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Assessing the socioeconomic inequalities in cervical cancer screening in sub-Saharan Africa: a decomposition analysis

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Abstract

Background Cervical cancer remains one of the most diagnosed diseases among women in sub-Saharan Africa (SSA). Despite global efforts to eliminate this disease, the incidence rate in SSA continues to rise due to barriers to screening, vaccination, and treatment access. Numerous studies have examined the barriers women face in accessing cervical cancer screening, but little has been reported about inequality. The few available studies are limited to single countries. In this study, we examined the socioeconomic inequalities in cervical cancer screening in SSA.

Methods Data from the Demographic and Health Surveys of 10 sub-Saharan African countries was used for the analysis. A weighted sample of 46,471 women aged 30-49 was included in the study. We used wealth index and educational attainment as measures of socioeconomic status. Socioeconomic inequalities in cervical cancer screening were constructed using concentration curves. We then computed the concentration index (CIX) to quantify the magnitude of socioeconomic inequality. A decomposition analysis was conducted to examine the factors associated with socioeconomic inequality in cervical cancer screening.

Results The concentration curve was below the line of equality for all countries, indicating a disproportionate concentration of cervical cancer screening uptake among the wealthy and educated, except for Mauritania, where educational attainment was insignificant. With wealth index, positive concentration indices, indicating being advantaged with higher screening uptake were found among women in the richest wealth index (CIX = 0.753), those with incomplete secondary (CIX = 0.195), complete secondary (CIX = 0.378) and higher education (CIX = 0.575), and women who were working at the time of the survey (CIX = 0.031). Similarly, positive concentration indices were observed among women with primiparity (CIX = 0.279) and multiparity (CIX = 0.128), those who read newspapers/magazines (CIX = 0.335), listened to radio (CIX = 0.108), and watched television (CIX = 0.301). With level of education, women with complete primary (CIX = 0.151), incomplete secondary (CIX = 0.478), complete secondary (CIX = 0.761) and higher education (CIX = 0.916), those in the richer (CIX = 0.077) and richest wealth index (CIX = 0.391), those currently working (CIX = 0.022), women with primiparity (CIX = 0.0.325) and multiparity (CIX = 0.147), those who were exposed to read newspapers/magazines (CIX = 0.511), listened to radio (CIX = 0.109), and watched television

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(CIX = 0.220) had positive concentration indices, indicating being advantaged with higher cervical cancer screening uptake.

Conclusion Cervical cancer screening in SSA is characterized by pro-rich and pro-higher educational inequalities. Existing interventions could be restructured to prioritise accessibility and inclusion, particularly for women from poorer households and those with a lower level of education. The findings are crucial for policymakers and public health practitioners aiming to address cervical cancer screening disparities in SSA.

Keywords Cervical cancer, Decomposition, Demographic and Health Survey, Inequality, sub-Saharan africa

Introduction

The world has taken significant steps towards cervical cancer prevention; yet, cervical cancer remains a public health challenge, causing mortalities and morbidities among women. Cervical cancer is mainly caused by the persistent infection of high-risk human papillomavirus or immunosuppression, which has early sexual debut, multiple sexual encounters, concomitant sexual infections, tobacco smoking, and cervical dysbiosis as its risk factors [1–3]. It is the fourth most frequently diagnosed cancer in women globally [4]. In sub-Saharan Africa (SSA), it is the most diagnosed cancer in about half of the countries [4]. Estimates from the 2020 Global Cancer Observatory statistics show that there were about 604,127 new cases of cervical cancer worldwide, resulting in about 341,831 deaths [5]. Women in SSA are among the most vulnerable groups, with about 10.2% of women aged 15 years and above who are at increased risk of this disease. Again, SSA accounts for 19.59% and 24.55% of the global burden of cases and deaths due to cervical cancer, respectively [6].

In 2018, the World Health Organization (WHO) called for the global elimination of cervical cancer, with positive responses from over 70 countries and international academic societies [7]. The WHO introduced a comprehensive global strategy to accelerate the elimination of cervical cancer as a public health threat. About 194 countries pledged to collaborate to eliminate cervical cancer for the first time through this strategy [8]. To be able to achieve this, the WHO has outlined a triple-intervention strategy with a target expected to be achieved by the year 2030 [7]. The targets of the intervention are that (i) 90% of girls would be fully vaccinated by age 15, (ii) 70% of women would be screened with a high-performance test two times per life by 35 and 45 years of age, and (iii) 90% of women identified with cervical disease would receive treatment and care. WHO also emphasises screening for women aged 30 to 49 years among the general population and 25 to 49 years among women living with HIV, as part of efforts to eliminate cervical cancer. Adoption of these strategies could help to minimise cervical cancer-related mortalities and deaths [9].

