

Individual level Factors Associated with Human Papilloma Virus (HPV) Vaccine Coverage Among Adolescent Girls in Pastoralist Community of Kajiado North Sub-County, Kajiado County, Kenya

*Elizabeth Herman¹, David Masinde², David Sang³

¹Master Public health Scholar, Department of Public Health, Maseno University,

²Department of Public Health, Maseno University,

³Department of Public Health, Maseno University

*Corresponding Author

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ABSTRACT

Introduction: Globally, Human papilloma virus (HPV) is the leading cause of ano-genital cancers with cervical cancer as the top cause of cancer deaths in women. Over 90% of these deaths occur in low-income countries where cancer control strategies remain inadequate. The HPV vaccine was introduced in 2019 as a primary prevention strategy targeting girls aged 9 to 14 years. However, vaccine uptake remains suboptimal undermining its population-level impact especially amongst underserved populations like pastoralists. Uptake of the HPV vaccine has been sub-optimal with only 33% of the targeted population receiving the first dose in 2020 and 16% returning for the 2nd dose. HPV vaccine uptake among pastoralist populations is generally low compared with national averages because pastoralists are mobile, live in remote places often underserved by health systems. While the disruption of vaccination programs by the COVID-19 pandemic contributed to the low coverage, other determinants such as low demand associated with individual level factors fueled by misinformation have also play a role.

Objectives: This study assessed the HPV vaccine coverage among adolescents aged (9-14) years in pastoralist communities in Kajiado North, Kajiado County, Kenya.

Methodology: This was an analytical cross-sectional study anchored on Andersen Behavioral Model of Health Services Use. Adolescent girls (n=422) aged 9-14 years selected through simple random sampling method constituted the study population. Purposive sampling was used to select Ministry of Health representative. Structured questionnaires were used collect quantitative data while In-depth interviews and Key Informant Interviews collected the qualitative data. SPSS version 28 was used for data analysis. HPV vaccine coverage was summarized in frequencies and proportions. Influence of individual level factors associated with HPV vaccine uptake was determined using chi square and binary logistic regression

Results: Some 41% of the participants had received two doses of HPV vaccine while 70% had receive at least one dose. Age and education had statistically significant associations with uptake of the HPV vaccine. Parent's/ caretaker's education and HPV vaccine had statistically significant relationships with uptake of HPV vaccine differed.

Conclusion: This is one among the few studies that focused on the individual level factors associated with Human Papilloma Virus (HPV) vaccine coverage among adolescent girls in pastoralist communities in Kenya and specifically Kajiado North Sub- County, Kajiado County. Uptake of the HPV vaccine was sub-optimal with only 41% of the targeted population receiving the recommended two doses. Therefore, Ministry of Health and the County Government of Kajiado County and with should develop appropriately tailored messages for communities for upscaling of HPV vaccine uptake.

Key Words: Human Papilloma Virus (HPV), Vaccine Coverage, Adolescent girls, Pastoralist Communities.

INTRODUCTION

Cervical cancer disproportionately affects Indigenous populations globally based on a multidimensional aspect such as the individual based factors, the sociocultural factors as well as the health service influencers (MacDonald et al., 2023). HPV vaccination provides protection against HPV types 16 and 18 which are responsible for approximately 70% of cervical cancer cases (Gillespie, Buchanan, Schneider, & Paolucci, 2022).

The optimal age of vaccination is in the early adolescent period, before sexual debut with possible HPV infection. The World Health Organization (WHO,2022) has set a target of vaccinating 90% of girls by age 15 by 2030 as part of the global cervical cancer elimination strategy (WHO,2018). The vaccination comprises two doses of the vaccine, six months apart and can prevent most cases of cervical cancer, if given before a girl or woman is exposed to the virus (WHO,2021). However, health reports from studies indicate that some girls miss out on the mandatory second dose a scenario which is more common in hard-to-reach with health information communities like the pastoralists (WHO,2023).

In well-resourced settings with established immunization infrastructures, such as Australia, the United Kingdom, and Canada, uptake rates for the two-dose regimen frequently exceed 80–90% (Drolet et al., 2019). In Norway, disparities in uptake were observed across ethnic backgrounds, with education levels being the strongest determinant of vaccination (Bjerke, Laake, & Feiring, 2021). In the United States, ethnic variations and parental vaccine awareness significantly shaped uptake patterns (Anuforo, McGee-Avila, & Toler, 2022).

