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State of human papilloma virus vaccine uptake among girls (15–21 years) in Zambia: analysis of a 2024 national survey

Joshua Okyere^{1,2*} and Mutinta Monze³

Abstract

Background The World Health Organisation recommends that countries will achieve at least a 90% human papilloma virus (HPV) vaccine uptake by the year 2030. Tracking the performance of Zambia is necessary to inform programme implementation and ensuring equitable coverage. This study estimates the prevalence of HPV vaccine uptake in Zambia, and examines its associated factors.

Methods Data from the 2024 Zambia demographic and health survey was analysed ($n = 3,942$ girls aged 15–21). Analyses accounted for the complex survey design using sampling weights, clustering, and stratification. Multivariable logistic regression was computed in STATA 14. The adjusted odds ratio and 95% confidence intervals were reported. Statistical significance was set at $p < 0.05$.

Results Overall, 61.8% (95%CI: 59.8–63.5) of the participants had ever received HPV vaccine. Among respondents who reported ever receiving the HPV vaccine, 46.3% and 53.2% had received one dose and two doses, respectively. HPV vaccine uptake was higher among girls with primary education (AOR = 4.45; 95%CI: 2.91–6.79), those with secondary/higher education (AOR = 9.08; 95%CI: 5.86–14.05) compared with those with no formal education. Exposure to family planning messages was positively associated with vaccine uptake (AOR = 1.32; 95%CI: 1.12–1.55). Initiation of sexual activity was inversely associated with vaccination, both for debut before age 15 (AOR = 0.79; 95%CI: 0.64–0.99) and at age 15 years or older (AOR = 0.77; 95%CI: 0.66–0.90). Higher odds of vaccination were found among girls from middle-wealth households (AOR = 1.27; 95%CI: 1.01–1.60). Rural dwelling girls had higher odds of HPV vaccination than their urban counterparts (AOR = 1.42; 95%CI: 1.15–1.75). There were lower odds of HPV vaccine uptake in Copperbelt (AOR = 0.72; 95%CI: 0.54–0.96), Lusaka (AOR = 0.70; 95%CI: 0.52–0.93), and Muchinga (AOR = 0.68; 95%CI: 0.50–0.94), while higher odds were observed in Southern Province (AOR = 1.40; 95%CI: 1.05–1.87) compared with Central Province.

Conclusion To ensure equitable coverage, the Zambian Ministry of Health must intensify vaccine availability and access, particularly among girls with no formal education, those residing in poorer households and girls in urban areas. Family planning education campaigns and mass media platforms can be leveraged to raise HPV vaccine awareness.

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Keywords Cervical Cancer, HPV, Vaccination, Health Service Utilisation, Zambia

Introduction

Globally, cervical cancer is regarded as the most preventable cancer [1]. Yet, it is the 4th most common cancer among women worldwide, with 660,000 new cases and around 350,000 deaths reported in 2022 [2]. Available evidence indicates that about 94% of cervical cancer mortality occur in low-and-middle-income countries, including Zambia [3]. In Zambia, there were 3,620 new cases and 2,285 cervical cancer death in 2022, making it the leading cancer and cancer-related cause of death in the country [4].

Literature suggests that about 95% of cervical cancer cases are attributable to persistent human papilloma virus (HPV) infections that result in precancerous lesions, and eventually cancer when left untreated [2]. This means that addressing HPV infections is essential to the elimination of cervical cancer. It is upon this basis that the World Health Organisation (WHO) developed the agenda 90-70-90 of which the first 90 envisions that by the year 2030, 90% of girls would be fully vaccinated with HPV vaccine by age 15 [3]. In 2022, the WHO updated its recommendation on HPV vaccination schedules, stating that a single-dose schedule provides comparable efficacy and durability of protection to a two-dose regimen for girls aged 9–14 years [5]. Consequently, one dose is now considered sufficient for full protection in this age group in many settings.

Recognising the significance of vaccination towards cervical cancer elimination, many LMICs, including Zambia, have begun to roll out HPV vaccines. Since 2019, Zambia has rolled out a free national HPV vaccination programme which is conducted annually as part of the first round of Child Health Week [6, 7]. Primarily, the HPV vaccine is administered in health facilities and through school and community outreaches [6, 8]. The national HPV vaccination programme currently targets only girls due to the high risk of HPV infection among this group, as well as the limited financial resources to make it gender-neutral [8]. Studies conducted in Zambia have shown that there is a good knowledge and acceptability of the HPV vaccine among girls, however, the challenge usually concerns parental consent, being out of school, and concerns about possible side effects [6, 7, 9].