Significant progress has been made globally to eliminate cervical cancer, resulting in a decline in recent years [10]. However, sub-Saharan African countries continue to report an increasing cervical cancer incidence due to inadequate access and uptake of screening, vaccination, and treatment services [11]. This situation has been attributed, in part, to the poor performance of screening programs, inconsistency, and poor implementation of screening policies [12, 13]. A recent study using data from 52 surveys from 28 SSA countries estimated that only 14% of women aged 30–49 years had ever been screened in 2020, with variations across countries and regions [14]. Similarly, only 19% of women in five SSA countries aged 21 to 49 years self-reported that they have ever been screened for cervical cancer [15]. Also, most women in SSA get late cervical cancer diagnosis, which contributes to poor survival outcomes [16]. Screening is important because it helps to identify precancerous cellular changes on the cervix that could develop into cervical cancer if they are not appropriately treated.

Recent studies have shown that distance to health facilities, women's decision-making, wealth index, and education are major factors influencing cervical cancer screening uptake in SSA [17–19]. Cervical cancer is a disease that disproportionately affects populations with limited access to national vaccination programs, population-based screening measures, and quality treatment options. The existing literature suggests that a woman's risk of developing cervical cancer, the timing of its onset, and the availability of safe and cost-effective diagnostic and treatment services are closely linked to their socioeconomic status [9]. Although numerous studies have examined the barriers women face in accessing cervical cancer screening, little is known about how inequalities affect screening uptake.

The few existing studies are limited to single countries [20, 21] but highlight inequalities in cervical cancer screening uptake. For instance, in Malawi, Chirwa [20] reports the existence of pro-rich inequalities in cervical cancer screening, with the magnitude of inequalities being more profound in urban areas than in rural areas. Similarly, Keetile et al. [21] found that in Botswana, cervical cancer screening was concentrated among women

with a higher socioeconomic status; the authors also identified wealth status as the major contributor to the observed inequalities. However, these findings do not show inequalities in cervical cancer screening at the regional level. Therefore, our study aimed to examine the socioeconomic inequalities in cervical cancer screening in SSA. The findings presented in this study would help in formulating focused interventions to support efforts being made to encourage cervical cancer screening in SSA.

Methods

Data source

A weighted sample of 46,471 women aged 30–49 was pooled from the the Demographic and Health Surveys (DHS) of 10 sub-Saharan African countries. Only countries with data on cervical cancer screening were included in the study. The countries were Benin, Burkina Faso, Cote d'Ivoire, Cameroon, Gabon, Kenya, Madagascar, Mauritania, Namibia, and Zimbabwe (Table 1). The data was extracted from the women's files in each of the 10 countries. Since 1984, the DHS Program has been running in over 90 low- and middle-income countries (LMICs) [22]. The purpose of the DHS Program is to collect data to ascertain health and demographic trends in these LMICs [22]. A cross-sectional design was used in the DHS, and the respondents were sampled using a multistage sampling method. The detailed sampling technique has been highlighted in the literature [23, 24]. DHS used pretested questionnaires to collect data on health and demographic indicators from respondents, including uptake of cervical cancer screening. This paper was written following the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist [25].

Table 1 Distribution of study sample

Countries	Year of survey	Weighted sample (*N*)	Weighted percentage (%)	Cervical cancer screening uptake
1. Benin	2017-18	4,174	9.0	0.9
2. Burkina Faso	2021	4,946	10.6	19.8
3. Côte d'Ivoire	2021	4,211	9.1	7.7
4. Cameroon	2018	3,749	8.1	6.0
5. Gabon	2019-21	3,267	7.0	22.0
6. Kenya	2022	9,156	19.7	26.8
7. Madagascar	2021	5,136	11.1	2.1
8. Mauritania	2019-21	5,576	12.0	1.0
9. Namibia	2013	3,130	6.7	53.8
10. Zimbabwe	2015	3,126	6.7	23.2
All countries	2013–2022	46,471	100.0	15.7 [15.1, 16.4]

Variables

Outcome variable

The study's outcome variable was the uptake of cervical cancer screening. This was measured using a single question: "*Have you ever been screened for cervical cancer?*" Responses to this question were 0 = no and 1 = yes. We used these definite response options in the final analysis.

Stratifiers

We stratified the outcome variable by wealth index and educational attainment. In the DHS, wealth index was calculated as a composite score utilising readily available information on the types of water access and sanitary facilities, materials used in the construction of homes, and the possession of specific items by a household, such as bicycles and televisions. The household items were scored for each individual's household using principal component analysis (PCA). Five classes: poorest, poorer, middle, richer, and richest were created from the resulting scores [22, 26, 27]. We used these five categories in our final analysis. For educational attainment, each woman was asked to indicate the highest educational level attended or completed. The response categories were 0 = no education, 1 = incomplete primary, 2 = complete primary, 3 = incomplete secondary, 4 = complete secondary, and 5 = higher.

Explanatory variables

We selected 10 explanatory variables for inclusion in this study from the review of literature [15, 17, 18, 28]. Only the variables that were available in the DHS datasets across all the studied countries were included. The variables were the age of the women, marital status, current working status, parity, ever had sexual intercourse, exposure to watching television, exposure to reading newspapers or magazines, exposure to listening to the radio, place of residence, and survey countries.

