Health Systems Factors influencing Initiation to Human papillomavirus Vaccination among Adolescent Girls aged 9 to 17 years in Eastern Uganda. A Cross-sectional Study.

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Abstract

Background:
In many parts of Africa, cervical cancers are not identified or treated until advanced stages due to insufficient access to reproductive health care services, effective screening, and early treatment. To reduce the cervical cancer burden in the African Region, WHO will continue to support Ministries of Health to implement priority cancer prevention and control interventions that cut across the continuum of prevention, early detection, diagnosis, treatment, and palliative care services. The objective of the study is to determine Health systems factors influencing initiation to Human papillomavirus Vaccination among adolescent girls aged 9 to 17 years in Eastern Uganda.

Methodology:
The study adopted a population-based cross-sectional study design in which questionnaires were used in the data collection process. The data were analyzed in STATA. Data was collected from 4th/01/2021 to 20th/05/2022.

Results:
Health systems factors influencing initiation of HPV vaccination include perceived knowledgeability of health workers about HPV vaccines by the caretakers, community sensitization about HPV vaccination, availability of vaccines at the health facilities, and quality of care offered at the health facility. These are all reported with p-values less than 0.05 when assessed at bivariate

Conclusion:
Health systems characteristics play a role in influencing caretakers towards initiation to HPV vaccination when assessed in isolation. These factors significantly influence the caretaker's decision to initiate their adolescent girls to HPV vaccination.

Recommendations:
The District Health Officer should as a practice organize community sensitization about HPV vaccination for adolescent girls. This further calls for resource mobilization, since key informants who were in charge of health facilities reported inadequate funding to ensure proper facilitation of medical staff from the district to lower health center levels.

Email: fr.wa20156@gmail.com Date submitted: 11th/04/2022 Date accepted: 19th/05/2022

1 Background to the Study

In many parts of Africa, cervical cancers are not identified or treated until advanced stages due to insufficient access to reproductive health care services, effective screening, and early treatment. To reduce the cervical cancer burden in the African

Region, WHO will continue to support Ministries of Health to implement priority cancer prevention and control interventions that cut across the continuum of prevention, early detection, diagnosis, treatment, and palliative care services. (WHO, 2015).

Sub-Saharan Africa has the third-highest incidence (17.5%) of cervical cancer cases after India (17.7%) and East and Central Asia (18.2%). The region shares the second largest number of global cervical cancer deaths (21.6%) after India (25.4%). In SSA, NIPs (national immunization programs) have undergone steady advancements since the establishment of the Expanded Program on Immunization in 1974 (WHO, 2013). Tremendous progress has been made in increasing access to life-saving vaccines and reducing the burden of vaccine-preventable diseases in the region (Amponsah-Dacosta, 2020). Despite this, sub-Saharan Africa continues to lag in meeting global immunization targets (Amponsah-Dacosta, 2020).

In Uganda, HPV vaccines against HPV 16 and HPV 18 have been available since (Isabirye *et al,* 2020). The first HPV pilot vaccination in Uganda was first implemented in 2008 in Nakasongola and Ibanda districts to assess the feasibility of the intervention. The breakthrough of these pilot projects paved the way for a countrywide rollout of the HPV vaccination in November 2015 (Isabirye *et al,* 2020).

Cervical cancer is the number one cause of cancer-related death in women in Uganda. The WHO estimates that in 2014 approximately 3915 Ugandan women were diagnosed with cervical cancer and that 2160 died from the disease (ICO Information Centre on HPV and Cancer (Nakisige *et al.,* 2017). Whereas several interventions have been implemented, a 33.6% prevalence of human papillomavirus (HPV) among women in Uganda combined with low screening initiation has resulted in the country having one of the highest cervical cancer incidence rates in the world at 47.5 per 100,000 per year (ICO Information Centre on HPV and Cancer, (Nakisige *et al.,* 2017).

