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How can the uptake of HPV vaccination be increased in school going girls? a qualitative study with multiple stakeholders in Ganjam, Odisha

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Abstract

Objectives: Cervical cancer remains a significant public health challenge in low- and middle-income countries like India. Despite the efficacy of HPV vaccination, its uptake remains suboptimal. This qualitative study aimed to explore parental attitudes, knowledge, and decision-making regarding HPV vaccination for school-going adolescents in Ganjam, Odisha, to inform effective intervention strategies.
Methods: This qualitative study utilized semi-structured interviews, conducting Focus Group Discussions (FGDs), In-Depth Interviews (IDIs), and Key Informant Interviews (KIIs) of total 47 participants. Data were collected from December 2024 to January 2025 in Ganjam, Odisha. Data were analyzed using thematic analysis, aided by MAXQDA 2020 software.
Results: Five core themes emerged: Knowledge and Awareness Gaps (low awareness, confusion with other vaccines, information needs); Attitudes Towards HPV Vaccination (mixed institutional trust, accountability demands); Barriers to HPV Vaccination (cultural/social hesitancy, fear-driven hesitancy, individual and systemic barriers); Role of School Authorities (education and communication gaps); and Potential Collaborative Strategies (community engagement, policy and systems alignment). Participants showed positive sentiments towards trusted sources and community engagement, while negative sentiments were associated with fear, cultural norms, and systemic challenges.
Conclusions: HPV vaccine uptake is hindered by knowledge gaps, cultural/fear-driven hesitancy, and systemic barriers. Improving coverage and health literacy in resource-limited settings requires intensive communication, school-based education, paternal involvement, intersectoral collaboration, and policy changes, including UIP integration.

Keywords: HPV vaccination; school-based vaccination; qualitative study; school-going girls; stakeholders

Background

Cervical cancer continues to be a serious global health issue, especially in women, and a major cause of cancer mortality globally. Cervical cancer continues to be a major public health problem worldwide, especially in low- and middle-income countries (LMICs) such as India [1]. Despite being preventable and treatable if detected early, Cervical cancer ranks as the fourth most common cancer among women globally, with a high incidence and mortality rate in LMICs due to lack of access to preventive interventions such as HPV vaccination and cervical screening [2, 3]. The Human Papilloma Virus (HPV), the main cause of cervical cancer, is a major health risk for adolescents and young women in their reproductive years [3, 4]. Although all women may face the risk of developing cervical cancer during their lifetime, yet it remains a largely avoidable cause of death with timely and effective preventive interventions.

HPV vaccination helps prevent HPV infections and the development of related precancerous lesions. It can lower the risk of cervical cancer by around 70 % and also offers protection against other conditions like anal cancer, genital warts, and oropharyngeal cancer [5]. The World Health Organization (WHO) encourages HPV vaccination for girls aged 9–14 years, prior to the initiation of sexual activity, for maximum impact [6, 7]. This vaccination strategy aims to significantly reduce the occurrence of cervical cancer by increasing immunity against high-risk HPV types among young women, thereby improving overall public health

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outcomes [6, 8]. Despite its proven efficacy, the uptake of HPV vaccination in India remains suboptimal due to several reasons, including lack of awareness, sociocultural stigma, apprehensions about vaccine safety, and the absence of the vaccine from the Universal Immunization Programme (UIP). A recent systematic review and meta-analysis reported that the pooled prevalence of HPV vaccine uptake in South Asia is only 8 %, with India showing a pooled uptake of just 6 %, highlighting the urgent need for improved vaccination strategies and coverage in the region [9, 10] and the acceptability of the HPV immunization among caregivers of adolescent girls in rural areas [11, 12]. In order to improve vaccination uptake, these studies emphasize the necessity of focused interventions to address knowledge gaps about HPV and the HPV vaccine, attitudes, and particular barriers [13]. Vaccination programs in schools are acknowledged as an efficient method for reaching the intended group of teenage girls [14–16]. However, effective implementation requires a clear understanding of the perspectives of all stakeholders, including the girls, their parents, and school authorities [12, 17]. a significant example of successful school-based HPV vaccination program in India is a decision by the Government of Sikkim to be the first state to introduce the HPV vaccine to the girls of age group (9–13 years) via a statewide school based vaccination delivery strategy [18].

