

# Cervical Cancer Prevalence in sub-Saharan Africa and HPV Vaccination Policy: A Public Health Grand Challenge?

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## Abstract

Cervical cancer cases in low-income countries (LICs) are on the rise, whereas the reverse is true for high-income countries (HICs). With sub-Saharan Africa carrying the highest burden of cervical cancer cases and deaths globally, demand for governments in the region to act proactively in addressing the situation is a clarion call. Unfortunately, this is not the case as cervical cancer receives low attention from governments in the sub-Saharan region compared to other disease areas. Cervical cancer research interest and prevention policy has also been found to be low among researchers in sub-Saharan Africa. This paper comments on the sub-Saharan cervical cancer and HPV vaccination policy narrative and clarifies the imperative for action; in particular, given the resulting morbidity and mortality due to cervical cancer is preventable. The paper emphasizes scientists' call to promote health and the need for governments to consider research and researchers' opinion when designing policy to eradicate cervical cancer. The prevalence of the disease and the mortality rate in the sub-Saharan region represent a public health grand challenge. Engaging relevant stakeholders to actively collaborate in reducing and eventually eliminating the disease is encouraged.

**Keywords:** Cervical cancer, HPV vaccination, Policy, Priority, sub-Saharan Africa

## Introduction

“Women are not dying because of diseases we cannot treat. They are dying because societies have yet to make the decision that their lives are worth saving.”

**Dr. Mahmoud Fathala**

**Past President, International Federation of Gynaecology and Obstetrics (FIGO)**

One life lost is one too much to ignore, but when it comes to cervical cancer, it is reported that “(a) total of 740 women die each day” from the disease globally [1]. Cervical cancer is a leading (4<sup>th</sup>) cause of cancer among females and affects over half a million globally in a year [2-5]. In sub-Saharan Africa, it is the leading cause of cancer death among women [5,6].

The 2020 assessment by GLOBOCAN indicates that there were 604,000 new cases and 342,000 deaths from cervical cancer globally [5]. It has been estimated that about 372.2 million females under the age of 15 years are at risk of cervical cancer in Africa, of which 119,284 are

diagnosed every year, and 81,687 die from the disease (68.5% mortality rate) [7]. The World Health Organization (WHO) has estimated that as resource-poor regions like sub-Saharan Africa struggle in managing the disease, “without an effective intervention, global cervical cancer deaths will increase to 460,000 by 2040” [8].

Continuing evidence shows that regions with low Human Development Index (HDI) score experience disproportionately high levels of cervical cancer incidence and mortality rate [5,9,10]. This supports the high prevalence of cervical cancer cases and mortality in sub-Saharan Africa where the HDI has been historically low with high Human Poverty Indices (HPI). While this is the case, the high prevalence of the disease in low-income countries (LICs) has been attributed to the lack of political will, cultural issues, and poor health systems that cannot identify and treat precancerous lesions promptly [11-13].

Comparatively, high-income countries (HICs) have recorded a lower incidence rate of cervical cancer [14,15] attributed to policy decisions and actions such as cervical cancer screening to detect and treat at an early stage, and

the introduction of nationwide HPV vaccination programs [14,16,17]. For instance, a woman in the U.S. has a 70% chance of surviving cervical cancer while the survival chances for a woman in sub-Saharan African is 21% [18]. The high prevalence of cervical cancer in LICs delineates a case of global health inequity [19,20]. Gossa and Fetters have referred to this inequity as an ethical problem that expresses an “epidemiological tragedy” needing prioritization from policymakers and international donors [21]. According to the WHO, most people who are actively involved in sexual activity will be infected with HPV at some point in their lives [39]. This presents a societal health risk that requires government policy actions to avert needless suffering and risk of death for women due to HPV-associated cervical cancer.

### **HPV-Associated Cervical Cancer and Vaccine Intervention**

With over 200 different strains of HPV, about 15 strains have been identified as high-risk strains that cause various types of cancers (e.g., cervix, vulva, vagina, anus, penis, and oropharynx) [22,23]. Of these strains, the 16 and 18 strains have been identified as an etiological cause of cervical cancer [24-26]. Whereas HPV infections are themselves “asymptomatic and transient” with nearly 70% clearing in the first year of infection and nearly 91% clearing in the second year of infection, high-risk strains (16 and 18) parasitically persist longer than normal [26]. The persistence of HPV infections over several years can lead to “grade 2 or 3 cervical intraepithelial neoplasia (CIN) and cervical cancer” (ibid).

