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Effect of School-based Human Papillomavirus (HPV) Vaccination on Adolescent Girls' Knowledge and Acceptability of the HPV Vaccine in Ibanda District in Uganda

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Abstract

From 2008 to 2011, schoolgirls were vaccinated against HPV in two districts in Uganda following sensitization. This study assessed girls' knowledge of cervical cancer and HPV vaccine, and their acceptance of future vaccination of friends and hypothetical daughters. The cross-sectional, mixed methods comparative study was conducted in two districts. Univariate, bivariate, logistic regression and thematic analyses were done. HPV vaccination was positively associated with knowledge (Crude OR: 5.31, CI: 3.19–8.86; $p = 0.000$); but knowledge (Adjusted OR: 1.13, CI: 0.56–2.28; $p = 0.73$) and HPV vaccination (Adjusted OR: 0.92, CI: 0.16–5.36; $p = 0.93$) did not predict vaccine acceptability. Seemingly important motivations for vaccine acceptance were: its role in cancer prevention and advancement of reproductive health, minimal side effects, and positive peer role models. Major deterrents to vaccine acceptance were: rumours and misconceptions about possible side effects, perceived inadequate information about vaccine, and fear of side effects.

Keywords

Adolescent girls; knowledge; acceptability; vaccine; Uganda

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Contribution of Authors

Turiho played a leading role at all stages of the study. Okello participated in writing the research proposal, qualitative data analysis and reviewing manuscripts. Muhwezi participated in writing the proposal, statistical data analysis and reviewing manuscripts. Harvey, Byakika-Kibwika and Meya contributed during statistical data analysis and reviewing manuscripts. Katahoire participated in proposal writing and reviewed manuscripts. All authors mentioned approved the final version of the manuscript.

Introduction

Cervical cancer is the second most common cancer among women between 20 and 44 years worldwide[1]. Globally, about 500,000 new cases and about 274,000 deaths occur annually. More than 80% of these deaths occur in developing countries, where cervical cancer is the leading cause of cancer deaths among adult women. This is projected to increase to 90% by 2020[2]. A 2004–2006 study of sexually active young women seeking health services at a health centre in Kampala, Uganda found 75% infected with one or more HPV types[3]. Cervical cancer is predominantly caused by persistent infection with HPV types 16 and 18[1].

Two prophylactic HPV vaccines, Cervarix (bivalent) and Gardasil (quadrivalent), have been proven to be 90% effective in safely preventing HPV 16 and 18 infections, which together account for about 70% of cases worldwide[4]. Acceptability studies indicate an overall positive response towards HPV vaccination of young adolescent girls[2,5–7]. However, most previous acceptability studies involve parents and young adults. The views of young adolescents have rarely been addressed. Only one such published study was conducted in Uganda. It adopted a purely qualitative definition of acceptability as the girls' willingness or reluctance to be vaccinated and to complete all three doses[8].

Various sectors of the public have raised concerns that could potentially deter HPV vaccine acceptability. The concerns are: safety and unknown side effects[9–11]; efficacy[6]; high cost[7]; the inconvenience of taking the vaccine in three doses over a period of six months[7]; possibility of adolescent girls mistakenly believing the HPV vaccine to offer protection against all STIs and thus being encouraged to engage in sexual activity[11]; and the possibility of jeopardizing the future fertility of vaccinated girls[10]. In some environments, vaccination programs targeting young women have been misunderstood as attempts to control fertility or plots to reduce the population of certain groups[12].