Statistical analyses

Descriptive and regression analyses

Statistical analyses were carried out using Stata version 17.0. The proportion of women who were screened for cervical cancer was determined using percentages, and the results were spatially presented. Next, we examined the distribution as well as the independent association between the explanatory variables and cervical cancer screening uptake. The distribution of cervical cancer screening uptake was presented using percentages with their corresponding confidence intervals (CI). All the variables that had a p-value less or equal to 0.05 were considered statistically significant. Next, we performed a multivariable binary logistic regression analysis to estimate the factors associated with cervical cancer

screening. The results were presented using adjusted odds ratio (AOR) with their respective 95% CI.

Inequality analyses

Each of the wealth index and educational attainment inequalities in cervical cancer screening were examined using concentration curves, concentration index (CIX), and decomposition analysis. We estimated the concentration curves by plotting the proportion of cervical cancer screening on the y-axis and each of the wealth index and educational attainment on the x-axis. The resulting figures show the presence or absence of inequality, which is evident by the line of equality, which is 45 degrees [29, 30]. If the curve is over the line of equality, then cervical cancer screening uptake was considered to be concentrated among the poor or women with low level of education. According to Kakwani et al. [30] and O'Donnell et al. [29], there is a disproportionate concentration of cervical cancer screening uptake among the wealthy and educated if the curve is below the equality line.

Afterwards, we summarised the region between the equality line and the concentration curve that was first created in the concentration curve using the concentration index (CIX). We estimated this index using the formula that was created by Lerman and Yitzhaki [31], Jenkins [32], and Kakwani [33]. The values that are obtained vary from − 1 to + 1. A value of zero (0) indicates no evidence of wealth index or educational attainment inequality. When the concentration index is positive (+ 1), it means that the wealthiest or most educated people are the center of inequality, whereas when it is negative (−1), it means that the uneducated, as well as those with the lowest wealth index are the center of inequality. In addition, we calculated the concentration curve and index for each of the countries included in the study.

Next, we used the formula created by O'Donnell et al. [29] to decompose the concentration index and examine each variable's contribution to the extent of inequality in the study. Elasticity, concentration index value, absolute contribution, and relative percentage contribution were used to display the results. With a positive value indicating an increasing trend in cervical cancer screening uptake and a negative value showing a falling trend. The elasticity aspect of the results indicates the change in cervical cancer screening uptake resulting from a unit change in the explanatory variables. Additionally, a positive concentration index value indicates that cervical cancer screening uptake was concentrated in wealthier or more educated groups. In contrast, a negative value indicates that the uptake is concentrated in the poorer and less educated groups. In cervical cancer screening uptake, the relative percentage contribution indicates how much each model component contributed to the overall wealth and education-related inequality. Consequently, a positive value indicates rising wealth and inequality associated with education, while a negative value suggests falling disparity.

Ethical consideration

Since the study used a secondary dataset that is in the public domain, no ethical clearance was required. Before utilising the dataset, permission was obtained from the Monitoring and Evaluation to Assess and Use Results Demographic and Health Surveys (MEASURE DHS).

Results

Prevalence of cervical cancer screening in sub-Saharan Africa

Overall, the pooled uptake of cervical cancer screening was 15.7% [15.1, 16.4] **(**Table 1**).** The countries with the highest proportions of cervical cancer screening among women aged 30–49 were Burkina Faso, Gabon, Kenya, Namibia, and Zimbabwe. Benin and Mauritania had the lowest proportions for cervical cancer screening uptake (Fig. 1).

Bivariable analysis of cervical cancer screening in sub-Saharan Africa

In the bivariable analysis of cervical cancer screening in SSA, the highest proportion of screening uptake was found among women aged 40–44 years (17.8%), those with higher education (38.2%), those who were working at the time of the survey (17.0%), those who were never in union (28.0%), primiparous women (22.2%), and those who have ever had sex (15.6%). Women who watched television, listened to the radio, and read newspaper/magazine reported more uptake of screening with proportions of 21.5%, 19.7%, and 32.0%, respectively. Higher uptake of cervical cancer screening was recorded among women in the highest wealth index (25.9%) and those in urban areas (20.8%) (Table 2).