Despite the role of HPV vaccine in eliminating cervical cancer [3], and its acceptability in Zambia [6, 7, 9], there is limited nationally representative evidence regarding the magnitude of its uptake. The existing studies from Zambia have focused on their knowledge and attitudes [5], parental consent [7], cost-effectiveness of the vaccine delivery model [8], its acceptability [9], and implementation strategies [10, 11]. What remains unclear is

the prevalence of HPV vaccine uptake. Also, it remains unclear the factors that influence HPV vaccine uptake from a nationally representative perspective. Understanding the prevalence and determinants of HPV vaccine uptake is critical for strengthening programme implementation and ensuring equitable coverage. On this basis, the study estimates the prevalence of HPV vaccine uptake among girls 15–21 years in Zambia, and examines its associated factors.

Methods

Study design

Data from the 2024 Zambia Demographic and Health Survey (ZDHS) was analysed. The aim of the survey was to provide updated estimates of key population and health indices, including HPV vaccination. It must be noted that, the 2024 ZDHS sample frame was based on the 2022 Population and Housing Census [12]. The ZDHS employed a stratified two-stage sampling design. In the first stage, sampling units comprising enumeration areas were selected. Each province was stratified by urban and rural residence, resulting in 20 sampling strata. Enumeration areas were selected within each stratum using probability proportional to size, yielding a total of 545 clusters [12].

In the second stage, households were selected through systematic sampling. A complete household listing was conducted in all selected clusters, identifying an average of 111 households per cluster [12]. From each cluster, a fixed number of 25 households were selected using equal probability systematic sampling, producing a total sample of 13,625 households. The resulting sample is nationally representative and allows for valid estimates at national, urban and rural, and provincial levels [12]. Pretesting of the survey questionnaire was carried out between 21 August and 12 September 2023, while the actual data collection lasted from 17 January to 7 July 2024 [12].

Although the national HPV vaccination programme targets girls aged 9–14 years, the DHS collects vaccination data among older adolescents and young women. Girls aged 15–21 years included in this analysis would have been eligible for vaccination within the recommended target age range during earlier rounds of programme implementation. Analysing this age cohort therefore allows for assessment of cumulative uptake following programme rollout.

Measures

Outcome variable: The outcome variable in this study was HPV vaccine uptake. This was derived from the question: “Have you ever received HPV vaccination?”. This

Table 1 Weighted sample distribution of girls aged 15–21 (N = 3,942)