From 2008 to 2011, cohorts of adolescent girls in Ibanda and Nakasongola districts in Uganda were vaccinated annually against HPV. This was part of a demonstration project by the Government of Uganda and the Program for Appropriate Technology for Health (PATH) to evaluate different HPV vaccine delivery strategies. A school-based HPV vaccine delivery strategy was adopted in Ibanda targeting girls enrolled in primary grade five (P5). In Nakasongola, the HPV vaccine was delivered during the routine Child Days Plus (CDP) program, targeting girls of at least 10 years. Each eligible girl was to receive three doses of the vaccine administered in month 1, month 2 and month 6[13]. The vaccination with Cervarix followed sensitization about cervical cancer and HPV vaccination to enhance acceptability. We tested the hypothesis that HPV vaccine acceptability would be higher among vaccinated girls than unvaccinated girls since the former were sensitized. We expected vaccinated girls to have higher knowledge, perceive higher susceptibility to cervical cancer, perceive higher severity of cervical cancer and ultimately consider future HPV vaccination more acceptable as a result of the sensitization.

Methods

Study design, sample and population

This comparative, cross-sectional mixed methods study was conducted between November and December 2011 in Ibanda as a vaccination district and Mbarara as a comparison district. The two share borders and are largely similar socio-culturally. Using a formula for sample size calculation in comparative studies[14], we sampled 800 girls in P5 and P6 for the survey but located 777 (444 in Ibanda and 333 in Mbarara) during data collection. The sample of vaccinated girls was drawn from the 2010 and 2011 cohorts. The 2008 and 2009 vaccination cohorts were excluded because by the time of the study, those girls had completed primary school and it was difficult to trace them. Using multi-stage sampling, 16 schools, stratified by rural-urban location were selected in Ibanda and the same number in Mbarara. In Ibanda, all assenting primary five and six girls present on the survey day that had received at least one dose of the HPV vaccine were recruited. Similar criteria were followed in Mbarara except that girls there never received the HPV vaccine. Five FGDs each with 8–12 vaccinated girls in P5 or P6 were conducted in Ibanda, involving five schools that had not been sampled for the survey. FGD participants were selected purposively with the help of teachers, targeting self-confident and uninhibited girls who could talk freely in a group. Prior to the interviews, written consent was obtained from parents of the targeted girls.

Data collection

Selected girls were assembled in one or two rooms on the day of the survey. A pre-tested and translated self-administered questionnaire was used. Individually and confidentially, each girl selected for the survey filled the questionnaire under close supervision of a research assistant (RA). The questionnaire excluded respondent's name to ensure anonymity of data. Data was collected on socio-demographic characteristics. Acceptability of HPV vaccination was assessed by asking two hypothetical questions to both groups of girls; would they advise their friends to get HPV vaccine and would they be willing to let their daughters to be vaccinated in future? Each question was rated on a three-point Likert scale. Knowledge of cervical cancer and HPV vaccine was assessed through responses to 13 factual statements based on information from the print materials used for community sensitization prior to HPV vaccination. Some statements were correct while others incorrect; each statement had three answer choices. Perceived susceptibility to cervical cancer and perceived severity of cervical cancer were each assessed using four questions adopted from a previous study about HIV/AIDS[15]. For each perceived susceptibility and perceived severity question, a three-point Likert scale was used. The Principal Researcher or a trained RA moderated the FGDs using a FGD guide; a RA took notes of and tape-recorded the proceedings. FGDs mainly discussed the girls' observations during the vaccination, experiences of vaccination and attitudes about the vaccine.

Data management and analyses

Quantitative data were entered and cleaned using EpiData, then analysed using SPSS v. 16.0[16]. Data were summarized into frequencies, means and standard deviations (SD). Data on socio-demographics, knowledge, perceived severity and susceptibility to cervical cancer and vaccine acceptability were compared between vaccinated and unvaccinated girls using

Pearson's χ^2 (with Yates' correction). Logistic regression was used to adjust for possible interaction and confounding. Odds ratios (ORs) and confidence intervals (CI) were generated and statistical significance was set at 0.05.

Qualitative data was transcribed, word processed and entered into Atlas.ti[17] for coding and analysis. Codes were developed based on the broad themes identified from the data. The codes were used to retrieve segments of the data. Memos were written describing the patterns and variations in the different segments of retrieved data. Data matrices were drawn out of the retrieved data sets according to the plan of analysis. Verbatim quotations from the data were used to highlight key study findings. Qualitative data was used to interpret quantitative data.

