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ORIGINAL RESEARCH

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

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unsafe sexual behavior were barriers to HPV vaccination uptake.[22–26] 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).[27] 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[28] given by;

$$n = \frac{NC^2}{C^2 + (N-1)\ e^2}$$

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),[27] 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;

$$Nrp = \frac{N_P \times n}{N_T}$$

Where; Nrp 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	Nrp
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

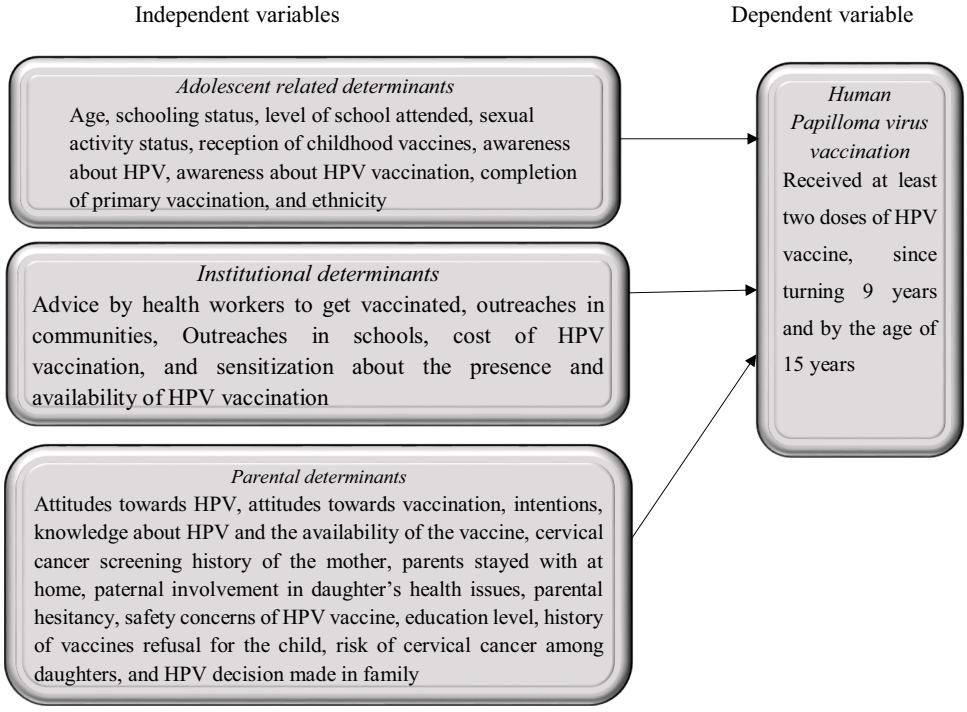

Figure 1 The conceptual frame based on the triadic theory of influence relating the independent variables towards the uptake of HPV vaccination.

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*)

Table 1 (Continued).

Variable	Category	Frequency (n=250)	Percentage
Perceptions of the HPV vaccination (Worry about the safety of vaccines like HPV)			
Variable	Yes = 182	No = 68	Total
The general view about childhood vaccination			
It is important	147 (75.4%)	48 (24.6%)	195 (100.0%)
Not all vaccinations are important	32 (64.0%)	18 (36.0%)	50 (100.0%)
The vaccinations are too many	3 (60.0%)	2 (40.0%)	5 (100.0%)
Fear of side effects of vaccines			
The general view about childhood vaccination			
It is important	147 (75.4%)	48 (24.6%)	195 (100.0%)
Not all vaccinations are important	32 (64.0%)	18 (36.0%)	50 (100.0%)
The vaccinations are too many	3 (60.0%)	2 (40.0%)	5 (100.0%)

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.

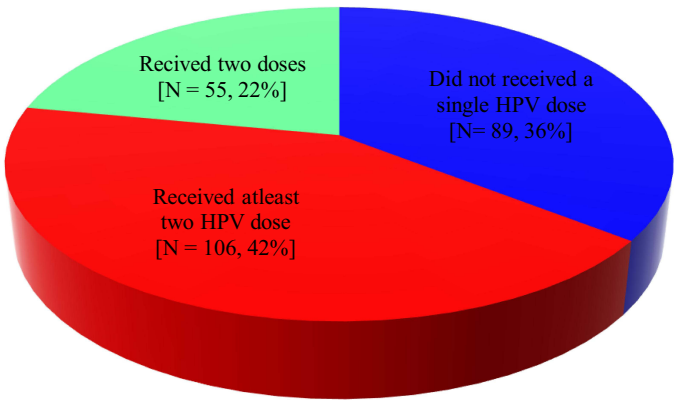

Figure 2 The proportion of the HPV vaccinated, and their vaccination schedule.

