295. The $p$−value is 0.00001, and the result is significant at $p < 0.05$

The chi−square statistic for other parameters of the table was non−significant at $p$−value < 0.05

The bolded categories in the table signify notable statistical differences among the groups

The cohort of responders comprises 72.58% from MBBS, 10% from physiotherapy, and 17.42% from nursing.

## Assessment of Knowledge

The students were evaluated based on various knowledge parameters. For example, 87.12% of students knew the causative agent, 52.72% knew that HPV 16 & 18 are harmful strains, and 82.12% of students knew that cancer cervix is preventable. A similar study found that about 71.5% knew cervical cancer is vaccine-preventable [12]. Unexpectedly, knowledge regarding the harmful strain was higher among physiotherapy students than among MBBS and Nursing. In comparison, only 50% of MBBS and nursing students know harmful strains. Overall, MBBS students have higher knowledge as compared to nursing and physiotherapy.

On average, > 62% of students were aware of the correct age group for vaccination, 60% knew about gender

**Table 2** Assessment of basic and advance knowledge

| Questions | Total (660) | MBBS (479) | Nursing (115) | Physiotherapy (66) |
|---|---|---|---|---|
| Basic knowledge* | | | | |
| Complete | 25.15% | 23% | 29.56% | 33.34% |
| Partial | 34.45% | 33% | 43.47% | 39.4% |
| None | 39.4% | 44% | 26.95% | 27.27% |
| Advance knowledge** | | | | |
| Complete | 7.12% | 9.6% | 0 | 1.5% |
| Partial | 22% | 21.7% | 22.6% | 22.72% |
| None | 71% | 68.7% | 77.4% | 75.75% |
| Both | 4.54% | 6% | 0 | 1.5% |

Responders were graded 0–3 based on having complete, partial, or no knowledge if they had answered 3 points, 2 points, and 0–1 point out of the three questions, respectively

*Questions for assessment of Basic Knowledge:

1. Whether sexually active females can receive the vaccine
2. Whether a female with an active infection can receive the vaccine
3. Post−vaccination is screening required or not?

**Questions for assessment of Advance Knowledge:

1. Whether Breast feeding females can get vaccinated or not
2. Whether Immunocompromised patients get vaccinated or not
3. Should screening be done before vaccination or not

neutrality of vaccines and the correct age group for vaccination, but > 50% were unaware that HPV vaccines are a part of IAP. However, less than 20% of respondents were aware of the types of vaccine available in India: bivalent, quadrivalent, and 9-valent, < 35% of students were aware of the correct vaccination dose as per age, > 45% of students had correctly identified the range of cost of one vial of the HPV vaccine.

Approximately only 5% of students know all four screening modalities: pap smear, VIA VILI, HPV DNA, and colposcopy, and roughly 65% of students were unaware of the screening interval as per FIGO guidelines. While knowledge was comparatively better in MBBS students than in other faculties, overall, students' knowledge regarding HPV screening was still very disappointing, suggesting a need for proper intervention. Only 3.03% of students knew that VIA-VILI is still the method of screening in rural India (in the study area), while 25% of students are aware that as per FIGO guidelines (pap smear + HPV DNA), a woman needs to be screened every five-yearly.

## Assessment of Basic and Advance Knowledge

In the current study, the term Basic Knowledge means to assess the fundamental knowledge associated with HPV vaccination. The questions considered under this category reflect the bare minimum knowledge that a healthcare professional must possess about vaccines in general. This helps them convince people to vaccines. The questions considered are as follows:

1. Whether sexually active females can receive the vaccine.
2. Whether a female with an active infection can receive the vaccine.
3. Post-vaccination is screening required or not?

Advanced knowledge refers to the technical aspects associated with specific vaccination situations that healthcare providers should know. This level of knowledge comes with acquiring in-depth vaccination knowledge that helps them deal with particular situations, and thus, extra effort is made toward vaccinating maximal individuals. The questions considered are as follows:

1. Whether Breast feeding females can get vaccinated or not.
2. Whether immunocompromised patients get vaccinated or not.
3. Should screening be done before vaccination or not?

The following scoring system was employed in the study:

- Score 0—If none of the answers is correct.
- Score 1—If any one answer is correct.
- Score 2—If any two questions are correct.
- Score 3—If all three questions are correct.

