Original Article

HPV Vaccine Hesitancy among Medical Students in Goa : A Cross-sectional Study

Ishani Kaushik[1], Pradnya B Desai[1], Hemangini Kishore Shah[2]

Abstract

Background : Human Papillomavirus (HPV) causes cervical, oropharyngeal and anogenital cancers, with types 16 and 18 being the most oncogenic. Cervical cancer is the second most common cancer among Indian women aged 15-44 years. Despite effective vaccines, HPV vaccine hesitancy remains prevalent. This study examines hesitancy among medical students in Goa using the WHO three Cs model (Confidence, Complacency and Convenience).

Materials and Methods : A cross-sectional study conducted at Goa Medical College from February, 2024 to November, 2024 surveyed 400 MBBS students using a self-administered questionnaire. Participants were selected via convenience sampling, and statistical analyses included percentages and significance tests.

Results : Only 22.5% (90 students) had received the vaccine, while 77.5% expressed hesitancy. Convenience was the leading factor (57.1%), primarily due to lack of awareness about vaccine availability, cost, and access. Complacency (18.8%) reflected perceived low risk, while confidence issues (11.8%) included safety and efficacy concerns. Despite 70.25% of students being aware of the vaccine, most had not taken it. Hospitals and schools were the primary sources of vaccine information (73.2%). Hypothetically, 75% would take the vaccine if included in the national immunization schedule and 69% if offered at college.

Conclusion : This study highlights that vaccine hesitancy is primarily driven by Convenience, followed by Complacency and Confidence.

Key words : Vaccine Hesitancy, Medical Students, WHO three Cs Model, HPV Vaccine, Cervical Cancer.

Human Papillomavirus (HPV), with over 200 types, causes cervical, oropharyngeal and anogenital cancers[1,2]. Cervical cancer, primarily due to types 16 and 18, ranks as the 4th most common cancer in women globally[2,3] and the 2nd most frequent among Indian women aged 15-44[4]. Despite bivalent, quadrivalent, and nine-valent vaccines, HPV vaccine hesitancy - defined as delayed acceptance or refusal despite availability[5] persists. This study evaluates vaccine hesitancy among Goa's medical students using the WHO 3Cs model[6,7], acknowledging their critical role as future healthcare advocates and influencers. The safety of HPV vaccines is strongly supported by the World Health Organization, the Centres for Disease Control and Prevention, the National Advisory Committee on Immunization, and other international health bodies[2,8].

Materials and Methods

Sample size : As per review of literature, considering the prevalence of the study "HPV Vaccine Hesitancy among medical students in China: a multicentre survey." [6] The sample size was calculated as follows :

$N = z^2pq/L^2$

Where,

N = sample size
z = confidence level
p = proportion of variable of interest (%)
q = complement of p, [1-p] (%)
L = allowable error on either side of the estimated 'p'[2]
and a Sample size of 400 was obtained.

Study Design : A cross-sectional study was planned to attain the objectives.

Study Period : February, 2024 to November, 2024.

Study Duration : Nine months.

Study Population : Medical Students.

Inclusion Criteria :

Consenting MBBS students enrolled in Goa Medical College who are under 26 years of age.

Exclusion Criteria :

Study participants who did not have a WhatsApp number.

Editor's Comment :

- Convenience barriers such as cost, access and unawareness are the primary causes of HPV vaccine hesitancy among medical students.
- Addressing these barriers through inclusion in immunization schedules, improved accessibility and targeted education can enhance vaccine uptake.
- Empowering medical students as public health advocates is crucial for bridging the gap between awareness and action.

Department of Community Medicine, Goa Medical College, Bambolim, Goa 403202
[1]MBBS, Student
[2]MD, Associate Professor and Corresponding Author
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Students who did not respond after three reminders.

Data Collection : Upon the approval of the Institutional Ethics Committee a formal online survey was conducted amongst the students of Goa Medical College (GMC) (the only Medical college in the state of Goa). The survey was based on three C model approved by WHO for vaccine hesitancy.

