Human Papillomavirus Vaccination Uptake and Its Predictors Among Female Adolescents in Gulu Municipality, Northern Uganda

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Background: Human papillomavirus (HPV) is the putative case of cervical cancer. However, uptake of HPV vaccination is reportedly low in Uganda. This study explored the predictors of HPV vaccination uptake among female adolescents aged 15–18 years in Gulu Municipality, in northern Uganda.

Methods: This was an analytical cross-sectional survey that was conducted among adolescents aged 15–18 years in Gulu Municipality. A structured questionnaire was used. Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 25. Descriptive statistics and a log binomial model were used to analyze the factors associated with HPV vaccination uptake.

Results: Less than a quarter of the female adolescents (22%) aged 15–18 years in Gulu municipality, Gulu district, had been vaccinated with the human papillomavirus vaccine. HPV vaccination uptake was lower by 23% among adolescents who stayed with their mothers only (aPR = 0.769, CI = 0.595–0.995, P = 0.046), and by 14% among adolescents whose parents were unmarried (aPR 0.859, CI = 0.776–0.951, P=0.003).

Conclusion: This study reports a low HPV vaccination coverage among adolescents in Gulu Municipality, which is associated with parental perceptions and marital status. Efforts to increase uptake should focus on parents of adolescents.

Keywords: human papillomavirus, cervical cancer, vaccination uptake, Uganda

Background

More than 80% of sexually active men and women worldwide are at risk of contracting Human Papillomavirus (HPV).¹ HPV is responsible for an estimated 630,000 new cases of cervical and genitourinary cancer worldwide each year.² The prevalence of cervical cancer is steadily increasing in low-income countries and causes significant morbidity and mortality.³–⁶ HPV screening and vaccination is projected to prevent up to one death per 100,000 women by 2034.⁷ Furthermore, efforts have been directed toward promoting primary prevention through the vaccination of adolescents.⁸,⁹ Because HPV infection is transmitted sexually,¹⁰ the 3-dose quadrivalent recombinant HPV vaccination strategy targets female adolescents aged 9 to 14 years,¹¹ for whom the first vaccination dose should be administered before a sexual encounter.¹²,¹³ Despite the global vaccination campaign to prevent HPV-related morbidity, HPV vaccination uptake remains unacceptably low.¹⁴,¹⁵ In Uganda, HPV vaccination was launched in 2015, and the 2-dose HPV vaccine series has since been integrated in the routine Uganda National Expanded Program on Immunization.¹¹,¹⁶ Uganda has the 7th highest incidence of cervical cancer and cervical cancer-related mortality in the world but HPV vaccination uptake is low.¹⁶ For example, a study of 460 female adolescents in the Lira district in northern Uganda found that HPV vaccination uptake was 17.61%.¹⁷ More, research evidence from Eastern Uganda affirmed an HPV vaccination initiation coverage of 49%, with 13.8% receiving the second vaccination dose.¹⁸ The low HPV vaccination uptake is multifaceted and can be attributed in part to a variety of predictors such as low vaccine knowledge, fear of pain, vaccine side effects, ethnicity, age, sexual behavior, immunization history, and school attendance status.¹⁶–²² Besides, some parents’ beliefs that HPV vaccination might encourage promiscuity, earlier sexual debut in young girls, and that the vaccine might lead to...
unsafe sexual behavior were barriers to HPV vaccination uptake. According to the Uganda Demographic and Health Survey (2016), only 12% of the targeted population in Gulu Municipality had been vaccinated, and the figure rose by a meager 5% (to 17%) in 2018 (District Health Information Software2, 2018). Studies are needed to further characterize the paltry HPV vaccine uptake in this region. The current study investigated the predictors of HPV vaccination uptake among female adolescents aged 15–18 years in Gulu Municipality, northern Uganda, to better understand the determinants of HPV vaccination uptake.

**Methods**

**Study Design, Site, and Duration**

We conducted a community-based cross-sectional survey in Gulu Municipality, northern Uganda. Gulu Municipality is bounded on the west by Amuru district, on the north east by Lamwo district, on the east by Pader district, on the southeast by Lira district, on the south by Oyam district, and on the southwest by Nwoya district. The region is a post-conflict area that was ravaged by the Lord Resistance Army insurgency from 1987 to 2006. This study was conducted between July to December 2020.

**Study Population and Enrolment**

The population was dyadic, consisting of adolescents aged 15 to 18 years old and their parents. The 15–18 age group was chosen because the study was conducted in 2020, which corresponded to five years after the introduction of HPV vaccination. Thus, at the time of the official launch of the HPV vaccination campaign in 2015, this age group (10–15 years) was eligible for HPV vaccination. The study included female adolescents between the ages of 15 and 18 who were legitimate residents of Gulu Municipality, northern Uganda.

