FACTORS INFLUENCING HUMAN PAPILLOMAVIRUS VACCINE UPTAKE IN ETHIOPIA: LESSONS FROM LOW-MIDDLE-INCOME COUNTRIES

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Factors Influencing Human Papillomavirus Vaccine Uptake in Ethiopia: Lessons from Low- and Middle-Income Countries

A thesis submitted in partial fulfilment of the requirement for the degree of Master of Science in Public Health and Health Equity

By Ekram Hussien Ahmed

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LIST OF ABBREVIATIONS

ASIR	Age-standardized incidence rate
ASMR	Age-standardized mortality rate
GN	Gender Neutral
GPI	Gender Parity Index
GO	Girls-only
GDP	Gross Domestic Product per capita
EPI	Expanded Program on Immunization
HAAPI	HPV Vaccine Acceleration Program Partners Initiative
HICs	High-income countries
HMF	Healthy Markets Framework
HPV	Human papillomavirus
LMICs	Low- and middle-income countries
MAPs	Microarray patches
MAC	Multi-age cohort
NITAG	National Immunization Technical Advisory Group
NGOs	Non-governmental organizations
PPP	Public–private partnerships
SDGs	Sustainable Development Goals
UNICEF	United Nations Children's Fund
USD	United States dollars
WHO	World Health Organization

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GLOSSARY OF KEY TERMS

Cervical cancer: Cervical cancer is a disease in which cells in the cervix grow out of control. The cervix connects the vagina (birth canal) to the upper part of the uterus (16).

Health Extension Workers: Frontline community health workers in Ethiopia trained to provide promotive, preventive, and basic curative health services focusing on maternal and child health, hygiene, disease prevention, and health education (10).

High-Risk HPV Genotype: Refers to types of human papillomavirus that are associated with persistent infections and an increased risk of developing cervical, anogenital, and oropharyngeal cancers (16).

Vaccine Acceptance: The degree to which individuals are willing to receive available vaccines or to have their children vaccinated (39).

Vaccine Hesitancy: The delay in acceptance or refusal of vaccines despite the availability of vaccination services (39).

ABSTRACT

Introduction: Cervical cancer remains a leading cause of cancer-related deaths among women in Ethiopia. The human papillomavirus vaccine is globally recommended for its primary prevention, yet uptake in Ethiopia has remained suboptimal since its introduction in 2018. This review explores the factors shaping HPV vaccine uptake in Ethiopia and draws on experiences from comparable low- and middle-income countries to inform actionable recommendations.

Methodology: A comprehensive literature review was conducted using peer-reviewed and grey literature identified through systematic searches in PubMed, Google Scholar, the Vrije Universiteit Amsterdam Library Portal, and relevant organisational repositories. Snowballing techniques were also applied. The review was guided by the Model of Determinants of Vaccine Hesitancy, which categorises uptake drivers into contextual, individual/group/social, and vaccine-specific factors.

Result: HPV vaccine uptake in Ethiopia is shaped by interconnected factors across individual, social, and system levels. Limited awareness and misinformation among adolescents and caregivers reinforce cultural concerns and mistrust. Out-of-school girls remain underserved because school-based vaccination strategies rarely reach them. Systemic barriers such as poor multisectoral coordination, absence of national policy, and reliance on donor funding undermine sustainability. Evidence from other LMICs highlights the value of locally adapted strategies, including culturally tailored communication, integration with adolescent health services, and targeted outreach efforts.

Conclusion: Improving HPV vaccine uptake in Ethiopia requires long-term planning, strengthened coordination across sectors, and inclusive strategies that prioritise hard-to-reach groups. Developing a dedicated national policy, securing domestic financing, and adapting evidence-based interventions to Ethiopia's context are essential to ensuring equitable and sustainable vaccine delivery.

Key words: HPV vaccine, vaccine hesitancy, Ethiopia, cervical cancer prevention

Word count: 11,695

INTRODUCTION

In my experience working as a medical doctor and public health professional in Ethiopia, I have cared for many women presenting with advanced stages of cervical cancer, often when little could be done beyond palliative care. I witnessed firsthand the pain and suffering endured by these women and their families, along with the financial burden of a preventable disease.

When Ethiopia introduced the HPV vaccine in 2018, it was an exciting moment for me both as a clinician and as a sexual and reproductive health and rights advocate. The vaccine offers protection to adolescent girls before they are exposed to HPV, and it helps reduce the disproportionate burden of cervical cancer among women in low-income countries like Ethiopia. For me, the HPV vaccine represents an investment in the futures of girls and women who are often underserved by the health system. This deeply personal and professional motivation led me to choose this topic for my thesis.

Cervical cancer remains the second most common cancer among women aged 15 to 44 years in Ethiopia. Despite efforts to expand screening and treatment services, coverage remains suboptimal, making HPV vaccination the most effective and equitable strategy to reduce this burden.

In this thesis, I aim to understand the factors that affect HPV vaccine uptake in Ethiopia and learn from successful approaches in other low- and middle-income countries to help improve HPV vaccine acceptance and contribute to the reduction of cervical cancer.

CHAPTER ONE: BACKGROUND

This section provides an overview of Ethiopia's geography, demographics, socioeconomic context, and health system. It also briefly outlines the burden of cervical cancer and HPV infection and describes the status of HPV vaccination efforts in Ethiopia.

1.1 Geographical Overview

Ethiopia is situated in the Horn of Africa, covering an area of approximately 1.1 million square kilometres (1). Ethiopia is projected to have a population of around 128.6 million, ranking it as Africa's second-most populous country, after Nigeria (1). Administratively, the country is divided into 12 regions and two chartered cities: Addis Ababa, the capital, and Dire Dawa (1,2), illustrated in Figure 1.

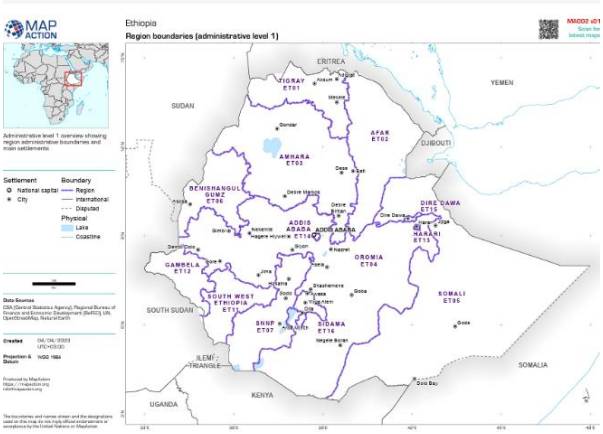

Figure 1. Administrative boundaries of Ethiopia *(2)*

1.2 Demographic Profile

Ethiopia's demographic profile is marked by a youthful population, with 41% under the age of 15, as shown in Figure 2 (3). Nearly a quarter of the population falls within the reproductive age group (15–49 years), while adolescents (10–19 years) account for 22%. Rural residents make up 79% of the population, with the remainder living in urban areas (4). According to the 2019 mini demographic and health survey, the country is home to over 80 ethnic communities and 90 distinct languages, with the Oromo (34.4%) and Amhara (27%) as the largest groups (4). Ethiopia is religiously diverse, with Orthodox Christians primarily residing in the northern and central highlands, Muslims predominantly in the eastern and southern regions, and Protestants mainly in the southern and western parts of the country (1).

1.3 Socio-economic and Cultural Landscape

According to the World Bank, the gross domestic product per capita (GDP) of Ethiopia is 1,272 United States dollars (USD), with around 24% of its population living below the national poverty line (5). Agriculture dominates Ethiopia's economy, providing jobs for more than 70% of the labour force and accounting for roughly 40% of the GDP (5).

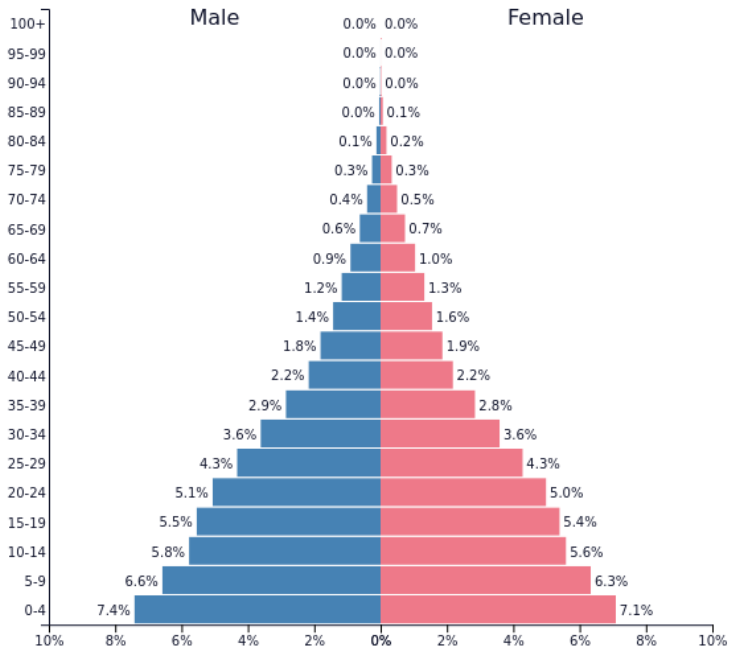

Figure 2. Age and Sex Structure of Ethiopia's Population, 2025 (3)

The adult literacy rate stands at 51%, with 57% of men literate compared to 44% of women, a disparity most pronounced in rural areas (4). School enrolment data reveal gender disparities across regions, measured by the Gender Parity Index (GPI), which compares girls' access to education relative to boys as a ratio. In primary and middle schools, girls outnumber boys in Amhara, Addis Ababa, and Sidama (GPI >1), while Afar has the lowest GPI, showing a significant gap in girls' enrolment compared to boys, as seen in Figure 3 (6). The expected age for primary school is 7–12 years and 13–14 for middle school (6).

The 2019 Ethiopian Mini Demographic and Health Survey indicated that among adults aged 15–49, men have greater access to media and technology than women. Radio listenership is reported at 36.2% for men, compared to only 24.1% for women (4). The gap is even wider for television access, with 47.3% of men having access versus just 3.3% of women. Mobile phone ownership is also higher among men (87.4%) than women (59.1%) (4).

Ethiopia is a predominately patriarchal society, with 32% of girls fearing to seek care without male permission, and 42% are reluctant to visit health facilities alone (4). Sociocultural taboos surrounding adolescent sexuality restrict girls' autonomy, mobility, and decision-making, resulting in lower utilisation of sexual and reproductive health services and poorer health outcomes (7,8). The high prevalence of early marriage (40% nationally and over 50% in regions like Afar and Amhara) adds to these challenges by restricting girls' autonomy and access to care (9).

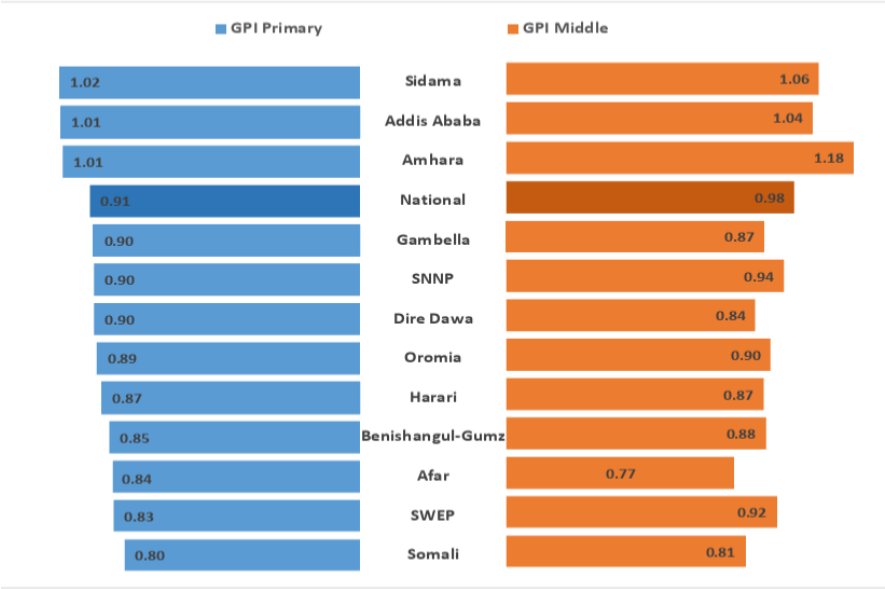

Figure 3: Gender Parity Index for Primary and Middle Level Education by Region, 2022/23 (6)

1.4 Health System Overview

Ethiopia's health system is organised into three levels: tertiary care (speciality hospitals), secondary care (general hospitals), and primary care (health posts and health centres). Health Extension Workers (HEWs) are crucial in providing necessary health services linking the primary care to the community (10). As of 2022, the density of physicians in Ethiopia is 1.1 per 10,000 population (11).