This study addresses the gap in specific data on HPV vaccination uptake and its influencing factors in Ganjam, Odisha. This qualitative research explores the knowledge and attitudes related to HPV infection and HPV vaccination among school-going girls, their parents and key stakeholders in Ganjam. By understanding the local context and identifying the barriers to vaccination, this study seeks to provide valuable insights for developing strategies to increase HPV vaccine uptake and ultimately lower the impact of cervical cancer among this vulnerable population.

Study Setting: The research was carried out in the Sheragada and Digapahandi blocks, situated in the Ganjam District, Odisha, India. These blocks were purposefully selected as study sites due to their reported low rates of HPV vaccination and the need for context-specific strategies to improve awareness and uptake. High-uptake blocks were not included as the study focused on low-coverage areas where implementation challenges were greatest. Although other blocks in the district were not far ahead in HPV vaccine uptake, Sheragada and Digapahandi were identified by district authorities as having the lowest awareness and vaccination activity. Odisha, while making progress in educational outcomes, still faces challenges, particularly in upper primary education. According to the Unified District Information System for Education Plus (UDISE+), the annual average dropout rate at the upper primary level in Odisha was 6.93 %, with Ganjam district reporting a slightly lower rate of 5.81 % [19]. The public health infrastructure in Ganjam is primarily dependent on government primary health centres and sub-centres, which often struggle with human resource shortages and outreach inefficiencies, particularly in rural and tribal belts.

Study Design: This research employed a qualitative approach, explicitly grounded in a constructivist paradigm, to explore the knowledge, attitudes, and barriers affecting HPV vaccination uptake among school-going girls and their parents. The study also examined collaborative approaches among school authorities and stakeholders to enhance vaccination coverage. The qualitative method was specifically utilized to obtain in-depth, context-specific information regarding the lived experiences and nuanced views of the participants on HPV vaccination, recognizing that their understanding is socially constructed through interaction and interpretation.

Study participants

The study population comprises two primary groups: school-going girls aged 9–14 years enrolled in government schools within the Ganjam District of Odisha, and their parents. Key stakeholders involved in HPV vaccination promotion within these communities were also included. These stakeholders encompassed school authorities, specifically principals and teachers involved in school health programs, and healthcare professionals actively engaged in vaccination programs. The healthcare professionals included Auxiliary Nurse Midwives (ANMs), Community Health Officers (CHOs), Medical Officers (both MBBS and AYUSH), and gynecologists (both government and private facilities) administering HPV vaccines and conducting cervical cancer check-ups. Girls outside the age group of 9–14 years, as well as school staff, parents, and healthcare professionals unwilling to participate, were excluded from the study.

Sampling and sampling size

A purposive sampling method was employed, which was well-suited for qualitative research as it facilitated the selection of information-rich participants who could provide in-depth insights into the study's objectives. Sample size was guided by the principle of thematic saturation, where data collection was concluded once no new insights or themes emerged. Several qualitative data gathering methods were employed in order to record a range of viewpoints. Focus Group Discussions (FGDs) were organized with school-going girls to explore their knowledge, attitudes, and perceived barriers regarding HPV vaccination. In-Depth Interviews

(IDIs) were conducted with school principals, teachers, parents, and healthcare professionals to assess their perspectives on existing vaccination efforts and challenges. Additionally, Key Informant Interviews (KIIs) were conducted with gynecologists involved in HPV vaccination and Cervical cancer screening. initiatives to gather expert insights (Table 1). Thematic saturation was achieved after three parental interviews (two fathers and one mother). Additionally, a female teacher and an ANM who were also parents contributed parental perspectives. Triangulation with FGDs and KIIs further confirmed saturation, emphasizing depth and diversity over quantity.

Table 1: Number of IDIs, FGDs and KIIs Conducted for this study.

