



IMPACT OF A DIGITAL EDUCATIONAL INTERVENTION ON KNOWLEDGE, ATTITUDE, AND BEHAVIOURAL INTENTIONS REGARDING HPV, CERVICAL CANCER, AND HPV VACCINATION AMONG NON-MEDICAL FEMALE UNIVERSITY STUDENTS: A QUASI-EXPERIMENTAL STUDY

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Abstract

Background

Cervical cancer is the second most common cancer among women in India, primarily driven by persistent infection with high-risk Human Papillomavirus (HPV) types. Despite the availability of effective prophylactic HPV vaccines, awareness remains sub-optimal, particularly among non-medical young adults. This study evaluated baseline knowledge regarding HPV and cervical cancer among non-medical female university students and assessed the effectiveness of a digital educational intervention on their knowledge, attitude, and behavioural intent.

Methods

A single-arm, pre- and post-intervention quasi-experimental study was conducted among 100 non-medical female students selected via purposive sampling. Baseline knowledge was recorded using a pre-tested, structured electronic questionnaire administered through Google Forms. A comprehensive digital educational presentation was delivered via email. Post-intervention evaluation utilized identical knowledge assessment questions and a 5-point Likert scale to gauge attitudinal shifts. Data were analysed using descriptive statistics and McNemar's test to determine statistical significance ($p < 0.05$).

Results

At baseline, while 75% of participants were aware of cervical cancer, deep health literacy was critically low: only 51% knew it was caused by a virus, and just 31% understood the link between HPV and cervical cancer. Only 21% identified high-risk HPV types (16 and 18). Although 48% knew a vaccine existed, only 16% could name specific vaccines, and a mere 12% were vaccinated. Post-intervention, McNemar's test demonstrated a statistically significant improvement in all core knowledge domains ($p < 0.001$). Highly favourable behavioural intent was observed, with 95% of participants expressing willingness to undergo vaccination and 88% committing to peer advocacy.

Conclusion

Knowledge regarding HPV-induced oncogenesis and vaccination among non-medical female students is critically low despite high general literacy. A brief, targeted digital intervention successfully bridged knowledge gaps and significantly enhanced vaccine acceptance. Integrating structured HPV awareness campaigns into university orientation programs is urgently needed to reduce the cervical cancer burden in India.

Keywords: Cervical Cancer, Human Papillomavirus, HPV Vaccine, Health Education, Knowledge, Attitude, Young Adults.

1. Introduction

Cervical cancer represents a major global public health challenge, accounting for over 500,000 new diagnoses and 275,000 deaths annually worldwide. Low- and middle-income countries (LMICs) bear more than 85% of this global disease burden, with India contributing significantly to mortality rates due to delayed diagnosis and inadequate screening mechanisms. Overwhelming epidemiological and molecular evidence establishes persistent infection with high-risk oncogenic Human Papillomavirus (HPV) types—predominantly HPV-16 and HPV-18—as the primary cause of cervical malignancies. Primary prevention through prophylactic HPV vaccination offers a highly effective strategy to curb viral transmission and subsequent dysplasia. Commercially available vaccines target adolescent girls and young women aged 9 to 26 years. However, in India, HPV vaccines are not yet universally incorporated into the National Immunization Schedule, largely due to historical trial suspensions, financial constraints, socio-cultural stigmas surrounding sexually transmitted infections, and a pervasive lack of public awareness.

Non-medical university students represent a critical demographic. As young adults navigating reproductive health choices, their knowledge directly influences personal vaccination uptake and peer-to-peer health promotion. While prior literature has evaluated medical trainees, research focusing on non-medical female students in Tier-2 Indian cities remains sparse.

Objectives

- To assess the baseline knowledge and awareness regarding HPV transmission, oncogenesis, and vaccination among non-medical female university students.
- To evaluate the impact of a structured digital educational intervention on participant knowledge, attitude, and behavioural intent toward HPV vaccination.

2. Materials and Methods

2.1 Study Design and Setting

A single-arm quasi-experimental (pre- and post-intervention) study was conducted in a private University of Meerut, Uttar Pradesh, India.