Factors associated with cervical cancer screening in sub-Saharan Africa

Among women's age groups, the likelihood of undergoing cervical cancer screening increased with age, with the highest association observed in the 45–49 age group (AOR = 1.61; 95% CI: 1.42–1.82). Compared to never-married women, those separated reported higher odds of cervical cancer screening uptake (AOR = 1.25; 95% CI: 1.01–1.55). Also, the odds of cervical cancer screening uptake increased with increasing level of education, with the highest likelihood among women with higher level of education (AOR = 3.01; 95% CI: 2.47–3.68). Women who were working at the time of the survey (AOR = 1.15; 95% CI: 1.05–1.26) and those who had ever had sex (AOR = 3.24; 95% CI: 1.72–6.10) were more likely to undergo cervical cancer screening compared

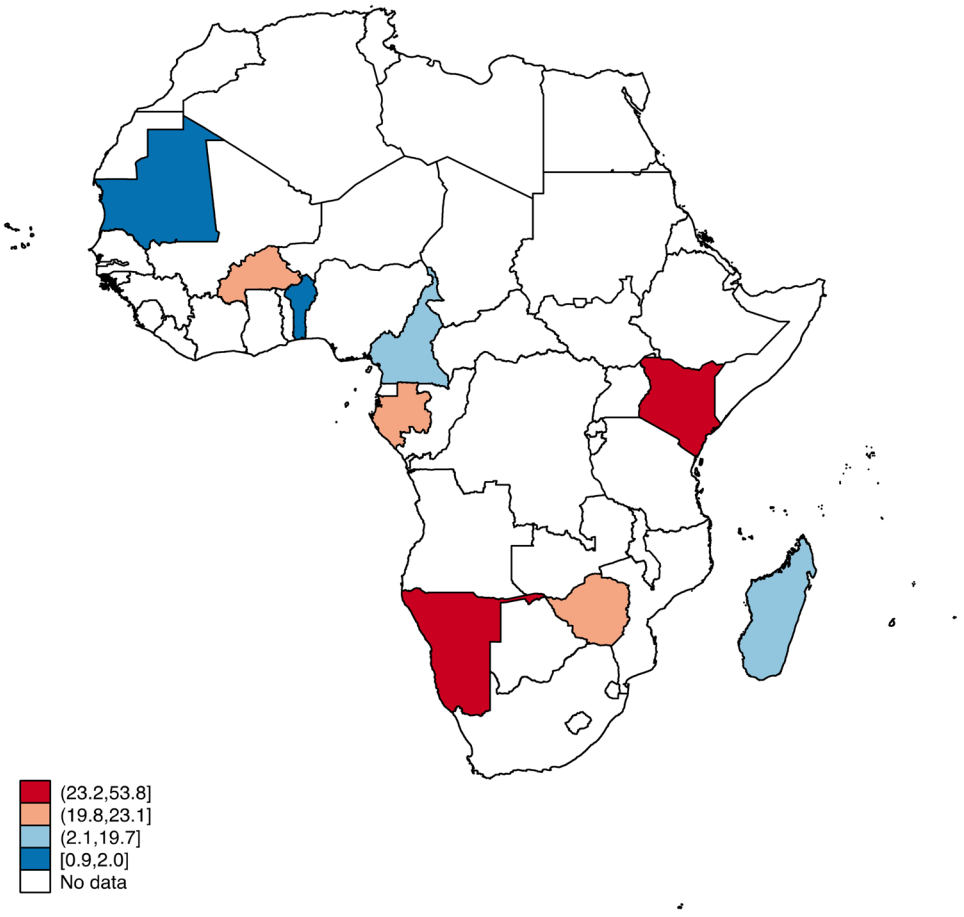

Fig. 1 Prevalence of cervical cancer screening in 10 sub-Saharan African countries

to those who were not working and those with no history of sexual intercourse, respectively. Compared to women who had no exposure to the media, higher odds were reported among those who were exposed to television (AOR = 1.27; 95% CI: 1.15–1.41) and newspaper or magazine (AOR = 1.29; 95% CI: 1.16–1.44). Our analysis indicates that the odds of cervical cancer screening increased with increasing wealth index, with the highest odds among women in the richest wealth status (AOR = 2.26; 95% CI: 1.87–2.73). Additionally, significant variations were observed across countries. For instance, Mauritania had the lowest odds (AOR = 0.03; 95% CI: 0.02–0.05), while Namibia had the highest odds (AOR = 2.22; 95% CI: 1.88–2.62) compared to Burkina Faso (Table 3).

Inequalities in cervical cancer screening uptake by wealth index

Figure 2 shows the concentration index and curve of the wealth-related inequalities in cervical cancer screening uptake. The positive and statistically significant concentration index (CIX = 0.236; p-value < 0.001) and the curve that lies below the line in the black diagonal dotted line (line of equality) indicate that cervical cancer screening uptake is concentrated among women in households with higher wealth index. Consistent results were obtained for all countries. This was significant across all the countries, except for Mauritania (Fig. 3).

Wealth-related inequalities in cervical cancer screening uptake

Table 4 shows the decomposition analysis of wealth-related inequalities in cervical cancer screening uptake in SSA. Being in the richest wealth index contributed 10.008% to wealth-related inequalities in cervical cancer screening uptake, while higher educational attainment contributed 15.340% to this inequality. Being exposed to television, radio, and newspapers or magazines contributed 6.161%, 4.357%, and 7.262%, respectively, to the wealth-related inequalities. Multiparous women contributed 4.039% to wealth-related inequalities.