Method	Participant type	Number of participants	Participants characteristics	Socio-demographic characteristics		
				Education	Occupation	Residential status
FGDs	Government school girls (9–14 yrs)	4 FGDs (6–8 participants per group)	Female students age (9–14 years) studying in government schools, Ganjam Odisha	Middle school and high school	Students	Rural
IDIs	MBBS medical Officer	1	29-year-old male medical Officer posted at CHC, sheragada	MBBS	Medical Officer	Urban
	AYUSH medical Officer	1	35-year-old female AYUSH medical Officer posted at PHC Jharipadar	BAMS	Medical Officer (AYUSH)	Urban
	Community health Officers (CHOs)	1	32-year-old female CHO posted at Padmapur subcenter	BSc. Nursing	CHO	Rural
		1	26-year-old female CHO posted at Digapahandi	GNM	CHO	Rural
	Auxiliary nurse midwives (ANMs)	1	47-year-old female ANM posted at CHC, Digapahandi	MBA (health care administration)	ANM	Rural
		1	41-year-old female ANM posted at CHC, sheragada	ANM	ANM	Rural
	School staff (Principals/Teachers)	2 sheragada (1 school Principal, 1 school Teacher)	58-year-old male school Principal from girls high school, Bardansahi	BSc. B.Ed.	School Principal	Rural
			31-year-old male school teacher from girls high school, Bardansahi	MSc. B.Ed.	School teacher	Urban
		2 Digapahandi (1 school Principal, 1 school Teacher)	53-year-old female school Principal from girls high school, Digapahandi	MA. B.Ed.	School Principal	Urban
			30-year-old female school teacher from girls high school, Digapahandi	MSc. Zoology	School teacher	Rural
		2 tribal school (1 school Principal, 1 school Teacher)	43-year-old female school Principal from R D girls high school, Padmanapur	BSc. B.Ed.	School Principal	Rural
			34-year-old female school teacher from R D girls high school, Padmanapur	B.Ed.	School teacher	Rural
	Girl's parents (fathers & mother)	3 (2 fathers, 1 mother)	35-year-old father, resident of Digapahandi	Illiterate	Farmer	Rural
			36-year-old father, resident of Padmanapur	7th Pass	Painter	Rural
			40-year-old mother, resident of Digapahandi	10th Pass	Housewife	Rural
KIIs	Gynecologists	2 (1 Govt facility, 1 private facility)	52-year-old male gynecologist posted at CHC, sheragada	MBBS MD, OBGY	Gynecologist	Rural
			33-year-old female gynecologist Posted at SUM hospital, Berhampur	MBBS MD, OBGY	Gynecologist	Urban
Total		15 IDIs, 2 KIIs, 4 FGDs				

Data collection method

Data collection was conducted in the Sheragada and Digapahandi blocks of Ganjam district between December 2024 and January 2025. A semi-structured interview guide was developed based on the study objectives and relevant literature. The interview guide covered all key concepts related to HPV vaccination, including knowledge, attitudes, and barriers, as well as existing collaborations and potential promotion strategies for the vaccines.

Focus group discussions (FGDs), Key informant interviews (KII) and in-depth interviews (IDIs) were used as methods for data collection. All data were collected in the Odia language. To facilitate open communication, FGDs were held in designated school libraries, providing a comfortable and neutral setting. Conversely, IDIs were conducted in private locations, such as empty classrooms or designated rooms, to ensure confidentiality and maximize participant comfort. All sessions were audio-recorded after obtaining voluntary agreement from participants, and comprehensive field notes were taken to document contextual details and non-verbal cues. Although formal back-translation was not performed, translation quality was assured through a three-step process involving bilingual translation, independent verification, and reconciliation of discrepancies.

