

Inequitable by design:

A critical review of national HPV vaccination programmes and their approaches to out-of-school girls

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Funded by the Bill & Melinda Gates Foundation, this report synthesizes knowledge on HPV vaccination strategies designed for out-of-school (OOS) girls, the vast majority of whom are excluded from school-based HPV vaccine delivery strategies. The review focuses on non-school delivery strategies in low- and middle-income countries for girls aged 9-19, and finds limited evidence on designing and implementing HPV vaccination programmes specifically for OOS girls. Addressing the identified barriers is essential to improve coverage and achieve equitable access to HPV vaccines in line with the WHO 2030 target of achieving 90% coverage.

Introduction

Cervical cancer is the fourth leading cause of cancer in women globally, with an estimated 660,000 new cases and 350,000 deaths in 2022.¹ Human Papillomavirus (HPV) is identified as the primary cause of 90% of cervical cancers.² The prevalence of cervical HPV in women is highest in sub-Saharan Africa (24%), followed by Latin America and the Caribbean (16%), Eastern Europe (14%), and South-East Asia (14%).³ The virus also causes other cancers in both men and women, including in the genital areas, mouth, and throat.⁴ Taken together, new cancer cases attributed to HPV infection globally comprise over 830,000 in 2022.⁵

HPV-related cervical cancers are preventable as they develop slowly over 15–20 years, allowing multiple opportunities for secondary prevention (e.g., HPV DNA test, cytology, visual inspection with acetic acid) and possible therapeutic measures. Since 2006, highly effective HPV vaccines have been available. As of early 2025, there are six prophylactic vaccines available globally, all licensed for girls nine years or older and two for boys of the same age.⁴ If given before becoming sexually active, the HPV vaccine has the potential to prevent over 90% of all HPV-related cancers worldwide.⁶

Since the approval of the first HPV vaccine in 2006, 149 countries have introduced the vaccination as part of their national immunisation programmes for girls.⁷ Global HPV vaccine coverage is low: in 2023, only 20% of age-eligible girls and 6% of age-eligible boys were fully vaccinated.⁸ Among countries with the HPV vaccine introduced, geographical disparities in the coverage exist: upper-middle-income countries had the highest estimated HPV coverage rate at 72%, while lower-middle-income countries had the lowest at 46% in 2023.⁹

Given the age of the target population, most routine immunisation programmes deliver HPV vaccines through school.² While the school platform gives an opportunity to achieve high coverage cost-effectively, it excludes a large cohort of girls, who are either temporarily or permanently out-of-school (OOS) or beyond school age.¹⁰ Globally, an estimated 129 million girls are out of school in 2025, including 34 million of primary school age (6–11 years) and 28 million of lower-secondary school age (12–17 years).¹¹ In 2023, the proportion of girls who were OOS was highest in sub-Saharan Africa, with 22% of girls of primary school age and 38% of girls of lower secondary school age not enrolled.¹² COVID-19 school closures compounded the proportion of OOS girls.¹³ Studies have projected that 11–20 million girls would not return to school after closures.^{14,15}

The WHO has established a global target of achieving 90% coverage of HPV vaccine by 2030 among girls before 15 years of age.¹⁶ Given the imperative of reaching the 2030 target and the need to move beyond “business as usual” to achieve equitable coverage, we sought to identify and synthesise the state of knowledge on HPV vaccination strategies for OOS girls. We also aimed to provide recommendations for programmes that could better target reaching these important and vulnerable populations.

Methodology

Search strategy and selection criteria

References for this review were identified using EBSCO and PubMed databases through a title and abstract search with the combination of the search terms for “humanpapilloma virus vaccine,” “HPV vaccine,” “out-of-school,” “hard-to-reach,” “vulnerable girls,” and “adolescen,*” “outreach,” “community,” or

“community-based strategy” to identify relevant articles written and published between January 1, 2006, and June 30, 2025. Articles were also identified using the snowball method to scan reference lists of articles reviewed to identify other relevant studies.

Articles were selected for final inclusion if they focused on: (1) low- and middle-income countries, (2) non-school delivery platforms, (3) girls 9-19 years of age, and (4) OOS adolescents. Studies were excluded if they focused on high-income countries, broader immunisation or cancer prevention and control efforts, including vaccine hesitancy or screening, and if the target group was too broad or unspecified.