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*)

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		
Father involvement in daughter affairs						
Yes	62	24.8	13 (21.0%)	49 (79.0%)	0.955 (0.861 −1.059)	0.381
No	172	68.8	40 (23.3%)	132 (76.7%)	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	2 (9.5%)	19 (90.5%)	1.103 (0.934–1.302)	0.248
To some extent	30	48.4	8 (26.7%)	22 (73.3%)	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	41 (22.5%)	141 (77.5%)	0.989 (0.928–1.054)	0.738
No	68	27.2	14 (20.6%)	54 (79.4%)	1.000	
Worried about the safety of the HPV vaccine						
Yes	182	72.8	41 (22.5%)	141 (77.5%)	0.989 (0.928–1.054)	0.738
No	68	27.2	14 (20.6%)	54 (79.4%)	1.000	
Adolescents have ever been refused to be vaccinated, by parents or guardian						
Yes	38	15.2	9 (23.7%)	29 (76.3%)	1.092 (0.584–2.040)	0.784
No	212	84.8	46 (21.7%)	166 (78.3%)	1.000	
Daughter at risk of cervical cancer in case she does not get vaccinated						
Yes	161	64.4	36 (22.4%)	125 (77.6%)	0.994 (0.937–1.056)	0.852
No	89	35.6	19 (21.3%)	70 (78.7%)	1.000	
Kind of parenthood to the daughter						
Authoritarian	182	72.8	37 (20.3%)	145 (79.7%)	1.035 (0.967–1.109)	0.321
Permissive	68	27.2	18 (26.5%)	50 (73.5%)	1.000	
Daughter health decision-maker						
One of the parents	140	56.0	39 (27.9%)	101 (72.1%)	0.984 (0.769–1.258)	0.896
Both parents	87	34.8	11 (12.6%)	76 (87.4%	1.071 (0.838–1.368)	0.586
The entire family	19	7.6	4 (21.1%)	15 (78.9%)	1.023 (0.786–1.330)	0.868
The adolescent herself	4	1.6	1 (25.0%)	3 (75.0%)	1.000	
Gender						
Male	24	9.6	5 (20.8%)	19 (79.2%)	1.007 (0.910–1.108)	0.882
Female	226	90.4	50 (22.1%)	176 (77.9%)	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	92.4	51 (22.1%)	180 (77.9%)	0.994 (0.894–1.106)	0.916
No	19	7.6	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 (0.899–1.134)	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%.[37] 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,[38] 17.61% in the entire Uganda,[18] and 13.8% in Eastern Uganda.[18] Only one study, by Isabirye et al, reported a 22% HPV vaccination coverage in Uganda;[36] 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.[39,40] As a result, low HPV vaccine uptake is undoubtedly a significant impediment to achieving cervical cancer eradication.[19,35,41,42] Previous reports have consistently shown that most adolescents receive only a single dose of the HPV vaccine,[43–45] 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.[46,47]

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.[48]

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,[23,25,38] 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.[49]

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.[50] 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.[31,36,51] 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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Disclosure

The authors declare no conflict of interest in this work.