Ethical issues and approval

Ethical and regulatory approval was obtained from the Higher Degrees Research and Ethics Committee of Makerere University College of Health Sciences and the Uganda National Council for Science and Technology. The relevant local government and school authorities gave administrative permission.

Results

Respondents' socio-demographic characteristics and HPV vaccination status

The overall mean age of girls was 13.4 years (SD = 1.41). The mean age of vaccinated girls (13.4 years, SD = 1.41) and unvaccinated girls (13.3 years, SD = 1.40) did not significantly differ. The overall age range of girls was 9–19 years. Data in Table 1 describes respondents' likelihood to support the HPV vaccination according to their HPV vaccination status and socio-demographic characteristics. Respondents who were likely to support the vaccination and those who were unlikely to support it did not significantly differ on any of the assessed characteristics.

Knowledge of cervical cancer and HPV vaccine, perceived susceptibility to cervical cancer and perceived severity of cervical cancer

Knowledge about cervical cancer and the HPV vaccine was significantly more among vaccinated girls. Vaccinated and unvaccinated girls did not significantly differ on levels of perceived susceptibility to cervical cancer. Vaccinated and unvaccinated girls also did not significantly differ on perceived severity of cervical cancer (Table 2).

Acceptability of HPV vaccination

More unvaccinated girls [308 (92.5%)] compared to vaccinated girls [397 (89.4%)] were likely to support HPV vaccination although the difference was not significant (Crude OR: 0.69, CI: 0.41–1.14; $p = 0.14$). Girls who supported the HPV vaccine and those who did not support it did not significantly differ in terms of knowledge of cervical cancer and HPV vaccine (Crude OR: 0.79, CI: 0.43–1.47; $p = 0.46$), perceived susceptibility to cervical cancer (Crude OR: 1.17, CI: 0.69–1.98; $p = 0.56$) and perceived severity of cervical cancer (Crude OR: 1.30, CI: 0.74–2.29; $p = 0.36$).

In a regression model, 705 (90.7%) of girls over all were likely in the future to support HPV vaccination of their daughters and friends leaving 72 (9.3%) of girls unlikely to support vaccination. Vaccination against HPV did not predict adolescent girls' acceptability of the HPV vaccine even after controlling for the other predictor variables (Table 3). None of the hypothesized predictors, independently or in interaction with HPV vaccination status, predicted acceptability of the vaccine.

Motivations for acceptability of HPV vaccination

All the FGDs depicted vaccinated girls' positive attitudes about HPV vaccination. The primary motivation for HPV vaccine acceptability was appreciation of its preventive role against cervical cancer; a disease that girls had been informed was painful, deadly and associated with future childlessness. Participants who supported vaccination of their friends and hypothetical daughters did so hoping to protect their uteri and cervices from cancer for them to bear children in future. They apparently understood cervical and uterine cancers to be synonymous.

> *We were well taught by our teachers and health workers that the vaccine would be of benefit to us by preventing cervical cancer…* (FGD at School 4)

Girls realized that side effects were rare as highlighted during the pre-vaccination sensitization. Some girls were initially reluctant to take the HPV vaccine but later accepted and turned up for subsequent doses after realizing that those who received the first dose were not harmed. Moreover, some girls were reportedly encouraged by their friends to get vaccinated without clearly understanding its purpose.

Deterrents to acceptability of HPV vaccination

In spite of the pre-vaccination sensitization, introduction of the HPV vaccine triggered several negative rumours that threatened acceptability among targeted adolescents and their parents. Every FGD mentioned some girls who refused vaccination because they heard that those vaccinated could become barren or would face a greater risk of life-threatening childbirth complications. A participant at School 2 believed that after vaccination, she would give birth to only twins. Some parents were reported to have discouraged or barred daughters from HPV vaccination due to the misinformation.