Data extraction and synthesis

Two reviewers (SL, TNA) independently screened studies for eligibility based on title/abstract review. Alongside standard bibliographic information, the data points extracted from papers eligible for full-text review included context/setting of vaccination programme outside of school, delivery strategies, and community involvement. An inductive thematic synthesis was then conducted, with two reviewers (SL, TKD) independently analysing the data and collaboratively refining five thematic groupings. The synthesis incorporated a critical perspective, enabling an assessment of how comprehensively and consistently evidence on designing and implementing HPV vaccination programmes for OOS girls was reported across studies.

Results

A total of 832 articles were identified through the searches on EBSCO and PubMed. Following deduplication, title and abstract screening, and snowballing, 59 articles were selected for full-text review. Following the full-text review, we identified a final dataset of 23 articles referring to HPV vaccination for OOS girls. A summary of our key findings is presented in the annex.

Only four articles focused explicitly on OOS girls, including a formative study based on community perspectives that provided considerations for designing programmes in the Indian context,¹⁷ an evidence synthesis on service delivery strategies,¹⁸ a formative study assessing the impact of mothers’ cervical cancer screening on daughters’ HPV vaccination,¹⁹ and a more general commentary that focused on approaches for enhancing delivery.²⁰

Eighteen articles, including seven summative studies, one cross-sectional survey, and ten country case studies, described lessons learned from the overall HPV programme development and implementation. One formative study assessed the potential acceptability of a future HPV vaccination programme. OOS girls were only marginally mentioned in these articles.

Eighteen articles focused on Africa, including Rwanda, Kenya, Mali, Mozambique, Senegal, Tanzania, Uganda, Zambia, and Zimbabwe, and one each in Haiti and India. Except for Tanzania, all countries primarily used a school-based strategy with an outreach component for girls temporarily or permanently unreachable through the school platform. Tanzania deployed a health facility-based strategy with outreach at community sites.

All the articles reviewed were primarily descriptive, focusing on the programme development, decision-making, and implementation process. Concerning OOS girls, little to no evidence was presented on HPV vaccination coverage, outcomes, or the effectiveness of strategies deployed to reach them. However, many articles did discuss the perceived importance of multisectoral collaboration, community health worker

engagement, communication, planning, and implementation. We summarise these discussions below, noting again the lack of evidence presented on effectiveness.

Multisectoral collaboration

The articles noted the importance of high-level political commitment²¹ with multidisciplinary collaboration across ministries, including the Ministry of Health, Education, Finance, and Gender, research institutes, development partners, and local governments as factors that enabled the success of the HPV programme implementation.^{22–24} Community-level engagement with health workers, school health coordinators, teachers, community workers, and religious and community leaders was also perceived as critical to generating demand and providing girls, including those out of school, and their families with information about the HPV vaccine.^{25–31} However, although acknowledged, the studies lacked detailed descriptions of these factors.

Community health worker engagement

The articles emphasised community health workers as having a critical role in identifying, informing, and following up OOS girls to get vaccinated. A synthesis of evidence from 45 LMICs found that in settings where community health workers had been successfully used to identify OOS girls and girls who missed doses, there was a marked improvement in coverage.³² In Zimbabwe and Tanzania, for example, village health workers contributed to microplanning by identifying and registering OOS girls.^{23,25,27} In Rwanda, community health workers tracked temporarily absent and non-enrolled girls through home visits and referred them for vaccination.²² Likewise, in Zambia, community health workers tracked girls and invited them for vaccination at school sites.³³ In Haiti, a field worker followed up with three phone calls and a home visit in case a girl missed her second appointment at the clinic.³⁴ In Mali, community health workers reached out to mothers with unvaccinated OOS daughters to increase demand for a simultaneous CC screening for mothers and HPV vaccination for daughters.¹⁹ In India, parents and girls considered community health workers administering HPV vaccines within the community as preferable, given that they can accommodate girls' needs and schedules that often included competing priorities, such as household chores.¹⁷

Communication activities

Many studies noted that a lack of knowledge of the HPV vaccine and its benefits, combined with prevailing rumours and misinformation among girls, their families, health workers, and communities at large, contributed to vaccine hesitancy and, consequently, low HPV vaccine uptake.^{20,28–30,35}

Studies identified increasing knowledge and debunking myths, including through religious and community leaders and health workers, as successful strategies to encourage vaccination both among the OOS girls and their families, who often served as gatekeepers to vaccination.^{17,25,35,36}