**Table 3** Assessment of attitudes of students

| Questions | Total (660) | MBBS (479) | Nursing (115) | Physiotherapy (66) |
|---|---|---|---|---|
| 1. Considers vaccine safe* | 89.54% | **91.85%** | **79.13%** | **90.90%** |
| 2. Vaccinated individual | 7.72% | 9.4% | 2.60% | 4.54% |
| 3. Willing to get vaccinated as well as recommend | 89.84% | 91.23% | 86.95% | 84.84% |
| 4. First-degree relatives being vaccinated | 19.54% | 19.62% | 13.04% | 30.30% |

*Statistical difference noticed between MBBS and NON−MBBS students regarding the consideration of vaccines to be safe or not. The chi−squared statistic is 9.0402. The $p$−value is 0.002641. The result is significant at $p < 0.05$

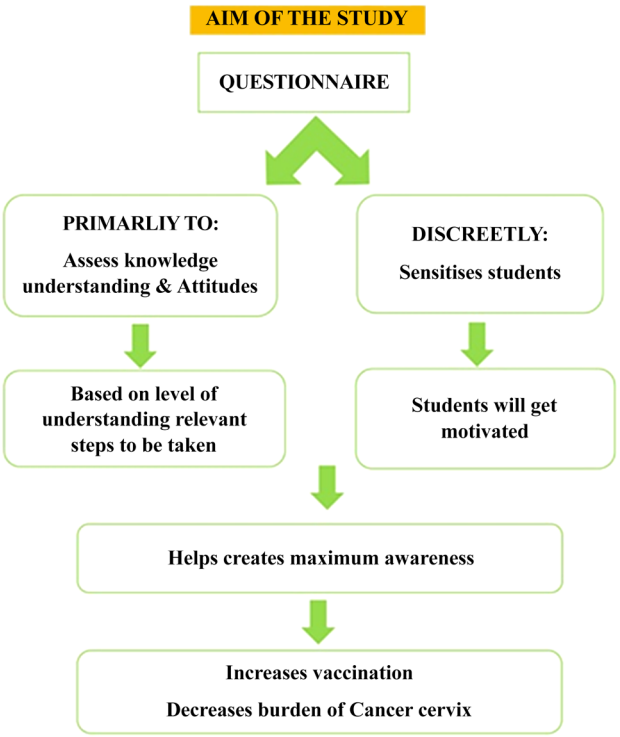


**Fig. 1** A flow chart describing the design of the study

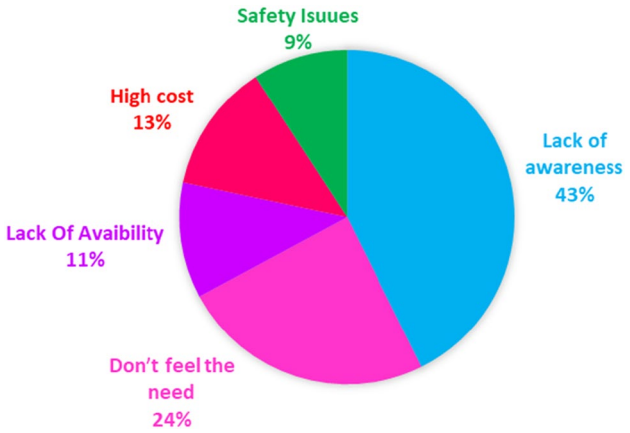


**Fig. 2** Pie chart depicting the reasons for Students not being vaccinated

Scoring and categorization were done separately for the "Basic" and "Advanced" assessments. Further, the individuals were categorized according to the following categories:

- No Knowledge—If the participant scores 0 or 1
- Partial Knowledge—If the participant scores 2
- Complete Knowledge—If the participant scores 3

Also, at the end of the survey, the percentage of responders possessing Complete Knowledge (who scored 3) in both Basic and Advance knowledge was calculated and expressed in percentages.

The percentage of complete basic knowledge was significantly higher among Physiotherapy students (33.34%) compared to MBBS and Nursing students. Overall, it is reflected that nearly 44% of MBBS students need more presence of basic knowledge, in comparison with < 30% of the non-MBBS population who lacks completed basic knowledge.

While complete advanced knowledge was only reflected among MBBS students (10%), knowledge among non-MBBS groups was negligible.