Study Tool : Upon literature review, a self-administered questionnaire was designed based on the WHO three Cs model (Confidence, Complacency, and Convenience) to identify barriers to HPV vaccination. This model not only categorizes reasons for vaccine hesitancy but also provides a framework that can be integrated into medical education to teach students about vaccine-related behavioural dynamics and public health strategies.

The WHO approved three Cs model offers a structured approach to understanding hesitancy, which is critical for medical students as future healthcare providers and public health advocates. Questions were tailored to the target population for relevance. The participants were provided information on the purpose and details of the study and they could proceed to the questionnaire upon consenting.

Convenience sampling method was used and the link was disseminated in coordination with the class representatives and kept active until required number of responses were received. The questions were framed in an easy-to-understand manner for quick completion time however all the questions in the form were made mandatory to obtain complete information.

The questionnaire included four sections namely Informed consent & Participant Information Sheet, Demographic details, Participant's knowledge and Reasons for hesitancy which included the 11 options and provided space to mention any other reason for hesitancy. These included reasons based on

Confidence:

(1) Heard or read negative news/ Have Less knowledge on its safety.

(2) Had a bad experience with previous vaccinations due to health clinics/vaccinators.

(3) Health Care Workers' unreliable attitudes towards the HPV vaccine.

(4) Parents are not comfortable about the vaccine.

(5) Religious Reasons.

Complacency :

Vaccination was not considered as important.

Convenience :

(1) Don't know where to get vaccinated

(2) Don't know when to get vaccinated.

(3) The vaccination site is far away and requires a long journey.

(4) Don't know where to get reliable information from.

Statistical Analysis : The responses obtained were compiled in Excel format and percentages were calculated. Wherever relevant, tests of significance were applied.

Results

Batches consisted of 180 medical students each. We received 5(27.7%), 99(55%), 66(36.6%), 107(59.4%) and 123(68.3%) responses from Batch 2020, 2021, 2022, 2023 and 2024 respectively.

Of the total number of 400 study participants, 234 (58.5%) were females and the 166 (41.5%) were males (Table 1).

Vaccine Hesitancy & related factors: Though 307 (76.6%) of the participants agreed that the vaccine should be received by everyone irrespective of the sex, the vaccine uptake in our study was noted to be 22.5% (90 out of 400).

Of the 310 (77.5%) who did not receive the vaccine, 129 (77.7%) were males and 181 (77.3%) females. Hesitancy rates were 75.7% (122) in Rural and 78.9% (188) in Urban areas. The rate of hesitancy among different religions was 79.2% (42 out of 53), 77.2% (254 out of 329), 78.5% (11 out of 14) among Christians, Hindus and Muslims respectively showing no significant relation between religion and hesitancy.

Upon batch wise analysis, the hesitancy was found to be 100%, 90.90% (90), 84.8% (56), 63.55% (68), 73.9% (91) for batch 2020, 2021, 2022, 2023 and 2024 respectively. There was a significant variation in hesitancy among different batches with maximum hesitancy in 2021 batch and minimum hesitancy in batch 2023. There was a

Table 1 – *Distribution of study participants as per Socio-demographic details. (original)*

Details		Number	Percentage (%)
Age :	16-20	292	73%
	21-25	108	27%
Sex :	Male	166	41.5%
	Female	234	58.5%
Batch Year :	2020	5	1.25%
	2021	99	24.75%
	2022	66	16.5%
	2023	107	26.75%
	2024	123	30.75%
Residence :	Urban	239	59.75%
	Rural	161	40.25%
Religion :	Hindu	329	82.25%
	Muslim	14	3.5%
	Christian	53	13.25%
	Others	4	1%

decline in rate of hesitancy from batch 2020 to 2023, showing a decrease in hesitancy in the newer batches. (Table 2).

Source of Information : 73.2% (270) people got the information about the vaccine from hospitals/schools making it the biggest source of information. Other sources were doctor consultation (21.1%), family or friends (19%), radio/TV (10.8%), newspaper/magazine (14.1%), internet (16.5%).