Many African countries are still far from reaching this goal due to health system constraints, socioeconomic barriers and limited awareness about HPV vaccine (CDC,2020). Despite the availability of vaccines and national vaccination programs, not all girls the age of 9-14 are immunised as per the recommended schedules (WHO,2020). World Health Organization (WHO,2021) reports of missed opportunities for HPV vaccination and low coverage rates in developing countries, which may be attributed to various socio-cultural factors (WHO, 2022).

HPV vaccine uptake among pastoralist populations globally is generally low compared with national averages, mainly because pastoralists are mobile, remote and often underserved by health system (WHO, 2023). Studies have shown that children residing among the pastoral communities are at risk of early initiation of sexual activity (UNICEF, 2021). Such factors that tend to affect the rate of vaccination coverage amongst the girls were also reported by Bangura, Xiao, Qiu, Ouyang (2020)

In 2019, Kenya introduced the HPV vaccine to be given to 10-year-old girls (Amoth, P. 2019; MoH, 2019). In Kenya, the vaccination coverage for HPV is estimated to be 34% after it jumped from 25% in 2019, to 33% in 2020 (UNICEF, 2021). Barriers to uptake of HPV vaccine in this region may include factors like lack of awareness, cultural beliefs, and vaccine hesitancy but pastoralists may have contextual impediments (MOH,2023). Thus, this background forms the gaps in the uptake of HPV vaccine in the proposed study locale.

A close examination of specific communities in Kenya including the Maasai who practice pastoralism with other retrogressive cultural practices including FGM could inform the context-specific basis of the low uptake of the HPV vaccinations. The pastoralist communities are characterized by low awareness of cervical cancer and HPV vaccine, high mobility of families, school absenteeism among girls (UNICEF, 2021).

Individual-level factors constitute the immediate determinants of health behavior, encompassing the knowledge, beliefs, perceptions, and socio-demographic characteristics of the primary decision-makers, typically parents or guardians, as well as the adolescents themselves ((Kiptoo et al., 2023; Ochieng et al, 2022). These predisposing factors establish the initial propensity to accept vaccination and influence whether the full multi-dose schedule is completed.

The literature on individual-level determinants of HPV vaccine uptake in Kenya and similar contexts reveals a complex interplay of cognitive, attitudinal, and structural elements that require careful examination (MOH

Kenya, 2023). Higher maternal education is frequently associated with increased vaccine uptake. (Wanyoro et al., 2021) found that girls whose mothers had completed secondary education were 1.8 times more likely to have initiated vaccination. This association is attributed to educated mothers having greater exposure to health information, stronger literacy skills, and higher self-efficacy in navigating health systems.

A foundational body of evidence establishes that caregiver knowledge about HPV as reported in studies across Sub-Saharan Africa consistently demonstrate that parents who possess accurate information about the link between HPV infection and cervical cancer are significantly more likely to initiate and complete the vaccination series for their daughters (Wanyoro et al., 2021). Conversely, parental reluctance—rooted in cultural traditions, mistrust of modern medicine, or reluctance to discuss adolescent sexuality—reduces vaccination coverage (Al-Ghuraibi, Dighiri, Elrggal, & Obaid, 2022).

In the Kenyan context, (Ochieng et al., 2022) found that among caregivers who initiated but did not complete the vaccine series, 41% reported being unaware that a second dose was required at the time of first-dose vaccination. This suggests that the information provided at the first visit was either insufficient or not adequately retained thus highlighting the need for clear, reinforced communication about the full schedule.

Beyond knowledge, caregiver attitudes and beliefs exert a powerful, often decisive influence on vaccine uptake decisions (Al-Ghuraibi, Dighiri, Elrggal, & Obaid, 2022). The distinction between knowing about a health intervention and believing it to be necessary, safe, and appropriate for one's child is critical. (Ochieng et al., 2022) found that caregivers who reported hearing negative rumors about the vaccine were 2.8 times more likely to express hesitancy, and this effect was stronger when rumors came from multiple sources.

Ochieng et al (2022) documented that among families who initiated but did not complete the vaccine series, transportation costs were cited as a barrier by 28% of respondents. For the second dose, these costs represent a recurring burden that may not have been anticipated.

The quality of communication between adolescents and caregivers also matters. (Mugo et al., 2020) found that only 23% of caregivers reported discussing the vaccine with their daughters, and many discussions were brief and superficial, leaving adolescents without information or voice in decisions affecting their health.