Data analysis

Data were analyzed using thematic analysis, following the framework proposed by Braun and Clarke and aided by the software MAXQDA 2020 [20]. This involved a **hybrid deductive–inductive approach** to analyze the qualitative data. The following steps were undertaken:

(1) **Familiarization:** Transcripts from In-depth interviews, focus group discussions (FGDs), and key informant interviews (KIIs) were read multiple times to thoroughly immerse in the data, gaining a deep understanding of the participants' perspectives on HPV vaccination.
(2) **Coding:** Initial codes were generated to identify significant features of the data that were relevant to the research objectives, such as knowledge and attitudes towards HPV vaccination, barriers to HPV vaccination, the role of school authorities, and potential collaborative strategies between school authorities and other stakeholders.
(3) **Generating Themes:** The codes were then grouped into broader themes that captured patterns in the data, reflecting the key insights related to the research questions.
(4) **Reviewing Themes:** The themes were examined and adjusted to ensure they clearly reflected the data and remained distinct from each other. This process involved checking for consistency across the data and ensuring that the themes reflected with the research objectives.
(5) **Theme Identification and Labeling:** Each theme was clearly defined and named to reflect its core essence, making it easier to communicate the findings effectively.
(6) **Writing Up:** The final analysis was compiled into a comprehensive narrative, integrating direct quotes from participants to illustrate the themes and provide a rich, detailed account of their experiences and perspectives on HPV vaccination.

Ethical considerations

The study received ethical approval from the Institutional Academic Ethics Committee, ICMR-Regional Medical Research Centre, Bhubaneswar (Ref: ICMR-RMRC/AEC-2024/002). All procedure in line with ICMR National Ethical Guidelines for Biomedical and Health Research involving Human Participants.

All participants provided written informed consent and assent prior to participation. Interviews were done in private or semi-private rooms to ensure confidentiality. Transcripts and the audio recordings were kept secure and only made available to authorized research staff. No material or monetary incentives were given.

Results

The qualitative analysis carried out in this study identified five key themes that significantly influence the knowledge, attitudes, and barriers related to HPV and its vaccination: Knowledge and Awareness of HPV and HPV Vaccination, Attitudes Towards HPV Vaccination, Barriers to HPV Vaccination, Role of School Authorities in HPV Vaccination, and Potential Collaborative Strategies for HPV Vaccination Promotion. These themes and associated their sub-themes, provide a comprehensive understanding of the factors affecting HPV vaccine uptake. The subthemes are shown in (Table 2), and the codebook is given as an additional file.

The following is a deeper elaboration of the themes found and some significant quotes from the respondents:

Theme 1: Knowledge and Awareness of HPV and HPV Vaccination.

Participants demonstrated varying levels of knowledge and awareness regarding HPV and cervical cancer. Two subthemes emerged:

Awareness Gaps: Majority of participants lacked awareness and understanding on HPV, cervical cancer, and the HPV

Table 2: Summary of themes and sub-themes.

Theme	Sub-theme	Key insights
1. Knowledge and awareness of HPV and HPV vaccination	Awareness gaps	Low awareness, confusion with the other vaccine, cervical cancer unknown
	Information needs	Demand for localized data, symptoms clarity, need for visual/tangible evidence
2. Attitudes towards HPV vaccination	Institutional trust	Mixed trust in institutions, hesitant confidence, fear of counterfeit vaccines.
	Accountability Dem ands	Concern about account-ability, fear of fake vaccines
3. Barriers to HPV vaccination	Cultural & social hesitancy	Cultural resistance, parental authority, social conformity
	Fear-driven hesitancy	Fear of side effects, injec-tion fear, past COVID vaccination trauma, misinformation
	Individual-level bar-riers and systemic Barriers	Schedule conflicts, menstruation, exam timing Supply/logistics issues, inequitable access, disability inaccessibility
4. Role of school au-thorities in HPV vaccination	Education gaps	Teachers as facilitators, need for expert sessions, untrained teachers.
	School-parent communication gaps	Poor communication from school to parents, missed school-based opportunities
5. Potential Collaborative strate-gies for HPV vaccina-tion promotion	Community engagement	Community health workers, peer influence, grassroot mobilization
	Policy & systems	Intersectoral collaboration, policy alignment, certifica-tion incentives.

vaccine. A few respondents were completely unfamiliar of term cervical cancer, as indicated in the following quote:

"No. I haven't heard of cervical cancer" (FGD1-School girl).

