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Impact of health education on cervical cancer and HPV vaccine knowledge in adolescent girls in selected schools in Karnataka-mixed-method

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Abstract
Background: Cervical cancer is the second leading cause of cancer deaths among women in India, with a significant proportion of the female population at risk
Objective: To determine the impact of a health education programme on knowledge regarding cervical cancer and HPV vaccination among adolescent girls, and to explore factors influencing baseline knowledge.
Methods: A sequential explanatory mixed-methods, one-group pre-test post-test+ design was employed for this pilot study, among 60 adolescent girls in selected schools in Karnataka. For the quantitative phase, the samples were selected using a multistage stratified random sampling technique, and for the qualitative phase purposive sampling technique was used. After the pre-test, two focus group discussions (FGDs) with five participants each were conducted to explore factors influencing low knowledge. Post-test was conducted after the health education
Results: Pre-test knowledge was low, with 73.3% of participants having inadequate knowledge. The FGDs revealed key barriers, including a lack of structured health education, misconceptions and myths, and limited parental guidance. Post-intervention, adequate knowledge increased to 83.3%, with significant improvements in knowledge (mean difference = 6.40, $t = -20.342$, $p < 0.001$).
Conclusion: This study found that the health education programme improved adolescent girls' knowledge and attitudes about cervical cancer and HPV vaccination. Before the intervention, participants had inadequate knowledge but after, they showed significant improvement. The study also identified barriers to prevention, including a lack of health education and misconceptions. To achieve sustained behaviour change, comprehensive strategies involving families, schools, and communities are necessary.

Keywords: Cervical cancer, HPV vaccine, health education, adolescent girls, mixed method

Introduction

Cervical cancer, the second most common form of cancer in women worldwide, is on a fast and steady rise, accounting for more deaths in women than any other cancer in the developing world. India accounts for nearly one-third of the global cervical cancer deaths [1]

Cervical cancer involves the malignant change of cervical tissue, primarily due to the human papillomavirus (HPV). HPV types 16 and 18 are particularly common among Indian women and significantly contribute to the disease. This emphasizes the urgent need for better awareness and prevention strategies to mitigate HPV's impact on women's health. [2] The disease is the second leading cause of cancer deaths among women in India, with a significant proportion of the female population at risk. [3]

Women in low- and middle-income nations, including India, experience a greater burden because of restricted access to screening and vaccination. Both married and unmarried women are at risk, and the illness frequently goes unnoticed until it reaches more advanced stages, leading to elevated mortality rates. [4-5] Several key risk factors contribute to this issue, including early marriages that may limit individual autonomy, having multiple sexual partners, which increases exposure to sexually transmitted infections, and experiencing multiple pregnancies that can strain a woman's health. Additionally, factors such as poor genital hygiene, which can lead to infections, malnutrition that compromises overall health, and a general lack of awareness about reproductive health all play crucial roles in increasing susceptibility to the disease.[2,6]

Methodology

This pilot study was conducted using a sequential explanatory mixed-methods design with one group pre-test and post-test study design. The study targeted 60 adolescent girls aged 12–16 years in selected schools in Karnataka for quantitative data collection. The samples were selected using a multistage stratified random sampling technique. Using a structured questionnaire, knowledge regarding cervical cancer and HPV vaccination was assessed. After the pre-test data collection and analysis, qualitative data were collected from 10 girls by conducting 2 focus group discussions (FGD- with 5 participants for each group) and discussing the determinants and influencing factors for lack of knowledge. The samples for qualitative data collection, the samples were selected using non-non-probability purposive sampling technique based on their pre-test knowledge score.

Post-test knowledge was reassessed using the same questionnaire, after providing the health education regarding cervical cancer and HPV vaccination, which lasted for 60 minutes. Further, Quantitative data analysis was done using SPSS 20.0. Qualitative data was analysed using thematic analysis of FGDs identified key barriers and influencing factors for low knowledge. The study adhered to strict ethical guidelines, obtaining approval from school

authorities and ensuring parental consent, participant assent, and confidentiality. Creating awareness can take the women a long way to take care of their health.