**Sample Size Estimation and Sampling**

The study used a formula by Nassiuma given by:

\[ n = \frac{N \cdot C^2}{C^2 + (N - 1) \cdot e^2} \]

Where \( n \) is the estimated sample size, \( N \) is the population size (50,000 female adolescents in Gulu Municipality targeted in the district’s HPV vaccination program), \( C \) is the coefficient of variation (fixed between 0 and 30%), and \( e \) is the margin of error (fixed between 2–5%). On substitution with a 25% coefficient of variation, a 95% confidence interval, a 5% margin of error, and a population of 50,000;

\[ n = \frac{50000 \times 0.25^2}{0.25^2 + (50000 - 1) \times 0.05^2} = \frac{3125}{12.497} = 250 \]

Thus, a minimum of 250 female adolescents were considered.

Multi-stage sampling was used to select the participants. First, stratified sampling was used to stratify the four divisions of Gulu district, and each division was treated as a stratum from which parishes were later randomly sampled. This was accomplished by numbering all parishes in a given stratum and writing the numbers on separate pieces of paper. The papers with those numbers were ruffled and placed, one at a time, in a box until the required number was reached. The selected papers were unfolded, and the numbers inscribed on them were checked to ensure that they corresponded with the numbers on the previously created parish outline. The parishes with the same number as those sampled in a given division were chosen. The other three strata followed the same procedure. Thereafter, convenience sampling method was used in a village to sample the households. In this, a household in a given village was approached, rapport was established with the inhabitants, and an interview was conducted if eligible inhabitants (a parent and a 15-year-old female adolescent) were present. Following that, the nearest household in any direction was approached until the required number of households was obtained. This prerequisite number was based on the calculation;

\[ N_{rp} = \frac{N_P \times n}{N_T} \]
Where; \( N_{rp} \) represented the number of adolescents and parents needed per parish; \( N_p \) as the total number of eligible adolescents available in a sampled parish, which was estimated by the local government records (2019), and \( n \) being the estimated sample size (250). Thus,

| Sub County | \( N_p \) | \( N_T \) | \( n \) | \( N_{rp} \) |
|------------|---------|---------|-------|--------|
| Bardege   | 7619    | 32,506  | 250   | 59     |
| Laroo     | 6331    | 32,506  | 250   | 49     |
| Layibi    | 7977    | 32,506  | 250   | 61     |
| Pece      | 10,579  | 32,506  | 250   | 81     |

**Study Variables**
The dependent variable was HPV vaccination, and the independent variables were institutional, parental, and adolescent-related predictors. The health services were the institutional predictors, whereas the parental predictors were the characteristics of the parents and/or guardians. Female adolescent characteristics that influenced HPV vaccination uptake were referred to as adolescent-related predictors. These variables were developed using theoretical modeling for health promotion research that is centered on tier three of promotion, in which contextual influences of health behavior are defined as those that allow for the integration of multiple levels of influence to establish an overall view of health behavior change. The triadic theory of influence (TTI)\(^{29}\) was used in this case. Following the TTI, three constructs were chosen as independent variables and conceptualized (Figure 1).

**Data Collection Approach and Tool**
A structured questionnaire (Appendix 1) was used to collect quantitative data, which was divided into five sections: socio-demographic characteristics, HPV vaccination status, assessment of institutional characteristics, assessment of parental characteristics, and adolescent-related characteristics. Based on existing literature, this was developed\(^{16,17,29–35}\) and pretested among

![Figure 1](https://doi.org/10.2147/AHMT.S383872)

**Figure 1** The conceptual frame based on the triadic theory of influence relating the independent variables towards the uptake of HPV vaccination.
25 female adolescents in Kisenyi parish, Makindye division, Kampala City. Following that, changes were made to improve clarity, content, and comprehension. The adolescent’s role was to complete two sections of the questionnaire before her parent was interviewed privately. Before data collection, the expert review was used to ensure content validity through psychometric testing. In addition, survey research assistants were recruited and trained in tandem with the objectives, questionnaire, assenting, and consent processing. Following the acquisition of assent/consent, the adolescents were engaged first in the absence of their parents, and then their parents were asked to respond to questions in the other sections in the absence of the adolescents.

Data Management and Analysis
Questionnaires were compiled and reviewed for omissions, response errors, and missing responses daily. Those who were affected were corrected, and if multiple significant deviations were discovered, this inclusion was dropped and compensated for by enrolling an additional participant. Once all questionnaires were cleaned and deemed ready, they were entered into SPSS version 25.0. Descriptive analysis was carried out, tabulated, and reported as frequencies and percentages. Bivariate analysis was used to determine the relationships between variables. We performed bivariate analysis with the log-binomial model since the magnitude of the outcome was greater than 10%. From the bivariate analyses, significant variables (p<0.05) were still fitted into a log-binomial model, and co-founding characteristics were controlled for. The confounders were socio demographic and parental characteristics, which were chosen depending on the variable being adjusted. At this level, statistical significance was established using an alpha level of 5%, and findings were reported in terms of prevalence ratios at 95% confidence.