In Kenya, for example, home visits conducted by chiefs, headmen, teachers, social workers, or community health workers were used to encourage vaccination.³⁶ In India, vaccinated peers serving as “champions” were deployed to reach OOS girls.¹⁷ In Ethiopia, women’s groups mobilized OOS girls.²⁶ While many also described deploying social media text messages and, to a lesser extent, radio as information channels, there was no evidence presented on the effectiveness of these or other communication strategies.^{2,20}

In Uganda, previously vaccinated 10- to 15-year-old girls were trained as peer educators to co-create HPV vaccine health education messages and reach out to unvaccinated peers to address any concerns and explain the benefits.³⁷

Similarly, while one study on lessons learned from 56 LMICs reported that a comprehensive communication plan with designated spokespersons and a crisis response plan was critical to identify and promptly address circulating rumours and misinformation, there was no formal analysis of the effect of the plan.²

OOS girls focus in planning

While the studies included detailed descriptions of designing, planning, and implementing HPV vaccination programmes, descriptions of considerations for OOS girls were limited. Where reaching OOS girls was referenced, authors identified a number of challenges.

Several studies described quantifying the vaccine-eligible OOS girls as a challenge at the national and local levels.^{2,20,32,35,38} Broad estimates at the national level, often based on census and household data, required further calculations at the local level. An evidence synthesis from 21 LMICs identified community-based strategies as the most commonly cited methods for identifying and enumerating OOS girls. More specifically, strategies included peer tracing and outreach by health workers, teachers, church, civil society, and civil service organisations.¹⁸ Case studies from Tanzania²³ and Zimbabwe²⁵ described that local health facility staff, supported by community health workers and school health coordinators, enumerated and tracked the girls. Another study described a “snowballing” method, according to which a girl out of school was expected to identify others not attending school.²⁰

Many articles noted that strategies to reach OOS girls were less planned compared to school-based delivery and lacked guidance. For example, a study in Mozambique identified the absence of a clear implementation plan for outreach activities and guidance on timelines, roles, duties, and strategies to reach girls, resulting in challenges in implementation.³¹ Likewise, in Uganda, a lack of a coherent plan led to insufficient teacher awareness of the national HPV vaccination policy, resulting in the mistaken belief that the vaccine was intended only for school-going girls.³⁰

In one study, age-based eligibility was described as a potential barrier to access, particularly for girls who were unsure of their age or for whom health centres required proof of age.²

OOS girls focus in implementation

In terms of implementation, while articles described countries organising large-scale training of health workers,^{23–25} there was no description of the extent to which outreach to OOS girls were included as part of the training.

Some studies described reaching OOS girls as requiring more time and resources than school-based delivery. In Zimbabwe, for example, the vaccine was described as available for one month in health facilities to enable girls to receive the vaccination, compared to a one-week campaign in schools.²⁵ Likewise, in Mozambique, more days were described to be allocated for community outreach than school-based delivery, leading to an increase in the overall programme budget.³¹ In terms of financial resources, in Zambia, the financial cost-per-dose for health facilities and outreach sites was significantly higher, USD95.2 and USD31, respectively, compared to a financial cost-per-dose of USD3.4 for school-based delivery.³³

While a variety of types of vaccination sites from local health centres,^{20,22,25,34,35} to mobile clinics³⁶ to community outreach posts such as markets²⁹ to mop-up campaigns at schools^{25,38} were deployed, there were no data on the relative effectiveness of these approaches in reaching the target population.

Discussion

This critical review, based on 23 peer-reviewed articles, found very little evidence on vaccination coverage, outcomes, or strategies used to reach OOS girls, suggesting that this population group is only marginally considered within the current HPV vaccination programmes. Despite a relatively high number of OOS girls in LMICs and being recognised in the literature as a critical population group that school-based strategies miss, experiences and lessons learned to design and implement programmes appear to be limited, and where they exist, not well documented.

The studies reviewed suggest that multisectoral collaboration at both national and local levels, community health worker engagement, and effective communication efforts supported by religious and community leaders, peers, and health worker cadres are strategies to enable HPV vaccinations. However, "hard evidence" of the effectiveness of these strategies for OOS girls was not reported. These findings are consistent with the evidence review by Rosser et al, which identified limited evidence on the effectiveness of existing strategies for reaching OOS girls with HPV vaccination.¹⁸

Among the barriers, the studies indicate that data gaps hinder the enumeration of eligible girls, negatively affecting vaccine coverage. Also, lack of appropriate training and guidance, detailed implementation planning, or adequate human, time, and financial resources hinder HPV vaccine provision for OOS girls.

