

# Health System Factors Influencing Uptake of Human Papilloma Virus (Hpv) Vaccine Among Adolescent Girls 9-15 Years in Mbale District, Uganda

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## Research article

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# Abstract

**Introduction** Globally, cervical cancer is the fourth most common cancer in women with more than 85% of the burden in developing countries. In Uganda, cervical cancer has shown an increase of 1.8% per annum over the last twenty years. The availability of the Human Papillomavirus (HPV) vaccine presents an opportunity to prevent cervical cancer. Understanding how the health system influences uptake of the vaccine is critical to improve it. This study aimed to assess how the health systems is influencing uptake of HPV vaccine so as to inform policy for vaccine implementation and uptake in Mbale district, Eastern Uganda. **Methods** We conducted a cross sectional study of 407 respondents, selected from 56 villages. Six key informant interviews were conducted with District Health Officials involved in implementation of the HPV vaccine. Quantitative data was analyzed using Stata V.13. Prevalence ratios with their confidence intervals were reported. Qualitative data was audio recorded, transcribed verbatim and analyzed using MAXQDA V.12, using the six steps of thematic analysis developed by Braun and Clarke. **Results** 56 (14%) of 407 adolescents self-reported vaccine uptake. 182 (52.3%) of 348 reported lack of awareness about the HPV vaccine as the major reason for not having received it. Receiving vaccines from outreach clinics ( $p=0.02$ ), having many options from which to receive the vaccine ( $p=0.02$ ), getting an explanation on possible side-effects ( $p=0.024$ ), and receiving the vaccine alongside other services ( $p=0.024$ ) were positively associated with uptake. Key informants reported inconsistency in vaccine supply, inadequate training on HPV vaccine, and the lack of a clear target for HPV vaccine coverage as the factors that contribute to low uptake. **Recommendation** We recommend training of health workers to provide adequate information on HPV vaccine, raising awareness of the vaccine in markets, schools, and radio talk shows, and communicating the target to health workers. **Conclusion** Uptake of the HPV vaccine was lower than the Ministry of health target of 80%. We recommend more training of health workers to clearly provide adequate information on HPV vaccine, increasing awareness about the vaccine to the adolescents and reaching out to adolescents in and out of school for vaccination..

## Background

Globally, cervical cancer is the fourth most common cancer in women with more than 85% of the burden in developing countries ( 1). The majority of cervical cancer mortality occurs in developing countries, where screening and optimal treatment are not adequately available ( 2). Cancer of the cervix constituted 22.2% of all cancers among women in Sub-Saharan Africa in 2012 ( 3). In Uganda, cervical cancer is the number one cancer killer disease among women, followed by breast cancer ( 4). The incidence of cervical cancer in Uganda stands at 52 /100,000 women of reproductive age, making it one of the highest globally, with more than half of these women dying every year ( 5 , 6 ).The Kampala cancer registry showed that Uganda has one of the highest cervical cancer incidence rates in the world with an age standardized incidence rate of 47.5 per 100,000 against the global estimate of 15.8 by the World Health Organization in 2012 ( 7). Cervical cancer mortality in Uganda is estimated to be 29.3 per 100,000, and over 80% of diagnosed cases present with an advanced stage of the disease ( 8 ). Providing the Human Papilloma virus vaccine is aimed at primary prevention against cervical cancer so that there is no risk of

infection progressing to cervical cancer later in life, this is because HPV is responsible for almost 90% of cervical cancer cases ( 9 ).The Human Papillomavirus (HPV) immunization program is expected to have a significant impact on public health. It is estimated that the it will reduce deaths from cervical cancer by two-thirds if uptake reaches 80% ( 10). Two vaccines to prevent human papillomavirus (HPV) infection, the cause of cervical cancer, are now approved for use in over 120 countries. This has created an opportunity to greatly enhance prevention of cervical cancer. However, challenges exist with delivery of the vaccine to adolescents aged 9 to 15 years which is the recommended population for HPV vaccinations by the World Health Organization ( 11). This is because routine immunizations in most national programs target children younger than 5 years of age ( 12, 13). The Ministry of Health Uganda in partnership with a drug manufacturing company in the United States of America (Merk Sharpe and Dohme) launched a vaccine program in 2012, targeting 140,000 pre-adolescents. The HPV vaccine is relatively new in Uganda, it is given out free of charge but uptake has remained low in many districts with national average estimated at 17% ( 14) as of December 2016. Delivering HPV vaccines to young adolescents therefore requires a different kind of health programming ( 15). Since this is a new vaccine, very few studies have been conducted about factors influencing uptake of the vaccines, therefore this study aimed to assess how the health system is influencing uptake of the HPV vaccine for adolescents 9-15 years so as to inform HPV vaccination policy and implementation program in Uganda