A study carried out in Mbale discovered that only 14% of adolescent girls self-reported HPV vaccine initiation (Nabirye *et al.* 2020), which is lower than Lira district which is at 17.4% (Isabirye *et al,* 2020) and below the national average at 17%. (MOH, 2016) Despite all efforts from the stakeholders, Empirical evidence shows very low HPV vaccine initiation, hence the need for the current study to establish the study Health systems factors influencing initiation to HPV vaccination among adolescent girls aged 9 to 17 years in Eastern Uganda.

2 Methodology

Research Design

This study employed a cross-sectional study design and adopted a quantitative approach to data collection. A cross-sectional design further allowed for an investigation of similar cases at the same time thus, saving time, and costs since data were collected just once using questionnaires. This research design was used by Kisaakye et al. (2018) to conduct a related study in Northern Uganda.

Locale of the Study

This study was done in Mbale District including two city divisions from 4th/01/2021 to 20th/05/2022. Mbale District is a district in Eastern Uganda. It serves as the main administrative and commercial center in the sub-region. Mbale District is bordered by Sironko District to the north, Bududa District to the northeast, Manafwa District to the southeast, Tororo District to the south, Butaleja District to the southwest, and Budaka District to the west. Pallisa District and Kumi District lie to the northwest of Mbale District. Mbale, the largest town in the district and the location of the district headquarters, is located approximately 245 kilometers (152 mi), by road, northeast of Kampala, the capital of Uganda, and the largest city in the country. The coordinates of the district are 00 57N, 34 20E. It has an area of 518.8 square kilometers (200.3 sq. mi). The districts of Bududa, Manafwa, Namisindwa, and Sironko were part of the Mbale District before they were split off as independent districts. This area was chosen because prior related studies indicate a very low initiation to HPV vaccines (14%) as reported in Nabirye et al. 2020, compared to the national average of 17%. (MOH, 2016).

Study Population

A study population is a collection of individual units, informants, or respondents to whom the results of a survey are to be generalized (Dooley, 1995; Best & Khan, 1993 & Cardwell 1999. The study population was the Caregivers (parents or guardians) of adolescent girls in the age bracket of 9 – 17 years. The researcher interviewed parents or guardians, preferably females who had adolescent girls aged 9 – 17 years under their care in Mbale District to enlist information on personal and ado-

lescent girl characteristics, health systems factors, and community characteristics.

This study also targeted the health workers in health centers where HPV services are given in the catchment area because of their knowledge and positions as regards HPV. Included also were the household heads who offer care to adolescent girls aged 9 – 17 years living in either rural or urban setup in Mbale District. The age of the adolescents was determined through parents' / Guardians' reports. Further to this, the researcher only proceeded to administer the interview if the caregiver consented to participate in the study. Excluded were those caregivers in households who did not have girls within the age bracket of this study and those who refused to consent to participate in the study.

Sample Size

The sample is the part of the population that helps researchers to draw inferences about the population. Isaac and Michael (1995) indicate that larger sample sizes will result in smaller sampling errors, greater reliability, and an increase the power of the statistical test applied to the data. Several mathematical formulae have been proposed for sample size determination.

In this study, one of the objectives was to estimate the proportion of HPV initiation by caregivers of adolescents in the age bracket of 9-17 years, which was a dichotomous outcome variable (yes/no) in a single large population of unknown size.

Cochran (1977) and Sullivan (2020) propose the following formula for determining sample size for unknown large populations ($N > 50,000$).

$$n_0 = \frac{Z^2 * p * (1-p)}{e^2}$$

Where, is the sample size. Z is the value from the standard normal distribution reflecting the confidence level that will be used. e; is the acceptable sampling error p; is the estimated proportion of an attribute that is present in the population.