This lack of awareness was also reflected in comments like,

"We study environmental science… but not cervical cancer" (FGD1- School girl).

Information Needs: The respondents expressed a strong need for more detailed and context-specific information regarding HPV, cervical cancer, and the vaccine. They needed Evidence based data, education on symptoms, and explanation on the benefits of vaccination.

For instance, one participant requested, "First show us data on cervical cancer patients in Odisha" (IDI-Mother1), while another asked, "How will I know if I have cancer?" (FGD3- School girl).

Theme 2: Attitudes Towards HPV Vaccination.

Participants' attitudes towards the HPV vaccine were shaped by their institutional trust and accountability issues. The following sub-themes were identified:

Institutional Trust: Trust and distrust in institutions, particularly in education, healthcare providers, and health programs, played a crucial role in influencing the acceptance of vaccine. Some participants expressed trust in healthcare providers by stating:

"We'll take it if doctors say it's safe" (FGD2- School girl).

while others questioned the need for vaccination, asking,

"Why vaccinate if no one here has this cancer?" (IDI-Mother).

Accountability Demands: Accountability issues were also of prime concern, particularly regarding vaccine safety and responsibility for any ensuing negative effects.

Participants raised questions such as, "Who takes responsibility if something happens?" (IDI-Father).

and expressed fears about counterfeit vaccines: "What if they give duplicate vaccines?" (FGD1- School girl).

Theme 3: Cultural and Psychosocial Factors to HPV Vaccination

There were multiple barriers to the adoption of the HPV vaccine uptake that included cultural, social, psychological, and systemic factors. These barriers were categorized into three sub-themes:

Cultural & Social Hesitancy: Cultural norms and social dynamics, including patriarchal norms and the need for collective consensus, influenced vaccine acceptance.

One participant stated, "We cannot give permission without asking the father" (IDI-Mother).

highlighting the role of parental authority, while another indicated a desire for social conformity:

"I'll agree if all parents do" (IDI-Mother).

Fear-Driven Hesitancy: Anxiety related to vaccine side effects, needle fear, and prior negative experiences with vaccination contributed to hesitancy. Participants voiced concerns like, "What if we get fever after the vaccine?"

Individual and Systemic Barriers: Individual and system barriers significantly hampered vaccination activity in the shape of practical issues such as examination and menstruation scheduling conflicts, as well as vaccine related issues like supply shortages and access.

For example, participants mentioned, "Exams are important… we can't miss them" (FGD4-R2) and "Can't get vaccinated during periods" (FGD1-School girl).

Participants also reported challenges such as, "In COVID camps, only 40 got vaccines" (IDI-Father).

and raised concerns about equitable access: "How will disabled students get vaccinated?" (FGD4- School girl).

Theme 4: Role of School Authorities in HPV Vaccination.

The study highlighted the important role of school authorities in HPV vaccination programs, identifying both gaps and opportunities for improvement:

Education Gaps: Participants emphasized the need for integrating health education into school curricula and for involving teachers and healthcare professionals in educating students about HPV and the vaccine.

They suggested, "Teachers should explain benefits" (FGD3- School girl) and expressed a desire for "a session with doctors" (FGD- School girl).

"We don't receive any training or information about HPV vaccination, so it's difficult to guide students and parents about it." (IDI-School Teacher).

School-Parent Communication Gaps: Poor communication between schools and parents has been identified as a key barrier to vaccination. Participants reported instances where schools failed to adequately communicate health initiatives to parents, as the below quote,

"School doesn't inform us… my daughter brings tablets home" (IDI-Mother).

Theme 5: Potential Collaborative Strategies for HPV Vaccination Promotion

Participants suggested several collaborative strategies to enhance HPV vaccine promotion and uptake:

Community Engagement: The importance of engaging community members, local leaders, and health workers in vaccine promotion and education was highlighted. Respondents expressed trust in community health workers through the statement,

"ASHA didi explains everything" (IDI-Father).

and acknowledged the influence of peers: "Friends' actions influence uptake" (FGD1- School girl).