The literature on individual-level correlates of HPV vaccine uptake presents a nuanced picture, with patterns varying across settings and populations and yet interconnected. Caregiver knowledge provides a foundation but is insufficient without positive attitudes.

However, existing evidence on the influence of individual factors on HPV vaccine uptake among adolescents comes from hospital settings from other jurisdiction, leaving gaps in understanding how these factors operate within pastoralist communities such as Kajiado North Sub County. The context of Kajiado North Sub-County presents unique considerations for vaccine uptake. Such areas typically lack resources, trained staff and consistent vaccine supply compared to other areas hereby face distinct challenges (MOH, 2022).

Against this backdrop, there is a need for an assessment of HPV vaccine uptake and associated individual level factors by adolescent girls (9-14 years) among the pastoralist communities in Kajiado North, Kajiado County, Kenya.

MATERIALS AND METHODS

Study Area: The research was conducted in Kajiado North Sub-County, which is predominantly inhabited by Maasai pastoralist communities.

Study Design: This study employed a cross-sectional design to assess individual level factors associated with HPV vaccine uptake among adolescent girls aged 9–14 years in Kajiado North Sub-County, Kenya. This was a mixed methods design in which both quantitative and qualitative data was collected and analyzed.

Sample size calculation: The sample size was calculated using the following formula adopted from (Charan & Biswas, 2013) but developed by Cochran (Cochran, 1963). An adjusted sample size of 422 was adopted for the study.

Inclusion Criteria:

1. Adolescent/caregivers of girls aged 9-4 years old seeking treatment at the facilities Kajiado Norh Sub County
2. Adolescent who had been residents of Kajiado Norh Sub County continuously for six months prior to the study period.
3. Adolescent whose families confirmed that they were pastoralists within Kajiado Norh Sub County.
4. Adolescent/caregivers who voluntarily agree to take part in the study after giving informed consent.

Exclusion Criteria:

1. Those who had conflict-of-interest and or unwilling to provide objective input
2. Children age 9-4 years who were too unwell to participate in the study
3. Those declined to participate in the study at any stage during the study

Qualitative interviews participants- Healthcare Provider Participants including the Clinical officers and Nurses involved in HPV vaccination programs within the Sub County. All were eligible except those who had conflict-of-interest and or were unwilling to provide objective inputs

Procedure and Methods: For Quantitative The study adopted a convenience sampling design for adolescent girls aged between aged (9-14) years and visiting the health facilities for any services, and their parents and caretakers. Convenience sampling is a non-probability sampling design that is best suited for flowing masses of the study subjects with no predetermined interest in the study subjects (Vehovar, Toepoel, & Steinmetz, 2016). Quantitative data was collected using a structured questionnaire administered face-to-face to caregivers. The researcher selected and enrolled every girl turning up at the facilities regardless of the reason of the visit and automatically considered inclusion of their parents/caregivers into the study. The sampling was on a rollover basis till saturation of the desired sample size. **Qualitative** data was gathered through Key Informant interview guides (KII) and In-depth Interviews (IDI).

Piloting: The study tools were piloted in health facilities located in Kajiado Central subcounty with 42 girls (10% of actual sample size). Kajiado Central is one of the counties in Kajiado county which possess similar characteristics and community traditions as Kajiado North subcounty.

Reliability and Validity: Double-blind assessment of the research tools was done by two experts and their judgment of the tools content as relevant or irrelevant was determined using content validity index. A content validity index value of 0.7 (Polit & Beck, 2006) was considered sufficient to consider sufficient content validity of the quantitative data collection tools. Member checking was conducted, where preliminary interpretations are shared with a subset of participants to confirm accuracy and resonance for qualitative data collection tools. The data collection process was undertaken in two weeks

Statistical Analyses: Quantitative data was entered into Excel 2010, pre-coded then analyzed using SPSS version 28.0. Individual-level characteristics (age, level of education, household size and HPV vaccine awareness) of the respondents were compared between non-vaccinated and vaccinated adolescent girls using Chi square (χ^2) test.

In order to determine the strength and direction of the association between the independent variable (individual level) and dependent variable (HPV vaccine uptake), a binary logistic regression model was utilized. The statistical significance of the variables was tested at $P \leq 0.050$. For qualitative data, audio tape recordings were all together transcribed verbatim, coded and uploaded qualitative data analysis software Non-Versional Information Versatile Outcome (NVIVO) version 12 (Sanusi, 2019).