> *I know some girls who did not get vaccinated because they thought that the vaccine against HPV would prevent them from producing children or getting pregnant in future… They said it destroys a woman's eggs (ovaries) so that she does not produce children* (FGD participants at School 4)

Some FGD participants had reportedly heard that HPV vaccine causes cervical cancer, which would ultimately kill the vaccinated person. Others had heard that HPV vaccination was a disguised plot to enhance infertility or gradually kill those vaccinated in unexplained ways. Some of the vaccinated girls worried that it would affect their menstruation. They heard rumours that HPV vaccination would cause heavy menstrual flow and menstrual pain. A participant at School 4 mentioned a friend who had confided in colleagues that her menstrual periods were lasting longer after getting the HPV vaccine. Girls reported that while being prepared for HPV vaccination, they felt anxious that it would cause pain and

irritation. Many reported pain and swelling at the injection site and heard friends complaining about it for some time after the injections. Initial swelling on injection sites caused worries of probable long-term physical damage. However, the worries were usually short-lived.

> *I first feared taking the injection because I thought my arm would swell and I would not do any work or go to school… I thought I would bleed very much after the injection but there was no bleeding… My friend told me that it was painful and that worried me so much…* (FGD participants at School 5)

Discussion

Consistent with expectation in our study, significantly more vaccinated girls were knowledgeable about cervical cancer and HPV vaccine. This was in agreement with a post-vaccine introduction study that reported a positive association of HPV vaccination with knowledge of cervical cancer and HPV vaccine[18]. This study suggested that HPV vaccine sensitization messages were clearly disseminated and understood by recipients. Although significantly more vaccinated girls in our study were knowledgeable about cervical cancer and the HPV vaccine, knowledgeable girls were a minority in both groups. For the unvaccinated girls, this was not surprising since they had not been exposed to information about cervical cancer and the HPV vaccine. Low knowledge scores have been documented elsewhere among people not sensitized about cervical cancer and HPV vaccine and among people not vaccinated against HPV[10,19]. Surprisingly, our study found low knowledge scores among vaccinated girls who were exposed to information regarding cervical cancer and the HPV vaccine. This suggests that the pre-vaccination sensitization in Ibanda did not greatly increase the girls' knowledge. Future communication strategies in vaccination programs need to be re-visited with the view to improving their effectiveness.

Our findings did not confirm a positive relationship between knowledge and HPV vaccine acceptability. This is different from findings of other studies that report: knowledge as a significant predictor of readiness to accept HPV vaccine[20] and high vaccine coverage of girls[18]; low knowledge as being associated with incomplete vaccination and low immunization coverage[18–21] as well as girls' high risk of not being vaccinated[22]. However, our findings agree with other previous studies which contend that knowledge about cervical cancer, HPV and HPV vaccine is not always the primary motivation for HPV vaccine acceptance[18–23]. One such study reported that the primary motivation of parents to have their daughters vaccinated was the perception that the HPV vaccine promotes good health including cancer prevention as opposed to specific knowledge of cervical cancer or HPV[24].

Indeed in our study, evidence from FGDs suggested that the high acceptability of the HPV vaccine among HPV vaccinated girls was mainly due to the appreciation of the preventive role of the vaccine against cervical cancer. Appreciation of this role of HPV vaccine has been documented in other studies as a principal reason for adolescent and parental acceptance of HPV vaccines[8,10,19,22,25]. Vaccinated girls in our study also believed that HPV vaccination guaranteed their future fertility. Girls' desire to protect their uteri so that they could bear children in future has also been reported elsewhere as a motivation for

accepting HPV vaccination[8]. Our findings suggest that future marketing of HPV vaccines should emphasize its two perceived important roles: cancer prevention and protection against a disease that could jeopardize a woman's fertility.