The Federal Ministry of Health defines national health priorities and strategies, while Regional Health Bureaus adapt and implement them based on local needs. Zonal and district health offices oversee service delivery and planning in alignment with national directives (see Annex *1*) (10). There is improvement in childhood immunisation coverage in Ethiopia, with an increase from 14.3% in 2000 to 44.1% by 2019, but there is substantial regional variation, with the lowest coverage seen in the Afar, Somalia, and southwest regions (12). Ethiopia has achieved progress against infectious diseases like HIV and malaria, but tackling noncommunicable diseases like cancer, diabetes, and hypertension, which cause over 40% of deaths, still remains a problem (13).

1.5 Burden of Cervical Cancer and Human Papillomavirus Infection

According to the Global Cancer Observatory's 2022 estimate, cervical cancer accounted for 662,301 new cases and 348,874 deaths globally, corresponding to an age-standardised incidence rate (ASIR) of 14.1 and an age-standardised mortality rate (ASMR) of 7.1 per 100,000 women (14). Approximately 19% of global cervical cancer cases and 23.1% of cervical cancer-related deaths occur in Africa (14). Cervical cancer represents the second most prevalent cancer among African women aged 15 to 44 years (15).

In Ethiopia, cervical cancer is the second largest cause of cancer-related mortality, accounting for around 6,300 new cases and 4,884 deaths among women of reproductive age in 2022 (14). In the same year, the ASIR was 21.5 and the ASMR was 16.0 per 100,000 women (14). Persistent infection with high-risk strains of the human papillomavirus (HPV), a common viral infection that affects both men and women, is the main cause of cervical cancer. HPV infects

the throat, genitalia, and skin (16). Roughly four out of five sexually active women will acquire genital HPV at some stage in their lives. While the infection typically clears within two years, in about 10% of the cases it persists, leading to cervical abnormalities or genital warts (17).

Among Sub-Saharan African women aged 15–85, high-risk HPV types 16/18 have an average prevalence of 34% (18). However, a 2019 systematic review of Ethiopian women in the same age range with cervical abnormalities documented a higher detection rate of 53.6% for HPV 16/18 (19). Other high-risk HPV genotypes, such as HPV-52 (9.4%), HPV-58 (6.9%), and HPV-45 (5.2%), are emerging as common oncogenic strains linked to cervical, anogenital, and oropharyngeal cancers among Ethiopian women (19).

1.6 Prevention of Cervical Cancer

The primary prevention of cervical cancer is through the HPV vaccine; secondary prevention involves screening for cervical cancer coupled with early treatment of precancerous lesions, and tertiary prevention involves cancer treatment and palliative care (17). The World Health Organisation (WHO) has introduced the 90-70-90 strategy to eliminate cervical cancer by 2030. This strategy targets 90% HPV vaccination coverage, 70% screening coverage, and 90% treatment coverage for cervical disease (20).

Aligning with this strategy, Ethiopia has expanded its cervical cancer prevention and control efforts through the "*Combat Cervical Cancer*" program, increasing screening services to over 1,218 health facilities nationwide (21). Yet, as of 2019, estimated screening coverage among women aged 25 to 65 reached only 4% to 5% (22). In low-resource settings like Ethiopia, where cervical cancer screening is underutilised, HPV vaccination is recommended as the most effective strategy for preventing cervical cancer (23).

The initial 2006 WHO recommendation for the HPV vaccine was a three-dose schedule, which was updated to a two-dose regimen spaced six months apart in 2014 (24). The latest guidance from December 2022 endorses a single-dose schedule, with evidence confirming its comparable efficacy to multi-dose regimens (25).

1.7 HPV Vaccination in Ethiopia

Ethiopia introduced the HPV vaccine in 2018, with the initial plan of administering the vaccine to girls aged 9 to 14, ideally prior to sexual debut, but due to global vaccine supply constraints, the vaccine was provided to only 14-year-old girls (26). Ethiopia adhered to a two-dose vaccination schedule until March 2023, when the National Immunisation Technical Advisory Group recommended switching to a single-dose regimen to reduce program costs, minimise dropout rates, and maintain comparable levels of protection (27).

Ethiopia has conducted three nationwide HPV vaccination campaigns, reaching a cumulative total of 13 million girls by the end of 2024 (28). The initial phase focused on 14-year-old girls under a two-dose schedule, expanding coverage incrementally. The adoption of the single-dose regimen enabled the landmark multi-age cohort campaign in November 2024, which targeted girls aged 9 to 14 for the first time, as summarised in Table 1. This campaign vaccinated 6.8 million girls, contributing to the country's total coverage (28).

Table 1: Summary table of the HPV vaccination timeline in Ethiopia from 2018 to 2024 (26–28)

Time Period	Milestone	Target group	Dose schedule
December 2018 – January 2019	National launch	14-year-old girls	Two doses
January 2020-2023	Scaled-up campaign	14-year-old girls	Two doses
March 2024	Adopted single-dose policy	14-year-old girls	One dose
November 2024	Age expansion implemented	9- to 14-year-old girls	One dose

CHAPTER TWO: PROBLEM STATEMENT AND OBJECTIVES

2.1 Problem Statement and Justification

Cervical cancer is the second leading cause of cancer-related mortality among Ethiopian women, contributing to substantial social and economic burdens such as loss of productivity and financial hardship due to treatment costs (22). In response, Ethiopia introduced HPV vaccination in 2018 as a cornerstone prevention strategy(28) .

The HPV vaccination coverage is defined as '*the percentage in the target population who have received the final dose of HPV vaccine in a given year*' (29). Accurately measuring HPV vaccination coverage presents methodological challenges. Official coverage figures, often derived from administrative data, tend to be incomplete or inflated due to outdated census-based denominators (target population estimation) and possible double-counting in paper-based reporting systems (29).

The United Nations Children's Fund (UNICEF) and WHO generate more refined coverage estimates by triangulating multiple data sources, including administrative reports, Joint Reporting Forms, Demographic and Health Surveys, and the Multiple Indicator Cluster Surveys and on-site evaluation studies to account for contextual factors and resolve inconsistencies (28). Notable discrepancies persist between official national figures and WHO estimates, with the latter consistently indicating lower vaccination coverage in Ethiopia. This discrepancy is illustrated in Figure 4, which compares administrative data and WHO estimates of HPV vaccine coverage in Ethiopia from 2019 to 2023 (29).

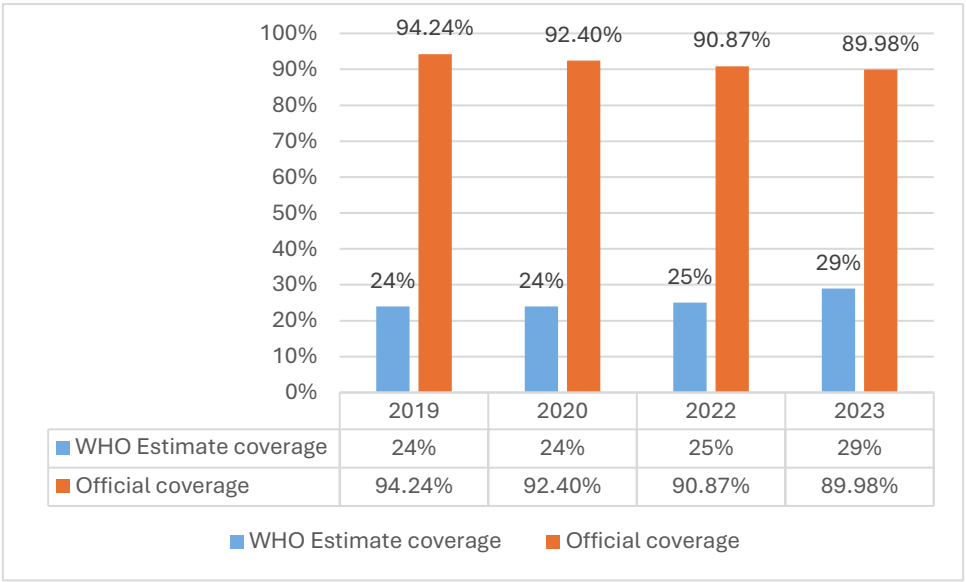

Figure 4. HPV Immunization Coverage: Official Reports and WHO Estimates from 2019 to 2023 (29)

Beyond national coverage figures, substantial regional disparities exist even in areas reporting relatively higher coverage; many communities remain underserved due to geographic, socioeconomic, and infrastructural barriers (30,31). A meta-analysis of eight studies conducted in Ethiopia reported a pooled HPV vaccine uptake of 42.1% with significant variation across regions: 66.5% in Oromia (North Shoa), 45.3% in Amhara (Bahir Dar), and 50.4% in SNNPR (Arba Minch), all lower than the national administrative coverage estimates (30). These gaps are more marked in conflict-affected and climate-vulnerable regions, including Afar, Somali, Tigray, and Amhara, where protracted insecurity, recurrent climate shocks (droughts and floods), and chronic infrastructure deficiencies impede vaccine access and delivery (31).

Previous studies in Ethiopia have identified limited awareness, cultural and religious beliefs, logistical challenges, and concerns about vaccine safety as key barriers to HPV vaccine uptake (32–36). However, this body of evidence remains fragmented, with many studies focusing narrowly on either demand-side (e.g., individual knowledge, attitudes) or supply-side issues (vaccine cost, delivery, health system capacity), without examining how individual, social, contextual, and health system-level factors interact to influence vaccine acceptance.

Research from low- and middle-income countries (LMICs) provides useful lessons on effective strategies to improve HPV vaccine coverage; little attention has been given to how such approaches could be adapted to Ethiopia's health system and sociocultural landscape. A comprehensive literature review that integrates and critically analyses existing literature is essential to inform equity-focused interventions that can improve HPV vaccine uptake and reduce the burden of cervical cancer in Ethiopia.

Modelling studies estimate that without action, CC will cause about 191,876 deaths among Ethiopian women from 2020 to 2070 (37). Ethiopia could eradicate cervical cancer as a major health threat by 2075 if the country attains the WHO's 90-70-90 objectives by 2030 (37). Economic analyses indicate that every dollar allocated to cervical cancer elimination generates an estimated $5.28 in economic returns over three decades through enhanced workforce productivity (38). In addition to these financial benefits, expanding HPV vaccination would support Ethiopia's achievement of multiple Sustainable Development Goals (SDG), with direct impact on those related to health (SDG 3) and gender equality (SDG 5) (21).

This literature review aims to address evidence gaps in the factors influencing HPV vaccine uptake in Ethiopia and provide recommendations for policymakers, healthcare providers, and researchers. By incorporating lessons from LMICs, the findings from the study seek to support HPV vaccination efforts in Ethiopia.

2.2 Study Objectives

The general objective of this study is to explore factors influencing HPV vaccine uptake in Ethiopia and critically analyse effective interventions from comparable LMICs to inform strategies for improving HPV vaccination uptake in Ethiopia.

Specific objectives

1. To identify the individual, social, contextual, and health system factors influencing HPV vaccination uptake in Ethiopia.
2. To analyse effective strategies and interventions that have improved HPV vaccination uptake in comparable LMICs.
3. To provide evidence-informed recommendations for improving HPV vaccine uptake in Ethiopia, targeting policymakers, healthcare providers, and public health researchers.

2.3 Analytical Framework

This study employs the model of determinants of vaccine hesitancy developed by WHO's Strategic Advisory Group of Experts on Immunisation as the guiding analytical framework (39). The model of determinants of vaccine hesitancy is a well-established framework for understanding vaccine hesitancy, defined as '*the delay in acceptance or refusal of vaccines despite the availability of vaccination services' (39).* The framework was originally developed to address vaccine hesitancy across all vaccines and categorises the determinants of vaccine uptake into three broad domains as illustrated in Figure 5 (39).