Ethical Approval: Approval to carry out this study was sought and obtained from School of Graduate Studies Maseno University. Ethical review clearance was obtained from Maseno University Scientific and Ethics Review Committee. Permit to conduct the research was also obtained from the National Commission of Science, Technology and Innovation. The permit was then used to secure an authorization letter from Kajiado County's Ministry of Health department. Further authority to conduct the study in Kajiado County was obtained from

departments of Education in the County Government of Kajiado. The administrative leaders of the County, were brought on board after being adequately briefed on the study and its purpose. The health facility administrators in Kajiado Sub County were also informed and appropriately engaged in the study for logistics and for participation as key informants.

Written informed consent was obtained from parents or guardians of the adolescent girls, and assent was obtained from the girls themselves. Confidentiality and anonymity were strictly observed throughout data collection and reporting, consistent with ethical guidelines for research involving minors (WHO, 2022).

RESULTS

Individual-level characteristics of study participants

The age of the respondents ranged from 9 - 11 years with 33.5% of the participants falling in the age bracket of 9-11 years while 66.5% of the participants falling in the age bracket of 12-14 years. Regarding education level of the participants, 0.2% were completely illiterate (no basic education), 97.3% had attained primary education and 2.5% of the participants had post primary education. 12.7% had existing medical condition while 87.3% did not have any medical condition.

Concerning parent's/caretaker's education, 3.8% of the participant's parents did not have any basic education, 37.4% had attained primary education while 58.8% had acquired post primary education. With regards household size, 13.9%, 55.8%, 28% and 2.3% of the participants originated from the household of <3, 3-5, 6-8 and >8 people respectively. 76.5% of the participants were aware of HPV vaccine while 23.5% were unaware of the HPV vaccine (Table 1).

Table 1: Individual level characteristics of adolescent girls on HPV vaccine uptake in Kajiado North Sub-County

Demographic characteristics		Frequency	Percentage (%)
Age	9-11 years	147	33.5
	12-14 years	292	66.5
Education level	None	1	0.2
	Primary	427	97.3
	Postprimary	11	2.5
Existing health condition	Yes	56	12.7
	No	383	87.3
Parent/caretaker education	None	17	3.8
	Primary	164	37.4
	Postprimary	258	58.8
Household size	<3	61	13.9
	3-5	245	55.8
	6-8	123	28
	>8	10	2.3
HPV vaccine awareness	Yes	336	76.5
	No	103	23.5

Data are frequencies and percentages of adolescent girls that constituted the study population with respect to Individual-level factors

HPV coverage in Kajiado North Sub-County among adolescent girls in pastoralist community in Kajiado North Sub- County

In this study, 70.8% (311/439) were ever vaccinated against HPV through having receive either one or two dose(s) of HPV vaccine. Out of this, only 41% (180/439) of the participants had received two doses of HPV

vaccine. The poor HPV vaccine uptake may be linked to the perceptions that vaccine results in infertility, a myth that taps into profound cultural anxieties around motherhood and lineage continuity. As one caregiver explained during an IDI session, "They say that the HPV vaccine closes the womb. What is the point of protecting her from cancer if she cannot bear children?"

This framing reveals how vaccine safety concerns are embedded in broader life aspirations and social expectations, thus supporting the utilization of the Andersen Behavioral Model of Health Services Use, developed by Andersen (1968) to provide a comprehensive framework for understanding the factors influencing individuals' utilization of healthcare services such as HPV vaccination. Another IDI participant affirmed: "I do not know the benefits and risks of the HPV vaccine and therefore I find it difficult to expose my daughters ages 9-14 years to it."

With respect to vaccine uptake of either one or two doses per specific location within Kajiado North Sub-County, Olkeri Ward, Ongata Rongai Ward, Oloolua ward, Ngong and Nkaimurinya Ward had 86.3%, 70.7%, 70%, 70% and 59% respectively (Table 2). Olkeri Ward depicted the highest proportion of adolescents who had been vaccinated (whether one dose or two doses) at 86.3%. This may be attributed to the fact that the population in this Ward has more health facilities, hence a better availability and accessibility to the HPV vaccine.