Here the research planned a study to generate a 95% confidence interval for the unknown population proportion, p. The range of p is 0 to 1, and therefore the range of p(1-p) is 0 to 1. From theory, to generate the most conservative, or largest sample size, p(1-p) has to be maximized and this is achievable when p = 0.5 (Sullivan, 2020). Z = 1.96 for a 95% confidence level, and the corresponding sampling error (margin of error) = 0.05. Computing these values in the formula yields 385

The research expects the population of caretakers of adolescents aged 9 – 17 years to be less than 50,000, thus, the finite population correction for proportions was;

$$n = \frac{n_0}{1 + \frac{n_0 - 1}{N}}$$

Where; n_0 - the initial sample size. n - adjusted sample size N - the expected population size. UBOS (2014) Population Projections of Mbale District from 2015-2020, puts the population of adolescent girls aged 9yrs to 17yrs at 46,810 (obtained by summing up specific age populations of the females in the target age bracket) in 2020. This number is a proxy approximation of caretakers since the researcher will consider only one adolescent girl in each household.

Substituting these values in formula 2, yields a sample size $n = 381$. For purposes of improving on the precision of the sample estimates, the research will take n = 400 for interview-administered questionnaires, a number slightly above the calculated value. All in all, 445 respondents (400 adolescents' caretakers, 10 Key Informants (a health facility in charge and his/her assistant in each sub-county) and 50 village health team members for FGDs will be selected to participate in the study (one FGD will consist of 10 village health teams, two (preferably females) out of an average of 3 per selected villages in selected sub counties). VHTs are selected on the background that they are knowledgeable about health services in their communities. All contributions from the participants will be appreciated to encourage free interaction so as to enhance productivity of the FGD. Each FGD session will be expected to last 15 to 30 minutes, giving every participant at least two minutes to contribute.

Sampling Procedure

The sampling technique is the process of selecting a sample from a given population. (Palys & Atchison, 2014; Cochran, 1977). This study employed a multistage sampling technique. Multistage sampling has been recommended because it concentrates the sample around several sample points rather than spread them over the entire area to be surveyed and at the same time gives precise estimates, hence reducing the cost (Cochran, 1977). Specifically, this study used a three-stage sampling procedure. In the first stage, the researcher stratified the sub-counties by location (urban and rural) and applied simple random sampling by lottery in each stratum to select five sub-counties/ divisions,

Table 1. Sample method, target population and sample size

Category of target population	Target population	Sample size	Sampling Method
Adolescent Girls	46, 810	400	Multistage sampling and Simple Random Sampling
KIs FGDs	56 395	10 50 (5 FGDs x10)	Purposive sampling Purpose Sampling
Total	-	**460**	

Source: Researcher's Intuition based on Sullivan (2020) and Cochran (1977)

the primary sampling units (PSU) out of the 21 in the whole district (i.e., Three rural-based and two urban-based). In the second stage, the researcher used a lottery simple random sampling to select three parishes /wards in each sub-county or division, the secondary sampling units (SSU) from each of the selected sub-counties/divisions.

A sampling frame consisting of a household list of adolescent girl caretakers in the selected parishes was constructed. This list was developed with the help of the village health trainers (VHTs) and local council one (LCIs) in the selected parishes. These moved together with research assistants from house to house enumerating caretaker households in which target adolescent girls existed. After listing, number of respondents per parish was established using probability proportional to size (i.e., a parish with a small number listed contributed small number of caretakers to participate in the study and vice versa) where the probability of selection was $\frac{number\ listed\ in\ a\ parish(m_i)}{Total\ sum\ listed\ in\ all\ the\ parishes\ (m)}$.

The required sample size per parish was determined using the formula; $\frac{number\ listed\ in\ a\ parish(m_i)}{Total\ sum\ listed\ in\ all\ the\ parishes\ (m)} \times n,\ n\ being\ the\ study\ sample\ size\ =\ 400$. This formula was first proposed by Lahili (1951) as cited in Cochran (1977)

In each parish, a caretaker to participate in the study was selected using the listing order of household numbers assigned apriori during the listing and interviewed them until the required sample size for the respective parish was obtained. Information was obtained from the caretaker about only one adolescent girl from each household so that the number of caretakers is a proxy for the number of adolescent girls for whom the caretakers provided the information.