We, as researchers, understand that having incomplete or deficient basic knowledge among the MBBS group is alarming, despite undergoing a curriculum that extensively teaches about vaccination. Also, as the first-line responders to any vaccine-related dilemma, MBBS students must thoroughly understand. Without appropriate Basic knowledge, the expectation of possessing Advance knowledge is nonsensical.

As low as merely 6% of MBBS students possessed both complete basic and advanced knowledge, and that among the other two groups is barely appreciable, which is disappointing and needs structured enforcement to elevate their knowledge and understanding.

The sample's mean score of basic knowledge is 1.69 (out of 3 points) ± 1.01 SD, which is average and requires necessary interventions to increase their basic knowledge. The chi-square statistic is 15.9379 the $p$ value is 0.000346. The result is significant at $p < 0.05$.

The mean score of advanced knowledge of the sample is 0.95 (out of three) ± 0.95 SD, which is less than average. The association between Advanced knowledge and faculty—MBBS versus Non-MBBS. Chi-squared statistic for this study is 16.3826, and the p-value is 0.000277. The result is significant at $p < 0.05$.

Overall < 5% of students possessed both basic and advanced knowledge, the responders who scored three on 3 points in questions regarding basic and advanced knowledge were considered as having both types of knowledge.

## Attitude Toward Vaccine

Up to 90% believe that vaccines are safe and have reflected the willingness to get vaccinated and recommend them (10% have doubted the vaccine safety), but < 10% of MBBS and < 5% of others have taken vaccines. General suspicion is higher among the nursing fraternity as 20% still have negative feelings regarding the safety of vaccines, and thus < 3% of nursing students have undergone vaccination. This positive attitude toward getting vaccinated is in comparison with

various studies conducted by Jyoti et al. [11], Boehner et al. [13], Fu et al. [14], and Blumenthal et al. [15].

Overall, vaccination status at the university is poor as only 7.72% ($n=660$) are vaccinated, all females. While in a similar study conducted in a North Indian college, 33.5% ($n=200$) of students were vaccinated, all of whom were females. (12).

## Discussion

We employed Google Search, Medscape, Pub med, and other online databases to get the most significant developments in this research literature. It was observed that among MBBS students' knowledge about HPV vaccines was comparatively higher, yet > 40% lacked knowledge about HPV vaccination eligibility and the number of doses to be administered as per age. Such lack of knowledge is consistent with up to 44% of first- and second-year students, as they are not sensitized regarding HPV cancer and vaccination until they reach Third-first. The percentage of unaware students is high.

In our study, 93.03% of students knew that vaccines against HPV are available in India. Similarly, a high awareness rate of the presence of HPV vaccines in the Indian market was reflected in some of the studies conducted by Jyoti et al. [11] and Kumar A et al. [12].

Structured Programs need to be designed to incorporate proper understanding amongst the students, mainly because they are the individuals who will be approached for seeking answers related to healthcare dilemmas. Even though healthcare professionals understand vaccines adequately, their poor knowledge regarding who can and cannot take them, when to take them, how many doses to take, and more can significantly impede lay people's ability to take them. According to the study, merely 5% of the study population understands vaccines in the primary and advanced sense.

The HPV vaccine in Gujarat, India, is only available in the private market; it is not government funded and is beyond the affordability of most middle & low-income families. It was reflected in the data collected that only 7.72% ($n=51$) of respondents had been vaccinated before the study was conducted. In addition, about 50% of students have asserted that they learned about HPV vaccination through their peers. Similarly, in another study, the participants reported their source of information to peers [16]. Thus, by sufficiently educating the medical fraternity individuals, the proper flow of information to the rest of the community is inevitable. In this study, the remaining students have stated that the Internet, news, and magazines are their sources of information. Similarly, in other studies, participants have cited news media, mass media, and HCPs as primary sources of information related to the HPV vaccine. [17, 18].

The most stated reason for not being vaccinated is a lack of awareness/knowledge (43%); even the practice of medical students will remain disappointing without proper knowledge and education regarding the need for HPV vaccination. Since students have reflected a higher acceptance of vaccinating and recommend it to others, we can accelerate their vaccination practices by providing them with appropriate knowledge. This contraindicating behavior of unsatisfactory vaccination despite strong vaccine safety beliefs could be due to ignorance toward getting vaccinated (reflected by 24% of students) and getting vaccinated against HPV is a choice in our country, not a compulsion. The cost of the vaccine is borne by the parents/guardians of the individual. Thus, this could be one of the hidden reasons for insufficient immunization. [19].