FGDs indicated that some vaccinated girls were mainly encouraged by their friends to get vaccinated against the HPV without fully understanding the vaccination. The positive role of peers in encouraging acceptability of vaccination among friends highlights the role that peers can play in promoting HPV vaccination in Uganda and beyond. Peer influence is a known positive and negative factor in adolescent acceptability of HPV vaccine in other studies[25–26]. More investigation is needed to assess the viability of peer education as a communication strategy in future HPV vaccination programs. The FGDs also indicated that some girls were initially reluctant to receive the HPV vaccine but later accepted subsequent doses after realizing from experiences of colleagues who took the first dose that the vaccine was not harmful. This behaviour has previously been noted among adolescents and their parents in other studies[8,22]. It is an important lesson for future vaccination program design in that there should be a provision for catch-up vaccination of those who later accept to be vaccinated after missing the initial dose. These results suggest that exposure to factual information about cervical cancer and HPV vaccine is not a sufficient condition for shaping adolescents' attitudes about the HPV vaccination. There are other seemingly relevant factors including: perceived role of the HPV vaccine in cancer prevention and advancement of reproductive health, observed minimal side effects, and positive peer influence. More research is needed to clarify the role of these factors and the aspects of knowledge that advance acceptability of the HPV vaccine.

Contrary to expectation, HPV vaccination tended to predict low support for the vaccination. FGD results offer a possible explanation for this. Although vaccinated girls expressed generally favorable attitudes about vaccination, the negative rumours mentioned by FGD participants seem to have generated anxiety among both targeted adolescents and their parents. Anxiety expressed in FGDs about the HPV vaccine such as infertility concerns[8,10,22] and unknown side effects[10–11,19,22] appear in other studies as potential deterrents to HPV vaccine uptake. The negative influence of rumours or misinformation on HPV vaccine acceptance has been documented in another study[21]. Future vaccination programs should have strategies to counteract rumours or misinformation. The revelation during FGDs that some girls were influenced by friends to take the HPV vaccine without clearly understanding its purpose suggests that some vaccinated individuals may not have embraced vaccination wholeheartedly. This could also partially explain the lower acceptance of vaccination among vaccinated girls. Lack of understanding of the essence of HPV vaccination among targeted adolescents at the time of vaccine delivery has been reported in another study in Uganda[8], suggesting inadequate preparation of girls for HPV vaccination. Other studies have implicated perceived inadequacy of information about the HPV vaccine as a major reason for adolescents' unwillingness to be vaccinated or parents' reluctance to endorse HPV vaccination[21,27]. Future programs should adequately invest in preparing communities for HPV vaccination.

Participants in FGDs mentioned anxiety about pain during their preparation for HPV vaccination. Pain and swelling of the injection site on the arm though they were usually

short-lived were common complaints. There was mention of a case of an altered menstrual cycle following HPV vaccination. These and other adverse effects like; dizziness and headache have been reported in other studies[8,28]. Although they are usually brief, non-serious and uncommon, the complaints are potential threats to acceptability. Future programs should include sensitization messages that clearly articulate the non-serious nature of the vaccine's known adverse effects, their remedies, and their transient nature. The programs should build on successes registered in the HPV vaccine demonstration project to prove to the doubting community members that vaccination is not harmful.

Methodological Limitations

Acceptability was assessed hypothetically, which may not necessarily translate into actual acceptance during real interventions. Acceptability was measured using only two questions leading to a limited range of acceptability scores that may have undermined the strength of its observed cause-effect relationship with the predictor variables. The exposed district and the comparison district were adjacent, which may have led to some contamination of the comparison sample with information that was disseminated during the pre-vaccination sensitization. There was a possibility of recall bias since some adolescents were interviewed one year after vaccination. The age design of the study whereby the same age cohort was simultaneously studied poses a limitation hence; longer term follow-up studies will be needed in future. Selection of FGD participants with the help of their teachers targeting girls sharing certain characteristics may have biased the results since those girls could have shared attitudes associated with shared characteristics. The study lacked a qualitative basis for interpreting survey results in the control district since FGDs were only done in the intervention district.