## Methods

### *Study design and population*

We conducted a cross-sectional study in Mbale district in Eastern Uganda. We used a structured questionnaire to interview the adolescent girls. we held six key informant interviews with health workers in the district. The quantitative and qualitative data collection methods helped to obtain convergence and substantiation among the different health system factors. The multiple perspectives aimed to provide an opportunity to develop a more complete understanding of the health system factors influencing HPV vaccine uptake.

### *Sampling*

For the structured questionnaire, we used Bennett's cluster survey sampling formula taking an assumption of a prevalence of 50%, a precision of 0.032 ( 16) and a margin of error of 5%. The sample size was 392 respondents. Taking a non-response rate of 10%, the final sample size was 431 respondents. In this study, a cluster was equivalent to a village. We randomly selected five sub-counties out of the twenty-three and from each sub county, we selected two parishes from each sub county to give a total of ten parishes. A list of all villages from the selected parishes was then used to randomly select the total of 56 villages. We then interviewed seven adolescents 9-15 years, eligible for the HPV vaccine from each village, taking only those who were residents of the selected villages in Mbale district for at least two years. A consideration of two years was taken because the national rollout of the vaccine was done in 2015. Care takers and adolescents who were not found in their homes after three consecutive

visits were replaced with the next household. If a care taker was too ill to take the interview, they were excluded and replaced.

Health system factors were assessed through key informant interviews and an observation checklist. The numbers of Key Informant Interviews were deemed sufficient when additional interviews yielded little new information on the core study objectives. The interviews were audio recorded after informed verbal consent was obtained from the participants. We observed for key vaccines, supplies in selected health facilities within the sub-counties using the WHO checklist for vaccines and supplies.

### *Dependent and independent variables*

The dependent variable was uptake of the HPV vaccine, this was measured by having a vaccination card that indicates the number of doses attained and recall of obtaining an injection on the left upper arm if the child was between 9-15 years. Initiation was defined as having received at least one of the recommended two dose series of the HPV vaccine and Uptake was defined as completing the two doses of the HPV vaccine.

### *Data analysis*

Quantitative data were entered into Excel 2010, and then exported to Stata Version 13 for statistical analysis. The data were summarized into frequencies and proportions for categorical variables and mean (SD). At bivariate level of analysis, prevalence ratio (PR) measure was used to assess relationship between the dependent variable (HPV vaccine uptake) and the independent factors. The prevalence ratios were computed using a generalized linear model with Poisson family and a log link with robust errors. At multivariable analysis, all the independent factors with a P value less than 0.15 at bivariate analysis were included in the multivariable model to obtain the adjusted Prevalence ratios. The backward elimination approach was used to obtain the best model with the log likelihood that was closer to zero. The significance level for all the analysis was set at  $P \leq 0.05$ . The model comprised of age group, tribe, religion, and occupation, having many options from which to receive the HPV vaccine, knowing where to report side effects, having received any other vaccines, getting HPV vaccine together with other services, knowing where to report the side effects, and receiving adequate information about the vaccine.

For qualitative data, audio tape recordings were all together transcribed verbatim, coded and uploaded qualitative data analysis software MAXQDA version 12. Recurring themes were identified within and between each interview (17). Two independent researchers were involved in coding. These transcripts were scrutinized to ensure reliability in the use of codes between the coders. The independent lists of codes were reviewed to assess inter-coder agreement. Discrepancies were clarified and resolved by comparing each coder's results with raw data until consensus was reached. A list of codes was then finalized. The codes were based on the study objectives.