- **Individual/group/social influence:** These include personal beliefs, level of knowledge, past experiences with vaccination, and social or peer norms that shape individual decisions regarding acceptance of a vaccine.
- **Contextual influences:** These refer to broader cultural, economic, environmental, historical factors that impact vaccine acceptance in a population.
- **Vaccine- and vaccination-specific factors:** These involve concerns related to the vaccine itself, including safety, side effects, or effectiveness, as well as issues related to how vaccination services are delivered.

This framework is well suited for the study because it allows for a comprehensive analysis of how individual beliefs, social norms, contextual factors, and health system dynamics interact to influence HPV vaccine uptake. As a recognised and validated model for understanding vaccine hesitancy, it captures influences at multiple levels, enabling the exploration of both challenges and facilitators. This approach aligns with the study's objectives by providing a clear structure to examine the range of factors affecting HPV vaccination in Ethiopia, helping to identify actionable entry points for improving HPV vaccination strategies in Ethiopia (39).

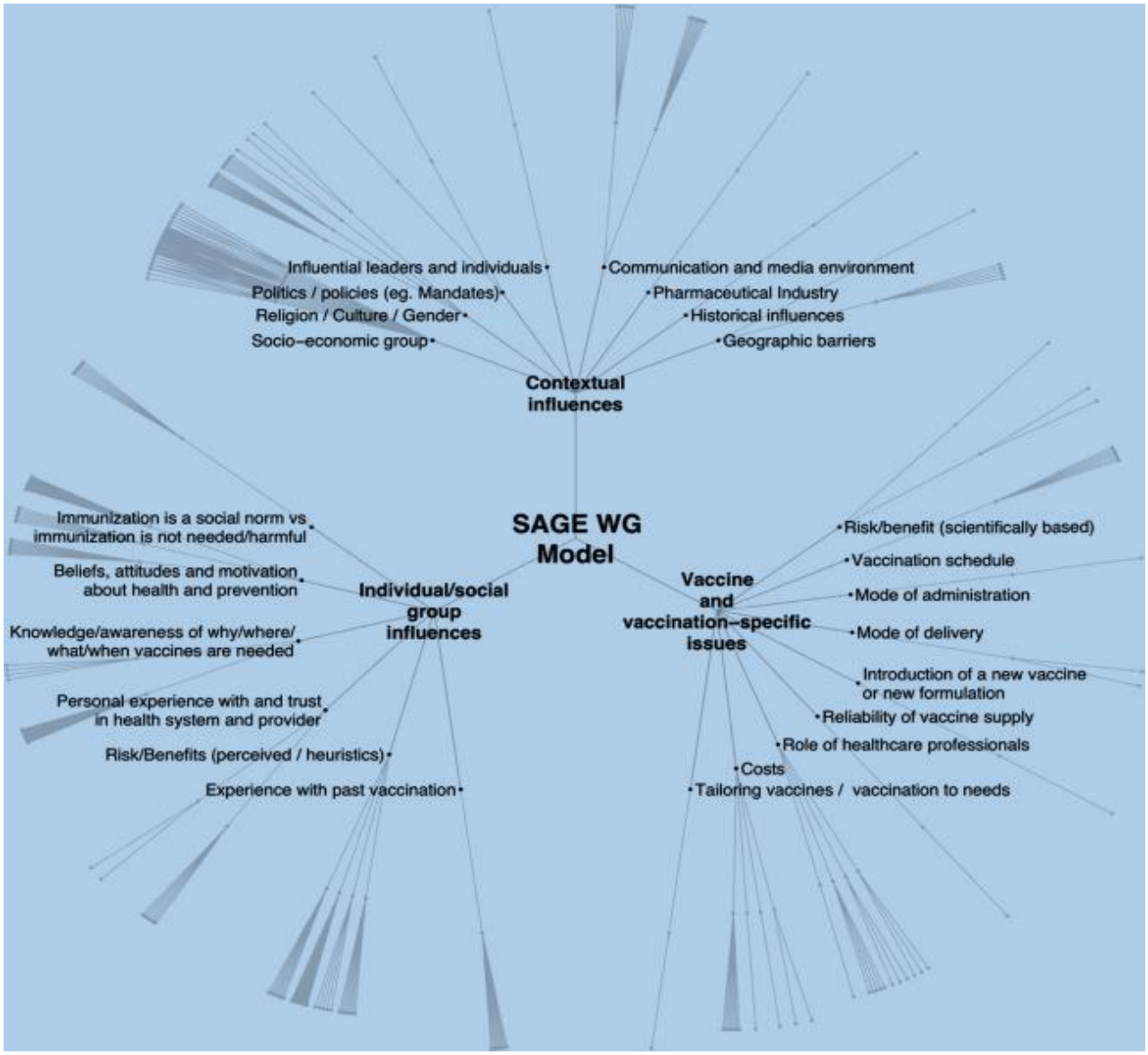

Figure 5: The Model of Determinants of Vaccine Hesitancy, 2014 (39)

CHAPTER THREE: METHODOLOGY

3.1 Study Design

This review employed a structured literature review.

3.2 Literature Search Strategy

A comprehensive search was conducted for both peer-reviewed and grey literature. Peer-reviewed articles were retrieved through PubMed, Google Scholar, and the Vrije Universiteit Amsterdam Library Portal. Grey literature was identified through targeted searches of organisational websites and repositories focusing on HPV vaccination and cervical cancer prevention. These organisations and repositories were identified by reviewing implementing partners listed in Ethiopia's national cervical cancer and immunisation strategies, as listed in Table 2. Relevant materials included evaluation reports, policy documents, program overviews, and conference presentations from established cervical cancer prevention initiatives.

A combination of keywords and Boolean operators was used, as detailed in Table 2. Keywords were developed based on the Model of Determinants of Vaccine Hesitancy and guided by common indexing terms used in similar studies on PubMed. Snowballing techniques of reviewing reference lists of included articles were also applied to identify additional sources. The final database search was completed on June 2, 2025**.** All references were managed in Zotero, where duplicates were removed. The de-duplicated library was uploaded to Rayyan, an online platform used to facilitate screening. The final selection included 115 sources: 78 peer-reviewed journal articles and 37 grey literature documents.

3.3 Inclusion Criteria

The following criteria were used to guide the selection of studies and documents for inclusion in this review:

General inclusion criteria

- **Language**: Studies and reports published in English to ensure consistency.
- **Publication Years**: 2015–2025 to capture recent evidence and developments.
- **Types of Sources**: Peer-reviewed articles and grey literature.
- **Geographical Scope:** Ethiopia and LMICs with contextual relevance to Ethiopia.

Objective-specific inclusion

Objective 1: Studies that explore individual, social, contextual, and vaccine- and vaccination-related factors influencing HPV vaccine acceptance, uptake, or coverage in Ethiopia.

Objective 2: Studies that describe interventions, programs, or strategies shown to improve HPV vaccine uptake in LMICs. To be included, these studies:

1. Demonstrated contextual relevance to Ethiopia (e.g., similar demographics, health infrastructure, or socioeconomic factors).
2. Presented qualitative or quantitative evidence of success.
3. Provided sufficient detail on implementation, challenges encountered, and lessons learnt.

Table 2: Literature search strategy summary

Search Focus	Objective 1	Objective 2
Search terms	(HPV OR "human papillomavirus") AND (vaccination OR immunization OR vaccine uptake OR vaccine coverage OR "vaccine acceptance" OR "vaccine hesitancy" OR "vaccine refusal") AND Ethiopia AND (factors OR barriers OR facilitators OR determinants OR attitudes OR perceptions OR acceptability OR awareness OR knowledge OR beliefs OR "health behaviour" OR "social norms" OR "community factors" OR "contextual factors" OR "health system factors" OR "vaccine-specific factors" OR "pharmaceutical industry" OR "vaccine cost" OR "delivery systems" OR "supply chain" OR "cold chain" OR "stockouts" OR "safety concerns" OR "side effects" OR "efficacy" OR "effectiveness" OR "school-based" OR "health worker attitudes" OR "religious beliefs" OR "cultural beliefs" OR "gender norms" OR "parental decisions" OR "media influence" OR "policy implementation" OR "program funding")	(HPV OR "human papillomavirus") AND (vaccination OR immunization OR "vaccine uptake" OR "vaccine coverage") AND ("low-income countries" OR "developing countries" OR LMIC OR "Sub-Saharan Africa") AND (strategy OR intervention OR program OR policy) AND ("school based" OR "community health workers" OR "supply chain" OR "cold chain" OR "task shifting" OR "mobile units" OR "reminder systems")
Geographical scope	Ethiopia	LMICs with contextual relevance to Ethiopia
Time frame	2015-2025	2015-2025
Type of literature	Peer-reviewed literature and grey literature	Peer-reviewed literature and grey literature
Databases for peer-reviewed literatures	PubMed, Google Scholar, Vrije Universiteit Amsterdam Library Portal	Same as objective 1
Sources for Grey Literature	WHO, UNICEF, GAVI, Ministry of Health–Ethiopia, Global Cancer Observatory, PATH, JSI, MSF, JHPIEGO, HAAPI Consortium, other HPV project reports and presentations	Same as objective 1
Screening approach	Title, abstract and full screening	Title, abstract and full screening
Peer-reviewed Results	53 included	25 included
Grey Literature Results	22 included through targeted search	15 included through targeted search

3.4 Exclusion Criteria

- Studies focusing exclusively on HPV vaccine development or clinical trials without addressing uptake or acceptance.

To ensure the credibility and rigour of the review, multiple high-quality sources were triangulated, including peer-reviewed journals and reports from established organisations. The quality of peer-reviewed articles was considered during selection, based on methodological clarity, sample adequacy, and relevance to the review objectives.

3.5 Data Extraction and Analysis

Data was extracted into an Excel spreadsheet capturing authorship, year, study design, and key findings. Findings for Objective 1 were categorised using the Model of Determinants of Vaccine Hesitancy. For Objective 2, effective interventions were synthesised thematically from the selected studies. All screening and analysis were conducted by a single reviewer.

CHAPTER FOUR & FIVE: RESULT

The result section presents factors influencing the uptake of HPV vaccination in Ethiopia under objective 1 and effective interventions and strategies to improve the uptake of the HPV vaccine in LMICs under objective 2.

4. Factors Influencing the uptake of HPV Vaccination in Ethiopia

This section describes factors affecting HPV vaccine uptake in Ethiopia, structured according to the three domains of the Model of Determinants of Vaccine Hesitancy (*Figure 5*) (39).

4.1 Individual/Group/Social Influences

This subsection presents the influence of individual-level perceptions and social relationships on the decisions about HPV vaccination.

4.1.1 Knowledge and awareness about vaccines

Low knowledge and awareness about the cervical and HPV vaccines leads to underestimation of personal risk, limited understanding of the vaccine's protective role, and susceptibility to vaccine misinformation (30,40,41). A multi-region study among schoolgirls in Oromia, Amhara, and the Southern regions revealed that those with a strong understanding and awareness of HPV were 6.7 times more likely to accept vaccination compared to their less-informed peers (30). Other studies in southwestern Ethiopia demonstrated that knowledge about HPV, including its modes of transmission and the vaccine's importance, among both adolescents and their parents increased willingness to receive the vaccination (40,41).

Caregivers' educational background influences HPV vaccine acceptance, with parents who have at least primary education more inclined to support vaccination (41,42). This may be attributed to improved health literacy, which enhances their ability to understand health risks and make informed decisions (34,43).

Information about HPV infection and the vaccine remains fragmented; in two cross-sectional studies conducted in northern Ethiopia, while most parents had heard of cervical cancer, only about a quarter recognised HPV as its cause (44,45). This was also reflected among urban Ethiopian female students, who understood the importance of the HPV vaccine but were unaware of its availability and where to access it (46,47).

4.1.2 Beliefs, attitudes about health and prevention

Preventive health services are underutilised in Ethiopia, with a 2024 systematic review reporting only half the population accessed health extension services, which primarily focus on preventive and promotive care (48). A mixed-methods study in Addis Ababa highlighted how, in the context of women's preventive care, discomfort discussing intimate issues and preferences for provider gender contributed to reluctance in seeking cervical cancer screening even when services were available (49).

When it comes to adolescent immunisation, evidence from central Ethiopia and Jimma shows that some perceive vaccines as unnecessary, with growing mistrust for vaccines administered beyond early childhood (33,50). Adolescents' willingness to receive vaccination often clashes with caregivers' beliefs, who hold decision-making power; for instance, research in Western Shewa showed that despite adolescent support, parental consent posed as a barrier to HPV

vaccination (51). These beliefs and attitudes towards vaccines are affected by what the individual understands about the benefits and encouragement from people around them, including family, peers, and health workers (52).