In a meta-analysis of 192 studies that tested over one million women globally for cervical HPV infection, Bruni and colleagues showed that the adjusted HPV prevalence among women with normal cytological findings was estimated to be 11.7% per 100,000 women (95% confidence interval (CI): 11.6–11.7%) [27]. The study shows that sub-Saharan African regions reported the highest adjusted prevalence of 24% at 95% confidence intervals (ibid). Sadly, most of these deaths occur among women who live in poverty [19].

On June 8, 2006, the U.S Food and Drug Administration approved Merck’s HPV antiviral quadrivalent (6,11,16 and 18) vaccine, Gardasil, “for females 9-26 years of age to protect against cervical, vulvar, and vaginal cancers caused by (HPV)” [28]. The latest version, Gardasil-9, provides wider protection against 9 different strains of HPV types (6,11,16,18,31,33,45,52 and 58) [29,30]. HPV Bivalent (16 and 18) Vaccine, Recombinant (a.k.a. Cervarix), “for use in females 10 through 25” years manufactured by GSK received approval from the U.S. FDA on October 15, 2009 [31-33]. Gardasil and Cervarix have been assessed by the WHO and endorsed as safe and efficacious for globally

use [34]. Currently, the Chinese biotechnology company, Xiamen Inovax Biotech, has also introduced a bivalent HPV vaccine, Cecolin, which has been approved by the China National Medical Products Administration. Cecolin is currently under review by the WHO for prequalification with a timeline to complete the review by the end of 2021 [35].

The HPV vaccination regimen is designed on a 3-dose program to be given at 0, 2, and 6-month time-point. Dobson and colleagues in a randomized clinical trial study of HPV vaccine in younger adolescents however showed that a 2-dose schedule for girls was “possible” [36]. While this is the case, a cohort study of 10,204 women in Alberta, Canada concluded that women who received full vaccination (> 2 doses) had a lower adjusted odds ratio (OR) of 0.72 (95% confidence interval [CI] 0.63–0.82) [37]. Those who had 2 dose HPV vaccination had an adjusted OR of 0.50 (95% CI 0.30–0.85) (ibid). The study suggests that the 3-dose regime provided greater protection and lowers the risk of cervical cancer among women. Even though the 3-dose schedule may provide lower risk, a cost-effectiveness assessment conducted by Laprise and colleagues have shown that a 2-dose schedule that provides a protection period of at least 10 years is cost effective [38]. The authors concluded vaccination with a 2-dose schedule that provides “longer than 30 years” is better than a 3-dose schedule (ibid). While some countries maintain the 3-dose schedule, the 2-dose schedule proves to be equally potent and economically cost-effective.

### **HPV Vaccination Programs in sub-Saharan African Regions**

Even though cervical cancer remains a life-threatening disease globally, vaccination against high-risk HPV strains (16 and 18) has prophylactically led to the prevention of the disease. While many HICs have explored and incorporated HPV vaccination in their healthcare programs (e.g., national immunization) besides other traditional interventions such as screening, this is not the case in most resource-poor settings – especially in sub-Saharan Africa where case incidence and mortality rates are high (see Table 1). This is further exacerbated by inadequate vaccine access in LICs where universal access to primary healthcare is often limited or unavailable [40], precluding opportunities for cervical cancer screening as a secondary prevention strategy that occurs in HICs [41]. For example, as of 2019, only nine sub-Saharan African States have been identified to have a Nationwide HPV vaccination program (see Table 1). According to HPV Information Center, three countries have announced the introduction of HPV vaccination program while 18 have a pilot project in place to introduce the vaccination nationwide (see Table 1). 19 countries however have no HPV vaccination program in place (see Table 1).