Result

The demographic information reveals that the sample is evenly split between school types, with 50% in private schools and 50% in public schools. Participants' ages varied from 12 to 16 years, with the largest group falling within the 12–13 years range (38.3%). A significant majority of adolescents lived with both parents (81.7%), while a smaller percentage resided with a guardian, a single parent, or others. In terms of maternal education, most mothers had completed secondary education (41.7%), followed by primary education (20%) and higher secondary education (18.3%), with fewer mothers having no formal education (11.7%) or graduate-level qualifications (8.3%). The majority of participants lived in urban (45%) and semi-urban (31.7%) regions. Most mothers were homemakers (53.3%), whereas fathers were mainly self-employed (38.3%) or employed in skilled labour (21.7%). A significant number of participants had undergone menarche (90%). Awareness regarding cervical cancer and HPV was notably low, with just 8.3% knowing cervical cancer and none being aware of HPV; additionally, HPV vaccine distribution was minimal, with only 1.7% vaccinated, 16.7% uncertain, and 81.7% not vaccinated. This indicates a lack of understanding and awareness of cervical cancer prevention among the sample, even with a high prevalence of menarche.

Table 1: Association between demographic variables and Pre-Test and Post-Test knowledge level of adolescent girls on cervical cancer and HPV vaccine in selected schools in Karnataka (Pilot study) n=60

S L	Variable	Chi-square Value (χ^2)	df	p-value	Result
1	School Type and Knowledge Level	0.377	2	0.828	NS
2	Age and Knowledge Level	7.743	8	0.459	NS
3	Living with and Knowledge Level	10.897	6	0.092	NS
4	Mother's Education and Knowledge Level	5.142	8	0.742	NS
5	Residence and Knowledge Level	1.517	4	0.824	NS
6	Mother's Occupation and Knowledge Level	4.217	8	0.837	NS
7	Father's Occupation and Knowledge Level	13.410	10	0.202	NS
8	Menarche and Knowledge Level	19.596	2	0.000	S
9	Heard of Cervical Cancer and Knowledge Level	1.983	2	0.371	NS
10	HPV Vaccine Status and Knowledge Level	0.940	4	0.919	NS

N - (Not Significant) S-(Significant)

There was a significant association between attainment of menarche and pre-test knowledge level with p =0.000

Table 2: Comparison of Pre-Test and Post-Test knowledge level of adolescent girls on cervical cancer and HPV vaccine in selected schools in Karnataka (Pilot study) n=60

Knowledge Level	Pre-test		Post-test	
	(n)	(%)	(n)	(%)
Adequate	2	3.3	50	83.4
Moderately Adequate	14	23.3	8	13.3
Inadequate	44	73.3	2	3.3
Total	60	100	60	100

The above table reveals that there was an increased level of knowledge: adequate knowledge from 3.3 % to 83.4% after the health education programme

Table 3: Showing the difference between Pre-Test and Post-Test knowledge score of adolescent girls on cervical cancer and HPV vaccine in selected schools in Karnataka (Pilot study) n=60

Variable	Pre-test Mean ± SD	Post-test Mean ± SD	Mean Difference	t-value	p-value (Sig., 2-tailed)	Result
Knowledge Score (0–12)	4.47 ± 1.94	10.87 ± 1.52	-6.40	-20.342	0.000	Significant

There was a highly significant improvement in knowledge after the educational intervention ($t = -20.342$, $p < 0.001$). Mean score increased from 4.47 to 10.87 out of 12. This indicates a substantial gain in knowledge.

Result of Qualitative analysis

Table 4: Qualitative analysis n-20

Theme	Code	Frequency	Percentage
Lack of awareness and health education	C1	10	50%
Misconceptions and myths	C2	6	30%
Limited parental guidance / Financial issues	C3	4	20%

The majority of girls (50%) identified lack of structured awareness as their main barrier, followed by misconceptions and myths (30%) and Limited parental guidance / Financial issues (20%). Peer influence and misinformation were less frequent but still significant.

Table 5: Thematic analysis – interpretation

Question	Key Findings	Dominant Codes	Themes	Interpretation
Q1. Challenges in knowing about cervical cancer and HPV at your age	Most participants reported a lack of awareness sessions in schools and families. Some attributed this to the absence of nearby health centres.	C1	Lack of awareness and health education	This indicates a significant gap in the delivery of health education for adolescents.

Q2. Why health information is not reaching girls	Participants said that myths, fear, and cultural stigma stopped them from discussing openly.	C2	Misconceptions and myths	Misconceptions and cultural beliefs prevent clear knowledge sharing.
Q3. Reasons for low knowledge among girls	Lack of parental communication and absence of lessons in school were reported as the main reasons.	C3	Limited parental guidance / Financial issues	Both home and school need to improve how they teach reproductive health.