4.1.3 Perceived benefits and risks of HPV vaccine

Perceived benefits about the HPV vaccine among both adolescents and their caretakers influence their willingness to take the vaccine (53, 54). In a study conducted in northern Ethiopia, about two-thirds of secondary school-aged girls recognised the vaccine's preventive benefits against cervical cancer (53). Parents who recognised the vaccine's protective effect were more likely to support their daughters in receiving the HPV vaccine (43, 54). This perception of benefit is often strengthened when communities witness the morbidity and fatalities caused by cervical cancer (55).

Adolescents who had initiated sexual activity had a favourable attitude towards taking a protective measure to prevent HPV infection and were more willing to take the vaccine compared to their sexually inactive peers due to heightened perceived vulnerability to acquiring HPV infection (32,47). In contrast, parents of younger daughters believe their children are at minimal risk of contracting HPV, often resulting in delayed vaccination decisions (50).

There are concerns around the moral implications and side effects of the HPV vaccines in several studies conducted in Ethiopia (45, 52,57–59). Among these, there is a common belief that receiving the HPV vaccine may encourage adolescent girls to engage in risky sexual behaviour (44,56,57). Additionally, fears that the vaccine could cause infertility had been reported as a major barrier to vaccine uptake across multiple studies (32,45,51,56,57). Some adolescents also express anxiety about the pain associated with the injection itself, which contributes to reluctance to receive the vaccine (51,58).

4.1.4 Personal experience with trust in health system and health care providers

Personal and familial experiences with the health system influence perceptions and acceptance of new health interventions. In one study, parents who had previously visited a health facility for cervical cancer screening were more likely to have received counselling and information on HPV and its prevention, which appeared to contribute to favourable attitudes toward the vaccine (58).

Engagement with reproductive health services was also linked to higher vaccine uptake among adolescents. According to the 2023 Performance Monitoring for Action Ethiopia survey, adolescent girls with prior use of sexual and reproductive health services had a threefold greater likelihood of receiving the HPV vaccine compared to those who had never accessed such services (59)**.** This effect appears to extend beyond individual experience to that of close family members. A 2023 study in Addis Ababa found that adolescent girls whose sisters had received the HPV vaccine in earlier campaigns were ten times more likely to accept vaccination themselves (47).

Trust in health services was also shaped by long-term exposure to government-led immunisation programs. Positive experiences with childhood vaccinations provided by public facilities were linked to greater acceptance of adolescent vaccines like HPV (42). Health care providers play as a bridge to build trust between the health system and the community and have been identified as credible sources of information regarding the HPV vaccine across multiple studies in Ethiopia (51,60–62).

4.2 Contextual Influences

This subsection examines how cultural values, religious beliefs, gender expectations, media narratives, and national policies influence public acceptance and demand for HPV vaccination.

4.2.1 Influential leaders and individuals

The Ethiopian government has demonstrated strong support for the HPV vaccine, exemplified by the participation of the current Minister of Health, who administered vaccines during the November 2024 HPV vaccination campaign to publicly affirm the vaccine's safety (63). This builds on earlier efforts by influential figures like former First Lady Roman Tesfaye, who played a prominent role in promoting HPV vaccination by raising public awareness and encouraging community and media engagement during the 2018 HPV campaign rollout (64).

Advocacy efforts extended beyond high-level officials to include locally trusted leaders. In a remote district of the Amhara Region, women's groups were engaged as vaccine advocates and were linked with HEWs to support vaccine delivery, helping to build community trust (65). Such efforts have not been consistently implemented across the country, `with the absence of ongoing involvement from trusted local figures being a major contributor to parental refusal and the spread of misinformation about the vaccine (34,42,66).

4.2.2 Communication and media environment

Mass media has served as a main channel for promoting HPV vaccine awareness and demand, supported through coordinated campaigns by the Ethiopian Ministry of Health to address vaccine hesitancy (67). The effectiveness of these efforts can be partially gauged through studies conducted in both urban and rural Ethiopia, which consistently identify mass media, alongside family, peers, and healthcare providers, as the main sources of information on the HPV vaccine (60,62,68,69). In one such study conducted in the Amhara Region, parents who had been exposed to HPV-related information through media were 2.7 times more likely to express willingness to vaccinate their daughters compared to those who had not encountered such media content (69). Aside from general media campaigns, school-based media programs provided adolescents with age-appropriate health education, which, according to students, served as a motivating factor for vaccine acceptance (32).

Creative media initiatives targeting adolescent girls, like Girl Effect's '*Yegna*' TV drama series, used narrative storytelling to improve HPV and cervical cancer knowledge while challenging harmful social misconceptions. The impact evaluation report of the program showed that Ethiopian girls exposed to the '*Yegna*' program had a 1.6 times higher likelihood of being knowledgeable about the HPV vaccine and were less likely to believe in myths linking vaccination to infertility (70).

4.2.3 Cultural norms and gender

In Ethiopia, discussions around sexual and reproductive health are often seen as taboo, limiting open communication within families and communities (8). This cultural silence makes it difficult to discuss the importance of HPV vaccination for adolescent girls (56). Girls from families where reproductive health topics are openly discussed with parents are more willing to accept the vaccine (35). Such open dialogue can increase both parents' and daughters' awareness of HPV risks and the protective value of vaccination (71,72). Cultural norms that view sexual health as a private matter discourage open discussions, allowing myths, like the vaccine promoting promiscuity or being only for sexually active girls, to spread through peer networks in the absence of accurate, family-based information (32,56–58). Strong social ties among Ethiopian mothers influence health decisions, with advice shared in daily conversations often valued above healthcare professionals' recommendations (73).

In many parts of Ethiopia, cultural gender roles assign women the responsibility of upholding modesty, obedience, and family honour (74). Under these environments, girls' health is often not considered a matter of personal choice but rather a decision to be made by the family or broader community (75). As a result, even when health services are accessible, girls may feel discouraged or unable to seek care without explicit permission from their family (74,75).

This limited autonomy is further constrained by the practice of early marriage, which disproportionately affects girls in rural Ethiopia (9). Early marriage shifts decision-making authority from parents to husbands, reducing girls' control over their own health choices. Moreover, it often leads to girls discontinuing their education and taking on domestic responsibilities at a young age, which excludes them from school-based HPV vaccination campaigns (76).

4.2.4 Religion

Health-seeking behaviours in Ethiopia are guided by religious belief systems, with faith-based treatments such as "*Tsebel*" (holy water) commonly viewed as trusted alternatives to clinical care in devout communities (77). Serious illnesses like cervical cancer are sometimes perceived as divine punishment for having multiple sexual partners, which can lead to stigma and discourage women from seeking screening, treatment, and vaccination (78). Parents who adhere to religious dogmas promoting abstinence from sex often view HPV vaccination as unnecessary, due to the low perceived risk of their children acquiring HPV infection (77). Some religious objections to the HPV vaccine stem not just from doubts about its necessity but also from concerns over the vaccine containing non-halal ingredients (73).

Religious leaders are trusted messengers, and their involvement has proven effective in promoting HPV vaccination in Ethiopia. A notable example comes from the Afar region, where collaboration with religious leaders to address vaccine-related misconceptions helped improve public acceptance and demand (79).

4.2.5 Socioeconomic status

Household income influences HPV vaccine acceptance in Ethiopia. Parents with lower income were less likely to vaccinate their daughters, potentially due to limited access to health information, lower health literacy, and reduced exposure to media (33,35,43). In Gondar (Amhara region), families from the wealthiest households were over three times more likely to accept the HPV vaccine than those from the poorest households, suggesting that greater

economic resources may increase prioritisation of preventive health services and access (66). Although the HPV vaccine is free in Ethiopia and school-based delivery reduces indirect costs, girls from low-income families who drop out of school face added barriers of transport and time to access the vaccine through outreach sites (80, 81).

4.2.6 Geographical barriers

Adolescent girls in urban areas are significantly more likely to be informed about and accept the HPV vaccine compared to their rural counterparts (50,82). A study conducted in central Ethiopia found that parents of girls aged 9–14 in rural areas were four times less likely to be knowledgeable about HPV than those living in urban areas (50). This disparity is partly attributed to limited access to health information in rural settings, where geographic barriers hinder effective outreach and awareness efforts (30). Adolescent girls in rural areas are less confident in the HPV vaccine's safety and effectiveness than those in urban settings, indicating a gap in health education and message delivery (82).

4.2.7 Pharmaceutical Industry

Ethiopia's ability to secure HPV vaccines is influenced by the global vaccine supply landscape and the concentration of production among a few pharmaceutical manufacturers (83). Ethiopia depends on Gavi, the Vaccine Alliance, to negotiate reduced prices essential for expanding immunisation programs (83). According to the updated WHO report from August 2024, five HPV vaccines have been approved for global use. However, only three of these are currently available to Gavi-supported countries: two bivalent vaccines (Cervarix and Cecolin) and Merck's quadrivalent Gardasil, as detailed in Table 3 *(83, 84).*

Table 3: Characteristics of WHO-Prequalified HPV Vaccines (84)

Vaccine	Bivalent			Quadrivalent	Nonvalent
Trade name	Cecolin®	Cervarix™	Walrinvax®	Gardasil®	Gardasil-9®
Manufacturer	Xiamen Innovax Biotech Co. Ltd.	GlaxoSmithKline Biologicals SA	Walvax Biotechnology Co. Ltd.	Merck Vaccines	Merck Vaccines
Date of WHO prequalification	14 October 2021	08 July 2009	02 August 2024	20 May 2009	09 February 2018
Antigen coverage	HPV 16&18	HPV 16 & 18	HPV 16&18	HPV 6, 11, 16, 18	HPV 6, 11, 16, 18, 31, 33, 45, 52, 58,

Merck controls the vast majority of the global HPV vaccine market, accounting for over 85% of supply (85). Such a monopoly restricts market diversity and flexibility, reinforcing global health inequities in vaccine access (85). The effects of Merck's dominant market control became evident when the company challenged the 2022 WHO SAGE recommendation to adopt a single-dose HPV vaccine. At that time Merck opposed the single-dose HPV regimen, arguing that the evidence was insufficient to revise its product labelling from three doses, thereby officially classifying the single-dose use as *off-label* (86).

In a 2023 global assessment, Merck's position was cited as one of the concerns behind many LMICs' hesitation to adopt the single-dose HPV schedule early (87). In Ethiopia, the official implementation of the single-dose regimen lagged by three years following WHO's endorsement (28). During this delay, the country missed out on the projected 30–50% reduction in program costs and experienced additional strain on cold chain logistics and human resources (88). Efforts are underway to enhance Ethiopia's capacity for local vaccine production by addressing barriers like a limited pool of trained specialists, high capital costs, and underdeveloped facilities. However, these initiatives remain in the early stages and have yet to support HPV vaccine manufacturing (89).

4.2.8 Historical Influences

The HPV vaccine has, at times, been misinterpreted as a covert government strategy to control population growth under the guise of a public health initiative (55). This mistrust is rooted in concerns about Ethiopia's rapid population growth and longstanding fears of foreign influence linked to dependence on external aid (68). Such scepticism conveys a broader historical pattern of sociocultural resistance to new health interventions targeting young women's reproductive health, reminiscent of the pushback encountered at the introduction of family planning programs in Ethiopia (90).

Vaccine hesitancy driven by myths and misinformation intensified during the COVID-19 pandemic, disrupting school-based delivery and causing HPV vaccination coverage in LMICs to drop to 50% by 2021 (91). Despite these setbacks, some regions in Ethiopia, like Tigray, had implemented mitigation strategies such as integrated vaccination campaigns that administered HPV and COVID-19 vaccines alongside routine immunisation catch-up programs and complementary health interventions that improved HPV uptake (92).

The conflict in northern Ethiopia, which began eight months after the COVID-19 pandemic was declared, further disrupted vaccination services and weakened public trust in the health system, reducing health-seeking behaviour (93). Beyond health system impacts, prolonged school closures, increased risks of gender-based violence, and the economic burden of transportation and school supplies discouraged parents from sending girls to school (94). This has hindered HPV vaccine delivery, which relied on schools as the main platform for reaching eligible girls (95).

Even with these challenges, it is important to recognise the strengths of Ethiopia's routine immunisation program. Through consistent delivery of essential childhood vaccines and strong community partnerships involving trusted health workers and local leaders, this program has fostered public trust throughout the years (96).