Policy & Systems: Participants highlighted the need for multi-sectoral coordination and collaboration among schools, health organizations, and non-governmental organizations (NGOs) to effectively promote and deliver HPV vaccines.

"Awareness must precede free vaccines… else, even free doses get rejected." (KII-Gynecologist Pvt).

One participant stated, "Success needs PRI, schools, and health sector teamwork" (IDI-CHO).

"Train teachers on HPV's role in cancer prevention." (IDI-Principal).

"MBBS doctors should train us." (IDI-ANM).

"Issue certificates as proof… encourage participation." (IDI-Medical Officer).

Additional layers of analysis, such as sentimental analysis, were carried out to enhance comprehension of the qualitative data.

The sentiment analysis shows varied attitudes towards HPV vaccination. Positive sentiments stem from trust in doctors, ASHA workers, and schools. Neutral views reflect limited awareness and a need for more information. Negative sentiments are linked to fear of side effects, cultural hesitancy, systemic barriers, and doubts about vaccine safety and authenticity (Table 3).

Table 3: Sentiment analysis of participants' knowledge, awareness, and barriers related to HPV vaccination and cervical cancer.

Sentiment	Knowledge and awareness	Description	Example quotes
Positive	Institutional trust	Participants willing to vaccinate if recommended by trusted sources.	"If doctor advises, I will take the vaccine." (FGD2-School girl) "we should take the vaccine before symptoms appear." (FGD1- school girl)
Positive	Community engagement	Trust in ASHAs, teachers, and school health workers for vaccine info.	"ASHA didi explains everything about the vaccine." (IDI-father) "if school and doctor say, we will take it." (FGD1- school girl)
Neutral	Awareness gaps	Many participants had limited or no knowledge about HPV or cervical cancer.	"No, I haven't heard of cervical cancer." (FGD1- school girl) "we study environment but not cervical cancer." (FGD1- school girl)
Neutral	Information needs	Desire for more detailed info about vaccine and disease symptoms.	"We will ask why we are given this vaccine." (FGD3- school girl) "what is the purpose of this injection?" (FGD2- school girl)
Negative	Fear-driven hesitancy	Fear of side effects and vaccine safety concerns cause hesitation.	"What if we get fever after the vaccine?" (FGD3- school girl) "will the vaccine be harmful?" (FGD5- school girl)
Negative	Cultural & social hesitancy	Need for family or male permission to vaccinate limits uptake.	"We cannot give permission without asking the father." (IDI-mother) "I'll agree if all parents agree." (IDI-mother)
Negative	Systemic barriers	Vaccine shortages and accessibility issues hinder vaccination efforts.	"In COVID camps, only 40 got vaccines." (IDI-father) "how will disabled students get vaccinated?" (FGD4- school girl)
Negative	Accountability demands	Doubts about vaccine authenticity and responsibility for adverse events.	"Who takes responsibility if something happens?" (IDI-father) "what if they give duplicate vaccines?" (FGD1- school girl)

Table 4: Sentiment analysis of the role of school authorities and collaborative strategies in promoting HPV vaccination.

Sentiment	Theme	Description	Example quotes
Positive	Role of school authorities in HPV vaccination: Education gaps	Participants see schools and teachers as vital educators and want more health sessions with doctors.	"Teachers should explain benefits." (FGD3- school girl) "we need a session with doctors." (FGD1- school girl)
Negative	Role of school authorities in HPV vaccination: School-parent communication gaps	Poor communication between schools and parents causes confusion and missed opportunities.	"School doesn't inform us… my daughter brings tablets home." (IDI-mother)
Positive	Potential collaborative strategies: Community engagement	Trust in ASHA workers, peer influence, and local health workers facilitates vaccine acceptance.	"ASHA didi explains everything about the vaccine." (IDI-father) "friends' actions influence uptake." (FGD1- school girl)
Positive	Potential collaborative strategies: Policy & systems	Respondents support multi-sector coordination (schools, health, NGOs) to improve vaccine uptake.	"Success needs PRI, schools, and health sector teamwork." (CHO)