Country	Total Population (2020) <sup>a</sup>	Percentage of Women Population (2020) <sup>b</sup>	Cervical Cancer Cases (2020) <sup>a</sup>	Cervical Cancer Mortality (2020) <sup>a</sup>	Age-standardized Incidence Rate <sup>a,d</sup>	Age-standardized Mortality Rate <sup>a,d</sup>	National Cervical Cancer Screening Program <sup>c</sup>	National HPV Vaccination Program <sup>c</sup>
Cameroon	26,545,864	50.1	2770	1787	33.7	23.4	Yes	Announced
Malawi	19,129,955	49.9	4145	2905	67.9	51.5	Yes (all women every 3-5 years)	Announced
Sierra Leone	7,976,985	50.1	504	367	21.2	16.4	Nil	Announced
Rwanda	12,952,209	50.9	1229	829	28.2	20.1	Yes (all women every 7 years)	National Program (since 2011)
Lesotho	2,142,252	50.8	541	362	56.8	38.7	Yes (all women every 3 years)	National Program (since 2012)
Uganda	45,741,000	50.0	6959	4607	56.2	41.4	Yes (all women every 3 years)	National Program (since 2012)
Seychelles	98,897	48.9	No data	No data	No data	No Data	Yes (all women every 3 years)	National Program (since 2014)
South Africa	59,308,690	50.5	10702	5870	35.3	19.6	Yes (all women every 3 years)	National Program (since 2014)
Botswana	2,351,625	49.5	374	208	34.4	20.1	Yes (all women every 5 years)	National Program (since 2015)
Senegal	16,743,930	50.4	1937	1312	36.3	26	Yes (all women every 3 years)	National Program (since 2016)
Mauritius*	1,271,767	50.6	123	61	12.6	5.2	Yes (all women every 3 years)	National Program (since 2016)
Kenya**	53,771,300	50.1	6799	3107	31.3	20.6	Yes (all women every 3 years)	National Program (since 2019)
Réunion	895,308	52.0	70	37	10.3	4.8	No Information	No Information
Angola	32,866,268	50.5	3195	1949	37.6	25	Nil	No Program
Cape Verde	555,988	50.4	46	27	17	10.5	Nil	No Program
Central African Rep	48,29,764	50.7	297	223	21.8	17.1	Nil	No Program

Country	Total Population (2020) <sup>a</sup>	Percentage of Women Population (2020) <sup>b</sup>	Cervical Cancer Cases (2020) <sup>a</sup>	Cervical Cancer Mortality (2020) <sup>a</sup>	Age-standardized Incidence Rate <sup>a,d</sup>	Age-Standardized Mortality Rate <sup>a,d</sup>	National Cervical Cancer Screening Program <sup>c</sup>	National HPV Vaccination Program <sup>c</sup>
Chad	16,425,859	50.3	890	650	20.2	16	Yes (all women every 3 years)	No Program
Comoros	869,595	49.6	167	109	56	39.8	Yes (all women every 3 years)	No Program
Congo	5,518,092	49.9	250	214	22.4	14.2	Yes ((all women every 3 years)	No Program
Congo (DR)	89,561,404	50.1	7772	5548	31.9	23.7	Yes (all women every 3 years)	No Program
Djibouti	988,002	50.0	63	44	15.3	11.2	Nil	No Program
Equatorial. Guinea	1,402,985	48.8	123	73	32.8	21.3	Nil	No Program
Eritrea	3,546,427	50.7	178	130	15.3	11.4	Nil	No Program
Gabon	2,225,728	49.8	236	118	30.8	16.4	Yes (all women every 3 years)	No Program
Guinea	13,132,792	49.5	2068	1463	50.1	37.2	Yes (all women every 3 years)	No Program
Guinea-Bissau	1,967,998	50.4	239	172	39.6	30.3	Yes (all women every 3 years)	No Program
Namibia	2,540,916	50.3	375	214	37.4	22.5	Yes (all women 1-year frequency)	No Program
Sao Tome and Principe	219,161	50.5	13	10	16	13.1	Nil	No Program
Somalia	15,893,219	50.4	1055	812	25.1	20.2	Nil	No Program
Sudan	43,849,269	49.6	1227	828	8.7	6.2	Nil	No Program

Country	Total Population (2020) <sup>a</sup>	Percentage of Women Population (2020) <sup>b</sup>	Cervical Cancer Cases (2020) <sup>a</sup>	Cervical Cancer Mortality (2020) <sup>a</sup>	Age-standardized Incidence Rate <sup>a,d</sup>	Age-Standardized Mortality Rate <sup>a,d</sup>	National Cervical Cancer Screening Program <sup>c</sup>	National HPV Vaccination Program <sup>c</sup>
Swaziland	1,160,164	50.1	341	214	84.5	55.7	Yes (all women every 3 years)	No Program
Benin	12,123,198	50.7	560	368	15.1	10.4	Nil	Pilot
Burkina Faso	20,903,278	50.3	1132	839	18.2	14.3	Yes (all women every 3 years)	Pilot
Burundi	11,890,781	50.9	1581	1126	49.3	38.5	Nil	Pilot
Côte d'Ivoire	26,378,275	49.5	2067	1417	31.2	22.8	Yes (all women every 3 years)	Pilot
Ethiopia	114,963,583	50.2	7445	5338	21.5	24.1	Yes (all women every 3 years)	Pilot
The Gambia	2,416,664	50.6	286	199	42.9	33.9	Yes (all women every 3 years)	Pilot
Ghana	31,072,945	49.1	2797	1699	27.4	17.8	Yes (all women every 3 years)	Pilot
Liberia	5,057,677	49.7	656	469	40.8	30.8	Nil	Pilot
Madagascar	27,691,019	50.1	3763	2460	41.2	29	Yes (all women every 3-5years)	Pilot
Mali	20,250,834	50.0	1934	1406	36.4	28.3	Yes (all women every 3 years)	Pilot
Mauritania	4,649,660	49.7	428	286	28.9	20.3	Yes (all women every 3 years)	Pilot
Mozambique	31,255,435	51.3	5325	3850	50.2	38.7	Yes (all women 30-55 years)	Pilot