4.2.9 Policies and Guidelines

This review did not identify a published national HPV vaccination policy in Ethiopia. Guidance on the HPV vaccination program in Ethiopia is addressed within *the Guideline for Cervical Cancer Prevention and Control in Ethiopia, 2021* (22), and *the Expanded Program on Immunisation (EPI) 2021–2025 plan* (26).

The *Guideline for Cervical Cancer Prevention and Control in Ethiopia* promotes cervical cancer prevention across a woman's life course, emphasising HPV vaccination as a vital step in protecting against cancer-causing HPV types before exposure (22). It calls for coordinated efforts across national, regional, and local health authorities to ensure consistent clinical and

public health practices. The guideline includes detailed implementation guidance for screening and treatment programs but provides limited operational detail specific to HPV vaccination (22).

The EPI 2021–2025 plan published by the Ministry of Health, Ethiopia(26) , details strategies to enhance immunisation services by addressing vaccine demand, supply management, financing, and equitable access. The plan references the introduction of the HPV vaccine and briefly describes delivery platforms, with an emphasis on cross-cutting factors that impact all vaccination programs (26).

4.3 Vaccine- and Vaccination-Specific Issues

This subsection outlines how supply, storage, delivery approaches, and healthcare provider roles impact HPV vaccine uptake.

4.3.1 Risk/Benefit (scientific evidence)

HPV vaccines have demonstrated strong efficacy in guarding against the HPV variants that are responsible for cervical and other anogenital cancers, as well as genital warts (97,98). The bivalent and quadrivalent vaccines offer 93% to 98% efficacy against HPV types that cause approximately 70% of cervical cancers and nearly all cases of genital warts (97). Gardasil 9 extends protection further, providing about 95% efficacy against HPV types responsible for up to 90% of cervical cancer cases. (98).

Long-term safety evaluations have consistently shown that the HPV vaccine is safe and well tolerated with no association between the HPV vaccine and infertility (97). The most common adverse effects are typically minor and resolve quickly, including localised reactions such as soreness, redness, or swelling at the injection site, along with transient symptoms like nausea or light headedness (84,86,99).

4.3.2 Mode of vaccine administration and vaccine formulation

The HPV vaccine is provided as a liquid suspension in single-dose vials or pre-filled syringes, minimising wastage and dosage errors. It must be stored at 2°C to 8°C, with a shelf life of 60 months for Cervarix and 36 months for Gardasil and is administered via intramuscular injection (84). Maintaining the recommended storage temperature and transporting vaccines is challenging in the less developed districts of Ethiopia due to frequent power outages, inadequate training of healthcare workers in vaccine handling, and nonfunctional equipment. These issues create logistical challenges for last-mile delivery during mass immunisation and outreach (100).

Compared to multi-dose formats, single-dose vials increase the cold chain storage burden during large-scale vaccination efforts, with the quadrivalent HPV vaccine requiring 15 cm^3 per dose and 10 doses packaged per box (84). The intramuscular route requires trained professionals, adding pressure to Ethiopia's health system, which is already facing a shortage of skilled personnel (31).

4.3.3 Vaccine supply

Ethiopia obtains the HPV vaccine through a partnership model involving Gavi, UNICEF, and pharmaceutical manufacturers. In this partnership, Gavi secures price reductions by negotiating directly with suppliers, while UNICEF manages procurement and oversees vaccine

distribution to Gavi-supported countries through long-term agreements with suppliers (101). The vaccine market is also shaped by Gavi's efforts to diversify suppliers and align demand forecasts with manufacturers' production plans, minimising risks of shortages and cost escalation (83).

A global shortage of HPV vaccines emerged after WHO endorsed the single-dose schedule, coinciding with Covid-19 and the adoption of multi-age cohort campaigns. This led to a significant supply constraint in 2021, as seen in Figure 6, resulting in delays in vaccine introductions in new countries and the postponement of planned campaigns (101,102).

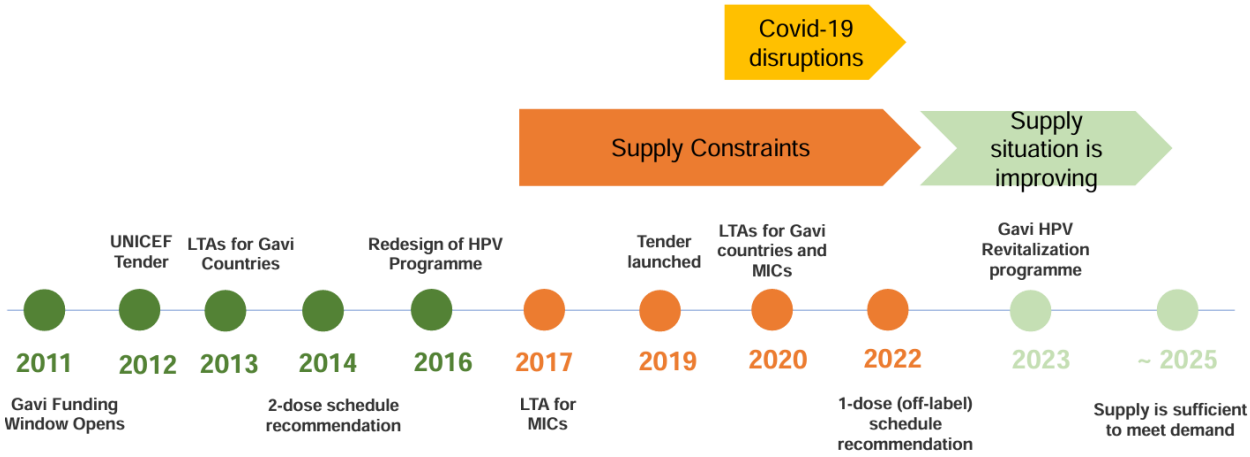

Figure 6: Market evolution of the HPV Vaccine, 2010 to 2023 (102)

As of late 2023, supply conditions have improved as new manufacturers obtained approval from WHO. By 2025 and beyond, overall production is projected to surpass the combined demand from countries supported by Gavi (101). This marks an advancement in one of the most essential attributes of a healthy vaccine market, ensuring that demand aligns with supply. The Healthy Markets Framework (HMF), developed by Gavi and its partners, evaluates the alignment between current and optimal conditions in vaccine markets across demand, supply dynamics, and innovation. Although the supply-meets-demand indicator is currently met, a continued concentration of country preferences on the quadrivalent HPV vaccine has led to imbalances in addressing national product needs. This misalignment is categorised as an unmet indicator related to product choice equity, as shown in Figure 7 (83).

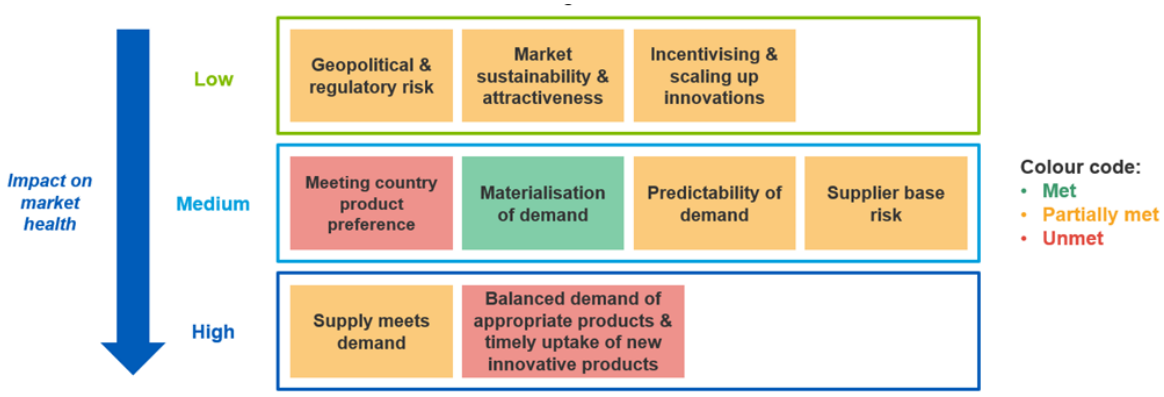

Figure 7: Assessment of HPV vaccine market health, 2023 (83)

4.3.4 Vaccine cost

Ethiopia benefits from Gavi's tiered financing system, which initially covers the full cost of vaccines and gradually transitions to co-financing as gross national income per capita rises, promoting long-term sustainability (103). Under this arrangement, the negotiated price of Gardasil 4 for Ethiopia is USD 4.50 per dose (104).

HPV vaccination program costs encompass both direct financial expenses (e.g., transport, per diems, community mobilisation) and indirect opportunity costs (e.g., health workers' and teachers' time, resource utilisation). The economic cost, which sums these components, is estimated at USD 7.19 per dose in Ethiopia, much higher than the financial cost of USD 2.23. Regional disparities exist, with remote areas like Afar incurring an economic cost of USD 18.13 per dose due to outreach demands, compared to just USD 5.80 per dose in Addis Ababa's centralised system (31). The majority of HPV vaccination costs, between 50% and 75% per dose, are attributed to human resources. This cost encompasses health workers alongside school staff and community stakeholders, all of whom play vital roles in ensuring the program's success (105).

4.3.5 Design of the vaccination program

This section discusses three interconnected components from the "vaccine and vaccine-related factors" domain of the model of determinants of vaccine hesitancy: vaccination schedule, mode of delivery, and tailoring the vaccination strategy to population needs. Given their closely linked nature and the limited stand-alone evidence available for each, they are addressed together in a single section.

A global review by Aggarwal et al. (106) identified three primary HPV vaccine delivery strategies: school-based, facility-based, and mixed approaches. School-based delivery is the most widely used approach, adopted by 64% of countries, though only 30% achieve over 70% coverage. Mixed delivery strategies are the most effective, with 53% of countries reaching over 70% coverage.

Each strategy has strengths and limitations, as summarised in Figure 8: School-based delivery achieves high coverage but misses out-of-school girls; facility-based is easier to integrate but has low turnout; mixed approaches are broad-reaching but require coordination and resources (106).

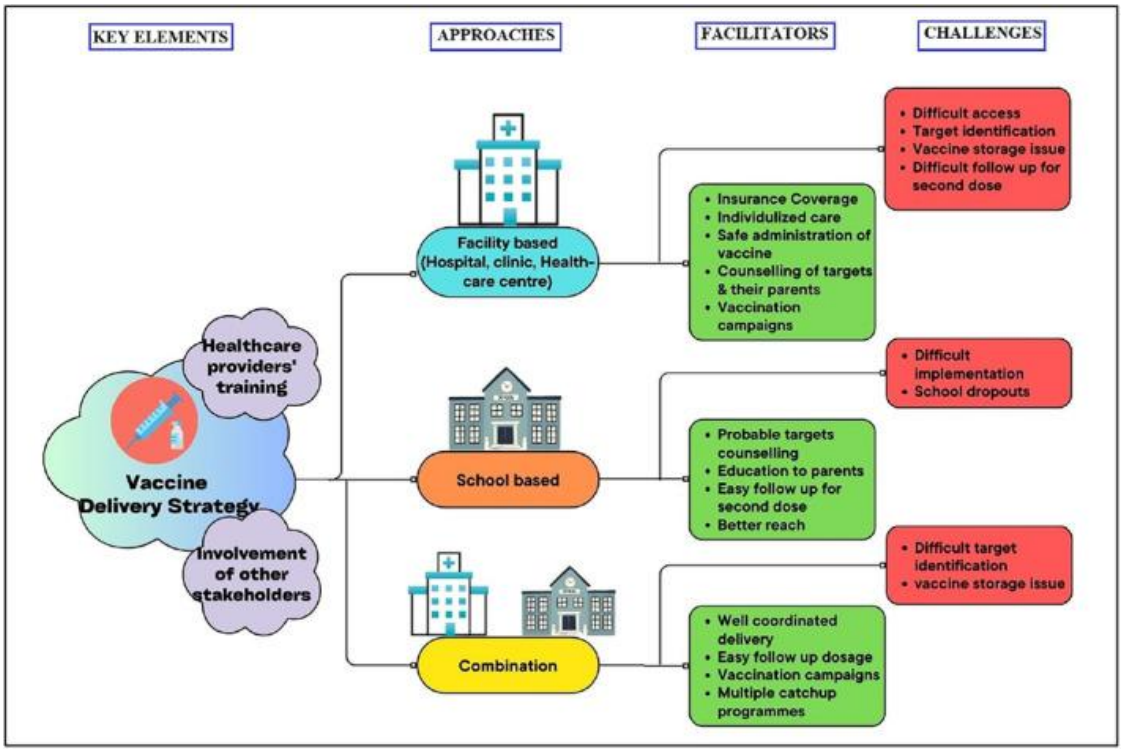

Figure 8: Summary of facilitators and challenges in HPV vaccination delivery strategies, 2024 (106)

HPV vaccination in Ethiopia is delivered predominately through school-based campaigns usually administered between October and December, shortly after the start of the school year (95). Schools serve as a practical platform to reach large numbers of adolescent girls, minimising barriers such as travel costs and the need for caregiver accompaniment, which are more common in health facility-based delivery (81). However, this approach faces equity and logistical challenges, including difficulties tracking absent students, those who transfer schools, and girls who are out of school (81,107).