Data was then condensed through expressive, text-based summaries and data display matrices. The matrices facilitated to distinguish among the themes and groups. Quotes were then selected that were

representative of the main themes.

## Results

A total of 407 respondents were interviewed from the calculated sample size of 432 giving a non-response rate of 9%.

### *Socio-demographic characteristics of the respondents*

Table 1 shows the baseline characteristics of the respondents; the mean age was  $11.8 \pm 1.8$  years with a minimum age of 9 years and a maximum of 15 years. 75% (306/407) of the respondents lived in rural areas. The care takers of the adolescents were mostly married (73.5%) with half of them having attained up to primary level of education (50.1%). Most of respondents were of the Gishu tribe (71.3%), and more than two thirds were of Muslim faith (41.5%). Most (71%) of the respondents lived approximately 1km to 3km from a health facility.

### Initiation of the HPV vaccine

Figure 1 shows the total number of adolescents interviewed, 49% (200/407) had initiated the vaccination, but of the 200 adolescents that had initiated the HPV vaccine, 13.8% (56/407) had received both doses and thus completed the vaccination. See figure 1.

Table 2 shows the main reasons for not receiving the vaccine. Lack of awareness was the main reason given by 45% (182/348) of the adolescents. While some respondents mentioned that they were not aware about the HPV vaccine, some were not aware of the number of doses that they must receive and others were not aware of the schedule or interval of the vaccines. Less than 2% (6/348) of the respondents mentioned unfriendly health workers as a major reason for failure to obtain the vaccine, while four percent 4% (14/348) of the respondents who had received one dose were aware that they were due for a second dose. Other reasons for not vaccinating include reluctance to vaccinate, being afraid of vaccines, and myths about the vaccines.

### Factors associated with uptake of the HPV vaccine

Table 3 shows that the prevalence of uptake was two times higher among the age group of eleven to twelve years (PR 2.1, 95% CI 1.0-4.4) compared to those who are nine to ten years. It was also twice higher among the Banyole ethnic group (UPR2.2, 95% CI,1.18- 4.04) compared to the bagishu, it was also six times higher among adolescents whose care takers were business women (unadjusted PRR 5.9, 95% CI 2.0- 16.9) compared to those who were housewives and two times higher among those who lived within a distance of 1-3Km from a health facility.

Uptake for the vaccine was also twice higher among those who had received other childhood vaccines (unadjusted PRR 1.8, 95% CI 1.05-3.01), and seven times higher among those who obtained HPV vaccine from outreach clinics (unadjusted PRR 7.4, 95% CI 3.6-15.15). Additionally, uptake was eleven times

higher among those who received an explanation on the side effects of the HPV vaccine (unadjusted PRR 10.6, 95% CI 5.5-20.57), six times higher among those who got the vaccines alongside other services (unadjusted PRR 5.8, 95%CI 3.4-9.7), seven times higher among adolescents who had many options from where to receive HPV vaccine (unadjusted PRR 7.1, 95% CI 3.5-14.18) and three times higher among those with knowledge of where to report side effects (unadjusted PRR 3.0 95% CI 1.7-5.1).

Table 4 shows the multivariable analysis, after adjusting for possible confounders, the prevalence of uptake of the HPV vaccine was two and a half times higher among girls who had received the vaccine from an outreach clinic (APR 2.6, 95% CI: 1.2-5.9) compared to those who obtained from static sites. It was also three times higher among those who received an explanation for possible side effects (APR 2.7, 95% CI 1.1-6.4) compared to those who didn't get an explanation. Prevalence was also twice higher among adolescents who received vaccines together with other services (APR 2.3, 95% CI 1.1-4.6) and four times more among adolescents who had many options from where to receive the HPV vaccine (APR 3.6, 95% CI 1.6-8.1) after controlling for all the other significant variables at bivariate analysis. See table below

### Barriers to service delivery

In the study, the major barriers to service delivery from the key informant interviews included low financing, myths about the vaccine, unclear communication on the target for the vaccine's coverage and transport challenges to reach the adolescents in the community. Funding for immunization activities was previously provided by other organizations that supplemented the Primary Health Care (PHC) funds but this was not happening at the time of the study. This is affirmed by one key informant who states that;

*"Previously, GAVI was supplementing the PHC Funds but in the last financial year, it has been hard to manage and I am sure that some facilities have not been able to conduct outreaches in both the schools and the community"*

*(Key informant, DHT)*

Some key informants revealed that private schools and private health facilities are not given the HPV vaccine and this creates inequity in access for those who prefer to utilize private health facilities for receipt of the vaccine and girls in private schools.