Positive concentration indices, indicating being advantaged with higher screening uptake, were found among women in the richest wealth index (CIX = 0.753), those with incomplete secondary (CIX = 0.195), complete secondary (CIX = 0.378) and higher education (CIX = 0.575),

Table 2 Bivariable analysis of cervical cancer screening in sub-Saharan Africa

Variables	*n* (%)	% [95% CI]	X^2 *p*-value
Women's age (years)			< 0.001
30–34	15,187 (32.7)	13.8 [13.0, 14.7]	
35–39	13,244 (28.5)	15.5 [14.5, 16.5]	
40–44	10,235 (22.0)	17.8 [16.6, 19.2]	
45–49	7,805 (16.8)	17.2 [15.9, 18.6]	
Educational attainment			< 0.001
No education	15,378 (33.1)	5.9 [5.3, 6.5]	
Incomplete primary	8,694 (18.7)	9.2 [8.3, 10.1]	
Complete primary	5,321 (11.5)	16.9 [15.5, 18.5]	
Incomplete secondary	9,902 (21.3)	20.9 [19.7, 22.2]	
Complete secondary	3,256 (7.0)	35.0 [32.2, 37.9]	
Higher	3,920 (8.4)	38.2 [35.6, 40.8]	
Current working status			< 0.001
Not working	15,024 (32.3)	13.1 [12.2, 14.1]	
Working	31,447 (67.7)	17.0 [16.2, 17.8]	
Marital status			< 0.001
Never in union	3,467 (7.5)	28.0 [25.8, 30.4]	
Married	29,353 (63.2)	14.2 [13.4, 15.0]	
Cohabiting	6,994 (15.0)	15.0 [13.7, 16.4]	
Widowed	2,093 (4.5)	15.8 [13.8, 18.1]	
Divorced	1,597 (3.4)	11.6 [9.5, 14.1]	
Separated	2,967 (6.4)	20.6 [18.3, 23.0]	
Parity			< 0.001
Nulliparity	1,929 (4.1)	18.3 [16.0, 20.9]	
Primiparity	3,686 (7.9)	22.2 [20.2, 24.4]	
Multiparity	22,566 (48.6)	19.7 [18.7, 20.7]	
Grandparity	18,290 (39.4)	9.3 [8.7, 10.0]	
Ever had sexual intercourse			0.079
No	195 (0.4)	9.8 [5.6, 16.7]	
Yes	46,276 (99.6)	15.8 [15.1, 16.5]	
Exposed to watching television			< 0.001
No	21,686 (46.7)	9.2 [8.6, 9.8]	
Yes	24,785 (53.3)	21.5 [20.4, 22.5]	
Exposed to listening to radio			< 0.001
No	19,019 (40.9)	10.0 [9.3, 10.7]	
Yes	27,452 (59.1)	19.7 [18.8, 20.7]	
Exposed to reading newspaper or magazine			<0.001
No	36,551 (78.7)	11.3 [10.8, 11.9]	
Yes	9,920 (21.3)	32.0 [30.3, 33.8]	
Wealth index			< 0.001
Poorest	7,755 (16.7)	6.6 [5.9, 7.4]	
Poorer	8,329 (17.9)	11.1 [10.1, 12.1]	
Middle	8,973 (19.3)	13.2 [12.1, 14.3]	
Richer	9,956 (21.4)	17.4 [16.2, 18.7]	
Richest	11,458 (24.7)	25.9 [24.2, 27.6]	
Place of residence			< 0.001
Urban	21,527 (46.3)	20.8 [19.6,22.0]	
Rural	24,944 (53.7)	11.4 [[10.7,12.1]	

and women who were working at the time of the survey (CIX = 0.031). Similarly, positive concentration indices were observed among women with primiparity (CIX = 0.279) and multiparity (CIX = 0.128), those who were exposed to reading newspapers/magazines (CIX = 0.335), listening to radio (CIX = 0.108), and watching television (CIX = 0.301).

Inequality in cervical cancer screening uptake by educational attainment

Figure 4 shows the concentration index and curve of the educational attainment inequalities in cervical cancer screening uptake. The positive and statistically significant concentration index (CIX = 0.036; *p*-value < 0.001) and the curve that lies below the line of the black diagonal dotted line (line of equality) indicate that cervical cancer screening uptake is concentrated among women in households with higher educational attainment. Consistent results were obtained for all fifteen countries. This was significant across all the countries, except for Mauritania (Fig. 5).

Decomposition analysis of educational attainment inequalities in cervical cancer screening uptake

A focus on the percentage contribution revealed that having higher education contributes 15.993% to educational attainment inequalities in cervical cancer screening uptake. Also, being exposed to watching television, listening to the radio, and reading newspapers or magazines contributed 2.943%, 2.890%, and 7.262%, respectively. Being in the richest wealth index and being multiparous also contributed 3.401% and 3.046%, respectively, to educational attainment inequalities in cervical cancer screening uptake (Table 5).