Overall, this review finds that OOS girls are not sufficiently considered in the design and implementation of national HPV vaccination programmes, leaving more than 100 million girls globally neglected.¹¹

For better inclusion, targeted HPV vaccination programmes could benefit from lessons learned from existing adolescent health programmes reaching OOS girls. These programmes, such as those delivering sexual and reproductive health, HIV, nutrition, or other health services or peer education, and platforms such as religious, cultural, and sports spaces and youth centres could serve as points for co-delivering HPV vaccination for OOS girls. To this end, given the heterogeneity of OOS girls and the socio-cultural contexts they reside in, defining best-suited programmes requires an understanding of the girls' characteristics, their communities, the services they use, and spaces where they spend their time.

WHO's updated recommendation for a single-dose HPV vaccination schedule for 9-14-year-old girls as opposed to the previous two- and three-dose schedules³⁹ should also help make the HPV vaccination programmes more cost-efficient,⁴⁰ particularly for OOS girls who, unlike girls at school, are more challenging to reach repeatedly.

While there are several limitations to this review, they do not account for the scarcity of articles that mention, let alone focus on, OOS girls. The limitations of this review are three-fold: first, we may have missed relevant research that describes the outreach strategies but does not explicitly discuss them in the context of OOS girls. Second, the two databases used may not comprehensively cover research on HPV vaccination, particularly studies published in regional journals. Finally, the search was limited to the English language, and other languages may have yielded additional findings. However, given that only 23 papers out of a total of 832 search results addressed OOS girls, this is likely indicative of a larger trend within the overall literature as opposed to a limited review strategy.

Conclusion

The WHO estimates that implementation of its Global Strategy to Accelerate the Elimination of Cervical Cancer as a Public Health Problem “could prevent 60 million cervical cancer cases and 45 million deaths over the next 100 years”. Girls who are out of school have an equal right to protection from cervical cancer, similar to their in-school counterparts. To this end, national HPV vaccination programmes consider incorporating complementary delivery strategies specially designed for OOS girls, particularly in contexts of high OOS rates.

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Annex. A summary of the articles included

Reference	Study design	Country	Summary
Binagwaho, et al. 2012 ²²	Case study	Rwanda	The article primarily focuses on school-based delivery; however, it mentions out-of-school (OOS) girls in the context of targeted outreach and referrals.
Black, et al. 2018 ²¹	Case study	Sub-Saharan Africa/ Rwanda	The authors provide an overview of HPV vaccine implementation in sub-Saharan Africa with a focus on strategies in Rwanda, including for OOS girls, that have resulted in high vaccination coverage.
Bonner, et al. 2017 ²⁰	Commentary	N/A	One of the two articles exclusively focused on HPV vaccination strategies targeting OOS girls. The authors outline key considerations and applicable methods/approaches to identify eligible OOS girls, understand barriers to vaccination, deliver effective communication, and increase access.
Carlton, et al. 2022 ²⁵	Case study	Zimbabwe	While primarily focused on school-based HPV vaccination delivery in Zimbabwe, the authors refer to OOS girls in the context of outreach activities and recommendations for future improvements, such as engaging traditional leaders to increase awareness.
Casey, et al. 2022 ³⁵	Case study	Senegal	The authors review Senegal's national introduction of the HPV vaccine, delivered primarily through a school-based platform. The authors note outreach-based strategies to reach OOS girls, such as referrals. The article also identifies barriers to success.
Crippin et al. 2024 ¹⁹	Case study	Mali	The authors evaluate a programme in Mali that paired HPV vaccination for OOS girls with cervical cancer screenings for their mothers. A 10.7% increase in HPV vaccination as a result of the paired programme was found.
Dochez et al. 2017 ²⁶	Summative study	17 African countries	The paper documents a capacity-strengthening project that focused on HPV vaccine introduction across 17 African countries. The resultant network created a platform for knowledge exchange, including identified strategies for reaching OOS girls.
Gallagher, et al. 2017 ³⁸	Summative study	45 LMICs	The authors synthesise evidence from HPV vaccination demonstration programmes and national programmes in 45 LMICs. While the primary focus is on school-based strategies, they note that nearly a third of the studies reviewed did not report a strategy for reaching OOS girls.
Holroyd, et al. 2022 ¹⁷	Formative study	India	An article exclusively focused on HPV vaccination strategies targeting OOS girls. Based on workshops with adolescent girls and focus group discussions with parents and community leaders, the authors find that engaging vaccinated peers and parents as champions could improve outreach to OOS girls.