Ethical Approval and Participant Consent
This study was approved by the research and ethics committee of Clarke International University (UG-REC-0015). Also, administrative permission was obtained from the authorities in Gulu Municipality. All participants provided written assent and consent for those under, and above 18 years, respectively. Participation was entirely voluntary, and confidentiality was ensured.

Results
Characteristics of Participants
A total of 250 adolescent-guardian pairs participated in the study. 58.0% (N = 145) of these adolescents were 15 to 16 years old, and 78.0% (N = 195) were still in school. Furthermore, 82.4% (N=206) of the adolescents were under the care of both parents. In contrast, 90.4% (N= 226) of the guardians were female, with 65.2% (N=163) being their mothers to the adolescents. Table 1 shows the socio-demographic characteristics and the perception towards the HPV vaccine safety.

HPV Vaccination Uptake, Awareness and Intention to Vaccinate
Among all adolescents, 52.0% (N = 130) had never received HPV vaccination. Figure 2 shows that 22% (N=55) of those vaccinated had received two doses of the HPV vaccine. Moreover, 73.6% (N=184) of the adolescents were unaware of the availability of an HPV vaccine. 79.6% (N=199) of female parents/guardians had never been screened for cervical cancer, 69.6% (N=174) had never heard of HPV, and only 38.8% (N=97) thought HPV vaccination was safe for adolescent girls.

Also, 82.8% (N=207) of parents/guardians had no plans to vaccinate their daughters against HPV before the age of 14. Furthermore, 72.8% (N=182) of the guardians who did not support HPV vaccination reportedly feared the vaccine’s side effects. Despite this, 64.4% (N=161) of guardians were aware that their daughters were at risk of cervical cancer if they were not immunized. More than 75.4% of guardians who said childhood vaccinations were important were concerned about vaccine safety against HPV, and an equal number were concerned about vaccine side effects.

Factors Associated with HPV Vaccination Uptake
The following parental characteristics were statistically significant with HPV vaccination: general opinion of childhood vaccination (p<0.001), parents staying with the child (p=0.001), and current marital status (p=0.001). According to the institutional characteristics, 60.0% (N=150) of the parents had never received advice about HPV vaccination for their daughter from a health worker. Moreover, only 54.4% (N=136) of girls had been educated about the importance of HPV
Table 1 Showing Socio-Demographic Characteristics and Perceptions of the Adolescents-Parent/Guardian Pairs

| Variable                              | Category          | Frequency (n=250) | Percentage |
|---------------------------------------|-------------------|-------------------|------------|
| **Adolescents socio-demographic characteristics** |                   |                   |            |
| Age                                   | 15 to 16 years    | 145               | 58.0       |
|                                       | 17 to 18 years    | 105               | 42.0       |
| Still in school                       | Yes               | 195               | 78.0       |
|                                       | No                | 55                | 22.0       |
| School-level in                       | Primary           | 24                | 12.3       |
|                                       | Secondary         | 171               | 87.7       |
| Religious affiliation                 | Christian         | 204               | 81.6       |
|                                       | Muslim            | 46                | 18.4       |
| Tribe belonged to                      | Acholi            | 207               | 82.8       |
|                                       | Not Acholi        | 43                | 17.2       |
| **Parent/guardian socio-demographic characteristics** |                   |                   |            |
| Gender                                | Male              | 24                | 9.6        |
|                                       | Female            | 226               | 90.4       |
| Age                                   | 18 to 30 years    | 23                | 9.2        |
|                                       | 31 to 42 years    | 83                | 33.2       |
|                                       | 42 to 54 years    | 125               | 50.0       |
|                                       | > 54 years        | 19                | 7.6        |
| Educated                              | Yes               | 231               | 92.4       |
|                                       | No                | 19                | 7.6        |
| School-level                          | Primary           | 84                | 36.4       |
|                                       | Secondary         | 132               | 57.1       |
|                                       | Post-secondary    | 15                | 6.5        |
| Relationship with the adolescent      | Father            | 44                | 17.6       |
|                                       | Mother            | 163               | 65.2       |
|                                       | Guardian          | 19                | 7.6        |
|                                       | Auntie            | 3                 | 1.2        |
|                                       | Grandparent       | 21                | 8.4        |
| Current marital status                | Married           | 170               | 68.0       |
|                                       | Single            | 58                | 23.2       |
|                                       | Separated         | 22                | 8.8        |

(Continued)
vaccination. Only 55.6% (N=139) said they had never been informed about the availability of HPV vaccines at health facilities. Furthermore, 49.2% (N=123) of parents reported that their daughters’ schools did not provide HPV vaccination services. The institutional factors had no statistically significant relationship with HPV vaccination uptake.