Positive concentration indices, indicating being advantaged with higher screening uptake were found among women with complete primary (CIX = 0.151), incomplete secondary (CIX = 0.478), complete secondary (CIX = 0.761) and higher education (CIX = 0.916), those in the richer (CIX = 0.077) and richest wealth index (CIX = 0.391), and women who were currently working (CIX = 0.022). Similarly, positive concentration indices were observed among women with primiparity (CIX = 0.0.325) and multiparity (CIX = 0.147), those who were exposed to reading newspapers/magazines (CIX = 0.511), listening to radio (CIX = 0.109), and watching television (CIX = 0.220).

Table 3 Factors associated with cervical cancer screening uptake among women in sub-Saharan Africa

Variables	AOR [95% CI]
Women's age (years)	
30–34	1.00
35–39	1.18** [1.07–1.32]
40–44	1.52*** [1.35–1.70]
45–49	1.61*** [1.42–1.82]
Educational attainment	
No education	1.00
Incomplete primary	1.47*** [1.27–1.71]
Complete primary	1.68*** [1.43–1.97]
Incomplete secondary	2.01*** [1.72–2.35]
Complete secondary	2.50*** [2.05–3.06]
Higher	3.01*** [2.47–3.68]
Current working status	
Not working	1.00
Working	1.15** [1.05–1.26]
Marital status	
Never in union	1.00
Married	1.10 [0.94–1.29]
Cohabiting	1.05 [0.88–1.26]
Widowed	1.12 [0.90–1.41]
Divorced	1.05 [0.78–1.43]
Separated	1. 25* [1.01–1.55]
Parity	
Nulliparity	1.00
Primiparity	1.02 [0.80–1.31]
Multiparity	1.11 [0.89–1.39]
Grandparity	1.02 [0.81–1.30]
Ever had sexual intercourse	
No	1.00
Yes	3.24*** [1.72–6.10]
Exposed to watching television	
No	1.00
Yes	1.27*** [1.15–1.41]
Exposed to listening to radio	
No	1.00
Yes	1.10 [1.00–1.21]
Exposed to reading newspaper or magazine	
No	1.00
Yes	1.29*** [1.16–1.44]
Wealth index	
Poorest	1.00
Poorer	1.39*** [1.21–1.60]
Middle	1.41*** [1.23–1.63]
Richer	1.66*** [1.41–1.95]
Richest	2.26*** [1.87–2.73]
Place of residence	
Urban	1.00
Rural	0.93 [0.83–1.03]
Country	
Burkina Faso	1.00
Benin	0.03*** [0.02–0.05]
Cote d'Ivoire	0.27*** [0.22–0.31]
Cameroon	0.15*** [0.13–0.18]

Table 3 (continued)

Variables	AOR [95% CI]
Gabon	0.54*** [0.43–0.67]
Kenya	0.76*** [0.66–0.87]
Madagascar	0.05*** [0.04–0.07]
Mauritania	0.03*** [0.02–0.05]
Namibia	2.22*** [1.88–2.62]
Zimbabwe	0.62*** [0.53–0.72]
Pseudo R^2	0.244

aOR Adjusted Odds Ratio

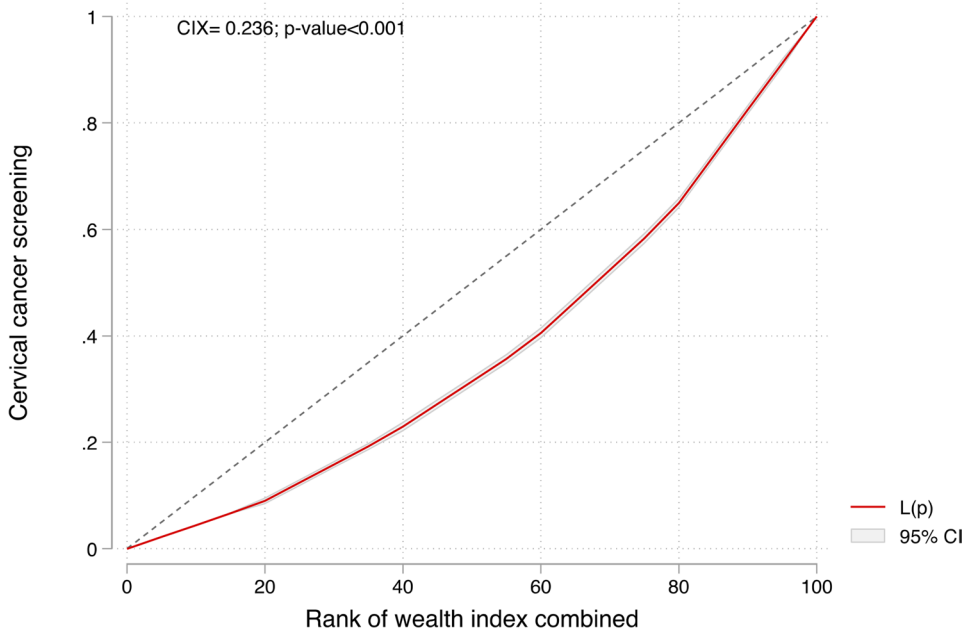

Fig. 2 Inequality in cervical cancer screening uptake by wealth index in sub-Saharan Africa