Table 2 Vaccine uptake per specific location within Kajiado North Sub-County

Locations within Kajiado North Sub-County	Not vaccinated n=128 (%)	Vaccinated n=311 (%)	Total n	% proportion of the total participants
Ngong Ward	21 (30)	50 (70)	70	15.8
Nkaimurinya Ward	37 (41)	52 (59)	89	20.3
Olkeri Ward	11 (13.7)	69 (86.3)	80	18.8
Oloolua ward	30 (30)	70 (70)	100	22.7
Ongata Rongai Ward	29 (29.3)	70 (70.7)	99	22.3

Cross-tabulation of HPV vaccine coverage in Kajiado North Sub-County with respect to specific locations (Wards)

Individual level factors associated with HPV vaccine uptake among adolescent girls in pastoralist community in Kajiado North Sub-County

Age significantly differed between non-vaccinated and vaccinated girls (P=0.013) with a majority of vaccinated girls (74.7% (218/311)) falling within the 12-14 year bracket. Education level and existing health condition between non-vaccinated and vaccinated adolescent girls were comparable (P=0.805) and (P=0.106) respectively. Parent's/caretaker's education and HPV vaccine awareness significantly differed between non-vaccinated and vaccinated adolescent girls with P=0.001, P=0.010 and P=0.001 respectively (Table 3).

Table 3: Differences in proportions of Individual-level characteristics between non-vaccinated and vaccinated adolescent girls in pastoralist community in Kajiado North Sub-County

Demographic characteristics		Uptake status		χ ² values	P value
		Not vaccinated (n=128)	Vaccinated (n=311)		
Age	9-11 years	54(36.7)	93 (63.3)	6.143	0.013
	12-14 years	74(25.3)	218 (74.7)		
Education level	None	0 (0)	1 (0.3)	0.433	0.805
	Primary	125 (29.3)	302 (70.7)		
	Postprimary	3 (27.3)	8 (72.7)		
Existing health condition	Yes	23 (40.7)	32 (59.3)	4.491	0.106
	No	105 (27.4)	278 (72.6)		
Parent/caretaker education	None	12(70.6)	5 (29.4)	15.943	0.001
	Primary	40 (20.4)	124 (75.6)		
	Postprimary	76 (29.5)	182 (70.5)		

Household size	<3	23 (37.7)	38 (62.3)	11.405	0.010
	3-5	66 (26.9)	179 (73.1)		
	6-8	32 (26.0)	91 (74)		
	>8	7 (70)	3 (30)		
HPV vaccine awareness	Yes	63 (18.8)	273 (81.2)	75.092	0.001
	No	65 (63.1)	38 (36.9)		

Study participants were categorised based on HPV vaccine uptake status. Statistical significance was determined by the Chi-square (χ^2) analysis. *P* values in bold are statistically significant.

Association between Individual-level characteristics and HPV vaccine uptake among adolescent girls in pastoralists community in Kajiado North Sub-County

With different reference groups per individual level factor, binary logistic regression was used to determine association between individual level factors and HPV vaccine uptake. Older girls (12-14 years) were less likely to take up HPV vaccine [OR=0.585, 95% CI=0.382-0.896, *P*=0.014]. Girls with post primary education were more likely to take up HPV vaccine though this was not statistically significant [OR=1.327, 95% CI=0.389-4.526, *p*=0.651]. The aspect of better uptake among those with post primary education was affirmed by KII 4 who stated that “*With higher education, the information about benefits of HPV vaccine and where to obtain the services becomes clearer*”. With respect to parent’s/ caretaker’s education, adolescent girls whose parents had primary and post primary education were more likely to take up HPV vaccine [OR=7.44, 95% CI=2.7440-22.406, *p*=0.001] and [OR=5.747, 95% CI=1.958-16.857, *P*=0.001] respectively.

Adolescent girls with HPV awareness were approximately 7 times more likely be vaccinated against HPV [OR=7.412, 95% CI=4.564-12.039, *P*=0.001]. To emphasize this finding, similar arguments were posted by KII,4 who stated that “*revealed that awareness of the benefits of the HPV vaccine positively influences uptake of the vaccine*”. Existing health condition and household size were not associated with HPV uptake *P*=0.759 and *P*=0.105 respectively (Table 4).