Table 2 shows the bivariate analysis findings between, adolescent, parental characteristics and HIV vaccination. The parental characteristics of general view about childhood vaccination (p<0.001), staying with parents (p<0.001), and current marital status (p<0.001) showed a statistically significant association in multivariate analysis. The prevalence of HPV vaccination uptake was lower by 12% among adolescents whose parents thought childhood vaccination was important (aPR = 0.882, CI = 0.835–0.931, p< 0.001). Further HPV vaccination uptake was lower by 23% among adolescents who stayed with their mothers only (aPR = 0.769, CI = 0.595–0.995, P = 0.046), and by 14% among adolescents whose parents were unmarried (aPR 0.859, CI = 0.776–0.951, P=0.003), Table 3 summarizes these findings.

Figure 2 The proportion of the HPV vaccinated, and their vaccination schedule.
Table 2 Showing an Unadjusted Relationship Analysis Between Adolescent and Parental Characteristics and HPV Vaccination

| Variable                        | n=250 | %    | HPV Vaccination Status | cPR (95% CI) | P-value |
|---------------------------------|-------|------|------------------------|--------------|---------|
|                                 |       |      | Vaccinated (2 HPV Doses), N = 55 | Vaccinated (Single or no HPV Doses), N = 195 |
|                                 |       |      |                        |              |         |
| **Adolescent characteristics**  |       |      |                        |              |         |
| Sexually active                 |       |      |                        |              |         |
| Yes                             | 41    | 16.4 | 9 (22.0%)              | 32 (78.0%)   | 0.997 (0.531–1.875) | 0.993   |
| No                              | 209   | 83.6 | 46 (22.0%)             | 163 (78.0%)  | 1.000   |
| Adolescents received all childhood vaccines |       |      |                        |              |         |
| Yes                             | 209   | 83.6 | 45 (21.5%)             | 164 (78.5%)  | 0.883 (0.486–1.605) | 0.683   |
| No                              | 41    | 16.4 | 10 (24.4%)             | 31 (75.6%)   | 1.000   |
| Aware of HPV                    |       |      |                        |              |         |
| Yes                             | 58    | 23.2 | 11 (19.0%)             | 47 (81.0%)   | 0.828 (0.458–1.496) | 0.531   |
| No                              | 192   | 76.8 | 44 (22.9%)             | 148 (77.1%)  | 1.000   |
| Aware of the existence of the HPV vaccine |       |      |                        |              |         |
| Yes                             | 66    | 26.4 | 17 (25.8%)             | 49 (74.2%)   | 1.247 (0.758–2.052) | 0.385   |
| No                              | 184   | 73.6 | 38 (20.7%)             | 146 (79.3%)  | 1.000   |
| Current age                     |       |      |                        |              |         |
| 15 Years                        | 108   | 43.2 | 20 (18.5%)             | 88 (81.5%)   | 0.920 (0.575–1.472) | 0.728   |
| 16 years                        | 142   | 56.8 | 35 (24.6%)             | 107 (75.4%)  | 1.000   |
| Still in school                 |       |      |                        |              |         |
| Yes                             | 195   | 78.0 | 5 (20.8%)              | 19 (79.2%)   | 1.442 (0.754–2.758) | 0.269   |
| No                              | 55    | 22.0 | 46 (23.6%)             | 149 (76.4%)  | 1.000   |
| School-level                    |       |      |                        |              |         |
| Primary                         | 24    | 12.3 | 5 (20.8%)              | 19 (79.2%)   | 0.869 (0.381–1.981) | 0.738   |
| Secondary                       | 171   | 87.7 | 41 (24.0%)             | 130 (76.0%)  | 1.000   |
| Religious affiliation           |       |      |                        |              |         |
| Christian                       | 204   | 81.6 | 45 (22.1%)             | 159 (77.9%)  | 1.015 (0.554–1.860) | 0.962   |
| Muslim                          | 46    | 18.4 | 10 (21.7%)             | 36 (78.3%)   | 1.000   |
| Tribe belonged to               |       |      |                        |              |         |
| Acholi                          | 207   | 82.8 | 46 (22.2%)             | 161 (77.8%)  | 1.062 (0.563–2.002) | 0.853   |
| Not Acholi                      | 43    | 17.2 | 9 (20.9%)              | 34 (79.1%)   | 1.000   |

(Continued)
### Table 2 (Continued).