References

1. Trottier H, Franco EL. The epidemiology of genital human papillomavirus infection. *Vaccine*. 2006;24:S4–S15. doi:10.1016/j.vaccine.2005.09.054
2. de Martel C, Plummer M, Vignat J, Franceschi S. Worldwide burden of cancer attributable to HPV by site, country and HPV type. *Int J Cancer*. 2017;141(4):664–670. doi:10.1002/ijc.30716
3. Jedy-Agba E, Joko WY, Liu B, et al. Trends in cervical cancer incidence in sub-Saharan Africa. *Br J Cancer*. 2020;123(1):148–154. doi:10.1038/s41416-020-0831-9
4. Ndejjo R, Mukama T, Musabyimana A, Musoke D. Uptake of cervical cancer screening and associated factors among women in rural Uganda: a cross sectional study. *PLoS One*. 2016;11(2):e0149696. doi:10.1371/journal.pone.0149696
5. Desta M, Getaneh T, Yeserah B, et al. Cervical cancer screening utilization and predictors among eligible women in Ethiopia: a systematic review and meta-analysis. *PLoS One*. 2021;16(11):e0259339. doi:10.1371/journal.pone.0259339
6. Nakisige C, Schwartz M, Ndira AO. Cervical cancer screening and treatment in Uganda. *Gynecol Oncol Rep*. 2017;20:37–40. doi:10.1016/j.gore.2017.01.009
7. Baussano I, Bray F. Modelling cervical cancer elimination. *Lancet Public Health*. 2019;4(1):e2–e3. doi:10.1016/S2468-2667(18)30189-0
8. Abdullahi LH, Kagina BM, Ndze VN, Hussey GD, Wiysonge CS. Improving vaccination uptake among adolescents. *Cochrane Database Syst Rev*. 2020;1(1):CD011895. doi:10.1002/14651858.CD011895.pub2
9. Ventola CL. Immunization in the United States: recommendations, barriers, and measures to improve compliance: part 1: childhood vaccinations. *PT*. 2016;41(7):426–436.
10. Gavillon N, Vervaet H, Derniaux E, Terrosi P, Graesslin O, Quereux C. Papillomavirus humain (HPV): comment ai-je attrapé ça? [How did I contract human Papillomavirus (HPV)?]. *Gynecol Obstet Fertil*. 2010;38(3):199–204. doi:10.1016/j.gyobfe.2010.01.003
11. World Health Organization. Human papillomavirus vaccines. *WHO Position Paper*. 2017;92(19):241–268.
12. Winer RL, Lee SK, Hughes JP, Adam DE, Kiviat NB, Koutsky LA. Genital human papillomavirus infection: incidence and risk factors in a cohort of female university students. *Am J Epidemiol*. 2003;157:218–226. doi:10.1093/aje/kwf180
13. Collins S, Mazloomzadeh S, Winter H, et al. High incidence of cervical human papillomavirus infection in women during their first sexual relationship. *BJOG*. 2002;109:96–98. doi:10.1111/j.1471-0528.2002.01053.x
14. Hirth J. Disparities in HPV vaccination rates and HPV prevalence in the United States: a review of the literature. *Hum Vaccin Immunother*. 2019;15(1):146–155. doi:10.1080/21645515.2018.1512453
15. Attia AC, Wolf J, Núñez AE. On surmounting the barriers to HPV vaccination: we can do better. *Ann Med*. 2018;50(3):209–225. doi:10.1080/07853890.2018.1426875
16. Arbyn M, Weiderpass E, Bruni L, et al. Estimates of incidence and mortality of cervical cancer in 2018: a worldwide analysis. *Lancet Glob Health*. 2020;8(2):e191–203. doi:10.1016/S2214-109X(19)30482-6
17. Kisaakye E, Namakula J, Kihembo C, Kisakye A, Nsubuga P, Babirye JN. Level and factors associated with uptake of human papillomavirus infection vaccine among female adolescents in Lira District, Uganda. *Pan Afr Med J*. 2018;31:184. doi:10.11604/pamj.2018.31.184.14801