Discussion

This study aimed to examine the socioeconomic inequalities in cervical cancer screening uptake among women of reproductive age in SSA. Evidence from our study shows that 15.7% of women in SSA had ever been screened for cervical cancer. Comparatively, our observed prevalence is slightly higher than the 13.4% that had previously been reported [17]. Another study conducted in 55 LMICs found the lifetime prevalence of cervical cancer screening to be 43.6%, which is higher than the observed prevalence in this study [34]. Should this prevalence persist, sub-Saharan African countries may be unable to contribute substantially towards the WHO's goal of getting 70% of women screened by high-performance screening tests by 2030 [35]. The prevalence of cervical cancer screening uptake was higher in Namibia and lowest in Benin, which aligns with an earlier study conducted in SSA [17]. Perhaps, the higher screening prevalence in Namibia can be attributed to proactive government initiatives, which encompass the adoption of Visual Inspection with Acetic Acid and cryotherapy for the "Screen and Treat" strategy aimed at women, along with the rollout of an extensive national awareness and screening campaign [36].

Our findings indicate, indeed, there are wealth-related and educational attainment inequalities in terms of cervical cancer screening uptake. Regarding wealth-related inequalities, concentration index curves suggest pro-rich inequalities in cervical cancer screening uptake. This result is consistent with a study conducted in Malawi [20], which similarly identified pro-rich inequalities in cervical cancer screening uptake. Our observation of pro-rich inequality was reflected in the decomposition analysis, in which being in the richest wealth index contributed 5.01% to the inequality. The pro-rich inequalities suggest that women from wealthier backgrounds are more likely to undergo cervical cancer screening compared to their less affluent counterparts. This observed trend may be attributed to several plausible explanations. First, financial barriers, such as the cost of screening services, transportation, and related expenses, could disproportionately affect individuals from lower socioeconomic

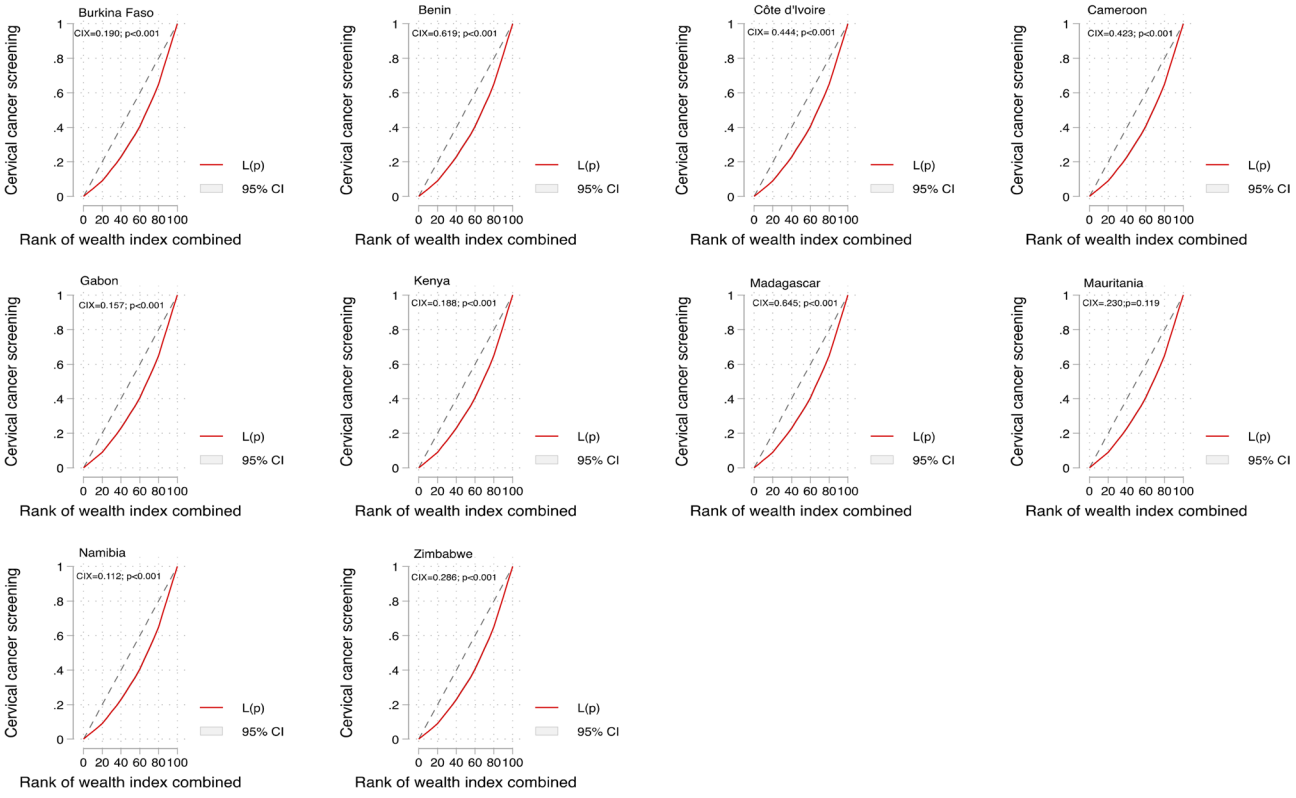

Fig. 3 Inequality in cervical cancer screening uptake by wealth index across the ten countries in sub-Saharan Africa