Characteristic	Weighted sample n (%)	Ever received HPV vaccination n (%) [95% CI]	p value
Overall	3,942 (100.0)	2,431 (61.8 [59.8–63.5])	
Education			< 0.001
No education	128 (3.3)	28 (22.1 [15.4–30.5])	
Primary	1,499 (38.0)	848 (56.6 [53.8–59.3])	
Secondary or higher	2,315 (58.7)	1,555 (67.2 [64.9–69.4])	
Internet use			0.654
Not at all	3,151 (79.9)	1,932 (61.3 [59.2–63.4])	
Rarely	98 (2.5)	64 (65.8 [54.3–75.6])	
Often	693 (17.6)	435 (62.8 [58.2–67.1])	
Mass media exposure			0.025
No	2,756 (69.9)	1,663 (60.4 [58.1–62.5])	
Yes	1,186 (30.1)	768 (64.8 [61.5–68.0])	
Age at first sex			0.240
Not had sex	1,626 (41.2)	1,029 (63.3 [60.3–66.3])	
Before 15 years	525 (13.3)	313 (59.6 [55.5–63.5])	
15 years or older	1,792 (45.5)	1,089 (60.8 [58.1–63.4])	
Exposure to family planning messages			< 0.001
No	2,807 (71.2)	1,662 (59.2 [57.0–61.4])	
Yes	1,135 (28.8)	769 (67.8 [64.6–70.9])	
Self-reported health status			0.430
Good	3,627 (92.0)	2,240 (61.7 [59.8–63.6])	
Moderate	283 (7.2)	176 (62.2 [55.8–68.3])	
Poor	32 (0.8)	16 (50.1 [33.4–66.9])	
Place of residence			0.025
Urban	1,927 (48.9)	1,146 (59.5 [56.6–62.3])	
Rural	2,015 (51.1)	1,285 (63.8 [61.3–66.1])	
Wealth index			0.027
Poorest	689 (17.5)	402 (58.4 [53.4–63.2])	
Poorer	684 (17.4)	415 (60.7 [56.8–64.5])	
Middle	823 (20.9)	555 (67.5 [63.7–71.1])	
Richer	874 (22.2)	537 (61.5 [57.2–65.6])	
Richest	873 (22.1)	522 (59.8 [55.7–63.8])	
Region			< 0.001
Central	467 (11.8)	307 (65.7 [61.7–69.5])	
Copperbelt	547 (13.9)	321 (58.7 [53.3–63.9])	
Eastern	463 (11.7)	287 (62.1 [56.2–67.6])	
Luapula	311 (7.9)	189 (60.6 [53.2–67.5])	
Lusaka	671 (17.0)	364 (54.3 [48.5–59.9])	
Muchinga	178 (4.5)	98 (55.3 [48.5–62.0])	
Northern	308 (7.8)	197 (64.1 [58.1–69.6])	
North-Western	264 (6.7)	162 (61.1 [55.6–66.3])	
Southern	483 (12.3)	341 (70.5 [65.1–75.3])	
Western	250 (6.4)	166 (66.3 [60.8–71.5])	

had a response of yes, no and don't know. We recoded the responses so that don't know and no will become "no". And so, the final variable was dichotomous, with a response of "yes" indicating receipt of the HPV vaccine.

Explanatory variables: Several variables were selected as explanatory variables. This selection was informed by previous studies [13–22] that have examined the determinants of HPV vaccine uptake among girls. The variables included level of education [13, 14], frequency of internet use [15], wealth index [16], exposure to mass media [17, 18], age at first sex [19], exposure to family planning messages [14], place of residence [20, 21], and region of residence [22] (see Table 1). Exposure to family planning messages was measured using a composite indicator capturing whether respondents reported exposure to family planning information through Manzi Therapy or other health programmes. Exposure to mass media was derived from three variables capturing the frequency of reading newspapers, listening to radio, and watching television; a composite binary indicator was created to reflect exposure to at least one of these media sources [23]. Household socioeconomic status was measured using the DHS wealth index and categorised into quintiles ranging from poorest to richest. Age at first sexual intercourse was grouped into three categories: not had sex, initiation before age 15 years, and initiation at age 15 years or older.

Statistical analyses

The analyses accounted for the complex survey design. As such, sampling weights were generated by dividing the DHS individual weight variable by 1,000,000. The weights were applied using the `svyset` command in Stata. This specified the primary sampling units and strata to adjust for clustering and stratification. Descriptive statistics were used to summarise the distribution of socio-demographic characteristics, exposure variables, and HPV vaccine uptake. Weighted frequencies and proportions with 95% confidence intervals (CI) were reported for all covariates.

Bivariate logistic regression models were fitted for each covariate separately to estimate crude odds ratios (COR) and 95% CI for HPV vaccine uptake. All covariates were included in a multivariable logistic regression model to estimate adjusted odds ratios (AOR) and 95% CI. Covariate selection for the multivariable model was guided by prior empirical literature [13–22] and conceptual relevance to HPV vaccination uptake rather than statistical significance at the bivariate level. Variables reflecting socioeconomic position, information exposure, sexual behaviour, and geographic context were included a priori. Multicollinearity was assessed using variance inflation factors, and all variables retained in the final model had values below commonly accepted thresholds, indicating