*"We supply the vaccine to the public and private not for profit health facilities, we are not giving the private clinics, this is because many of them are not equipped with the cold chain and they do not report to us."*

*(Key Informant, District Health Team)*

*"We give out this vaccine to government schools only, the private schools don't benefit because they have to obtain parental consent for their pupils to get it. In the Government schools, the school authority gives the consent"*

*(KI health facility in-charge)*

Facilitators to service delivery

HPV vaccine delivery has been made easier through the school-based delivery approach because the target group was clear but there was confusion as to whether to vaccinate those in primary five since the target class is primary four. With the school-based approach, health facilities have been able to liaise with schools to make it easy for the adolescents to receive HPV vaccine as stated by one key informant below

*“Health facilities liaise with the schools so that arrangements are made for the HPV vaccination, for example they set aside a classroom where the equipment can be placed so that the vaccination can take place”*

(Key informant, Nurse)

Barriers for Human Resources for Health

The major barriers to human resources for health mentioned were the inadequate staff to run the work in the health center and insufficient training on HPV vaccine.

*“We have few staff, which also compromises our service delivery. If some health workers go to the outreach clinic, you can feel the impact in the health facility when a few of us are left here”*

(Key Informant Nurse)

Despite the inadequate staff at the health facility, the VHTs and other community mobilisers support the health workers in mobilizing the community to take their daughters for vaccination thus motivating them. In addition, health workers were motivated to work with the available Primary Health Care (PHC) funds. The team work and role played by the Village health teams and other mobilisers in the community motivated them.

*“PHC funds have helped to facilitate vaccinators and this is a good strategy for us. In addition, we use phone messages to thank them for the good work they do despite the hardship”* (Key informant DHT)

Barriers to Vaccines, supplies and medicines

Inconsistency in vaccine supply was noted in both the checklists and from various key informants and records in health facilities; the first supply of vaccines doses was underestimated

*“The inconsistency in vaccine supply is a major barrier to completion of the doses, and it is something that I know is beyond the District Health Office to handle.”*

(Key informant DHT)

*“Supply of the vaccine is very poor and inconsistent. Despite this, we give out the doses as and when we receive the stock, but in that case, we can’t ascertain the efficacy of the vaccine”*

(Key informant DHT)

The integration of the HPV vaccines with other services such as child days plus helps to increase coverage by taking advantage of the existing infrastructure to provide the vaccine. This is expressed by some key informants

*“Furthermore, this is an integrated service and people get very many services at once, may be this has contributed to the success”*

(Key informant Nurse)

## **Discussion**

The study estimated the level of uptake for the bivalent HPV vaccine in Mbale district, in eastern Uganda and found that 14% of the study participants were fully vaccinated. However, the estimated uptake in this survey was lower than what the district reports for HPV uptake of 32%. This discrepancy may be due to errors in reporting from various health facilities into the Health Management Information System ( 18, 19). The variance may also be due to unreliable census figures, an unclear denominator due to the stringent eligibility criteria for adolescent girls who should receive the HPV vaccine

### *Inadequate training of health workers*

The low uptake of the HPV vaccine was attributed to inadequate training among health workers about the vaccines; Uganda merged the measles campaign, polio Supplementary Immunization Activities (SIA) and HPV vaccine introductory activities due to limited bandwidth within UNEPI and the failure of the country to raise sufficient funds to cover all activities. However, this led to key critical shortfalls in HPV implementation: training of health workers on HPV vaccine was reduced from three days to one day; and there was no social mobilization messaging on HPV vaccine because the vaccine had not yet arrived in the country, hence demand couldn’t be increased yet the vaccine was not immediately available