2.2 Study Population and Sampling

The study population comprised 100 non-medical female students enrolled across various non-medical faculties (e.g., arts, science, commerce, management). A purposive sampling technique was used.

- **Inclusion Criteria:** Non-medical female undergraduate/postgraduate students willing to provide informed consent.
- **Exclusion Criteria:** Students with a prior background in medical or allied health sciences, and those who failed to complete both pre- and post-intervention surveys.

2.3 Educational Intervention and Procedure

Due to COVID-19 pandemic restrictions preventing physical group assemblies, data collection and educational delivery were executed entirely through digital channels:

- **Pre-Intervention Phase:** Participants received a semi-structured electronic questionnaire via Google Forms to establish baseline sociodemographic profiles and knowledge levels across 16 thematic questions. Content validity was established by a panel of three community medicine experts, and the tool was pre-tested via a pilot study among 10 students (excluded from the final analysis) to ensure clarity.
- **Educational Intervention:** Following baseline completion, an educational 15-slide PowerPoint presentation detailing HPV biology, transmission routes, clinical manifestations (genital warts, cervical dysplasia), target age groups for vaccination, and vaccine safety was distributed directly to participants' registered email addresses. The material was designed to be thoroughly reviewed within approximately 15 minutes.
- **Post-Intervention Phase:** Automated electronic reminders were sent 72 hours post-delivery to ensure participants reviewed the material. A post-intervention questionnaire featuring identical knowledge retention questions and an additional 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) was administered to measure changes in attitude, doctor consultation intent, and peer advocacy.

2.4 Statistical Analysis

Data were exported from Google Sheets into Microsoft Excel and analysed using SPSS Version 26.0. Since the final sample size tracking maintained a complete response rate from all initial participants (N = 100), categorical variables are expressed as absolute frequencies and percentages interchangeably.

To evaluate the true efficacy of the digital intervention, participant's correct vs. incorrect responses for identical pre- and post-intervention thematic questions were cross-tabulated. McNemar's test for paired nominal data was applied to determine statistical significance. Attitudinal data from the 5-point Likert scale were condensed into three categories (Agree, Moderately Agree, Disagree) for descriptive clarity. Statistical significance was set at $p < 0.05$

3. Results

3.1 Socio-Demographic Profile

Out of 100 participants, 91% resided in urban areas, while 9% belonged to rural backgrounds. Family structure analysis revealed that 78% lived in nuclear families and 22% resided in joint families.

3.2 Baseline vs. Post-Intervention Knowledge Assessment

The digital educational intervention resulted in highly significant improvements across all evaluated health literacy domains.

- **Cervical Cancer Awareness:** At baseline, 75% of participants were aware of cervical cancer, with social media serving as the primary source of information (61%). Post-intervention, general awareness reached 100% ($p < 0.001$).
- **Etiology and Pathogenesis:** At baseline, only 51% correctly identified a virus as the cause of cervical cancer, while deep understanding of how HPV specifically relates to oncogenesis was critically missing (31%). Post-intervention, correct identification of viral etiology and the HPV-cancer link rose to 94% and 91% respectively ($p < 0.001$).
- **Strains and Transmission:** Baseline identification of high-risk strains (HPV 16 and 18) was the weakest area at just 21%. This improved significantly to 87% post-intervention ($p < 0.001$). Similarly, knowledge that HPV causes genital warts rose from 50% to 96% ($p < 0.001$).

Parameter Evaluated	Pre-Intervention Correct (%)	Post-Intervention Correct (%)	McNemar χ^2	p-value	Primary Baseline Source / Context
Awareness of Cervical Cancer	75%	100%	23.04	<0.001	Social Media (61%), Print Media (23%)
Identified Viral Etiology	51%	94%	41.02	<0.001	Hereditary (14%), Bacteria (14%), Unaware (21%)
Awareness of Transmission Route	74%	98%	22.09	<0.001	Unprotected Sexual Intercourse
Knowledge of HPV-Cervical Cancer Link	31%	91%	58.01	<0.001	High baseline knowledge deficit
Identified High-Risk Strains (16, 18)	21%	87%	64.06	<0.001	Unaware of strain differences (51%)
Awareness of Vaccine Availability	48%	99%	49.08	<0.001	Social Media (51%), Family/Print (40%)
Knowledge of Specific Vaccine Names	16%	85%	67.01	<0.001	Poor specific product knowledge

Note: Baseline vaccination coverage was extremely low; only 12% of participants were vaccinated, and merely 10% of those with eligible female siblings (n=52) reported sibling vaccination.