| Variable                                                                 | n=250 | %    | HPV Vaccination Status                          | cPR (95% CI) | P-value |
|--------------------------------------------------------------------------|-------|------|-----------------------------------------------|--------------|---------|
|                                                                          |       |      | Vaccinated (2 HPV Doses), N = 55               |              |         |
|                                                                          |       |      | Vaccinated (Single or no HPV Doses), N = 195   |              |         |
| Parental characteristics                                                 |       |      |                                               |              |         |
| Heard about the HPV vaccination program                                  |       |      |                                               |              |         |
| Yes                                                                      | 174   | 69.6 | 35 (20.1%)                                    | 139 (79.9%)  | 1.036 (0.970–1.106) | 0.297  |
| No                                                                       | 76    | 30.4 | 20 (26.3%)                                    | 56 (73.7%)   | 1.000   |         |
| HPV vaccination is regarded as safe for adolescent girls                 |       |      |                                               |              |         |
| Yes                                                                      | 97    | 38.8 | 20 (20.6%)                                    | 77 (79.4%)   | 1.013 (0.955–1.074) | 0.672  |
| No                                                                       | 153   | 61.2 | 35 (22.9%)                                    | 118 (77.1%)  | 1.000   |         |
| The general view about childhood vaccination                              |       |      |                                               |              |         |
| It is important                                                          | 195   | 78.0 | 44 (22.6%)                                    | 151 (77.4%)  | n.a     |         |
| Not all vaccinations are important                                       | 50    | 20.0 | 11 (22.0%)                                    | 39 (78.0%)   |          |         |
| The vaccinations are too many                                            | 5     | 2.0  | 0 (0.0%)                                      | 5 (100.0%)   |          |         |
| Had any intentions to vaccinate their daughter for HPV before she made 14 years |       |      |                                               |              |         |
| Yes                                                                      | 43    | 17.2 | 9 (20.9%)                                     | 34 (79.1%)   | 1.007 (0.934–1.086) | 0.850  |
| No                                                                       | 207   | 82.8 | 46 (22.2%)                                    | 161 (77.8%)  | 1.000   |         |
| Heard about HPV                                                           |       |      |                                               |              |         |
| Yes                                                                      | 76    | 30.4 | 19 (25.0%)                                    | 57 (75.0%)   | 0.976 (0.915–1.041) | 0.463  |
| No                                                                       | 174   | 69.6 | 36 (20.7%)                                    | 138 (79.3%)  | 1.000   |         |
| Ever screened for cervical cancer (Females)                              |       |      |                                               |              |         |
| Yes                                                                      | 46    | 20.4 | 12 (26.1%)                                    | 34 (73.9%)   | 0.969 (0.895–1.050) | 0.443  |
| No                                                                       | 180   | 79.6 | 37 (20.6%)                                    | 143 (79.4%)  | 1.000   |         |
| Adolescent stays with both parents                                       |       |      |                                               |              |         |
| Yes                                                                      | 206   | 82.4 | 43 (20.9%)                                    | 163 (79.1%)  | 1.037 (0.955–1.126) | 0.386  |
| No                                                                       | 44    | 17.6 | 12 (27.3%)                                    | 32 (72.7%)   | 1.000   |         |
| Parents stayed with                                                       |       |      |                                               |              |         |
| Mother only                                                              | 21    | 47.7 | 7 (33.3%)                                     | 14 (66.7%)   | n.a     | n.a     |
| Father only                                                              | 17    | 38.6 | 4 (23.5%)                                     | 13 (76.5%)   |          |         |
| Relatives                                                                | 5     | 11.4 | 1 (20.0%)                                     | 4 (80.0%)    |          |         |
| Friends                                                                  | 1     | 2.3  | 0 (0.0%)                                      | 1 (100.0%)   |          |         |