Data Collection Methods and Instruments

In this study, both quantitative and qualitative strategies of data collection were adopted. The study adopted both the questionnaire and interview method as the data collection methods in eliciting data from the respondents.

Research instruments

The researcher developed three data collection instruments; The interviewer-administered questionnaire for collecting quantitative data from caregivers of adolescent girls aged 9-17 years, open-ended questions for key informants and focus group discussions questionnaires to collect qualitative data from the health facility in-charges who were the key informants (Boyce and Neale, 2006) and from the village health trainers (VHTs) who constituted the FGDs. This strategy of adopting both methods of data collection help to prevent the inefficiencies of using just one method.

Validity and Reliability

Reliability

Reliability is a measure of the consistency of scores obtained (Gray, 2004). Amin (2005) emphasizes that reliability is the dependability or trustworthiness of research results or the degree to which a measuring instrument consistently measures what it is supposed to measure.

The reliability of this research tool was assessed through brainstorming on all the question items about initiation to HPV vaccination among adolescent girls under care. The questions that seemed to have contradictions were adjusted to fit the research context based on the research objectives. The Cronbach-alpha standard measure of internal consistency could not be applied as the mixed nature of questionnaire items could not fit the theoretical assumptions. That is (1) all the item variable values should be on a continuous or Likert scale (Cronbach, 1951) (2) all the item variables should

be dichotomous (Technical Whitepaper #7: KR20 & coefficient alpha, 2007)

Validity

The validity of an instrument refers to the extent to which the instrument measures what it is intended to measure. Amin (2005) and (Gray, 2004) point out that a research instrument is valid if it measures what it is supposed to measure and when the data collected through it accurately represents the respondents' opinion.

To ensure that there is internal validity of the research instruments used in this study, the researcher first discussed the draft questionnaires with the supervisors and two colleagues (MPH candidates) for scrutiny, language clarity, comprehensiveness of content, and length of the questionnaire and removal of ambiguity. Recommendations of the supervisors, lecturers, and colleagues were used in the correction of the instruments before pre-testing. To ensure the content validity of the instruments, the researcher availed the corrected questionnaires to the research supervisors of Bugema University. The content validity index (CVI) was calculated using the formula below.

$$CVI = \frac{number\ of\ question\ items\ considered\ relevant}{Total\ number\ questions\ in\ the\ questionnaire.}$$

$$content\ validity\ index,\ CVI = \frac{28}{33.} = 0.85$$

The CVI calculated results should be within the accepted range of 0 to 1. The result from the computation of CVI were interpreted according to George and Mallery (2003) scale:

Source: George and Mallery (2003)

Amin (2005) points out that the researcher should consider the content valid only when the CVI > 0.70.

Thus, a CVI of 0.85 was considered good enough for the tool to be used.

Data Collection Process

This study entirely used primary data that was collected using interviewer administered questionnaire. Primary data will help the researcher to enlist only required information by customising the questionnaire and further to minimise missing data (Institute for Work and Health, 2008). The data was quantitative.

3 Data Analysis:

Quantitative data was analysed using STATA to generate frequency tables at univariate analysis level and tests of association and significance at bivariate. Finally, at multivariate analysis to generate odds ratios (measure of effect) and p- values to assess the factors influencing initiation to HPV vaccine among adolescent girls in Mbale district.

4 Results:

Out of 400 questionnaires that were delivered to respondents 388 (97%) were returned with sufficient responses. The reason why some questionnaires were not filled was due to misplacement by the research assistants and a few with inadequate responses were ignored. The 388(97%) respondents were considered adequate for this analysis.