Vaccine Availability : If the vaccine was added in the national immunization schedule, 300 (75%) people agreed to take the vaccine, 85 (21.3 %) were not sure and 15 (3.7%) refused to take the vaccine. If the vaccine is made available in the college itself, 276 (69%) people agreed to take the vaccine, 106 (26.5 %) were not sure and 18 (4.5%) refused to take the vaccine.

Among those aware of the vaccine, only 88 (22%) received it, while 281 (70.25%) did not, reflecting high hesitancy (Table 3).

Using the three Cs model, (Confidence, Complacency, Convenience)

From a total of 287, Hesitancy due to Confidence was found in 34 (11.8%) of people, due to Convenience in 164 (57.14%) and due to complacency in 54 (18.8%). Additionally, 4 (1.39%) of people were hesitant due to all three causes, 11(3.8%) were hesitant due to both Confidence and Convenience, 18 (6.27%) due to both Convenience and Complacency, and 2 (0.06%) due to both Confidence and Complacency.

Table 2 — *Distribution of study participants as per HPV vaccine uptake & various parameters (original)*

Parameters	HPV Vaccine Uptake		
	Yes (%)	No (%)	
Sex :			
Female	22.7	77.3	*Chi Square = 0.0072; df=1;*
Male	22.3	77.7	*P=0.93 (Significance at <0.05; Not Significant)*
Residence :			
Urban	21.1	78.9	*Chi Square = 0.45; df=1;*
Rural	24.3	75.7	*P=0.49 (Significance at <0.05; Not Significant)*
Religion :			
Hindu	22.8	77.2	*Chi Square = 3.032; df=3;*
Christian	20.8	79.2	*P=0.387 (Significance at <0.05; Not Significant)*
Muslim	21.5	78.5	
Others	0	100	
Batch Year :			
2020	0	100	*Chi Square = 26.51; df=4;*
2021	9.1	90.9	*P=0.000025 (Significance at <0.05; Highly Significant)*
2022	15.2	84.8	
2023	36.45	63.55	
2024	26.1	73.9	*df = degree of freedom*

Table 3 — *Pattern of Vaccine uptake with regards to knowledge of the vaccine (original)*

Knowledge about the HPV vaccine	HPV Vaccine Uptake		
	Yes (%)	No. (%)	
Present	88 (22 %)	281(70.25%)	*Chi Square = 4.95 df=1, P=0.02 (Highly Significant) df = degree of freedom*
Absent	2(0.5%)	29 (7.25%)	

Discussion

Hesitancy and the three Cs : Vaccination hesitancy refers to the reluctance or refusal to be vaccinated despite the availability of the vaccines. There can be various factors associated with vaccine hesitancy such as lack of information, misinformation, fear about its side effects, doubts on its effectiveness, mistrust in healthcare staff, etc. Experts have divided these reasons majorly into 3 categories : Convenience, Complacency and Confidence. Through the use of the three Cs model, medical students can better understand how factors like misinformation (confidence), perceived risk (complacency) and accessibility (convenience) influence public health outcomes. This fosters critical thinking and equips them with the knowledge to counteract vaccine hesitancy in their future practice.

From the study we conducted, we found that the major reason for hesitancy among students is convenience, ie, they did not know where to get the vaccine, its availability was low, or high-cost was the reason. Other reasons for the hesitancy are confidence (12% of the students did not have confidence in the vaccine because they had learnt about side effects or in effectiveness of the vaccine). Complacency contributed as a reason for 18%. Some students think they are not at risk and hence are reluctant to take it. Hence, the youth need to be convinced about the benefits. Rest of the students had more than one factor for their hesitancy. Convenience being the major reason for hesitancy across the population makes it easy for healthcare providers to reach out and provide vaccination by making it easily available and cutting down the cost of the vaccine. Thus, including it as a vaccine in the vaccination schedule by the Government may be helpful in reaching out to the general public. For the remaining hesitant population (lacking confidence or complacency), targeted efforts are required. For them, healthcare providers need to be more sensitive towards the excellence of the vaccine. Extensive health education, social media outreach, and parental counselling are urgently needed.