Discussion

The results of this pilot study emphasize both the existing knowledge gaps and the success of an educational intervention regarding cervical cancer and HPV vaccination among adolescent girls in selected schools in Karnataka. The demographic analysis showed a well-balanced representation of participants from various school types, with most students living with both parents and situated in urban or semi-urban areas. Despite a high rate of menarche at 90%, the level of awareness about cervical cancer was only 8.3%, and awareness regarding HPV infection was nonexistent (0%), while a mere 1.7% had received the HPV vaccine. These results align with prior studies in similar contexts that indicated poor knowledge among adolescents and low rates of HPV vaccination due to limited health education exposure and persistent myths [7-8]

Chi-square analysis showed that the majority of demographic factors, such as school type, age, parental education, and occupation, were not significantly related to knowledge levels ($p > 0.05$). Interestingly, knowledge level was significantly associated with menarche ($\chi^2 = 19.596$, $p < 0.001$), indicating that adolescents who had experienced menarche might have been more open to reproductive health information, potentially stemming from personal experience or informal discussions. The absence of a significant connection between other demographic factors and knowledge highlights the importance of implementing targeted educational initiatives for all groups, rather than assuming certain subgroups possess greater knowledge.

The intervention resulted in a highly significant enhancement of both knowledge scores. The average knowledge score rose from 4.47 ± 1.94 to 10.87 ± 1.52 ($t = -20.342$, $p < 0.001$), signifying that most participants transitioned from having inadequate or moderately adequate knowledge to achieving adequate knowledge after the intervention. [7-9] These findings strongly indicate that structured health education programs are very effective in enhancing adolescent knowledge toward cervical cancer and HPV vaccination.

The primary obstacle hindering the prevention of HPV-related cancers is the lack of awareness. Notably, the absence of school-based health education is a critical factor contributing to missed opportunities for early prevention. In this study, it was found that most participants reported that cervical cancer and HPV vaccination were infrequently discussed in their schools, highlighting a significant gap in adolescent health education systems. This finding is consistent with previous research, which has identified adolescent girls as a vulnerable group that relies heavily on structured education to acquire accurate health information.

The second major theme, misunderstandings and myths, emerged as a significant factor contributing to negative attitudes towards cervical cancer prevention. Participants held beliefs that HPV vaccination could cause infertility or severe side effects, or that cervical cancer was solely associated with immoral behaviour. Such myths are frequently perpetuated by inadequate communication strategies and the lack of reliable, culturally sensitive information. In our study, the informational booklet directly addressed these myths, which likely contributed to the significant improvements in knowledge and attitudes observed post-test.

The third theme, characterised by limited parental guidance and financial barriers, underscores the socio-economic and familial factors that impact adolescent health behaviours. Many participants stated that their parents were either uninformed about cervical cancer or did not prioritise vaccination due to financial constraints. Additionally, the discussion highlighted that health decisions for adolescent girls are often made by parents or guardians, emphasising the need for parental education and involvement in preventive health programs.

The qualitative findings complement the quantitative outcomes by highlighting the contextual and socio-cultural barriers affecting adolescent girls' knowledge and attitudes. Overcoming these barriers through comprehensive, multi-level interventions is essential for enhancing HPV vaccine uptake and mitigating the burden of cervical cancer. This mixed-methods approach illustrates that educational interventions can yield immediate knowledge gains, yet lasting change necessitates sustained community engagement and systemic support.

Limitations

- The research was constrained by its limited sample size ($n = 60$) and the selection of only specific schools within a single area, which limits the applicability of the results.

Recommendations

- Future studies should involve larger and more diverse populations from various regions to enhance generalizability.
- School-based educational programs should be encouraged to dispel myths, enhance awareness of cervical cancer and HPV vaccination.

Conclusion

This investigation revealed that a health education programme was effective in enhancing adolescent girls' understanding and perceptions of cervical cancer and HPV vaccination. Prior to the intervention, participants exhibited insufficient knowledge; however, a notable improvement was observed subsequently. The study also highlighted barriers to prevention, which included insufficient health education and misconceptions. To facilitate long-term behavioural modification, comprehensive strategies involving families, schools, and communities are required.

Declaration

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