There are supplementary outreach and health facility-based strategies to reach out-of-school girls using government funding to cover logistics, but these efforts are constrained by the absence of financial incentives for community health workers and scarce resources (31). Regions with high out-of-school girls, such as Afar and remote areas in the Amhara region, have adopted outreach-based strategies such as door-to-door vaccination, engaging local leaders, and community gatherings as their main delivery strategy, yet the coverage gaps remain (65, 79).

Accurate estimation of the target vaccination population remains a significant bottleneck due to challenges in age determination, lack of reliable data on out-of-school girls, and weak microplanning at subnational levels contributing to vaccine shortages or wastage (81). While schools help generate lists of eligible students, effective outreach to those outside the education system heavily relies on local health workers, who are often under-resourced and unsupported (81,107). The program's reliance on campaign delivery with an irregular schedule rather than integration into routine immunisation services has led to poor coordination and limited continuity, weakening overall program effectiveness (55).

5. Interventions and Strategies to Improve HPV Vaccine Uptake in LMICs

This section outlines effective interventions from comparable LMICs to improve HPV vaccine uptake, categorised into themes of demand generation, supply-side improvements, and program design.

5.1 Effective Interventions to Increase Demand for HPV vaccine

This subsection presents targeted approaches in LMICs that address HPV vaccine hesitancy and increase demand for the HPV vaccine.

5.1.1 Digital Interventions to Increase Demand for HPV

Digital strategies to boost HPV vaccine demand often involve interactive short message service reminders, informative videos, mobile applications, and social media engagement through platforms such as WhatsApp and Facebook, along with targeted digital advertisements and educational content (108). These approaches can improve knowledge, counter myths, and increase short-term uptake, though their long-term effectiveness depends on cultural fit, integration with health services, and ongoing support (109).

A video-based educational intervention in Ghana, which addressed cervical cancer and HPV vaccination, improved participants' knowledge and awareness by presenting comprehensive information. However, its impact on HPV vaccine uptake could not be evaluated, as the vaccine had not yet been introduced in Ghana during the study period (110). The SEARCH study in Uganda used automated phone alerts and customised text messages to remind parents about scheduled HPV vaccine appointments. For every 3–4 parents who received reminders, one additional adolescent was vaccinated (111).

In Bangladesh, a social media campaign on Facebook and Instagram increased HPV vaccine uptake by 5.3–9.5 percent using behavioural messages on girls' empowerment, parental involvement, community norms, and direct registration links (112). To prevent misinformation from spreading, social media campaigns should actively combat conspiracy theories, which can fuel vaccine hesitancy and reduce uptake (113).

5.1.2 Tailored health messaging to the local context

Tailored health messaging involves considering the content, the messenger, and how the message is understood by the target audience and involves trusted community figures to build trust and increase engagement (114).

Malawi achieved 81% HPV vaccine coverage by 2020 by training teachers to deliver culturally adapted education. The teachers served as trusted messengers to counter misinformation from traditional herbalists (115). Healthcare providers in Tanzania conducted focus group discussions with teachers about HPV vaccination, using Swahili-language oral narratives and visual aids. This approach significantly increased teachers' willingness to encourage parents to vaccinate their children (116).

Adolescent peer educators in Kampala's urban slums addressed HPV vaccine fears by educating girls, sharing experiences, and linking them to health facilities, raising first-dose uptake to 60.7% among hesitant girls (117). In northern Nigeria, a respected Islamic religious leader boosted HPV vaccine uptake by publicly supporting cervical cancer prevention. He led

by example, having his daughters vaccinated, and used sermons, community dialogues, and home visits to dispel misconceptions about vaccine safety and spiritual causes of illness (118).

Men's engagement in cervical cancer prevention was shown in a multi-region cross-sectional study in Nigeria, where nearly six in ten men were willing to support and cover the cost of HPV vaccination for female family members (119). A pilot intervention in semi-urban South Africa provided men with cervical cancer education tools to inform women in their households; 55% actively shared the information. The study emphasised the need for structured support to overcome sociocultural barriers and maintain male engagement (120).

5.2 Effective Interventions to Improve HPV vaccine supply

This subsection presents interventions that strengthen vaccine supply and manufacturing capacity in Africa.

5.2.1 Public–Private Partnerships

Rwanda's HPV vaccine rollout stands as a best practice in leveraging public–private partnerships (PPP) to overcome supply challenges through partnership with Merck for an initial donation of two million doses, which jumpstarted the national program (121). Midway through the first year, Merck reduced the vaccine price by over 70% to demonstrate the feasibility of HPV vaccination programs in Africa, expand its market reach, and attract international support (121)**.**

PPPs can also accelerate the development of innovative vaccine delivery methods like microarray patches (MAPs), which painlessly deliver vaccines through the skin and reduce the need for needles and trained staff, making them ideal for remote settings (122). In Ethiopia, PATH, in collaboration with the Ministry of Health, is assessing the feasibility and acceptability of HPV MAPs, positioning the country for early adoption once the technology becomes available (123).

5.2.2 Supporting local manufacturing capacities for vaccines in Africa

The COVID-19 pandemic renewed attention to Africa's vaccine production gaps, prompting continent-wide efforts such as the 2021 launch of the Partnerships for African Vaccine Manufacturing, which aims to produce 60% of the continent's vaccine needs locally by 2040 (124). South Africa and Senegal demonstrate effective approaches to scaling sustainable vaccine production in Africa (125–129).

South Africa hosts Africa's most advanced vaccine manufacturing sector, with the Biovac Institute serving as a best-practice example (124,125). Supported by the South African government and international funding, Biovac has built sustainable capacity through infrastructure upgrades, technology transfers from global pharmaceutical companies, and targeted workforce training (125). The creation of the WHO mRNA Vaccine Technology Transfer Hub in Cape Town in 2021 enhanced South Africa's mRNA vaccine production, aiming to transfer technology to LMIC manufacturers and reduce global vaccine inequity (126).

Senegal relies on a single manufacturer, *Institut Pasteur de Dakar*, which has over eight decades of expertise as the continent's exclusive yellow fever vaccine manufacturer (127). Senegal's progress in vaccine production is backed by regulatory improvements; in 2024, its national medicine agency achieved WHO Maturity Level 3, accrediting it to independently authorise and monitor vaccine safety and quality (128). A 45 million USD investment from a

partnership with the African Development Bank and the International Finance Corporation is funding a facility expected to produce around 300 million vaccine doses annually (129).

5.3 Effective HPV Program Design Approaches to Increase Uptake and Equity

This subsection presents adaptations of HPV vaccination programs in LMICs to address coverage gaps and promote equity.

5.3.1 Integration of HPV vaccination into existing health programs

Integrating HPV vaccination into existing health services enhances access and coverage by leveraging existing infrastructure (130). It enables the delivery of multiple interventions, improves health outcomes, fosters community acceptance, and extends services to out-of-school adolescents who often have limited healthcare access (130,131).

When selecting services for integration, programs should consider factors such as the feasibility of single-visit delivery, alignment with the HPV vaccination schedule, disease burden, and acceptability of service (131). A review by Dochez et al.(132) suggests a range of potential health interventions that could be integrated with HPV vaccination; a summary of these options, presented in Table 4, provides a useful foundation for designing comprehensive adolescent health programs.

Tanzania's HPV-Plus program, funded by Gavi and implemented by Jhpiego with government support, integrated HPV vaccination into school-based adolescent health services (133). The program organised monthly school visits by health workers to deliver HPV vaccines to 14-year-old girls, along with vision and nutrition screening and sexual and reproductive health education to both girls and boys aged 10–14. The HPV-Plus program achieved nearly 100% coverage in the implementation region and was sustained beyond the end of donor funding through government ownership (133).

Togo took a similar route by combining the vaccination of 10-year-old girls with school-based, gender-sensitive health education on puberty, hygiene, and handwashing (134). The program achieved 91% second-dose HPV coverage and high participation in the health education from both girls and boys, helping normalise menstrual hygiene and challenge gender norms (134). Malawi and Uganda integrated HPV vaccination into teen clubs that serve as support groups and antiretroviral treatment delivery points for adolescents living with HIV, helping to reach this vulnerable group more effectively (135).

Table 4: Overview of health services that can be integrated with HPV vaccination programs, 2017 (132)

Intervention category	Possible complementary interventions
Screening	Vision screening (if referral/glasses available & affordable)
Provision of information	HPV information | Reproductive and sexual health education; HIV prevention, condom promotion | Promotion of physical exercise | Prevention of mosquito borne diseases | Menstrual hygiene education | Warnings on substance abuse (tobacco, alcohol, drugs)
Commodity delivery	Anti-helminthic treatment | Insecticide treated bed nets for malaria prevention |Iron and folic acid supplementation | Provision of condoms for those engaged in sexual activity | Menstrual hygiene products
Vaccines	Td booster | Hepatitis B | Meningococcal |Typhoid | Rubella

5.3.2 Gender-Neutral Approaches in HPV Vaccination Programs

Gender-neutral (GN) HPV immunisation, which includes both boys and girls, has been widely adopted globally, with 43 countries, predominantly high- and upper-middle-income nations, implementing this approach (136). This shift tried to address the limitations of Girls-only (GO) programs that focus solely on cervical cancer and often overlook diverse sexual behaviours, such as those in polygamous societies, same-sex relationships, and non-penetrative transmission routes (137).

A heatmap modelling cervical cancer incidence in India over 100 years, as illustrated in Figure 9, indicates that without vaccination, incidence remains high at 11 cases per 100,000 women-years, well above the WHO elimination threshold of 4 (20,139). As seen in Figure 9, a girls-only strategy with 90% coverage reduces incidence to 2.4, below the elimination target, though achieving such coverage is difficult in many settings, and at 60% coverage, incidence remains above the threshold at 4.7 per 100,000 (138). However, the same model demonstrates that introducing gender-neutral vaccination at the same 60% coverage lowers incidence to 2.8, surpassing the elimination goal, while adding boys when 90% of girls are already vaccinated shows minimal additional benefit, highlighting that gender-neutral strategies are most impactful where girls' coverage is low (138, 139).

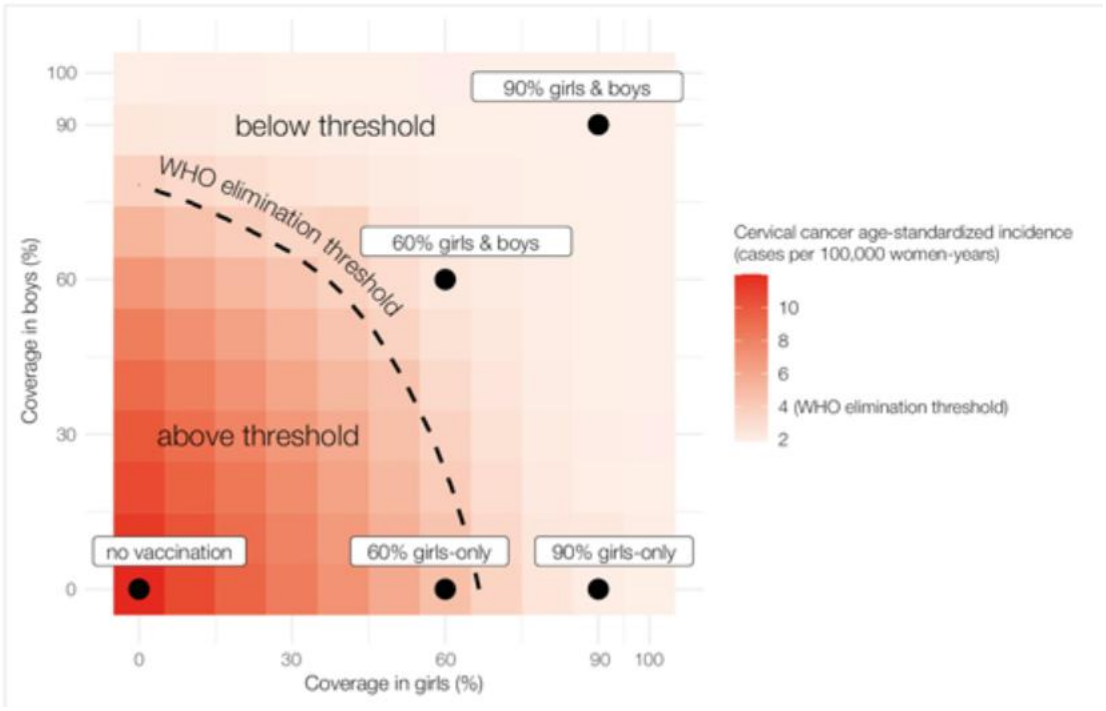

Figure 9: Projected age-standardized cervical cancer incidence among vaccinated birth cohorts in India based on HPV vaccination coverage in girls and boys, 2023 (138)

GN vaccination improves program resilience during disruptions by providing indirect protection to unvaccinated girls through vaccinated boys, especially relevant where age gaps in sexual partnerships exist, though this benefit diminishes over long-term disruptions. (139).