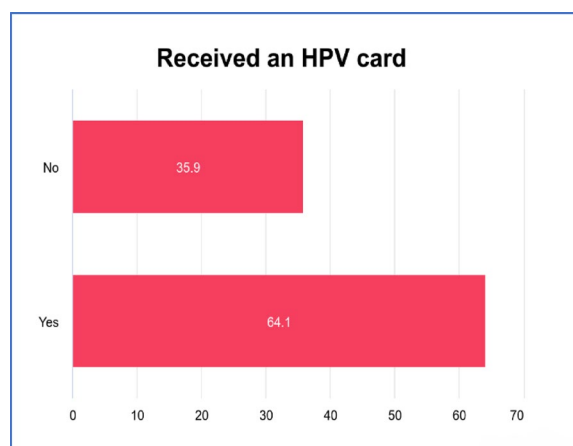


Fig. 1 Received an HPV card

no serious collinearity concerns. Province and place of residence were included simultaneously to capture both broader geographic variation and urban rural differences in vaccine uptake. Self-reported health status was included as a control variable to account for potential differences in health awareness and healthcare engagement, although it was not expected to be a primary determinant of vaccination. Statistical significance was set at a two-sided p -value < 0.05 . The analyses were carried out in STATA version 14 (StataCorp, College Station, TX, USA).

Results

Weighted sample distribution

The total sample analysed was 3,942. Of this number, the majority had secondary or higher education (58.7%), did not use the internet at all (79.9%), resided in rural areas (51.1%), had a good self-rated health status (92.0%), and resided in Copperbelt (13.9%). Only 30.1% were exposed to mass media while 28.8% were exposed to family planning messages (Table 1). Also, 45.5% had their first sex at age ≥ 15 years.

Prevalence of HPV vaccination uptake

Overall, 61.8% (95%CI: 59.8–63.5) of the participants had ever received HPV vaccine (see Table 1). The prevalence of HPV vaccine uptake was significantly higher among those with secondary/higher education (67.2% [64.9–69.4]), those exposed to mass media (64.8% [61.5–68.0]), those exposed to family planning messages (67.8% [64.6–70.9]), those residing in rural areas (63.8% [61.3–66.1]), those in middle wealth index households (67.5% [63.7–71.1]), and those residing in the Southern region of Zambia (70.5% [65.1–75.3]). Among girls who reported sexual debut before age 15 years, 59.6% (95% CI: 55.5–63.5) had ever received HPV vaccination.

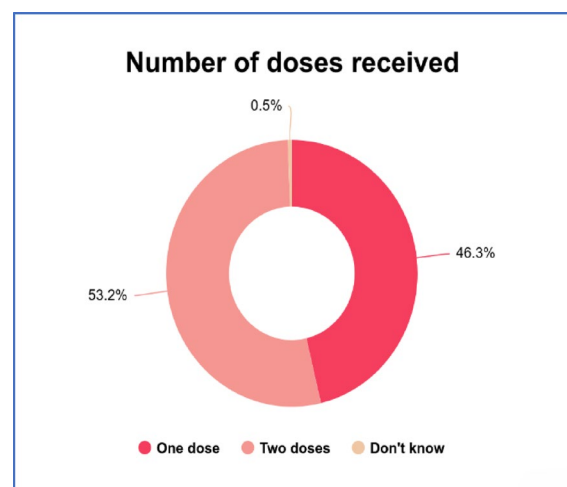


Fig. 2 Number of doses received

Documentation, doses and place of receipt of HPV vaccine

Figure 1 shows that 64.1% of the participants who had undergone vaccination received an HPV card. Also, among those who had ever receive the vaccine, 46.3% and 53.2% had received one dose and two doses of the HPV vaccine, respectively (Fig. 2). The findings also show that schools were the main place where HPV vaccines were administered (91.1%), followed by public health facilities (6.9%) (Fig. 3).

Factors associated with HPV vaccine uptake in Zambia

Table 2 shows the results from the unadjusted and adjusted regression analyses. In the unadjusted model, education, media exposure, age at first sex, exposure to family planning messages, wealth index and province of residence significantly predicted HPV vaccine uptake. In the adjusted model, girls with primary education had over fourfold higher odds of vaccination (AOR = 4.45; 95%CI: 2.91–6.79), while those with secondary or higher education had approximately ninefold higher odds (AOR = 9.08; 95%CI: 5.86–14.05) compared with those with no formal education. Exposure to family planning messages continued to be positively associated with uptake (AOR = 1.32; 95%CI: 1.12–1.55). Initiation of sexual activity remained inversely associated with vaccination, both for debut before age 15 (AOR = 0.79; 95%CI: 0.64–0.99) and at age 15 years or older (AOR = 0.77; 95%CI: 0.66–0.90). Socio-economic disparities persisted, with higher odds of vaccination among girls from middle-wealth households (AOR = 1.27; 95%CI: 1.01–1.60). Rural residence emerged as a significant predictor after adjustment, with rural girls having higher odds of HPV vaccination than their urban counterparts (AOR = 1.42; 95%CI: 1.15–1.75). There were lower odds of HPV vaccine uptake in Copperbelt (AOR = 0.72; 95%CI: 0.54–0.96), Lusaka (AOR = 0.70; 95%CI: 0.52–0.93), and Muchinga (AOR = 0.68; 95%CI:

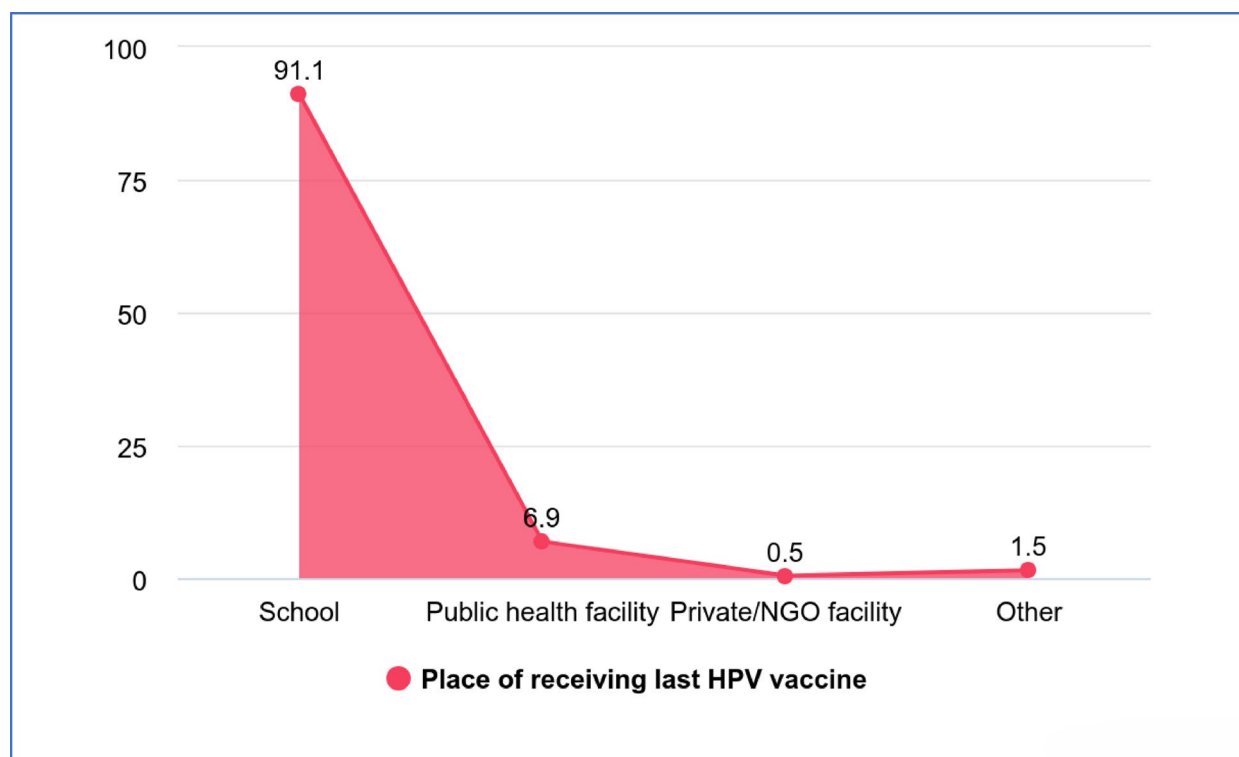


Fig. 3 Place received last HPV vaccine

0.50–0.94), while higher odds were observed in Southern Province (AOR = 1.40; 95%CI: 1.05–1.87) compared with Central Province.