Righteous usage of social media as a platform to dissipate information across the community can be a good strategy. It can be opted for by the government and at individual levels by healthcare providers to increase knowledge and solve related queries.

Healthcare practitioners with adequate basic knowledge regarding vaccination will empower their knowledge pool with advanced knowledge. Once appropriate and relevant initiatives are taken up by institutes to boost the students' knowledge, we can project to have a well-equipped Healthcare practitioner community that is qualified enough to educate their non-medical peers, encourage them to get vaccinated, and spread the word throughout their communities, as suggested in a recent study by Cates JR et al. and Brewer NT et al. raised a point that vaccination could be encouraged if suggested by healthcare providers [20, 21]. Thus, knowledgeable and well-aware healthcare personnel are the need of the hour.

Lack of awareness of vaccinations during schooling, especially during the target age group (9–14 years), is observed as students lack stimulation regarding the knowledge of HPV cancer, HPV vaccination, and its importance. Thus, by incorporating educational seminars at the school level, students and their parents can freely interact with Obstetricians & Gynecologists, and Pediatricians to learn about the need to vaccinate against HPV. Such initiatives can help improve the vaccination rate and reduce the number of individuals who remain unknown to the very boon of getting protected against vaccine-preventable cancer and ultimately reducing the burden of cancer cervix in society.

## Conclusion

The Human Papillomavirus is well known among college students, but they lag in HPV vaccination. There needs to be a better level of knowledge regarding the various screening modalities among the students. Students showed a strong

preference for receiving the HPV vaccine, despite insufficient knowledge.

Lack of awareness and ignorance of vaccination are barriers. Most students consider vaccines safe. Yet, contrary to this belief, only one-tenth of the university's population is vaccinated. Through proper education, students can be a pivotal part of changing the community's mindset to improve the general health of the population.

Positive attitudes are built on awareness and knowledge. Indigenously designed and produced low-cost vaccines, coupled with the vaccine's success by the Serum Institute of India, could significantly increase the number of people vaccinated against HPV, resulting in improved population health.

**Supplementary Information** The online version contains supplementary material available at https://doi.org/10.1007/s13224-023-01891-4.

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**Author Contributions** NP and NR designed the study. NR, NP, MJ and PM prepared questionnaires and collected the data. HP performed data analysis and made tables and figures for the manuscript. NP, HP wrote the manuscript. All authors contributed to the revision of the manuscript and read and approved the submitted version.

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## Declarations

**Conflict of interest** The authors declare that they have no known competing financial interests or personal relationships that could influence the work reported in this paper.

**Ethical Approval** This study was conducted after approval of our institution's institutional human research ethics committee and certified that the study was performed under the ethical standards laid down in the 1964 Declaration of Helsinki.

**Informed Consent** Permission from the head of each discipline was obtained prior to the start of the study, and each participant's implied consent was taken and recorded prior to their participation.