Table 4: Binary logistic analysis of Individual-level characteristics associated with HPV vaccine uptake among adolescent girls in pastoralists community in Kajiado North Sub-County

Demographic characteristics		cOR	95%CI	P value
Age	9-11 years	Ref.	-	0.014
	12-14 years	0.585	0.382-0.896	
Education level	None	xxx	xxx	0.651
	Primary	Ref.	-	
	Postprimary	1.327	0.389-4.526	
Existing health condition	Yes	0.687	0.041-11.586	0.759
	No	Ref.	-	
Parent/caretaker education	None	Ref.	-	0.001
	Primary	7.440	2.470-22.406	
	Postprimary	5.747	1.958-16.875	
Household size	<3	Ref.	-	0.105
	3-5	1.642	0.910-2.961	
	6-8	1.721	0.893-3.317	
	>8	0.259	0.061-1.104	
HPV vaccine awareness	Yes	7.412	4.564-12.039	0.001
	No	Ref.	-	

With non-vaccinated adolescent girls as the reference group, Binary logistic regression was used to determine association between the Individual-level factors and HPV vaccine uptake. Statistical significance was determined at *p* ≤ 0.05. Abbreviations: Ref.; Reference category, cOR; crude odds ratio, CI; Confidence interval, xxx; did not run in the regression model

DISCUSSION

HPV vaccine coverage among children in pastoralists communities in Kajiado North Sb-County

This study found out that only 41% of the adolescent girls had received two doses of HPV vaccine. This finding was relatively lower than finding of similar studies done in developed Countries like Taiwan (91%) and Scotland (94.4%) (Loke, Kwan, Wong, & Wong, 2017).

The differences in previous findings from the current finding could be due to differences in vaccine accessibility as developed countries have better access to vaccine coverage and having an already implemented routine vaccination program to eligible girls. Similarly, higher levels of sensitization and friendlier healthcare workforce in the more developed countries was likely to yield better vaccine uptake. This level of uptake resonates with the global observation on the pastoralists HPV vaccine uptake which is recorded as lower than the national averages, mainly because pastoralists are mobile, remote and often underserved by health system (WHO, 2023).

These predisposing factors establish the initial propensity to accept vaccination and influence whether the full multi-dose schedule is completed as outlined by Anderson Behavioral Model of utilization of health service. (Ochieng et al., 2022) found that caregivers who reported hearing negative rumors about the vaccine were 2.8 times more likely to express hesitancy, and this effect was stronger when rumors came from multiple sources.

Age at HPV vaccine uptake was statistically significant with majority of older adolescent girls falling within the age bracket of 12-14 years taking up the vaccine relative to those falling within the age of 9-11 years. This finding is attributed to lack of adequate information on HPV vaccine uptake and negative attributes to vaccine relative to older adolescents (Bocquier et al., 2023; Rujumba, 2021).

It is also worth noting HPV vaccination specifically among the target age group (9-14 years) is associated with complexities in adherence as well as tracking uptake of health services (Beyen et al., 2022). This is hinged on the fact that adolescent girls may not have the same continuity of care as younger children who are seen regularly for growth monitoring. Reduced number of visits to the facilities may also limit the contact sessions for health education with healthcare workers thus leaving the exercise to the one-off school programs (Ochieng et al., 2022). This current result shows that the Kenya's Ministry of Health initiative of vaccinating adolescent girls aged 9-14 years has not reached many girls as per the WHO recommendations (Nakisige et al., 2020) especially among the pastoralist community where anti HPV vaccine stigma operates through anticipated judgment of the caregivers by other community members in reaction.

Individual-level Factors Influencing Uptake of the HPV Vaccine among adolescents in pastoralist communities in Kajiado North Sub- County.

Individual-level factors constitute the immediate determinants of health behavior, encompassing the knowledge, beliefs, perceptions and socio-demographic characteristics of the primary decision-makers, typically parents or guardians, as well as the adolescents themselves ((Kiptoo et al., 2023; Ochieng et al, 2022). These predisposing factors establish the initial propensity to accept vaccination and influence whether the full multi-dose schedule is completed.

Caregivers who reported hearing negative rumors about the vaccine were 2.8 times more likely to express hesitancy, and this effect was stronger when rumors came from multiple sources (Ochieng et al., 2022). Adolescent girls with HPV awareness especially through having witnessed cancer patients were approximately 7 times more likely be vaccinated against HPV. This was similarly observed among caregivers who reported knowing someone affected by cervical cancer, initiation rates were 2.3 times higher than among those with no personal connection to the disease. Conversely, the study affirms the fact that lack of information of HPV vaccine has been shown to be of the factors associated with low vaccine uptake (Nakayita et al., 2023).