5 Discussion:

6 Health Systems Characteristics.

Results in Table 3 reveal that more than half of the caretakers, 357 (92.0%) of adolescent girls in the study age bracket reported that distance from home to the nearest Health facility was less than 5km. 174 (44.8%) of the respondents reported existence of a community sensitization about HPV vaccine and over 223 (57.5%) believe that there are vaccines at the health facilities. 330 (85.1%) reported that these vaccines are easily accessible to clients although 30 (7.7%) report that these drugs are offered at a cost. However, 299 (77.1%) of the caretakers judged the quality of care offered by the personnel at the health facility to be good.

Health Systems Factors and initiation to HPV Initiation

The study sought to investigate significant health systems factors influencing initiation to HPV vaccination among adolescent girls aged 9 to 17 years in Mbale District by interviewing their caretakers. The bivariate results are presented in Table 4. As it can be seen from Table 4, the health systems factors that had a statistically significant association with initiation to HPV were; health worker's knowledge about HPV ($\chi^2 = 16.45,\ df = 1,\ p - value = 0.000$), community sensitization about HPV vaccination ($\chi^2 = 24.45,\ df = 1,\ p - value = 0.000$), availability of vaccines at the health facilities ($\chi^2 = 33.13,\ df = 1,\ p - value = 0.000$) and quality of care at the health facility ($\chi^2 = 26.08,\ df = 1,\ p - value = 0.000$). Factors that did not show a statistically significant associa-

Table 2. Showing Validity of Instruments

CVI	VALIDITY OF INSTRUMENT
0.90 - 1.00	Excellent
0.80 – 0.89	Good
0.70 – 0.79	Acceptable
0.60 – 0.69	Questionable
0.50 – 0.59	Poor
0.00 – 0.50	Unacceptable

Table 3. Health systems characteristics

Health systems Characteristics	Frequency (n)	Percentage (%)
Health Worker's Knowledge about HPV	**388**	
Yes	293	75.5
No	95	24.5
Distance of nearest Health facility from homes	**388**	
< 5km	357	92.0
Above 5km	31	8.0
Community sensitization About HPV vaccine	**388**	
Yes	174	44.8
No	214	55.2
Availability of vaccines at health Facility	**388**	
Yes	223	57.5
No	165	42.5
Accessibility of vaccines to clients	**388**	
Yes	330	85.1
No	58	14.9
Cost of HPV vaccines	**388**	
Yes	30	7.7
No	358	92.3
Quality of care	**388**	
Poor	89	22.9
Good	299	77.1

(Source: Primary Data 2021)

tion with initiation to HPV reported with p-values ≥ 0.05.

Health systems factors influencing initiation to HPV vaccination among adolescent girls aged 9 to 17 years were; perceived knowledgeability of health workers about HPV vaccines by the caretakers, community sensitization about HPV vaccination, availability of vaccines at the health facilities and quality of care offered at the health facility. These were all reported with p-values less than 0.05 when assessed both at bivariate. Details are reported in Table 4. These findings are supported by Nabirye et. al (2020) who reports that inconsistency in vaccine supply and inadequate training on HPV vaccine, as the factors that contribute to low uptake.

7 Conclusions

Health systems characteristics play a role in influencing caretakers towards initiation to HPV vaccination when assessed in isolation. These factors significantly influence the caretaker's decision to initiate their adolescent girls to HPV vaccination.

7.1 Recommendations:

Practice

1. The District Health Officer should as a practice organize community sensitizations about HPV vac-

Table 4. Bivariate Results on health systems characteristics Associated with HPV Vaccine Initiation among Adolescent girls aged 9 to 17 years inMbale District