Conclusion

HPV vaccination did not predict vaccine acceptability. Significantly, more vaccinated girls were knowledgeable but knowledge was not positively associated with HPV vaccine acceptability. Relatively few vaccinated girls were knowledgeable, yet the vaccine acceptability scores were generally high. This highlighted the important role of factors other than knowledge in shaping adolescent girls' attitudes towards HPV vaccine. Several seemingly major motivations for and deterrents to acceptability of the HPV vaccine were identified.

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Table 1

Background characteristics of respondents by acceptability of HPV vaccine

Background characteristics	Acceptability of HPV vaccine (N = 777)		*p* value
	Likely to support HPV vaccine (n = 705) *(%)*	Unlikely to support HPV vaccine (n = 72) *(%)*	
HPV vaccination status			
Vaccinated	397 (56.3)	47 (65.3)	0. 14
Unvaccinated	308 (43.7)	25 (34.7)	
Age			
Younger adolescent (9–14 years)	561 (79.6)	58 (80.6)	0.84
Older adolescent (15–19 years)	144 (20.4)	14 (19.4)	
Kind of school			
Exclusively day	540 (76.6)	59 (81.9)	0.30
Both day and boarding	165 (23.4)	13 (18.1)	
Location of school			
Rural	476 (67.5)	53 (73.6)	0.29
Urban	229 (32.5)	19 (26.4))	
Class			
Primary six	423 (60.0)	41 (56.9)	0.62
Primary five	282 (40.0)	31 (43.1)	

Notes:

a. For all background or predictor variables, likely to support odds are divided by unlikely to support odds

b. Significance at $p \leq 0.05$

Table 2

HPV vaccination status by Knowledge of cervical cancer and HPV, perceived susceptibility to cervical cancer and perceived severity of cervical cancer

	Knowledge (N = 777)		
Vaccination status	Knowledgeable (n = 127) *(%)*	Not knowledgeable (n = 650) *(%)*	Crude OR (95% CI)
Vaccinated	108 (85.0)	336 (51.7)	5.31 (3.19–8.86)***
Unvaccinated	19 (15.0)	314 (48.3)	1.0
	Perceived susceptibility to cervical cancer (N = 775) [+]		
Vaccination status	**High susceptibility (n = 261) *(%)***	**Low susceptibility (n = 514) *(%)***	**Crude OR (95% CI)**
Vaccinated	149 (57.1)	294 (57.2)	1.00 (0.74–1.35)
Unvaccinated	112 (42.9)	220 (42.8)	1.0
	Perceived severity of cervical cancer (N = 773) [+]		
Vaccination status	**High severity (n = 612) *(%)***	**Low severity (n = 161) *(%)***	**Crude OR (95% CI)**
Vaccinated	344 (56.2)	98 (60.9)	0.83 (0.58–1.18)
Unvaccinated	268 (43.8)	63 (39.1)	1.0

Notes:

a. For each outcome variable, 2nd column odds are divided by 3rd column odds

b. [+] Figures do not add up to 777 because of missing cases

c. *** Significant at $p \leq 0.001$

Table 3

Predictors of adolescents' acceptability of HPV vaccine derived by logistic regression analysis

Respondents' characteristics	Adjusted ORs (95% CI)
Vaccinated against HPV	0.92 (0.16–5.36)
Knowledgeable about cervical cancer and HPV vaccine	1.13 (0.56–2.28)
Perceiving high susceptibility to cervical cancer	0.95 (0.50–1.83)
Perceiving high severity of cervical cancer	0.57 (0.29–1.10)
Vaccinated, knowledgeable about cervical cancer and HPV vaccine [x]	1.52 (0.28–8.25)
Vaccinated, perceiving high susceptibility to cervical cancer [x]	0.75 (0.25–2.30)
Vaccinated, perceiving high severity of cervical cancer [x]	3.22 (0.79–13.18)

Notes:

a. Number of observations = 771

b. [x] Interaction between HPV vaccination and indicated variable

c. Significance at $p \leq 0.05$