Country	Total Population (2020) <sup>a</sup>	Percentage of Women Population (2020) <sup>b</sup>	Cervical Cancer Cases (2020) <sup>a</sup>	Cervical Cancer Mortality (2020) <sup>a</sup>	Age-standardized Incidence Rate <sup>a,d</sup>	Age-Standardized Mortality Rate <sup>a,d</sup>	National Cervical Cancer Screening Program <sup>c</sup>	National HPV Vaccination Program <sup>c</sup>
Niger	24,206,636	49.7	622	475	10.4	8.4	Yes (all women every 5 years)	Pilot
Nigeria	206,139,590	49.4	12075	7968	34.6	20.7	Yes	Pilot
Tanzania	59,734,213	50.0	10241	6525	62.5	42.7	Yes (all women every 3 years)	Pilot
Togo	8,278,737	50.5	455	309	19.1	13.8	Nil	Pilot
Zambia	18,383,956	49.9	3161	1904	65.5	43.4	Yes (all women every 3 years)	Pilot
Zimbabwe	14,862,927	50.7	3043	1976	61.7	43	Yes (all women every 3 years)	Pilot

Data source and description:

<sup>a</sup> Data obtained from International Agency for Research on Cancer. Population Fact Sheets. <https://gco.iarc.fr/today/fact-sheets-populations> (assessed on 19 March 2021)

<sup>b</sup> Data sourced from Population of the world and countries. <https://countrymeters.info/en> (assessed on 21 March 2021)

<sup>c</sup> Data sourced from HPV Information Center. Statistics. <https://hpvcentre.net/datastatistics.php> (assessed on 21 March 2021)

<sup>d</sup> Age-Standardized Incidence Rate and Age-Standardized mortality Rate are measured in per 100,000 women per year.

\*Data sourced from Mauritius: Introduces Human Papillomavirus Vaccine for the Prevention of Cervical Cancer <https://www.vaccineconfidence.org/latest-news/mauritius-introduces-human-papillomavirus-vaccine-for-the-prevention-of-cervical-cancer#:~:text=The%20vaccine%20is%20available%20for,from%20free%20vaccination%20against%20HPV> (assessed on 19 March 2021).

\*\* Data sourced from Kenya introduces cervical cancer vaccine nationally <https://www.gavi.org/news/media-room/kenya-introduces-cervical-cancer-vaccine-nationally> (assessed on 21 March 2021)

**Table 1:** Epidemiological Data for Cervical Cancer and HPV Vaccination for sub-Saharan Africa Regions.

## Challenges to HPV Vaccination in sub-Saharan African Regions

The availability of HPV vaccines in HICs has been successful mostly through responsive government priority setting [42-44], which is not the case in resource-poor settings like sub-Saharan Africa (Table 2). For example, in a comprehensive epidemiological review of cervical cancer disease burden in sub-Saharan Africa, the authors noted that the extent of the cervical cancer problem has been “under-recognized and underprioritized” [45] in comparison to other high mortality diseases such as HIV/AIDS, tuberculosis and malaria.

Even though some African nations developed initiatives and programs to promote awareness and introduce HPV vaccines to their citizens, program and policy inertia due to various factors that hinder HPV vaccine uptake and coverage has made this a challenge. In a recent study, the authors reported that only 1-2% of women between the age of 10-20 received HPV vaccination in the region [46]. A driving factor to the problem to the low HPV vaccination problem has been attributed to the lack of resources to finance and deploy the vaccines in the region [47]. While the Global Alliance for Vaccine Immunization (GAVI) provides support to some LICs to enable access to HPV vaccines, other countries are unable to do so due to their