With respect to parent's/ caretaker's education, adolescent girls whose parents had primary and post primary education were more likely to take up HPV vaccine [OR=7.44, 95% CI=2.7440-22.406, $p=0.001$] and [OR=5.747, 95% CI=1.958-16.857, $P=0.001$] respectively. To emphasize this finding, similar arguments were

posted by KII,4 who stated that “revealed that awareness of the benefits of the HPV vaccine positively influences uptake of the vaccine. On the flipside, girls with post primary education were more likely to take up HPV vaccine though this was not statistically significant. This may be partially attributed to their ability to comprehend the risk benefits analysis in the context of HPV vaccine. With respect to parent’s/ caregiver’s education, adolescent girls whose parents had primary and post primary education were more likely to take up HPV vaccine. This is in tandem with an earlier study which also stated that higher maternal education is frequently associated with increased vaccine uptake (Wanyoro et al., 2021).

This study reported that girls whose mothers had completed secondary education were 1.8 times more likely to have initiated vaccination. This association is attributed to educated mothers having greater exposure to health information and much more cognizant of the benefits of the HPV vaccine. This study also noted that while perceived threat motivated initiation, it did not consistently predict completion, suggesting that other barriers intervene between the decision to start and the action of returning for the second dose.

CONCLUSION

Human papilloma virus vaccine uptake and coverage among adolescent girls in pastoralists communities in Kajiado North Sub-County is still relatively low with 70.8% (311/439) were ever vaccinated against HPV through having receive either one or two dose(s) of HPV vaccine. Out of this, only 41% (180/439) of the participants had received two doses of HPV vaccine. This finding suggests existence of the systemic and behavioral barriers to HPV vaccine uptake that increase inequalities in vaccine access among underserved populations especially related to their mobile lifestyle

Among the individual-level factors, age was reported as having a statistically significant relationship with uptake of the HPV vaccine where it emerged that older girls (12-14 years) were more likely to take up HPV vaccine. Girls with post primary education were more likely to take up HPV vaccine though this was not statistically significant [OR=1.327, 95% CI=0.389-4.526, $p=0.651$]. The aspect of better uptake among those with post primary education was affirmed by KII 4 who stated that “*With higher education, the information about benefits of HPV vaccine and where to obtain the services becomes clearer*”.

RECOMMENDATIONS

1. Due to the sparsely distributed facilities and the mobile life of pastoralists, the Ministry of Health, the Division of National Vaccines and Immunization Program (NVIP) and Kajiado North Sub- County health facility management teams should emphasize interoperability so that patients who receive their first HPV dose at one facility may receive their second dose at another.
2. The the Ministry of Health, the Division of National Vaccines and Immunization Program (NVIP). These may also be augmented with mobile HPV vaccination clinics in addition to the school-based vaccination.
3. Standard clinic hours may be inaccessible for pastoralist families whose mobile way of life require contextual adjustment for flexibility and therefore Kajiado North Sub-County health
4. Ministry of Health, the Division of National Vaccines and Immunization Program (NVIP) and Kajiado North Sub- County health facility management teams should leverage on community-based vaccination programs which are sensitive to adolescent girls in pastoralist community.
5. Kajiado County health department should consider integrating information on uptake of HPV vaccines in the health services during regular hospital (reproductive Health, HIV, Outpatient Department, Maternal and Child Health among the target groups. This model will integrate vaccination seamlessly into the facilities's complex operations while maintaining quality and accessibility.

Recommendations for further research

1. The study revealed substantial attrition between the first and second dose uptake. This presents a critical implementation challenge that undermines both individual protection and population-level herd immunity. (A total of **70.8% (311/439)** were ever vaccinated against HPV but **only 41% (180/439)** of the participants had received two doses of HPV vaccine). A study should be undertaken to tease out the

“Determinants of uptake of the second dose HPV vaccine dose among adolescent girls 9-14 years in the pastoralist communities of Kajiado North Sub County, Kajiado County, Kenya.”

Study Limitations

The cross-sectional design of the study limited data collection to a single point in time, precluding causal inferences and the assessment of temporal changes. This limitation was addressed by interpreting the findings strictly in terms of associative relationships and situating them within the context of existing longitudinal literature where applicable.

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