Cameroon expanded the national HPV vaccination program to a gender-neutral, single-dose strategy in 2022(140) . This strategy, along with intensified community outreach, tripled girls' vaccination in 2023, reaching 166,188 more girls at a cost of USD 747,846, while male vaccination, fully funded by the government, cost USD 506,745, as Gavi support focuses on girls (140).

Including boys in Cameroon's HPV vaccination efforts helped dispel gender-specific misconceptions such as those linking the vaccine to infertility in girls, fostering greater public acceptance, and supporting gender-equitable prevention (144). This strategy encountered major operational hurdles, such as limited staffing and overstretched health facilities, showcasing the importance of reinforcing health system capacity to maintain gender-neutral vaccination programs (141). Switching to GN vaccination programs should not undermine efforts targeting girls, the primary group, as WHO recommends expanding to secondary groups only when it is feasible, financially sustainable, and does not divert resources from girls' vaccination or cervical cancer screening (142).

5.3.3 Expansion of HPV Vaccination to Out-of-School Girls

Efforts to expand HPV vaccination access to out-of-school adolescent girls must begin by addressing the lack of a standardised definition for this group (107). The term is often used inconsistently across HPV programs, generally referring to girls aged 9–14 not enrolled in formal education (107). Grouping together all the out-of-school girls in a single category without distinguishing between those who have discontinued school, those who were never enrolled, those who are displaced, or the young mothers hinders efforts to accurately identify, count, and provide effective vaccination outreach to them (143).

From the experiences of six LMICs, the HPV Vaccine Acceleration Program Partners Initiative (HAAPI) consortium identified four archetypes of out-of-school girls, each reflecting different reasons for exclusion from school, as summarised in Table 5 below (144).

Table 5: Archetypes of Out-of-School Girls in HPV Vaccination Programs, HAPPI Consortium ,2024 (144)

Archetypes	Reasons girls are OOS
Poverty and socio-economic barriers	Adolescent workers Domestic responsibilities Girls in migrant worker families
Ethnic, religious, or cultural factors	Gender norms Early marriage or pregnancy Religious education Nomadic lifestyles
Conflict and natural disasters	Armed conflicts or natural disasters have led to school closures Displacement
Physical or mental disabilities	Inadequate educational facilities and support services Social stigma toward disabilities

Although these archetypes provide valuable insights, it is recommended that each country conduct its own mapping and enumeration exercises. This approach ensures that vaccination strategies are tailored to the specific distribution and characteristics of out-of-school girls within their unique local contexts (143, 144).

For instance, in Mali, the “Our Daughters, ourselves” initiative improved HPV vaccine coverage by 10.7% by engaging mothers to bring out-of-school daughters for vaccination and recruit other community pairs (145). The initiative incentivised participation with maternal cervical cancer screening and used culturally tailored storytelling cloths as visual reminders, incorporating cues for the 6-month vaccine dose and 12-month screening. By empowering mothers as community advocates, the intervention successfully reached out-of-school girls through family and social networks (145).

Targeting out-of-school girls in Malawi involved mobilising local leadership, where the government collaborated with village heads to organise community meetings. The village heads, supported by radio campaigns, encouraged out-of-school girls to attend vaccination outreach sessions held within their villages (146).

A district in Cameroon partnered with Catholic Church leaders who educated congregants about cervical cancer prevention during services and promoted the upcoming HPV vaccination campaign, boosting vaccine acceptance. This faith-based approach also facilitated outreach to out-of-school girls in the community through established religious networks (147).

CHAPTER SIX: DISCUSSION AND CONCLUSION

This literature review set out to explore the factors influencing HPV vaccine uptake in Ethiopia and to critically examine effective interventions from comparable LMICs to guide efforts to improve HPV vaccine uptake in Ethiopia. The review found that the uptake of the HPV vaccine in Ethiopia is affected by a combination of low awareness among adolescents and caregivers, persistent myths linking the vaccine to infertility and promiscuity, limited trust in the health system, and poor access for out-of-school girls. These challenges are compounded by weak multisectoral collaboration, heavy dependence on donor funding, and the absence of a national HPV vaccination policy. Evidence from other LMICs points to practical solutions such as culturally relevant communication, integration with adolescent health services, and locally driven outreach strategies that could be tailored to the Ethiopian context. These findings point to the importance of multisectoral coordination, targeted support for hard-to-reach groups, and long-term planning to ensure the program can last beyond external funding.

6.1 Implications of Key Findings of the Study

The discussion is organised by study objectives, with this first section analysing the implications of the key findings of the study and the second section analysing the relevance of interventions from other LMICs to Ethiopia.

Knowledge and awareness gaps

Lack of knowledge and awareness about HPV, cervical cancer, and the purpose and benefits of the vaccine among adolescents, caregivers is a major driver of vaccine hesitancy In Ethiopia. These gaps reflect broader structural challenges in health education and communication systems, including uneven access to health information, underinvestment in community outreach, and weak integration between health and education sectors.

These knowledge deficits are more pronounced among rural, low-income, and less-educated communities, where structural inequities limit access to accurate, timely, and trusted health information. In such settings, individuals often rely on peers and community hearsay, making these populations more susceptible to misinformation. This highlights a need to move beyond conventional awareness campaigns focused on improving individual knowledge to strategies that address the structural conditions that create and sustain these information gaps.

Cultural norms, gendered perceptions, and the role of trust

Knowledge gaps and limited access to accurate information create space for anti-vaccine myths to spread. In a patriarchal Ethiopian society, targeting girls with a vaccine linked to a sexually transmitted infection evokes discomfort and suspicion, especially when communication strategies do not engage cultural values or address gender-related anxieties. These misconceptions are embedded in broader narratives about gender, control, and morality.

Public perceptions of the HPV vaccine are closely linked to trust in the health system and in the motives of government and international actors. This trust is not formed at a single point of contact but is built over time through repeated, respectful, and transparent interactions with the health system. Sustaining this trust requires engagement beyond the campaign period, including platforms for open dialogue to address community concerns. It also means training healthcare providers in respectful communication and cultural sensitivity.

Unidirectional health messaging focused on clinical facts may therefore be inadequate or even counterproductive. Instead, interventions should be culturally responsive, involve trusted community and religious leaders, and frame HPV vaccination in ways that align with locally valued goals like protecting fertility, safeguarding daughters' futures, and promoting family health.

Operational Barriers and Sustainability

Ethiopia's school-based HPV vaccination campaign leverages existing educational infrastructure to reach adolescent girls enrolled in school. However, it fails to reach out-of-school girls, who face exclusion due to poverty, traditional gender norms, early marriage, and geographic barriers. These factors limit their school attendance, access to healthcare, and exposure to reliable information, making them the most vulnerable to HPV infection and cervical cancer. The program's design inadvertently reinforces existing inequities by missing the populations at greatest risk. The short vaccination windows of the campaign-style school-based delivery, along with resource scarcity, undermine outreach activities for out-of-school girls.

The framing of HPV vaccination as the sole responsibility of the health sector has contributed to weak coordination with the education sector, local government, and civil societies, creating gaps in planning and delivery. This lack of collaboration, inaccurate population data, and poor microplanning lead to incorrect target group estimation.

The absence of a standalone national HPV vaccination policy limits the program's ability to respond to its unique service delivery and communication demands. While including HPV vaccination guidelines within cervical cancer control strategies improves operational efficiency, it often overlooks adolescent-focused planning, education sector involvement, and targeted outreach for out-of-school girls. During this review, the author noted that existing policy documents devote minimal space to HPV vaccination compared to the more comprehensive guidance on cervical cancer screening. This may partly stem from the program's relatively recent introduction; it also suggests a lack of institutional prioritisation.

Without a dedicated national policy and a clear domestic transition strategy, HPV vaccination efforts in Ethiopia will be vulnerable to stockouts, delays, and fragmented implementation. As Gavi support phases out, long-term sustainability will require political will, intersectoral alignment, and a shift from externally driven campaigns to nationally owned, integrated, and adolescent-responsive health programming.

6.2 Applying Lessons from LMICs to the Ethiopian Context

Many LMICs have adopted a wide range of approaches to increase HPV vaccine uptake, tailored to their social, political, and health system contexts. Ethiopia has made important strides in political commitment and localised community engagement; lessons from other countries with similar contexts offer critical insights for scaling and strengthening the HPV vaccination.

Demand generation through tailored messaging

Effective HPV vaccine demand generation in several African countries has involved culturally tailored messaging and trusted community influencers, such as teachers, peers, parents, and religious leaders (115–118). Ethiopia has made progress through high-level advocacy and grassroots efforts engaging religious leaders and women's groups alongside health extension workers.

Rather than replicating isolated interventions, a multi-level demand generation strategy linking national messaging with regional and district implementation is needed. This requires strong coordination among schools, health workers, and community leaders. Peer and parental influencers already involved in adolescent health or girls' empowerment programs could be trained to lead community dialogues, dispel myths, and build positive vaccine narratives.

Digital platforms, like Ethiopia's successful "Yegna" TV show, have broadened reach and helped dispel vaccine myths. NGO partnerships, like the Yegna-Girl Effect model, can be scaled to produce locally tailored content in multiple languages and platforms to reach diverse audiences. However, gender gaps in media and technology access limit this reach, as women and girls in Ethiopia are less likely to own phones, use the internet, or watch TV (9). While digital strategies can engage male decision-makers, they must be paired with community-based approaches that involve girls and caregivers directly.

HPV Service Delivery and Integration

Integrating HPV vaccination into broader adolescent health services has proven effective in countries like Tanzania, Togo, Malawi, and Uganda (133–135). Ethiopia's own experience bundling HPV with COVID-19 vaccines and other routine services in the Tigray region indicates the potential for application.

In Ethiopia, transitioning from campaign-based delivery to integrated, routine health could improve sustainability, streamline resources, and access hard-to-reach groups who are often missed by school-based campaigns. To avoid overburdening frontline workers or compromising service quality, implementation should be phased and informed by system readiness. Success will require adequate resources, and a context-specific understanding of which service combinations are feasible.

Reaching out to schoolgirls

Expanding HPV vaccination to reach out-of-school adolescent girls is a critical yet under-addressed issue in Ethiopia. Interventions involving trusted networks such as mothers, traditional leaders, and religious institutions have successfully increased vaccine uptake among these populations. Applying such lessons in Ethiopia requires a grounded understanding of who the out-of-school girls are and how to reach them. Although global frameworks offer typologies, direct replication is unsuitable due to Ethiopia's unique demographic and geographic realities. Instead, bottom-up mapping is needed to identify key subgroups like domestic workers, married adolescents, migrant girls, or those displaced by conflict.

Ethiopia's door-to-door outreach and community mobilisation in regions like Afar and Amhara show that tailored approaches are feasible (65,79). Leveraging local community structures like women's development groups can help locate and engage out-of-school girls, mirroring the success in Mali and Cameroon. The need for such efforts is heightened by the growing number of girls displaced by the conflict in northern Ethiopia. These populations are mobile and poorly tracked by current data systems (93,94). Existing outreach models are too static to meet this evolving need. Locally driven efforts are underway in Ethiopia (68,82,73); the next step is scaling up systematically with context-specific data and stronger planning.