Causes	Description	Effects	Mitigating Strategies	Benefits
Healthcare System	Due to healthcare logistical challenges in many sub-Saharan African nations, the quality of healthcare is usually inadequate or below the acceptable standard.	Cervical cancer may not be properly diagnosed or detected.	Cost-effective incremental improvement in healthcare logistics should be adopted to bring all healthcare facilities to an acceptable standard.	Improvement in logistics and training of staff to effectively provide cervical cancer interventions.
Financial Resource Allocation	Health issues such as cervical cancer may compete for the same allocated financial resource for health intervention. Governments may inequitably allocate resources to address diseases that are highly endemic or affect a larger portion of the population. This may push diseases such as cervical cancer that affect a section of the public to the backburner.	Cervical cancer case numbers may increase.	Governments should negotiate effectively with vaccine manufacturers for the best deal possible that they can afford. This must be in addition to the utilization of all available donor supports (e.g. Gavi).	Availability of cervical cancer interventions such as screening and HPV vaccines.
Policy Specificity	Some sub-Saharan African countries do not have a specific policy that addresses cervical cancer.	Cervical cancer receives less visibility within the policy space.	Governments should have a specific policy that details prevention and control strategies.	Governments will have a working document that will obligate them to act following the plans in the policy document.
Priority Setting	Governments may have a high interest in some areas of governance such as the economy, defense, or youth unemployment. Such political realities and context may be influenced by various stakeholders whose interest in cervical cancer prevention may be of low priority.	low priority setting for cervical cancer may lead to increasing cervical cancer case numbers.	Stakeholders within and outside of government working in the interest of women and/or cervical cancer prevention and control must push the agenda to be heard through effective publicity and governmental lobbying process.	Leadership in population health and global health promotion through interventions such as screening and HPV vaccination.

Vaccine Hesitancy	The fear that HPV vaccine may not be safe or efficacious. Some people may also refuse vaccination on religious or cultural grounds, while others may refuse vaccination based on inaccurate information.	Low uptake if HPV vaccines are available to the public (e.g., pilot or national program). This may increase HPV-related cervical cancer.	Governments and relevant stakeholders must embark on mass education using social media portals, TVs, radios, and print media.	Nationwide coverage and high uptake of HPV vaccination.
Education	Public information on cervical cancer, HPV, or HPV vaccination in some sub-Saharan African nations is low.	Ignorance of the disease may increase risk and eventually case numbers.	Public education through media outlets, community education outreach, school programs, and religious platforms should be encouraged.	Awareness may reduce the risk and case numbers.

**Table 2:** Some Challenges in Cervical Cancer Prevention and Control in sub-Saharan Africa.

inability to meet certain pre-qualification requirements [48]. This directly expands the inequity that exists in HPV vaccination among countries, especially in the sub-Saharan African region.

## Conclusion

While acknowledging the contributions of sub-Saharan African scholars in the cervical cancer prevention and control narrative, there is a subtle passiveness as expressed in the number of articles coming from the region and the leadership role taken in joint publishing [49].

This disengages an active participation space for scholarships that could inform policymakers on interventional strategies. Cervical cancer prevention and control in sub-Saharan Africa also seems to be of low priority in the region due to possibly competing disease areas or other governmental interests than cervical cancer prevention and control. For example, in Ghana, where cervical cancer is the most common cancer among women, it is the least prioritized for intervention by governments [50,51]. According to a report by the International Agency for Research on Cancer (IARC), 8.57 million women from the ages of 15 years and above are at risk of cervical cancer in Ghana [52]. Not surprisingly, cases of cervical cancer continue to rise in Ghana [23,50-53]. While this is the case, citizens' knowledge remains low about cervical cancer, HPV, and/or HPV vaccination. A cross-sectional study of 285 adolescents in Ghana shows that about 91.2% of the participants had not heard of HPV and 95.4% had not heard of HPV vaccination, for example [54]. Previous studies reported similar findings in Ghana, indicating low public education on cervical cancer, its prevention, and/or control [50,55,56]. In a systematic review estimating the knowledge and awareness of the HPV vaccine and acceptability to vaccinate in sub-Saharan Africa, the authors concluded that "there is an urgent need for more

education to inform the public about HPV, HPV vaccine, and cervical cancer, particularly to key demographics, (adolescents, parents and healthcare professionals)" [57].

The International Covenant on Economic, Social, and Cultural Rights (ICESCR) highlights health as a fundamental human right to the enjoyment of the highest attainable standard of physical and mental health. Most sub-Saharan African countries are signatories to the ICESCR, through which they commit to protecting citizens' right to health as a fundamental human right. Sub-Saharan governments are thus obligated to take measures to protect the health of their citizens, in this case, women against cervical cancer.

Cervical cancer not only threatens women's health but also contributes to worsening the socio-economic challenges in the sub-Saharan region due to lost human capital. It thus presents a public health grand challenge that is imperative to address by engaging all stakeholders, including scientists, and particularly governments in the sub-Saharan region, working together to reduce and eventually eliminate the disease in alignment with the WHO's global strategy to eliminate cervical cancer by 2030 [58].

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## Conflicts of Interest

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