Analysis of sentiments related to school authorities and collaborative strategies indicates a dichotomy. Participants positively view schools and teachers as important educators and advocate for more health sessions involving doctors. Additionally, there's a positive sentiment towards community engagement, recognizing the influence of ASHA workers, peers, and local health workers in facilitating vaccine acceptance, as well as support for multi-sector coordination among schools, health organizations, and NGOs to improve vaccine uptake. Conversely, negative sentiments are associated with poor communication between schools and parents, which results in confusion and missed vaccination opportunities (Table 4). The conceptual framework depicting the determinants influencing HPV Vaccine uptake among school going-girls is shown in (Figure 1).

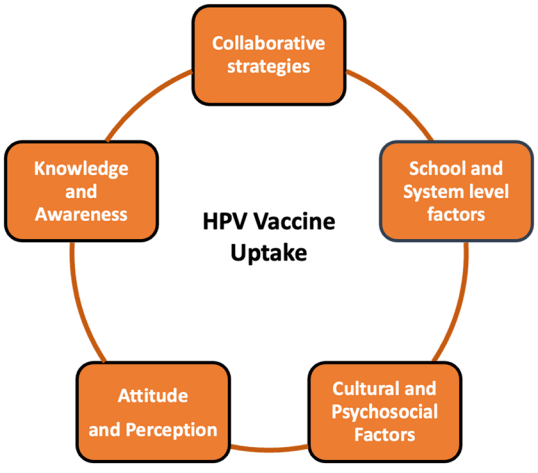

Figure 1: Determinants influencing HPV vaccine uptake among school-going girls.

Discussion

The findings of this study underscore the complex interplay of factors influencing HPV knowledge, attitudes, and vaccination barriers among school-going girls, their parents, and key stakeholders in Ganjam, Odisha. The thematic analysis also exposed considerable gaps in knowledge and awareness of HPV and its vaccine, such as understanding of HPV transmission and vaccine efficacy, echoing findings from other studies in India that also report low HPV Vaccination knowledge [21]. This lack of knowledge is a critical barrier, as seen in the expressed need for more context-specific health information and awareness. Though there is a degree of institutional trust in schools and healthcare providers, concerns about vaccine safety, responsibility, and the likelihood of counterfeit vaccines cause hesitation.

These results are consistent with existing studies demonstrating that parental acceptance of the HPV vaccine among Indian communities is determined by equivalent factors, such as knowledge, trust in healthcare providers, and socio-cultural considerations. These concerns are consistent with studies in other parts of India, which have also identified vaccine safety and cost as major obstacles to HPV vaccine acceptance [22, 23]. Effective strategies to increase HPV vaccine uptake should focus on closing existing knowledge gaps through targeted education and building trust by ensuring vaccine safety and transparency.

The study also underscores the pivotal roles of schools and healthcare providers in promoting HPV vaccination. Participants noted that school-based interventions, coupled with strong recommendations from trusted healthcare professionals, are highly effective in increasing vaccine acceptance. This finding highlights the need for interventions that not only educate but also build trust and

address systemic barriers such as limited accessibility and cost. The findings carry several practical implications:

One key point is the critical need to address awareness gaps and normalize conversations about HPV vaccination among adolescents by integrating comprehensive HPV vaccination education into existing school health program curricula. Another important implication is that the study revealed that many mothers deferred vaccination decisions to fathers, highlighting the influence of male family members in health-related choices. Community-based awareness campaigns should be designed to actively involve fathers and male caregivers in dialogue and decision-making processes, thereby promoting shared parental responsibility and increasing vaccine acceptability.

Furthermore, a lack of effective communication between schools and parents was found to contribute to confusion and missed vaccination opportunities. It is essential to establish structured school-to-parent communication mechanisms such as SMS alerts, circulars, or regular parent-teacher meetings to ensure that families are adequately informed about upcoming vaccination drives and have their concerns addressed in a timely manner. Lastly, Cost and accessibility were identified as major barriers to vaccine uptake. Policymakers should prioritize the inclusion of the HPV vaccine in the UIP to ensure equitable access across socioeconomic groups, especially in underserved and rural regions like Ganjam. This policy-level intervention would significantly reduce the financial burden on families and improve national vaccination coverage.