(Continued)
| Variable                                      | n=250 | %   | HPV Vaccination Status                                      | cPR (95% CI)       | P-value |
|-----------------------------------------------|-------|-----|-------------------------------------------------------------|--------------------|---------|
| Father involvement in daughter affairs       |       |     |                                                             |                    |         |
| Yes                                           | 62    | 24.8| Vaccinated (2 HPV Doses), N = 55                             | 0.955 (0.861 – 1.059) | 0.381   |
| No                                            | 172   | 68.8| Vaccinated (Single or no HPV Doses), N = 195                | 0.943 (0.858 – 1.035) | 0.216   |
| Not sure                                      | 16    | 6.4 | 2 (12.5%)                                                   | 14 (87.5%)         | 1.000   |
| The extent of paternal involvement            |       |     |                                                             |                    |         |
| To a large extent                             | 21    | 33.9| Vaccinated (2 HPV Doses), N = 55                             | 1.103 (0.934 – 1.302) | 0.248   |
| To some extent                                | 30    | 48.4| Vaccinated (Single or no HPV Doses), N = 195                | 1.004 (0.840 – 1.199) | 0.969   |
| To a small extent                             | 11    | 17.7| 3 (27.3%)                                                   | 8 (72.7%)          | 1.000   |
| Fear of side effects of vaccines              |       |     |                                                             |                    |         |
| Yes                                           | 182   | 72.8| Vaccinated (2 HPV Doses), N = 55                             | 0.989 (0.928 – 1.054) | 0.738   |
| No                                            | 68    | 27.2| Vaccinated (Single or no HPV Doses), N = 195                | 0.989 (0.928 – 1.054) | 0.738   |
| Worried about the safety of the HPV vaccine   |       |     |                                                             |                    |         |
| Yes                                           | 182   | 72.8| Vaccinated (2 HPV Doses), N = 55                             | 0.989 (0.928 – 1.054) | 0.738   |
| No                                            | 68    | 27.2| Vaccinated (Single or no HPV Doses), N = 195                | 0.989 (0.928 – 1.054) | 0.738   |
| Adolescents have ever been refused to be vaccinated, by parents or guardian |       |     |                                                             |                    |         |
| Yes                                           | 38    | 15.2| Vaccinated (2 HPV Doses), N = 55                             | 1.092 (0.584 – 2.040) | 0.784   |
| No                                            | 212   | 84.8| Vaccinated (Single or no HPV Doses), N = 195                | 1.000              |         |
| Daughter at risk of cervical cancer in case she does not get vaccinated |       |     |                                                             |                    |         |
| Yes                                           | 161   | 64.4| Vaccinated (2 HPV Doses), N = 55                             | 0.994 (0.937 – 1.056) | 0.852   |
| No                                            | 89    | 35.6| Vaccinated (Single or no HPV Doses), N = 195                | 1.000              |         |
| Kind of parenthood to the daughter            |       |     |                                                             |                    |         |
| Authoritarian                                 | 182   | 72.8| Vaccinated (2 HPV Doses), N = 55                             | 1.035 (0.967 – 1.109) | 0.321   |
| Permissive                                    | 68    | 27.2| Vaccinated (Single or no HPV Doses), N = 195                | 1.000              |         |
| Daughter health decision-maker                |       |     |                                                             |                    |         |
| One of the parents                            | 140   | 56.0| Vaccinated (2 HPV Doses), N = 55                             | 0.984 (0.769 – 1.258) | 0.896   |
| Both parents                                  | 87    | 34.8| Vaccinated (Single or no HPV Doses), N = 195                | 1.071 (0.838 – 1.368) | 0.586   |
| The entire family                             | 19    | 7.6 | Vaccinated (2 HPV Doses), N = 55                             | 1.023 (0.786 – 1.330) | 0.868   |
| The adolescent herself                        | 4     | 1.6 | Vaccinated (Single or no HPV Doses), N = 195                | 1.000              |         |
| Gender                                        |       |     |                                                             |                    |         |
| Male                                          | 24    | 9.6 | Vaccinated (2 HPV Doses), N = 55                             | 1.007 (0.910 – 1.108) | 0.882   |
| Female                                        | 226   | 90.4| Vaccinated (Single or no HPV Doses), N = 195                | 1.000              |         |

(Continued)
Table 2 (Continued).

| Variable                                           | n=250 | %     | HPV Vaccination Status                  | cPR (95% CI) | P-value |
|----------------------------------------------------|-------|-------|-----------------------------------------|--------------|---------|
|                                                    |       |       | Vaccinated (2 HPV Doses), N = 55        |              |         |
|                                                    |       |       | Vaccinated (Single or no HPV Doses), N = 195 |              |         |
| Age                                                |       |       |                                          |              |         |
| 18 to 30 years                                     | 23    | 9.2   | 2 (8.7%)                                | 21 (91.3%)   | 0.330 (0.072–1.516) | 0.154 |
| 31 to 42 years                                     | 83    | 33.2  | 18 (21.7%)                              | 65 (78.3%)   | 0.824 (0.350–1.940) | 0.658 |
| 42 to 54 years                                     | 125   | 50.0  | 30 (24.0%)                              | 95 (76.0%)   | 0.912 (0.404–2.059) | 0.825 |
| More than 54 years                                 | 19    | 7.6   | 5 (26.3%)                               | 14 (73.7%)   | 1.000   |       |
| Receive any formal education                       |       |       |                                          |              |         |
| Yes                                                | 231   | 93.4  | 51 (22.1%)                              | 180 (77.9%)  | 0.994 (0.894–1.106) | 0.916 |
| No                                                 | 19    | 6.6   | 4 (21.1%)                               | 15 (78.9%)   | 1.000   |       |
| School-level                                       |       |       |                                          |              |         |
| Primary                                            | 84    | 36.4  | 19 (22.6%)                              | 65 (77.4%)   | 0.985 (0.871–1.115) | 0.816 |
| Secondary                                          | 132   | 57.1  | 29 (22.0%)                              | 103 (78.0%)  | 0.989 (0.878–1.114) | 0.856 |
| Post-secondary                                     | 15    | 6.5   | 3 (20.0%)                               | 12 (80.0%)   | 1.000   |       |
| Relationship with the adolescent                   |       |       |                                          |              |         |
| Father                                             | 24    | 9.6   | 11 (25.0%)                              | 33 (75.0%)   | 1.050 (0.418–2.636) | 0.917 |
| Mother                                             | 183   | 73.2  | 34 (20.9%)                              | 129 (79.1%)  | 0.876 (0.385–1.992) | 0.752 |
| Guardian                                           | 19    | 7.6   | 4 (21.1%)                               | 15 (78.9%)   | 0.884 (0.277–2.818) | 0.835 |
| Auntie                                             | 3     | 1.2   | 1 (33.3%)                               | 2 (66.7%)    | 1.400 (0.238–8.250) | 0.710 |
| Grand parent                                       | 21    | 8.4   | 5 (23.8%)                               | 16 (76.2%)   | 1.000   |       |
| Current marital status                             |       |       |                                          |              |         |
| Married                                             | 170   | 68.0  | 33 (19.4%)                              | 137 (80.6%)  | 0.946 (0.881–1.016) | 0.125 |
| Single                                             | 58    | 23.2  | 20 (34.5%)                              | 38 (65.5%)   | 0.867 (0.787–0.955) | 0.004* |
| Separated                                          | 22    | 8.8   | 2 (9.1%)                                | 20 (90.9%)   | 1.000   |       |
| Institutional characteristics                       |       |       |                                          |              |         |
| Received advice from any health workers about getting daughter vaccinated for HPV |       |       |                                          |              |         |
| Yes                                                | 100   | 40.0  | 27 (27.0%)                              | 73 (73.0%)   | 1.446 (0.909–2.301) | 0.119 |
| No                                                 | 150   | 60.0  | 28 (18.7%)                              | 122 (81.3%)  | 1.000   |       |
| Community sensitization about the need for HPV vaccination |       |       |                                          |              |         |
| Yes                                                | 136   | 54.4  | 28 (20.6%)                              | 108 (79.4%)  | 1.018 (0.960–1.079) | 0.558 |
| No                                                 | 114   | 45.6  | 27 (23.7%)                              | 87 (76.3%)   | 1.000   |       |