Discussion

There is ubiquitous consensus that HPV vaccination is central to the elimination of cervical cancer [2, 3]. As such, it is imperative for nations, including Zambia, to track its progress and strengthen strategies. This study contributes to tracking Zambia HPV vaccine uptake among girls. The findings indicate that 61.8% of girls had ever received an HPV vaccination. The estimated HPV vaccine uptake is lower than the 90% coverage that the WHO envisions for each country [3]. Nonetheless, the uptake prevalence in Zambia is higher than what has been reported in East Africa (35%) [20] and sub-Saharan Africa (28.5%) [24]. It is, however, lower than the prevalence reported in Uganda (63%) [25] and Kenya (63.8%) [26]. Given that the uptake prevalence is more than 50%, we argue that Zambia is doing fairly well. However, it is unlikely for the country to reach a 90% coverage by the end of 2030.

In terms of the place of delivery of vaccine, we observed that schools were the most reported area. This aligns with Zambia's national HPV vaccination programme which is primarily administered through school outreaches [6, 8]. A plausible explanation for why most girls received the vaccine in school is the nomenclature of the

vaccine. Typically, it is recommended that the vaccine be administered between ages 9 and 14 [3, 24]. This age group is usually the school year for these girls. Delivering the vaccine through schools facilitates efficient identification, access, and coverage of eligible girls, while minimising logistical barriers associated with community-based delivery. In contrast, reaching girls of the same age group outside the school setting is more resource intensive and susceptible to missed opportunities.

Among respondents who reported ever receiving the HPV vaccine, just over half reported receiving two doses (53.2%). Meanwhile, in countries like Kenya [26] and Hong Kong [27], about 63.8% and 80.8% had received a second dose of the HPV vaccine, respectively. Our findings are, however, consistent with countries like Tanzania [28] and Uganda [29] where only 21.3% and 42.3% of girls have received a second dose of the HPV vaccine, respectively. We argue that unlike the first dose, which is often delivered through well-coordinated, one-off school outreach campaigns, the second dose requires effective follow-up, accurate record keeping, and sustained engagement with both schools and caregivers. This follow-up can be challenging, and thus, affect the receipt of a second dose. The regression analysis identifies education, media exposure, age at first sex, exposure to family planning messages, wealth index, place of residence and province of residence as significant explanatory factors.

Table 2 Factors associated with HPV vaccine uptake among girls (15–21 years) in Zambia

Characteristic	Model I		Model II	
	COR [95%CI]	p-value	AOR [95% CI]	p value
Education				
No formal education	Ref.		Ref.	
Primary	4.32 [2.86–6.53]	< 0.001	4.45 [2.91–6.79]	< 0.001
Secondary or higher	7.55 [5.00–11.40]	< 0.001	9.08 [5.86–14.05]	< 0.001
Internet use				
Not at all	Ref.		Ref.	
Rarely	1.33 [0.85–2.08]	0.209	1.05 [0.67–1.64]	0.843
Often	1.15 [0.96–1.38]	0.134	0.97 [0.78–1.21]	0.770
Mass media exposure				
No	Ref.		Ref.	
Yes	1.27 [1.10–1.46]	0.001	1.09 [0.94–1.28]	0.258
Age at first sex				
Not had sex	Ref.		Ref.	
Before 15 years	0.78 [0.64–0.96]	0.017	0.79 [0.64–0.99]	0.040
15 years or older	0.84 [0.73–0.97]	0.015	0.77 [0.66–0.90]	0.001
Exposure to family planning messages				
No	Ref.		Ref.	
Yes	1.46 [1.26–1.68]	< 0.001	1.32 [1.12–1.55]	0.001
Self-reported health status				
Good	Ref.		Ref.	
Moderate	0.97 [0.76–1.25]	0.814	0.90 [0.70–1.15]	0.397
Poor	0.76 [0.38–1.54]	0.450	0.79 [0.38–1.65]	0.537
Wealth index				
Poorest	Ref.		Ref.	
Poorer	1.11 [0.91–1.36]	0.317	0.96 [0.78–1.19]	0.724
Middle	1.55 [1.27–1.90]	< 0.001	1.27 [1.01–1.60]	0.040
Richer	1.27 [1.04–1.55]	0.022	1.07 [0.80–1.43]	0.641
Richest	1.15 [0.94–1.42]	0.180	0.96 [0.69–1.33]	0.800
Place of residence				
Urban	Ref.		Ref.	
Rural	1.11 [0.97–1.26]	0.127	1.42 [1.15–1.75]	0.001
Province				
Central	Ref.		Ref.	
Copperbelt	0.80 [0.61–1.05]	0.115	0.72 [0.54–0.96]	0.027
Eastern	0.85 [0.65–1.11]	0.231	1.13 [0.85–1.51]	0.392
Luapula	0.87 [0.66–1.16]	0.355	1.08 [0.80–1.45]	0.624
Lusaka	0.66 [0.51–0.87]	0.003	0.70 [0.52–0.93]	0.014
Muchinga	0.64 [0.48–0.87]	0.004	0.68 [0.50–0.94]	0.018
Northern	0.93 [0.70–1.24]	0.623	1.16 [0.86–1.56]	0.343
North-Western	0.81 [0.61–1.08]	0.158	0.95 [0.70–1.30]	0.768
Southern	1.24 [0.94–1.63]	0.129	1.40 [1.05–1.87]	0.022
Western	1.03 [0.76–1.38]	0.858	1.13 [0.83–1.55]	0.443