3.3 Post-Intervention Attitudinal and behavioural Shifts

Following the intervention, participants completed a Likert-scale evaluation to capture changes in subjective attitudes and prospective behaviours.

Evaluation Metric (5-point Likert Scale)	Strongly Agree (%)	Moderately Agree (%)	Disagree (%)
Resolution of doubts regarding HPV & vaccine	88%	12%	0%
Intent to consider receiving HPV vaccination	95%	5%	0%
Intent to consult a physician prior to vaccination	57%	43%	0%
Intent to advocate/inform peers about HPV vaccine	88%	12%	0%

4. Discussion

Persistent infection with high-risk human papillomavirus —principally HPV-16 and HPV-18—is firmly established as the primary cause of cervical carcinoma worldwide. In India, cervical cancer remains a major public health burden due to sub-optimal screening mechanisms and limited public health messaging targeting primary prevention.

Our findings reveal a stark contrast between general awareness and detailed health literacy among non-medical female students. While 75% had heard of cervical cancer, deep understanding regarding viral etiology (51%), high-risk strains (21%), and vaccine specifics (16%) was severely lacking. This supports observations by Rashid et al. (2016) and Mehta et al. (2013), who reported that formal non-medical education does not automatically ensure adequate reproductive health knowledge.

Social media was identified as the primary information channel for over 60% of students. While social media broadens reach, it carries the risk of spreading unverified information. Public health agencies should actively utilize digital channels to deliver evidence-based health education to young adult demographics.

The low baseline vaccination rate observed in our cohort (12%) and among their female siblings (10%) reflects broader national challenges, including high out-of-pocket costs, lack of physician recommendations, and the absence of universal national vaccine program coverage. Notably, our targeted digital intervention led to strong post-intervention outcomes, with 95% of participants expressing willingness to undergo vaccination and 88% committing to peer advocacy. This confirms that digital health education can effectively reduce vaccine hesitancy and build health literacy.

4.1 Limitations of the Study

While this study successfully demonstrates the short-term benefit of a low-cost educational intervention, several limitations must be acknowledged:

1. **Lack of a Control Group:** Without a parallel un-interventined control arm, we cannot completely rule out external confounding factors, though the short timeline between surveys minimizes this risk.
2. **Social Desirability and Intent vs. Behaviour:** The post-intervention assessment measures behavioural *intent* rather than actual vaccine uptake. Because HPV vaccination requires substantial out-of-pocket expenditure and multiple doses in India, positive intent may not translate directly into clinical behaviour.
3. **Sampling and Generalizability:** The use of purposive sampling within a single university cohort in a Tier-2 city restricts generalizability to the broader, more socio-economically diverse population of female youth across India.

5. Conclusion and Recommendations

Conclusion

Non-medical female university students display low baseline awareness regarding HPV transmission, oncogenesis, and prophylactic vaccination, leading to low coverage rates. However, a low-cost digital educational intervention executed during a phase of high digital reliance proved highly effective at resolving knowledge gaps and fostering positive attitudes toward vaccination.

Recommendations

- **Curricular Integration:** Universities should incorporate structured reproductive health modules into non-medical orientation programs.
- **Digital Campaigns:** Health authorities should deploy targeted social media initiatives to reach young adult populations.
- **Policy Action:** Expanding subsidized HPV vaccination access will help bridge the gap between positive intent and actual vaccine uptake.

Declarations & Ethical Considerations

- **Ethical Approval:** The research protocol, questionnaire, and consent forms were formally submitted and approved by the Institutional Ethics Committee
- **Informed Consent:** Digital informed consent was obtained from all participants prior to study enrollment.

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