(Continued)
Table 2 (Continued).

| Variable                                                                 | n=250 | % | HPV Vaccination Status | cPR (95% CI) | P-value |
|--------------------------------------------------------------------------|-------|---|------------------------|---------------|---------|
|                                                                          |       |   | Vaccinated (2 HPV Doses), N = 55 | Vaccinated (Single or no HPV Doses), N = 195 |         |
| Been made aware of the availability of the HPV vaccines at health facilities |       |   |                         |               |         |
| Yes                                                                      | 111   | 44.4 | 30 (27.0%)              | 81 (73.0%)    | 0.950 (0.896–1.008) | 0.092  |
| No                                                                       | 139   | 55.6 | 25 (18.0%)              | 114 (82.0%)   | 1.000   |
| Community provision of HPV vaccination services by HCWs                  |       |   |                         |               |         |
| Yes                                                                      | 46    | 18.4 | 9 (19.6%)               | 37 (80.4%)    | 1.017 (0.947–1.092) | 0.647  |
| No                                                                       | 204   | 81.6 | 46 (22.5%)              | 158 (77.5%)   | 1.000   |
| Provision of HPV vaccination services at daughter’s school, by any organization |       |   |                         |               |         |
| Yes                                                                      | 47    | 18.8 | 9 (19.1%)               | 38 (80.9%)    | 0.806 (0.398–1.634) | 0.550  |
| No                                                                       | 123   | 49.2 | 27 (22.0%)              | 96 (78.0%)    | 0.924 (0.552–1.547) | 0.764  |
| Not sure                                                                 | 80    | 32.0 | 19 (23.8%)              | 61 (76.3%)    | 1.000   |
| Vaccination services are provided for free in this district              |       |   |                         |               |         |
| Yes                                                                      | 192   | 76.8 | 44 (22.9%)              | 148 (77.1%)   | 1.054 (0.465–2.388) | 0.899  |
| No                                                                       | 35    | 14.0 | 6 (17.1%)               | 29 (82.9%)    | 0.789 (0.272–2.285) | 0.662  |
| Not sure                                                                 | 23    | 9.2  | 5 (21.7%)               | 18 (78.3%)    | 1.000   |
| Cost of HPV in district                                                  |       |   |                         |               |         |
| More than 10,000                                                         | 21    | 8.4  | 4 (19.0%)               | 17 (81.0%)    | 1.027 (0.894–1.180) | 0.707  |
| Less than 10,000                                                         | 131   | 52.4 | 29 (22.1%)              | 102 (77.9%)   | 1.009 (0.904–1.128) | 0.867  |
| Its free                                                                 | 77    | 30.8 | 17 (22.1%)              | 60 (77.9%)    | 1.010 (0.889–1.134) | 0.868  |
| Not sure                                                                 | 21    | 8.4  | 5 (23.8%)               | 16 (76.2%)    | 1.000   |

Notes: n.a: represents no inferential analysis done for that particular variable, because of having a null integer in its cross tabulation. Variables indicated with * showed a statistically significant association.