Gender-Neutral Vaccination

Including boys in HPV vaccination programs has been proposed to enhance equity, improve herd immunity, and address gendered misconceptions (139). Given Ethiopia's recent progress in vaccinating in-school girls, a girls-only strategy remains the most efficient use of limited resources. Operational experiences from countries like Cameroon showed that GN program contributed to increased vaccine acceptance and reduced gender-based stigma, but it also strained already overburdened health systems. Similar systemic limitations exist in Ethiopia, including critical shortages in human resources, cold chain capacity, and financing mechanisms. These must be addressed before any expansion to include boys is considered.

Introducing boys into the vaccination program should not be viewed as a way to dispel gender-specific myths. Addressing root causes through targeted communication aligned with local norms and involving men as advocates offers a more effective path to improving HPV vaccine acceptance. Consistent with WHO guidance, any move toward GN vaccination must not compromise progress toward cervical cancer elimination among girls (142). As supply stabilises and delivery platforms strengthen, introducing gender-neutral vaccination will promote gender equity and protect against HPV-related cancers beyond cervical cancer.

HPV Vaccine Supply and Financing

Countries like Rwanda have demonstrated that public-private partnerships and strong political commitment can help navigate supply bottlenecks (121). Recent advances in local vaccine manufacturing, such as those in Senegal (127), offer replicable models for other African countries to strengthen regional production and reduce reliance on external supply chains. Ethiopia, however, remains in the early stages of exploring local manufacturing or regional procurement mechanisms. Even with technical capacity building, structural barriers such as patent protections, limited market demand, and competing health priorities make HPV vaccine self-sufficiency a long-term goal rather than a near-term solution.

Ethiopia must proactively develop an HPV vaccine financing strategy that considers HPV as part of a life-course immunisation agenda. However, political will is needed to prioritise adolescent vaccines alongside high-burden childhood illnesses in future budgeting. In the interim, continued reliance on GAVI's support remains the most realistic path forward.

Overall, successful strategies from other LMICs offer valuable lessons, and when transferred across contexts, they must be carefully adapted and fine-tuned to align with local realities, needs, and constraints.

Relevance of the Framework

The model of determinants of vaccine hesitancy provided a useful structure for guiding the development of key search terms and thematic analysis and presentation of findings across individual, contextual, and vaccine-related factors. It also highlighted the interconnections between these domains, which was useful in interpreting the layered nature of vaccine hesitancy. However, the model was developed with childhood immunisation programs in mind, primarily those delivered through health facility and outreach-based platforms and therefore does not adequately account for additional delivery mechanisms such as school-based platforms. It also under-represents the role of non-health sectors, like the education sector, which is vital to the implementation of HPV vaccination programs. To address these gaps, the study incorporated broader systemic and intersectoral perspectives within the existing domains of the framework.

6.3 Strengths and Limitations

This review is limited to English-language publications, potentially excluding relevant studies in other languages. Reliance on publicly available sources may introduce publication bias. Despite efforts to use broad and systematic search strategies, some relevant literature may have been missed due to limitations in keyword combinations or search string design. Snowballing was used to mitigate this, but it may not have captured all eligible studies. The review was conducted by a single researcher, which may introduce some subjectivity. To address this, an iterative process with detailed notetaking was employed to ensure consistency and transparency.

Most Ethiopian studies were cross-sectional, focusing on knowledge, attitudes, and vaccine uptake, with limited qualitative research on cultural, religious, and social influences on HPV vaccine acceptability. The effects of conflict and displacement on vaccine delivery were rarely explored, requiring inference from related studies on disruptions in education and health services. There is a scarcity of literature on effective interventions in LMICs, with most evidence coming from HICs, reflecting gaps in local knowledge production and dissemination.

The review offers a timely and systematic synthesis of existing literature. It identifies key evidence, and policy gaps and provides a valuable foundation for developing practical strategies to improve HPV vaccine uptake in Ethiopia and comparable settings.

6.4 Conclusion

This review reveals that HPV vaccine uptake in Ethiopia is influenced by interconnected challenges at individual, social, and systemic levels. Low awareness and misinformation coexist with limited access for out-of-school girls and sociocultural barriers that reinforce exclusion. Weak coordination across sectors, the absence of a dedicated HPV vaccination policy, and reliance on donor funding threaten the program's sustainability and equity. Evidence from comparable settings highlights that effective HPV vaccination programs require strong political will, multisectoral collaboration, and tailored outreach to marginalised populations. Successfully adapting these strategies to Ethiopia's unique context demands strategic planning and political commitment to ensure long-term impact.

CHAPTER SEVEN: RECOMMENDATIONS

Based on key factors affecting HPV vaccine uptake and effective interventions from similar contexts, the following recommendations aim to improve HPV vaccination in Ethiopia. They are organized by target audience.

For National Policymakers

(*Ministry of Health, National Immunization Technical Advisory Groups*)

1) Develop a national policy and governance framework for HPV vaccination

The policy framework should:

- Formalize mechanisms for multisectoral collaboration, including formal joint planning and implementation committees involving the Ministries of Health, Education, Youth and Gender, and Finance, as well as civil society and development partners
- Outline a phased plan to increase domestic financing, starting with incremental budget allocations and leveraging transitional global support
- Provide a roadmap to shift from campaign-based delivery to integration with adolescent health services.

For Regional, Zonal and District-Level Government Authorities

2) Implement Context-Specific Demand Generation Strategies

- Provide oversight, resources, and supportive supervision to ensure alignment with national health communication strategies

- Engaging HEWs, teachers, peer educators, and local influencers to deliver consistent, culturally relevant messages for demand generation

3) Identify and reach out to out-of-school girls through decentralized microplanning

- Utilise participatory mapping with HEWs, women's associations, and peer networks to locate and reach out-of-school girls.

For Health Care Providers and Local Health Authorities

4) Provide structured, continuous training for health workers

- Offer ongoing training on HPV, cervical cancer, and adolescent communication.
- Incorporate HPV and cervical cancer education into routine health facility activities.

For Public Health Researchers and Academic Institutions

5) **Conduct qualitative and mixed-methods studies on out-of-school girls and outreach strategies**

- Research social dynamics, characteristics, and mobility patterns of out-of-school girls.

6) **Perform health economics analyses on integration and long-term HPV vaccine financing**

- Assess the cost-effectiveness of HPV vaccination integration into routine services.
- operational research on potential public-private partnerships for vaccine procurement examining regulatory, legal, and fiscal feasibility.

In the short term, priority should be given to integrating HPV vaccination into existing adolescent health services, launching tailored demand generation strategies, identifying out-of-school girls through microplanning, and building health worker capacity. In the intermediate term, developing a national HPV vaccination policy and generating context-specific evidence should be prioritised. In the long term, sustained progress will require multisectoral coordination and stable domestic financing mechanisms.

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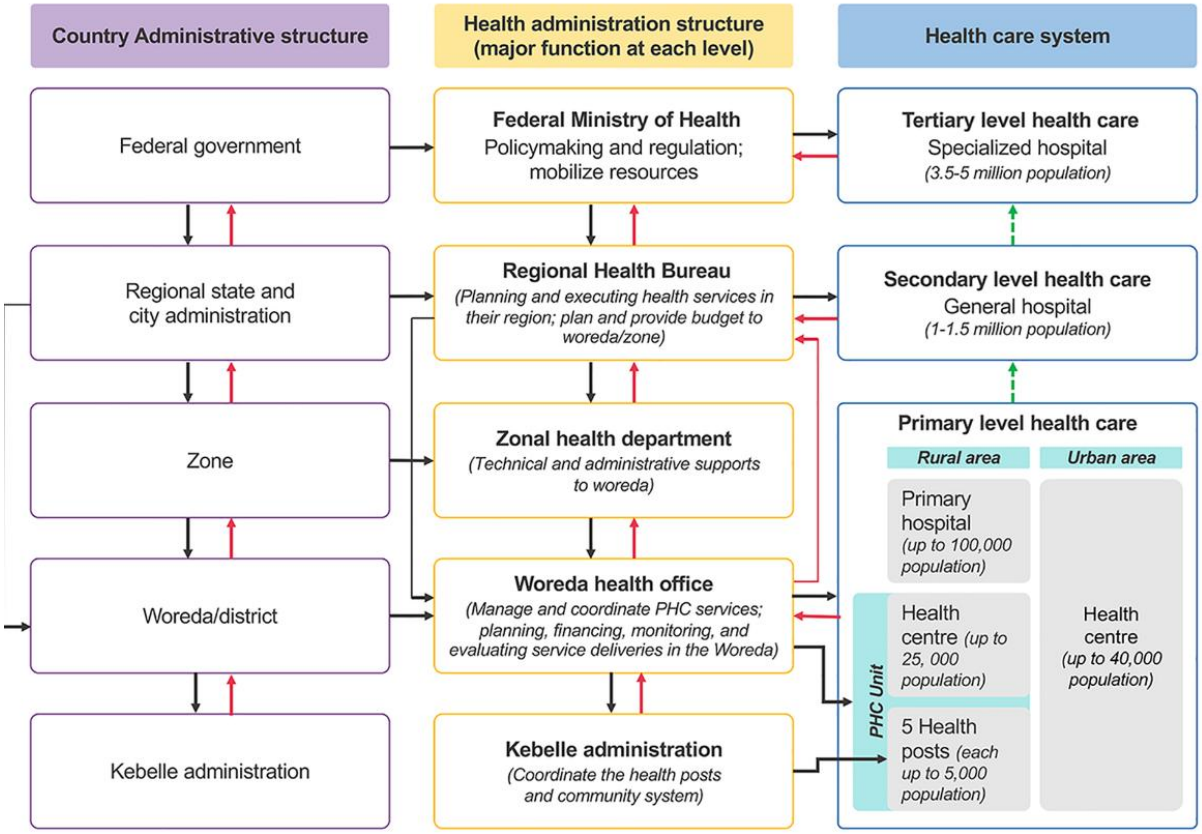
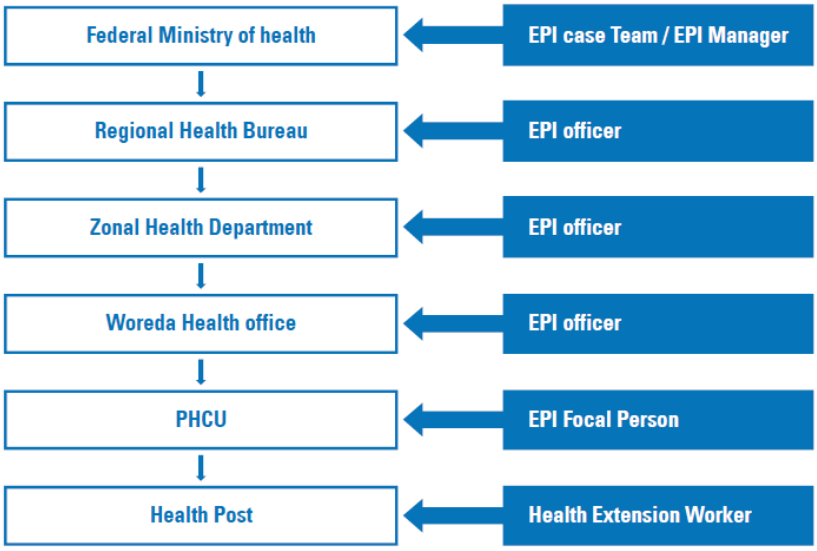
Appendix 1: Ethiopia's Health System Governance and Service Delivery Structure



Appendix 2: Structure of Immunization services in Ethiopia (26)



Appendix 3: Declaration for Use of Generative AI (GenAI)

☐ **I confirm that I have not used any generative AI tools to complete this assignment.**

☒ **I confirm that I have used generative AI tool(s) in accordance with the *"Guidelines for the Use of Generative AI for KIT Institute Master's and Short Course Participants."* Below, I have listed the GenAI tools used and for what specific purpose:**

Generative AI tool used	Purpose of use
1. Perplexity	Used for brainstorming during the topic selection phase
2. ChatGPT	Used to clarify unfamiliar concepts from reports and articles, and to better understand approaches to conducting a literature search.
3.QuillBot	Used to check grammar, punctuation, and to improve the use of formal academic language