It was observed that having formal education was associated with significantly higher likelihood of receiving the HPV vaccine. Similar findings have been reported in Turkey [13], Brazil [14], and Uganda [25]. For example, consistent to our findings, Asiimwe et al. [25] found that girls with formal education had a 4.1 times higher likelihood to receive an HPV vaccination. The observed positive association between formal education and HPV vaccine uptake in Zambia is particularly due to the delivery of

the national HPV vaccination programme, which prioritises school-based outreaches [6, 8]. But the issue is not only about having formal education. It ends to the level of education were girls with secondary or higher education were nine times more likely to receive the vaccine. This suggests that higher education makes it easier for girls to understand the benefits of getting vaccinated, the dangers of refusing to vaccinate, and offers an opportunity to dispel myths and misperceptions about the HPV vaccine.

Related to education was the issue of media exposure and exposure to health information. The results indicate that girls who are exposed to mass media have a 9% higher likelihood of receiving the HPV vaccine. Also, girls exposed to family planning messages have a 32% higher likelihood of being vaccinated. This aligns with earlier studies conducted in Nigeria [17] and Bangladesh [18] that have reported a positive association between mass media exposure and HPV vaccine uptake. It also analogous to Santos et al.'s study [14] that found that girls who are exposed to sexual health information (including family planning and HPV) have higher odds of receiving the HPV vaccine. The findings can be explained from the perspective that both mass media and health information exposure provides serve as a conduit to provide information about HPV vaccine availability, eligibility, and safety. This allays any fear, anxiety and doubts that otherwise would have prevented the girl from getting vaccinated.

Consistent with previous literature [16, 30, 31], we found that HPV vaccine uptake was significantly higher among girls in higher wealth households. For example, one systematic review revealed that girls from higher wealth households are 1.34 times more likely to receive HPV vaccination [30]. Similarly, evidence from Central Uganda indicates that girls from higher wealth households are twice as likely to receive HPV vaccination than their counterparts in poorer households [31]. A possible explanation could be that households with greater economic capacity are more likely to have better access to education, mass media, and digital communication platforms, which are necessary to increase awareness of HPV vaccination programmes, eligibility criteria, perceived benefits, and eventual vaccine uptake.

Existing evidence suggests that the HPV vaccine is more potent when it is administered before girls become sexually active [3, 24]. And so, it was not surprising that our study found that girls who were already sexually active were less likely to receive the HPV vaccine compared to those who had never had sex. However, this finding must be interpreted with caution. Given the cross-sectional design of the DHS, the temporal sequence between sexual debut and vaccination cannot be established. It is therefore not possible to determine whether sexual initiation preceded non vaccination or whether girls who were not vaccinated were more likely to initiate sexual activity earlier. The observed association may also reflect programme targeting practices that prioritise girls perceived to be sexually inactive or within specific age groups. As such, the relationship identified in this analysis should be interpreted as an association rather than evidence of causality.