Table 3 Showing Multivariate Logistic Regression of the Predictors of HPV Vaccination Uptake

| Variable          | cPR (95% CI)       | P value | aPR (95% CI)       | P value |
|-------------------|--------------------|---------|--------------------|---------|
| Parent stayed with|                    |         |                    |         |
| Mother only       | 0.833 (0.738–0.940)| 0.003*  | 0.769 (0.595–0.995)| 0.046   |
| Father only       | 0.882 (0.787–0.989)| 0.032   | 0.801 (0.582–1.103)| 0.174   |
| Relatives         | 0.900 (0.741–1.094)| 0.289   | 0.848 (0.612–1.174)| 0.320   |
| Friends           | 1.000              |         |                    |         |
| Current marital status |                |         |                    |         |
| Married           | 0.946 (0.881–1.016)| 0.125   | 0.941 (0.872–1.014)| 0.112   |
| Single            | 0.867 (0.787–0.955)| 0.004*  | 0.859 (0.776–0.951)| 0.003   |
| Separated         | 1.000              |         |                    |         |

Note: Variables indicated with * showed a statistically significant association.
Discussion
In response to the current health scourge of cervical cancer, the cervical cancer triple intervention program was launched, with an HPV vaccination target of 90%, a screening target of 70%, and a treatment target of 80%. However, as this study discovered, HPV vaccination coverage was low, with only 22% receiving the double dose. This finding is surprising, but it is consistent with previous reports. HPV vaccination coverage, for example, was reported to be 2.6% in Nigeria, 17.61% in the entire Uganda, and 13.8% in Eastern Uganda. Only one study, by Isabirye et al, reported a 22% HPV vaccination coverage in Uganda; however, their study did not consider two doses as an indicator. These findings indicate a significant gap, but the effectiveness of the HPV vaccine in reducing infection risk and cervical cancer-related mortality is dependent on receiving its effective dose. As a result, low HPV vaccine uptake is undoubtedly a significant impediment to achieving cervical cancer eradication.

Previous reports have consistently shown that most adolescents receive only a single dose of the HPV vaccine, which is consistent with the findings of our study. However, because this is a suboptimal dose, the population is still at high risk of HPV sequel.

The adolescent-related predictors of HPV vaccination uptake differed from the triadic theory of influence hypotheses. This study found no statistically significant association between characteristics in the proximal tier of influence (individual characteristics). This finding is because the vaccination window is between the ages of 9 and 14 years, an age range in which an adolescent has no control over their own health decisions, instead of relying on their parents or guardians.

The parental-related predictors of HPV vaccination are consistent with the triadic theory of influence, which holds that distal characteristics (interpersonal) can be used to predict health behavior. In contrast to other studies, the findings of this study revealed that the prevalence of HPV vaccination was lower by 23% among adolescents who only lived with their mothers. This discovery is related to single parenthood, specifically single motherhood. This is because of patriarchy and a lack of socioeconomic support.

The institutional predictors of HPV vaccination uptake did not show statistical significance. This supports the finding that whether or not an adolescent is vaccinated is at the discretion of the parents. This finding suggests that outreach to parents using various behavioral communication change approaches is necessary to increase HPV vaccination uptake. However, the findings of this study differ from previous reports that found an association with specific health care service characteristics. The difference in the latter studies was attributed to a relatively higher engagement with the adolescents’ parents. This emphasizes the importance of parental involvement in HPV vaccination programs.

The findings of this study should be interpreted in light of the fact that the study only included female adolescents who had passed the screening eligibility window (9 to 14 years). This implies that the study did not include adolescents who might have sought vaccination shortly or sought a second dose six months after the interview. Also, as the HPV vaccination had been launched 5-years prior to the conception and conduct of this study, there may have been a recall bias. This may have influenced the participants’ responses for this study.

Conclusion
Only 22% of female adolescents in Gulu Municipality were immunized against HPV. Furthermore, neither individual nor institutional characteristics predicted HPV vaccination uptake; rather, parental characteristics demonstrated significant predictive power. The following variables demonstrated statistical significance: perception of childhood vaccination, nature of parent stayed with if not both, and marital status. As a result, there is an urgent need to supplement and/or modify current behavior change communication efforts to focus on demystifying the HPV vaccine to parents.

Abbreviations
HPV, Human Papillomavirus; TTI, triadic theory of influence.

Data Sharing Statement
All relevant data are within the paper. The questionnaire used is included in Appendix 1.
Ethics Approval and Consent to Participate

Ethical approval was obtained from the research and ethics committee of Clarke International University (UG-REC-0015). Participation was entirely voluntary, and confidentiality was ensured where a copy of the proposal with a consent form was presented for approval before the beginning of the study. Also, written informed consent was obtained from all participants. The anonymity of participants was ensured at all stages of data collection and analysis.

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Author Contributions

CA, SM, BBJ and IMT conceived the study idea, and participated in study design; data acquisition, analysis, interpretation; and manuscript drafting and revision. SA, SM, BBJ and IMT oversaw the research design, cross-checked data collection tools. All authors contributed to data analysis, drafting or revising the article, have agreed on the journal to which the article will be submitted, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

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The authors declare no conflict of interest in this work.

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