18. Nabirye J, Okwi LA, Nuwematsiko R, et al. Health system factors influencing uptake of Human Papillomavirus (HPV) vaccine among adolescent girls 9–15 years in Mbale District, Uganda. *BMC Public Health*. 2020;20(1):171. doi:10.1186/s12889-020-8302-z
19. Wymann MN, Zographos AS, Altpeter E, Spicher VM, Low N, Mäusezahl-Feuz M. Human papillomavirus vaccine uptake in adolescence and adherence to cervical cancer screening in Switzerland: a national cross-sectional survey. *Int J Public Health*. 2018;63(1):105–114. doi:10.1007/s00038-017-1050-x
20. Morales-Campos DY, Flores BE, Donovan E, et al. A qualitative descriptive study of providers' perspectives on human papillomavirus vaccine administration among Latino/a adolescents in South Texas clinics: barriers and facilitators. *BMC Public Health*. 2022;22(443). doi:10.1186/s12889-022-12837-2
21. Mihretie GN, Liyeh TM, Ayele AD, et al. Knowledge and willingness of parents towards child girl HPV vaccination in Debre Tabor Town, Ethiopia: a community-based cross-sectional study. *Reprod Health*. 2022;19:136. doi:10.1186/s12978-022-01444-4
22. Rujumba J, Akugizibwe M, Basta NE, Banura C. Why don't adolescent girls in a rural Uganda district initiate or complete routine 2-dose HPV vaccine series: perspectives of adolescent girls, their guardians, healthcare workers, community health workers and teachers. *PLoS One*. 2021;16(6):e0253735. doi:10.1371/journal.pone.0253735
23. Birmingham WC, Macintosh JLB, Vaughn AA, Graff TC. Strength of belief: religious commitment, knowledge, and HPV vaccination adherence. *Psychooncology*. 2019;28:1227–1233. doi:10.1002/pon.5071
24. Davis K, Dickman ED, Ferris D, Dias JK. Human papillomavirus vaccine acceptability among parents of 10- to 15-year-old adolescents. *J Low Genit Tract Dis*. 2004;8:188–194. doi:10.1097/00128360-200407000-00005
25. Walhart T. Parents, adolescents, children and the human papillomavirus vaccine: a review. *Int Nurs Rev*. 2012;59:305–311. doi:10.1111/j.1466-7657.2012.00991.x
26. Zimet GD, Rosberger Z, Fisher WA, Perez S, Stupiansky NW. Beliefs, behaviors and HPV vaccine: correcting the myths and the misinformation. *Prev Med*. 2013;57:414–418. doi:10.1016/j.ypmed.2013.05.013
27. Gulu Municipality. District Health Information Software2; 2018.
28. Nassiuma DK. *Survey Sampling: Theory and Methods*. Nairobi: University Press; 2000.
29. Flay BR, Petraitis J. The theory of triadic influence: a new theory of health behavior with implications for preventive interventions. In: Albrecht GS, editor. *Advances in Medical Sociology: A Reconsideration of Models of Health Behavior Change*. Greenwich, CT: JAI Press. Vol. 4; 1994:19–44.
30. Hollins A, Wardell D, Fernandez ME, Markham C, Guilamo-Ramos V, Santa Maria D. Human papillomavirus vaccination status and parental endorsement intentions among undergraduate student nurses. *Int J Environ Res Public Health*. 2021;18(6):3232. doi:10.3390/ijerph18063232
31. Bernat DH, Gerend MA, Chevallier K, Zimmerman MA, Bauermeister JA. Characteristics associated with initiation of the human papillomavirus vaccine among a national sample of male and female young adults. *J Adolesc Health*. 2013;53(5):630–636. doi:10.1016/j.jadohealth.2013.07.035
32. Krakow M, Beavis A, Cosides O, Rositch AF. Characteristics of adolescents lacking provider-recommended human papillomavirus vaccination. *J Adolesc Health*. 2017;60(5):619–622. doi:10.1016/j.jadohealth.2016.11.028
33. Anuforo B, McGee-Avila JK, Toler L, et al. Disparities in HPV vaccine knowledge and adolescent HPV vaccine uptake by parental nativity among diverse multiethnic parents in New Jersey. *BMC Public Health*. 2022;22(1):195. doi:10.1186/s12889-022-12573-7
34. Robles C, Bruni L, Acera A, et al. Determinants of human papillomavirus vaccine uptake by adult women attending cervical cancer screening in 9 European countries. *Am J Prev Med*. 2021;60(4):478–487. doi:10.1016/j.amepre.2020.08.032