### *Lack of IEC material in the community and health facility*

Additionally, low uptake may also be attributed to the lack of information, education and communication (IEC) materials on HPV vaccine in health facilities, schools and other communal places such as markets. These IEC materials are usually a way of communicating health related information to a vast majority of the population, this is in agreement with findings from one study which stressed the lack of education material on HPV vaccination given by health professionals to young adolescents as a barrier to vaccine uptake and emphasized the need to improve education about cervical cancer, prevention and HPV vaccination ( 20). Several studies have highlighted the need for health workers to be trained to provide adequate information about this vaccine. In many of these studies, health workers are the most preferred

source of information and influence the decision to vaccinate ( 21-23). Furthermore, receiving adequate information from a health care provider greatly improved uptake of the vaccine, this finding is similar to other studies, where healthcare professionals impacted the choice for adolescents to receive the HPV vaccine ( 24, 25) and these decisions were shaped by confidence in the vaccination program and healthcare providers. This may call for health workers to provide a brief discussion on the vaccine, its benefits and possible side effects prior to administration ( 24).

#### *Brief explanation about the vaccine*

An interventional study conducted in the United States of America showed the effect of a brief (ten minutes) group HPV educational session on knowledge and intent to vaccinate among young adults. Individuals in the intervention group were three times more likely to take on the vaccine ( 26, 27); this is similar to findings from this study where girls who received an explanation on the side effects of the vaccine were almost three times more likely to take on the vaccine as compared to those who didn't receive an explanation. Findings from this study show that adolescents who received adequate information about HPV vaccine were more likely to receive it, and this is similar to findings from another study conducted in Kenya which discovered that perceiving oneself to be adequately informed was a strong determinant of HPV vaccine uptake ( 28). This means that health workers need to be trained to provide the necessary knowledge on HPV vaccine prior to provision on the vaccine to the adolescent girls.

#### *Low awareness among the target beneficiaries and caretakers*

Lack of awareness was another major factor influencing initiation and uptake of the HPV vaccine, this finding is similar to a study which sought to understand suboptimal HPV vaccine uptake among ethnic minority adolescents, with the strongest predictor of initiation reported as vaccine awareness ( 29, 30). The study also highlighted that the lack of information about HPV vaccine and where to obtain it by mothers negatively influenced their decision making ( 29). Additionally, a study among women in Malawi, showed that respondents believed that HPV vaccine uptake would be increased if information were dispersed throughout the community, since they strongly believed that this would address the challenge of low awareness on HPV vaccine ( 31). This shows the importance of social mobilization especially for new vaccines that are outside of the known target age group.

#### *Inadequate Human Resources for health*

This study also found that human resources for health were inadequate in various health facilities to provide HPV vaccine. This may be due to the inadequate staffing levels at the district which is estimated at 73% at the time of the study. Health workers usually have to leave the health facility and move to schools to provide the HPV vaccine to the girls; this leaves the work at the health facility to a few health workers and increases the burden on the few staff members who remain at the facility. This finding is similar to one study that looked at uptake of HPV vaccine in low and middle income countries and also revealed that human resources for health were inadequate for HPV vaccine delivery ( 32-34). The implication of this is that the Ministry of Health will need to find more innovative ways of increasing the

human resource needed to provide the vaccine to this special age group. The insufficient human resources was reported as a challenge to vaccine delivery, this is consistent with findings from another study where human resources find it a challenge to go to outreach clinics, they use “vaccinators” to help ease on the work load ( 32)

### *Vaccine stock outs*

The availability of HPV vaccines was mentioned throughout interviews as having influence over adolescent girl's uptake of HPV vaccine. As noted among the key informants, many times, the adolescents found the vaccine out of stock, and this worried the health workers about the efficacy of the vaccine since the second dose was received much later than the recommended time of six months interval. This finding is similar to a study in Malawi that elaborated the vaccine stock outs and inconsistency in supply as barriers to uptake ( 31).