To address vaccine confidence, workshops, lectures, and symposiums during college hours can effectively dispel myths and increase awareness. Convenience can be improved through Government initiatives, including making vaccines more accessible. Role-playing exercises and case studies in public health courses can help students handle vaccine hesitancy. Including the HPV vaccine in routine immunization schedules can broaden

coverage and increase uptake. Medical students must be educated on their key role in public health education and the benefits of vaccination to reduce complacency.

Knowledge and Attitude of Health Care Providers :

"Knowledge on the part of healthcare providers is also critical to vaccine uptake. Multiple studies have shown that the knowledge and attitudes of healthcare providers toward vaccination are reflected in parental attitudes toward vaccination"[9-11].

We found that people trust their Healthcare Professionals (HCPs) and the information they provide. This element is crucial when we consider that HCPs can promote vaccination by sharing accurate information and offering counselling to parents to facilitate decision-making. Nonetheless, previous studies have found that the percentage of HCPs who speak with parents about HPV vaccines for their children is very low[12,13].

Myths and Hesitancy :

When we asked students whether only sexually active individuals should receive the HPV vaccine or if everyone should, 14.5% believed that sexually inactive individuals are not at risk of contracting the virus and therefore do not need to be vaccinated. However, since the vaccine protects against multiple strains of the virus, it is important to encourage vaccination even for those who are not sexually active.

This misconception could be one of the reasons why many adolescents are not vaccinated at the recommended age. Parents may assume that their children are not sexually active and therefore do not need the vaccine. Such beliefs can persist across generations, emphasizing the importance of targeting parents of adolescents with accurate information about the vaccine's benefits.

Parents play an important role in perpetuating such myths among the young population. There are some studies where hesitancy among parents is shown in the above context. It is seen from some studies in the USA, Italy, etc. that parents' hesitancy towards the vaccine has a major role in the percentage of adolescents being vaccinated at the right time. Thus, it is important to target the parents and educate them about the benefits of the vaccine for their children.

The study found that most students cited schools, hospitals, and public lectures as their primary sources of information, highlighting the importance of health education in shaping their beliefs. Another study revealed that the media had the greatest influence on perspectives, followed by consultations with doctors. However, families and friends could negatively affect perceptions by sharing adverse personal experiences[14,15].

A study which focussed on vaccine related perspectives in adolescents highlighted the importance of providing complete information related to the vaccines and involving the adolescents, the major stakeholders, in the decision process[16].

A report on focus group discussions in Mysore, India (a city where 76% of the population is Hindu, 19% is Muslim, and 4% is Christian, Jain, Buddhist, or other religions) observed that many parents were accepting of the HPV vaccine, especially since it would prevent Cervical cancer. Although most of these parents felt strongly that young girls were unlikely to become sexually active before marriage, several did recognize that young people may engage in premarital sex, leading most to conclude that adolescent girls should be vaccinated between 15 and 18 years of age[9,17].

Several studies have reported that parents and caregivers may associate the vaccine with fears of compromising fertility[12,18] or giving children the permission to become sexually active[12,19].

Limitations :

This study has some limitations. Our study only targeted a specific subset of medical students, which limits the generalizability of our findings. Batch 2020 had limited participation due to exam schedules. Limited religious diversity in Goa restricts generalizability of inter-religious comparisons. Furthermore, our study did not include parents or younger students, whose perspectives would have been valuable in understanding the underlying reasons for hesitancy.

Conclusion

This study highlights that vaccine hesitancy is primarily driven by Convenience, followed by Complacency and Confidence. These barriers can be addressed by improving vaccine availability, affordability and accessibility. Making vaccines cheaper, including them in immunization schedules, and educating students on their effectiveness are key steps. Collaborative efforts from policy makers, healthcare providers, and educators will further increase vaccine uptake across diverse populations.

Confidentiality : All the entries were anonymous to maintain the privacy of the participants.

Conflict of Interest & Funding : None.

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