Health Systems Characteristics.	HPV Initiation Status		Chi-square Test Results	
	Yes n (%)	No n (%)	χ2 (df)	p-value
Health Worker's Knowledge about HPV			16.45(1)	**0.000***
Yes	123 (87.2)	170 (68.8)		
No	18 (12.8)	77 (31.2)		
Distance of nearest Health facility from homes			0.01(1)	0.918
Less than 5km	130 (92.2)	227 (91.9)		
Above 5km	11 (7.8)	20 (8.1)		
Community Sensitization About HPV vaccine			24.45(1)	**0.000***
Sensitized	87 (61.7)	87 (35.2)		
Not Sensitized	54 (38.3)	160 (64.8)		
Availability of vaccines at health Facility			33.13(1)	**0.000***
Yes	108 (76.6)	115 (46.6)		
No	33 (23.4)	132 (53.4)		
Accessibility of vaccines to clients			3.07 (1)	0.080
Yes	114(80.9)	216 (87.5)		
No	27 (19.1)	31 (12.5)		
Cost of HPV vaccines			0.19(1)	0.664
Cost attached	12 (8.5)	18(7.3)		
No cost attached	129 (91.5)	229 (92.7)		
Quality of care			26.08 (1)	**0.000***
Poor	12(8.5)	77 (31.2)		
Good	129 (91.5)	170 (68.8)		

*** Significant at** $\alpha = 0.05$

cination for adolescent girls. This further calls for resource mobilization, since key informants who were in-charges of health facilities reported inadequate funding) to ensure proper facilitation of medical staff from the district to lower health center levels.

2. Village health trainers (VHTs) should be empowered to do a household surveillance to enlist all adolescent girls who have not yet received the vaccination.

Policy

1. The ministry of health as a long-term plan should develop a monitoring strategy to ensure sustainable supply of HPV vaccines to the districts cascaded to the health center levels. This will ensure continued availability and easy access of the vaccines by the adolescent girl caretakers. In this way, initiation to HPV vaccine will increase.

2. The ministry of health should partner with the ministry of education and sports to jointly promote the initiation HPV vaccine by the adolescent girls at the recommended age since ministry of education and sports interacts with these girls most of the time during their growth in school.

8 Acknowledgement

ALL glory and honor to the almighty God creator of heaven and earth for giving me the ability to go through this journey up to this level. The Lord has protected me on the road, when I travelled in the wee hours of the night but his protection was always with me.

I also in a special way appreciate my kind reviewers, Professor David Ndunguts, Ass. Pof. David Mutekanga and Dr. Christopher Damulira for the rigor and constructive guidance extended to me during the course of this study.

I also appreciate the dean of Graduate studies, Dr. Rossette Kabuye, Dr. Paul Mukasa, and Mr. Jeff for your support in the several ways. May the Lord reward you.

I also extend my sincere appreciation to my Director, Mr., Erickson for the moral and financial support towards my academic success. All my col-

leagues at CURE children's hospital, Particularly the senior management team on which I am part and the Spiritual ministry team, thanks for your support and patience.

Lastly but not by any means least, I appreciate my Wife Elina, my children: Christus, Bacy, Joash, Dale, Alinda, Aaron and Emma, Thanks for being patient with me for this whole period you admired to spend more time with me but I was gone. May the Lord take you all beyond where I have reached in your own academic Journey. My mother Suzan, thanks for spending sleepless nights praying for my safety every time I travelled. May God bless you and add you more years.

Source of funding

This study was not funded.

Conflict of interests

No conflict of interests reported in the study.

9 List of Abbreviations

A Publisher details:

Publisher: Student's Journal of Health Research (SJHR)
(ISSN 2709-9997) Online
Category: Non-Governmental & Non-profit Organization
Email: studentsjournal2020@gmail.com
WhatsApp: +256775434261
Location: Wisdom Centre, P.O.BOX. 148, Uganda, East Africa.

Table 5. List of Abbreviations

CBCHS	Cameroon Baptist Convention Health Services
DNA	Deoxyribonucleic acid
FGD	Focus Group Discussions
HBM	Health Belief Model
HPV	Human Papilloma Virus
LC1	Local Council 1
NIPS	National Immunization Programs
WHO CURE	World Health Organization Crippled children rehabilitation effort
IRB	Institutional review board
ID	Identification
UBOS	Uganda bureau of standards
PSU	Primary sampling units
SSU	Secondary sampling Units
TSU	Tertiary Sampling Units
KI	Key Informant
CVI	Content Validity Index

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