The inconsistency in supply may be due to the fact that new vaccines impose pressure on the health systems of most developing countries. As a result, they are faced with challenges in their vaccine supply and logistics systems ( 35). Additionally, storage capacity bottlenecks can occur at national, regional, and district levels and system inefficiencies threaten vaccine access, availability, and quality. At the national level, HPV forecasts and supplies were adjusted to cater for peak demand during the months of April and October while at district level, due to the limited knowledge of target age group, health facilities forecasts and deliveries did not align with monthly need including peak periods resulting in surplus in supply in some health facilities and stock-outs in others

As Uganda adopts the HPV vaccine, the health system must attempt to reach people at different ages and in new settings, as a result, the logistics systems must be strengthened and improved.

### *Service Delivery*

Integration of services was found to significantly increase uptake of the HPV vaccine. This is because adolescents get extra services such as deworming, family planning, HIV testing and health education that are given at these outreach clinics. Gavi recommends that integrated programs offer opportunities for other age-relevant services such as de-worming and nutritional supplements. This integrated approach presents an opportunity to reduce the cost and burden on health systems of delivering separate interventions ( 36)

This study found the cold chain (fridges, thermometer, vaccine carriers, and storage space) and the infrastructure was adequate, this is contrary to findings from two previous studies, where infrastructure for the delivery of the HPV vaccine was found to be lacking ( 37, 38). The cold chain may have been found to be better due to the continuous support of the United Nations children's fund (UNICEF) and Gavi support to the Expanded Program on Immunization in the district. There has also been an improvement in infrastructure because of continuous and more preparation for cold chain due to the introduction of

Pneumococcal Conjugate Vaccine (PCV), and the change from Oral Polio Vaccine (OPV) to Injectable Polio Vaccine (IPV) plus other planned new vaccine introductions

The similarly striking low rates of HPV vaccination in a study among Cambodian American teenagers highlighted the need to improve vaccination outreach; ( 39). These findings are similar to this study and thus can be used to develop targeted public health HPV vaccination programs for various geographical groups, which will reduce cervical cancer disparities. Outreach clinics are suitable, particularly for children out of school.

This study revealed that cost was not a barrier to obtaining the vaccine, this is contrary to another study where cost was a barrier to vaccination ( 40). The difference in the findings may be due to the fact that the HPV vaccine is provided free of charge by the Government of Uganda and subsidized by the Global Alliance for Vaccines and Immunization ( 41). One more study conducted on predictors of HPV vaccination among daughters of low-income Latina mothers identified independent predictors of HPV vaccine uptake, and low worry about how to pay for the vaccine was a predictor for vaccination ( 42).

## Study Limitations And Strengths

This study was also cross-sectional in nature and although we found an association between awareness of the vaccine and its uptake, we cannot infer a causal relationship between awareness and uptake. To be exact, this present study cannot depict that awareness on the HPV Vaccine always results in uptake. Nonetheless, the study addressed one of the key areas which is salient in the effort needed to enhance HPV Vaccine uptake. It showed the need to build a resilient health system for the new vaccines which is important for program planning

## Conclusion

Uptake for the HPV vaccine in this study was defined as completing two doses of the vaccine. In this study, uptake was 14%. This is much lower than the 80% national HPV vaccine coverage target. Lack of awareness about HPV vaccine was found to be the main reason for the low uptake of the HPV vaccine. Besides, lack of communication and advocacy on the vaccine to raise awareness also hampered its uptake.

Factors that positively influenced uptake of the vaccine include receiving an explanation for possible HPV vaccine side effects, having many options from where to get the vaccine, getting the vaccine from an outreach clinic, and getting the vaccine alongside other services.

The study made the following recommendations;

Ministry of Health and implementing partners must aim at raising awareness about the HPV vaccine as a primary preventive mechanism against cervical cancer. In addition, the Government must nurture a public

private partnership to include private health facilities in providing the HPV vaccine so as to increase coverage in areas that are mainly served by the private health services.

The District Health Team should conduct on job training of health workers on HPV vaccine so that they can deliver quality information to the adolescents prior to receipt of the vaccine.