For instance, there have also been number of cross-sectional studies from India which reported low levels of HPV awareness and knowledge, even among specific populations such as medical students. This study found that a significant proportion of medical students in Delhi lacked basic knowledge about HPV infection and the HPV vaccine, highlighting a need for improved education within healthcare settings [9]. Similarly, studies involving parents of Indian adolescents found knowledge gaps to be central impediment to acceptance of the HPV Vaccine. One of the study reported that parental knowledge was a key predictor of HPV vaccine acceptability [11]. The findings from other countries also align with our study. A cross-sectional study in China revealed that parental awareness and attitudes significantly influence HPV vaccination uptake among adolescents [24]. Mullassery and Posmontier (2023) found that in the United States, lower Asian Indian parental acceptance of HPV vaccination was linked with perceived barriers and unfavorable spousal opinions [25].

In addition to addressing barriers, the study highlights several collaborative and enabling strategies that could be leveraged to improve HPV vaccine uptake. Strengthening partnerships between schools, frontline health workers, and community organizations is critical. Evidence from India and other LMICs shows that school-based delivery models supported by health departments and local governance bodies (e.g., Panchayati Raj Institutions) significantly improve vaccine coverage and acceptance [26, 27]. Community health workers such as ASHAs and ANMs play a pivotal role as trusted intermediaries, bridging information gaps and countering misinformation at the grassroots level [28]. Collaborative engagement of teachers, parents, and peer groups, combined with visible endorsement from local leaders can normalize HPV vaccination and reduce stigma [29]. Moreover, integrating HPV awareness sessions into existing school health programs and involving civil society partners and NGOs for advocacy and mobilization can further enhance outreach and sustainability [30, 31]. These multi-sectoral strategies, emphasizing trust, local ownership, and policy alignment, offer a practical framework for improving HPV vaccine coverage in similar low-resource settings.

The findings from these cross-sectional studies, distinguished by their larger sample sizes, reinforce the importance of knowledge deficits and attitudinal barriers as key obstacles to HPV vaccine uptake. Our qualitative study presents deep, contextualized insights into these factors within the specific setting of Ganjam, Odisha. The alignment of these qualitative findings with the broader trends identified in the quantitative studies suggests that the challenges observed in Ganjam are likely relevant to other populations. This consistency across different research approaches underscores the need for targeted interventions to enhance HPV knowledge, modify attitudes, and promote HPV vaccination.

Conclusions

This study provides key insights into factors influencing HPV vaccine uptake in Ganjam, Odisha. Major barriers included knowledge gaps, cultural hesitancy, fear of side effects, safety mistrust, and systemic issues like poor school-parent communication. However, strong enablers such as trust in healthcare providers (ASHA workers, teachers) and school platforms were identified. Participants stressed the need for localized awareness, HPV education in schools, and community engagement. To improve HPV vaccine coverage, a holistic approach is essential. This includes integrating the vaccine into the Universal Immunization Programme (UIP), training school and health staff, strengthening communication with parents, and fostering intersectoral collaboration. The study underscores the need for culturally tailored,

community-driven strategies that can inform both local and broader efforts toward cervical cancer prevention in low-resource settings.

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Research ethics: The study received ethical approval from the Institutional Academic Ethics Committee, ICMR-Regional Medical Research Centre, Bhubaneswar (Ref: ICMR-RMRC/AEC-2024/002). All procedure in line with ICMR National Ethical Guidelines for Biomedical and Health Research involving Human Participants.

Informed consent: Written informed consent and assent was obtained from participants.

Author contributions: JSK, SKP and MM conceptualized and designed the study. HRD, SP and PS collected the data. HRD and SKP analyzed and interpreted the data. HRD and SK prepared the manuscript. All authors contributed to the drafting and final review of the manuscript. The authors read and approved the manuscript.

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Data availability: The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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