Howard et al. 2017 ³²	Summative study	46 LMICs	The authors synthesise lessons from HPV vaccinations in 45 LMICs and summarise what works for HPV vaccination introduction. They refer to OOS girls in the context of the enumeration challenges and the important role CHWs play in identifying eligible OOS girls.
Li et al. 2022 ²⁷	Cross-sectional survey	Tanzania	The authors surveyed health workers, school personnel, community leaders, and council leaders to assess awareness, feasibility, and acceptability of Tanzania's HPV vaccination programme, which targeted both school and OOS girls. The programme was well accepted and those surveyed has adequate knowledge of HPV vaccine.
Lubeya et al. 2024 ²⁸	Case study	Zambia	The authors conducted key information interviews with teachers and healthcare workers to identify barriers to and facilitators of HPV vaccine delivery in Zambia. Barriers and facilitators specific to OOS girls are discussed, but OOS girls are not the primary focus.
Lubeya et al. 2024 ²⁹	Case study	Zambia	This study identifies barriers to HPV uptake in Zambia across three stakeholder groups: adolescent girls, parents, teachers, and healthcare workers. While OOS girls were not the primary focus, they were included in the study, and being OOS was identified as a key barrier to uptake.
Mphuru et al. 2022 ²³	Case study	Tanzania	The authors review Tanzania's HPV vaccination programme, including a health facility-based strategy. They note that community health workers and community leaders helped identify and register OOS girls. The implementation included large-scale training and social mobilisation.
Riviere et al. 2021 ³⁴	Summative study	Haiti	The authors report high HPV vaccination coverage for both school- and community-based strategies, but have a limited focus on OOS girls beyond describing the critical role of field workers in following up with OOS girls.
Rosser et al. 2025 ¹⁸	Summative study	22 LMICs	The authors synthesise existing evidence on service delivery strategies for reaching OOS girls with HPV vaccination in LMICs. Findings show that facility-based, community-based, and community outreach strategies are most frequently used, but more research is needed to evaluate implementation strategies.
Rujumba et al. 2021 ³⁰	Summative study	Uganda	The authors examined barriers to initiating and completing the two-dose HPV vaccine series recommended in Uganda. A lack of strategies targeting OOS girls was identified as a key barrier.
Simuyemba et al. 2023 ³³	Case study	Zambia	The authors investigate the cost of HPV vaccine delivery in Zambia, calculating per-dose cost across three delivery sites: schools, community outreach sites, and health facilities. They find delivery cost per dose at the latter two sites, which primarily cater to OOS girls, exceeds that of schools, noting that this might disadvantage OOS girls.

Soi et al. 2018 ³¹	Case study	Mozambique	The authors analyse the performance of a 2-year demonstration programme which relied primarily on a school-based strategy. Supplemental community outreach efforts lacked guidance on key issues such as timelines, roles, and how to reach OOS girls.
Tsu et al. 2021 ²	Summative study	56 LMICs	The authors synthesise lessons from HPV programmes in 56 LMICs, with limited references to OOS girls. However, the article describes key barriers to access for OOS girls and makes recommendations for regions with high numbers of OOS girls.
Tuheabwe et al. 2024 ³⁷	Formative study	Uganda	The authors pilot a peer-to-peer education approach in Kampala, Uganda that trained vaccinated girls aged 10-15 as Adolescent Peer Educators to address vaccine hesitancy with girls aged 9-13. Out of a group of 192 unvaccinated girls, including OOS girls, 145 expressed willingness to receive the vaccine, and 88 ultimately received their first dose.
Waheed, et al 2023 ²⁴	Summative study	14 LMICs	The authors synthesise evidence and lessons learned on introduction and sustainability challenges and mechanisms for achieving coverage based on a literature review and interviews focused on 14 LMICs. They refer to OOS girls in the context of data management and microplanning.
Watson-Jones et al. 2015 ³⁶	Formative study	Kenya	Based on interviews and focus group discussions with key groups such as adolescents and health workers, the authors assess the potential acceptability of a future programme for girls living in hard-to-reach populations and identify potential ways to reach them.