Consistent with previous studies [20, 21, 32], we found significant rural-urban differences in the uptake of HPV vaccine in Zambia. Girls residing in rural areas having

higher odds of vaccination compared with their urban counterparts. This finding contrasts with evidence from several previous studies that have reported lower uptake among rural populations [21, 32]. While this is counter-intuitive, a plausible explanation lies in the delivery strategy of the national HPV vaccination programme, which relies heavily on school-based outreach. In rural settings, school enrolment within the target age group may be more stable and concentrated, making it easier for vaccination teams to reach eligible girls during scheduled school visits. On the other hand, urban areas may have more heterogeneous schooling patterns, including private schools, informal educational settings, and higher rates of absenteeism, which may complicate systematic vaccine delivery. Nevertheless, this explanation remains speculative, and further qualitative and implementation focused research is required to better understand contextual factors driving rural urban differentials in HPV vaccination uptake in Zambia.

We also observed that girls in the Southern province had the highest odds to receives the HPV vaccine. Even though we found no existing evidence of the provincial differences in HPV vaccine uptake in Zambia, our findings may be explained from the position that girls in the Southern province have a high HPV infection [33]. This high infection may have triggered a higher perceived susceptibility, and informed the decision to receive HPV vaccination. More research is required to fully understand the nuances at play.

Implications for policy and practice

From the evidence presents, mass media platforms must be leveraged as conduits to provide information about HPV vaccine availability, eligibility, and safety. Given that exposure to family planning messages was associated with higher vaccine uptake, HPV vaccine information must be integrated in all national and provincial sexual health education campaigns and outreaches. Special attention must be given to Copperbelt, Lusaka, and Muchinga provinces, where the likelihood of receiving HPV vaccines is significantly low. The evidence also shows that the school-based outreaches are working effectively. And so, this should be sustained. However, efforts must be made to increase the targeting of out-of-school girls since they appear to have a lower likelihood of receiving the HPV vaccine. Through these reforms, Zambia may be able to increase the proportion of girls who receive full dose of the HPV vaccine.

Strengths and limitations

This study provides population level evidence that complements existing facility based and subnational research on HPV vaccination in the country. Also, the nationally representative dataset used allows for the generalisation

of the findings to the larger population of girls in Zambia. Appropriate statistical analytical techniques were used; thus, enhancing the validity of the study. Yet, there are some key limitations that must be acknowledged. The study was based on secondary data, as such, not all important variables were accounted for in the regression model. Key factors such as parental consent, perceived susceptibility, perceived benefits, and self-efficacy were absent in the ZDHS. Also, the cross-sectional nature of the ZDHS means that the findings from the regression analysis are associative effects. They must not in any way be interpreted as causal effects. As the outcome variable was self-reported, there is the possibility of recall bias. It is important to note that the estimates presented reflect ever receipt of the HPV vaccine and do not represent full vaccination coverage as defined by the WHO cervical cancer elimination targets. Given that HPV vaccination uptake in this study was common, the odds ratios reported may overestimate the magnitude of association compared to risk ratios.

Conclusion

In view of the estimated HPV vaccine uptake prevalence, we conclude that HPV vaccine uptake is moderately high among girls in Zambia. Although more than half of eligible girls have received at least one dose, substantial disparities persist by education, household wealth, place of residence, and province. To ensure equitable coverage, the Zambian Ministry of Health must intensify vaccine availability and access, particularly among girls with no formal education, those residing in poorer households and girls in urban areas. Family planning education campaigns and mass media platforms can be leveraged to raise HPV vaccine awareness.

Abbreviations

AOR	Adjusted Odds Ratio
CI	Confidence Interval
HPV	Human Papilloma Virus
LMICs	Low-and-middle-income Countries
WHO	World Health Organization
ZDHS	Zambia Demographic and Health Survey

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Author contributions

JO: Conceptualisation; Methodology; Formal analysis; Data curation; Software; Project administration; Validation; Writing – original draft; Writing – review & editing. MM: Conceptualisation; Methodology; Project administration; Validation; Writing – original draft; Writing – review & editing.

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Data availability

The datasets generated and/or analysed during the current study are available in the Measure DHS repository: <http://dhsprogram.com/data/available-datasets.cfm>.

Declarations

Ethics approval and consent to participate

All methods are in accordance with the Declaration of Helsinki. As this is a secondary analysis, ethical approval was not applicable. However, the National Health Research and Training Institute (NHRTI) and National Health Research Authority in Zambia granted ethical approval for the conduct of the ZDHS.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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