35. de Munter AC, Klooster TMST, van Lier A, Akkermans R, de Melker HE, Ruijs WLM. Determinants of HPV-vaccination uptake and subgroups with a lower uptake in the Netherlands. *BMC Public Health*. 2021;21(1):1848. doi:10.1186/s12889-021-11897-0
36. Isabirye A, Mbonye M, Asiimwe JB, Kwagala B. Factors associated with HPV vaccination uptake in Uganda: a multi-level analysis. *BMC Womens Health*. 2020;20(1):145. doi:10.1186/s12905-020-01014-5
37. World Health Organization. *Global Strategy Towards the Elimination of Cervical Cancer as a Public Health Problem*. World Health Organization; 2020.
38. Oluwole EO, Idowu OM, Adejimi AA, Balogun MR, Osanyin GE. Knowledge, attitude and uptake of human papillomavirus vaccination among female undergraduates in Lagos State, Nigeria. *J Family Med Prim Care*. 2019;8(11):3627–3633. doi:10.4103/jfmpc.jfmpc_520_19
39. Cheng L, Wang Y, Du J. Human papillomavirus vaccines: an updated review. *Vaccines*. 2020;8(3):391. doi:10.3390/vaccines8030391
40. Liu G, Mugo NR, Bayer C, et al. Impact of catch-up human papillomavirus vaccination on cervical cancer incidence in Kenya: a mathematical modeling evaluation of HPV vaccination strategies in the context of moderate HIV prevalence. *mEClinicalMedicine*. 2022;19(45):101306. doi:10.1016/j.eclinm.2022.101306
41. Dilley SE, Peral S, Straughn JM Jr, Scarinci IC. The challenge of HPV vaccination uptake and opportunities for solutions: lessons learned from Alabama. *Prev Med*. 2018;113:124–131. doi:10.1016/j.ypmed.2018.05.021
42. Dorji T, Nopsopon T, Tamang ST, Pongpirul K. Human papillomavirus vaccination uptake in low-and middle-income countries: a meta-analysis. *EClinicalMedicine*. 2021;34:100836. doi:10.1016/j.eclinm.2021.100836
43. Sankaranarayanan R, Joshi S, Muwonge R, et al. Can a single dose of human papillomavirus (HPV) vaccine prevent cervical cancer? Early findings from an Indian study. *Vaccine*. 2018;36:4783–4791. doi:10.1016/j.vaccine.2018.02.087
44. Brotherton JM, Budd A, Rompotis C, et al. Is one dose of human papillomavirus vaccine as effective as three? A national cohort analysis. *Papillomavirus Res*. 2019;8:100177. doi:10.1016/j.pvr.2019.100177
45. Pal M, Bandyopadhyay S. Single-dose nonavalent HPV vaccine: need of the hour. *Nepal J Epidemiol*. 2020;10(2):871–873. doi:10.3126/nje.v10i2.28962
46. Castellino SM, Allen KE, Pleasant K, Keyes G, Poehling KA, Tooze JA. Suboptimal uptake of human papillomavirus (HPV) vaccine in survivors of childhood and adolescent and young adult (AYA) cancer. *J Cancer Surviv*. 2019;13(5):730–738. doi:10.1007/s11764-019-00791-9
47. Lin L, Parra MM, Sierra VY, et al. Safety and Immunogenicity of the HPV-16/18 AS04-adjuvanted vaccine in 4–6-year-old girls: results to month 12 from a randomized trial. *Pediatr Infect Dis J*. 2018;37(4):e93–e102. doi:10.1097/INF.0000000000001871
48. Glenn BA, Nonzee NJ, Tieu L, Pedone B, Cowgill BO, Bastani R. Human papillomavirus (HPV) vaccination in the transition between adolescence and adulthood. *Vaccine*. 2021;39(25):3435–3444. doi:10.1016/j.vaccine.2021.04.019
49. Siu JY, Fung TKF, Leung LH. Barriers to receiving HPV vaccination among men in a Chinese community: a qualitative study in Hong Kong. *Am J Mens Health*. 2019;13(1):1557988319831912. doi:10.1177/1557988319831912

50. Rabiu KA, Alausa TG, Akinlusi FM, Davies NO, Shittu KA, Akinola OI. Parental acceptance of human papillomavirus vaccination for adolescent girls in Lagos, Nigeria. *J Family Med Prim Care*. 2020;9(6):2950–2957. doi:10.4103/jfmpc.jfmpc_102_20
51. Matsuno RK, Seay J, Porter B, Tannenbaum K, Warner S, Wells N. Factors associated with human papillomavirus vaccine initiation and compliance among U.S. military service members. *Mil Med*. 2022. doi:10.1093/milmed/usab562