## References

1. Shankar A, Roy S, Rath GK, Chakraborty A, Kamal VK, Biswas AS. Impact of cancer awareness drive on generating awareness of and improving screening for cervical cancer: a study among schoolteachers in India. J Glob Oncol. 2018;4:1–7.
2. Ramesh PS, Krishnamurthy S, Shrestha S, Nataraj SM, Devegowda D. Knowledge, awareness and prevalence of human papillomavirus among local university students and healthcare workers in south India: a cross-sectional study. Clin Epidemiol Glob Health. 2021;12:100839. https://doi.org/10.1016/j.cegh.2021.100839.
3. Narayana G, Suchitra J, Suma GK, Deepthi GN, Jyothi CD, Kumar BP. Physician's knowledge, attitude, and practice towards human papilloma virus (HPV) vaccine recommendation in Anantapur district, Andhra Pradesh. India Arch Pharma Pract. 2020;11(2):137–44.
4. Balasubramaniam SD, Balakrishnan V, Oon CE, Kaur G. Key molecular events in cervical cancer development. Medicina. 2019;55(7):384. https://doi.org/10.3390/medicina55070384.
5. Srivastava AN, Misra JS, Srivastava S, Das BC, Gupta S. Cervical cancer screening in rural India: status & current concepts. Indian J Med Res. 2018;148(6):687.
6. World Health Organization (2019) Global market study: HPV vaccines (No. WHO/IVB/19.04). World Health Organization. https://apps.who.int/iris/bitstream/handle/10665/311275/WHO-IVB-19.04-eng.pdf?sequence=5&isAllowed=y
7. Basu P, Roychowdhury S, Bafna UD, Chaudhury S, Kothari S, Sekhon R, Ratnam S. Human papillomavirus genotype distribution in cervical cancer in India: results from a multicenter study. Asian Pac J Cancer Prev. 2009;10(1):27–34.
8. American College of Obstetricians and Gynecologists. Human papillomavirus vaccination: ACOG committee opinion, number 809. Obstet Gynecol. 2020;136(2):e15–21. https://doi.org/10.1097/aog.0000000000004000.
9. Chatterjee A. The next generation of HPV vaccines: nonavalent vaccine V503 on the horizon. Expert Rev Vaccin. 2014;13(11):1279–90. https://doi.org/10.1586/14760584.2014.963561.
10. Shetty S, Prabhu S, Shetty V, Shetty AK. Knowledge, attitudes and factors associated with acceptability of human papillomavirus vaccination among undergraduate medical, dental and nursing students in south India. Hum Vaccin Immunother. 2019;15(7–8):1656–65. https://doi.org/10.1080/21645515.2019.1565260.
11. Singh J, Baliga SS. Knowledge regarding cervical cancer and hpv vaccine among medical students: a cross-sectional study. Clin Epidemiol Glob Health. 2021;9:289–92. https://doi.org/10.1016/j.cegh.2020.09.012.
12. Kumar A, Garg P. Knowledge, attitude and practice study about HPV and its vaccination among medical college students in north India. Int J Adv Med. 2020;7:1825. https://doi.org/10.18203/2349-3933.ijam20205042.
13. Boehner CW, Howe SR, Bernstein DI, Rosenthal SL. Viral sexually transmitted disease vaccine acceptability among college students. Sex Transm Dis. 2003;30:774–8.
14. Fu CJ, Pan XF, Zhao ZM, Saheb-Kashaf M, Chen F, Wen Y, Zhong XN. Knowledge, perceptions and acceptability of HPV vaccination among medical students in Chongqing, China. Asian Pac J Cancer Prevent. 2014;15(15):6187–93. https://doi.org/10.7314/APJCP.2014.15.15.6187.
15. Blumenthal J, Frey MK, Worley MJ, Tchabo NE, Soren K, Slomovitz BM. Adolescent understanding and acceptance of the HPV vaccination in an underserved population in New York City. J Oncol. 2012. https://doi.org/10.1155/2012/904034.
16. Shetty S, Shetty V, Badiger S, Shetty AK. An exploratory study of undergraduate healthcare student perspectives regarding human papillomavirus and vaccine intent in India. Womens Health. 2021;17:17455065211055304. https://doi.org/10.1177/17455065211055304.
17. Rashwan HH, Saat NZNM, Manan DNA. Knowledge, attitude and practice of Malaysian medical and pharmacy students towards human papillomavirus vaccination. Asian Pac J Cancer Prev. 2012;13(5):2279–83. https://doi.org/10.7314/APJCP.2012.13.5.2279.
18. Unger Z, Maitra A, Kohn J, Devaskar S, Stern L, Patel A. Knowledge of HPV and HPV vaccine among women ages 19 to 26. Womens Health Issues. 2015;25(5):458–62. https://doi.org/10.1016/j.whi.2015.06.003.

19. Ramavath KK, Olyai R. Knowledge and awareness of HPV infection and vaccination among urban adolescents in India: a cross-sectional study. J Obstet Gynecol India. 2013;63(6):399–404. https://doi.org/10.1007/s13224-013-0413-3.
20. Cates JR, Shafer A, Carpentier FD, Reiter PL, Brewer NT, McRee AL, Smith JS. How parents hear about human papillomavirus vaccine: implications for uptake. J Adolesc Health. 2010;47(3):305–8. https://doi.org/10.1016/j.jadohealth.2010.04.003.
21. DiAngi YT, Panozzo CA, Ramogola-Masire D, Steenhoff AP, Brewer NT. A cross-sectional study of HPV vaccine acceptability in Gaborone. Botswana PloS one. 2011;6(10):e25481. https://doi.org/10.1371/journal.pone.0025481.