There is need for the Ministry of Health to ensure that the expected target for coverage is made clear for all relevant stakeholders so that they work towards it and are capable of monitoring and evaluating their work.

## **Declarations**

### **Ethics approval and consent to participate**

Ethical approval to conduct this study was granted by the Higher Degrees Research and Ethics Committee (HDREC) of the Makerere University School of Public Health and the Uganda National Council of Science and Technology (UNCST). Permission was also obtained from the District Health Officer (DHO). Data was anonymized for analysis. Participants in the cross-sectional quantitative and qualitative interviews provided written informed consent and assent prior to the interview. Parents and guardians of the minors provided verbal consent prior to the interview of the adolescent girl.

### **Consent for publication**

Not applicable

### **Availability of data and materials**

The dataset used and analyzed during this study is available from the corresponding author upon reasonable request.

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### **Authors' contributions**

JN participated in designing the study, data collection, and statistical analyses and served as the lead author of the manuscript. CK and GK participated in study conception FM and NR participated in the analysis and interpretation of results. GK participated in qualitative data analysis. OAL and JNB played active roles as supervisors during all stages of the study as well as manuscript writing.

## Competing interests

The authors declare that they have no competing interest.

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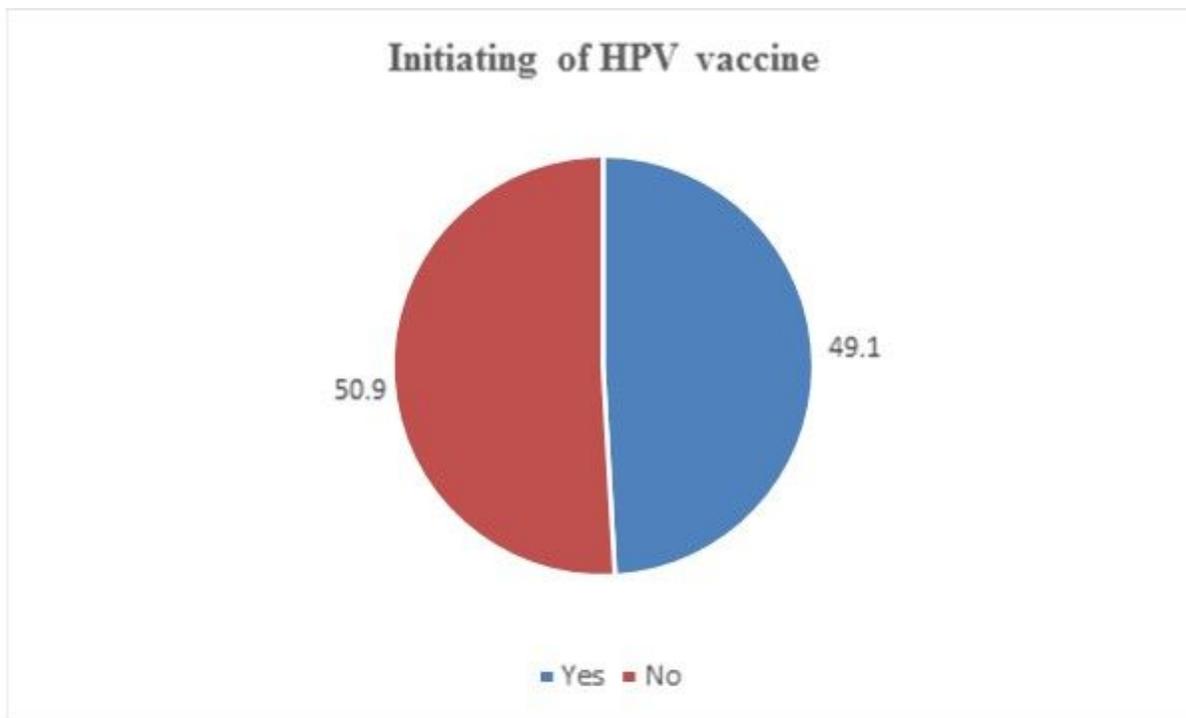
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## Figures



*Figure-1; Pie chart showing initiation of the HPV vaccine*



**Figure 1**

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