backgrounds, thereby limiting their access to healthcare services [17]. Women from wealthier households may also have greater access to information and resources on cervical cancer prevention and screening, enabling them to prioritise their health and seek timely screening. This is evidenced in the decomposition analysis, which showed that media exposure was a significant contributor to wealth-related inequalities in screening uptake.

Our findings also revealed the presence of educational attainment-related inequalities, specifically, there was a pro-higher education inequality, indicating that women with higher education were more advantaged in accessing cervical cancer screening compared to those with little or no formal education. This aligns with previous research conducted in Malawi [20] and Italy [37]. The decomposition analysis provided valuable insights into the factors contributing to these educational inequalities, with current employment status emerging as a significant positive contributor. This suggests that employed women with higher educational attainment may have greater access to healthcare resources, such as information, financial means, and flexible work schedules, which enable them to prioritise and utilize cervical cancer screening services. Results from the decomposition analysis also suggest that women with higher levels of education are more likely to be exposed to media channels such as television, radio, and newspapers, which may significantly influence their knowledge, attitudes, and behaviours related to healthcare seeking, including cervical cancer screening. It is, therefore, not surprising that media exposure was statistically significant in predicting screening uptake.

Beyond the socioeconomic inequalities, our study highlighted age, marital status, parity, and between-country differences as significant factors associated with cervical cancer screening uptake. Screening uptake was found to increase with age, corroborated by studies in Cameroon [28] and Ethiopia [38]. The WHO recommends that cervical cancer screening begin from the age of 30 (25 years in women living with HIV) [39], thus, explaining the higher odds of screening among older women of reproductive age than younger women. Additionally, since pre-cancerous lesions take a long time to develop into cervical cancer [40], older women may perceived a higher risk or susceptibility, further increasing their odds of been screened.

Higher parity was associated with increased cervical cancer screening uptake, consistent with a previous study in SSA [17], which reported higher screening odds among women with more children. It is, however, inconsistent with a cross-sectional study conducted among Ivorian women that found no significant association between parity and cervical cancer screening uptake [41]. Plausible explanations for this association may include the increased number of healthcare provider contacts

Table 4 Wealth-related inequalities in cervical cancer screening uptake

Variable	Elasticity	Concentration index	Absolute contribution	Percentage contribution
Wealth index				
Poorest	Reference			
Poorer	0.021	−0.487	−0.010	−4.257
Middle	0.016	−0.115	−0.002	−0.789
Richer	0.021	0.293	0.006	2.579
Richest	0.031	0.753	0.024	10.008
Women's age (years)				
30–34	Reference			
35–39	0.033	0.010	0.000	0.143
40–44	0.051	−0.012	−0.001	−0.266
45–49	0.044	−0.035	−0.002	−0.655
Marital status				
Never in union	Reference			
Married	−0.142	0.000	0.000	0.012
Cohabiting	−0.021	−0.065	0.001	0.581
Widowed	−0.007	−0.138	0.001	0.399
Divorced	−0.013	0.091	−0.001	−0.515
Separated	−0.007	0.052	0.000	−0.158
Educational attainment				
No education	Reference			
Incomplete primary	0.025	−0.149	−0.004	−1.554
Complete primary	0.043	−0.008	0.000	−0.139
Incomplete secondary	0.091	0.195	0.018	7.487
Complete secondary	0.049	0.378	0.019	7.841
Higher	0.063	0.575	0.036	15.340
Current working status				
Not working	Reference			
Working	0.025	0.031	0.001	0.326
Parity				
Nulliparity	Reference			
Primiparity	0.005	0.280	0.001	0.554
Multiparity	0.075	0.128	0.010	4.039
Grandparity	0.010	−0.239	−0.002	−1.008
Ever had sex				
No	Reference			
Yes	0.574	−0.001	−0.001	−0.293
Exposed to watching television				
No	Reference			
Yes	0.048	0.301	0.015	6.161
Exposed to listening to radio				
No	Reference			
Yes	0.096	0.108	0.010	4.357
Exposed to reading newspaper or magazine				
No	Reference			
Yes	0.051	0.335	0.017	7.262
Place of residence				
Urban	Reference			
Rural	−0.018	−0.309	0.006	2.354
Residual Concentration index			0.117	

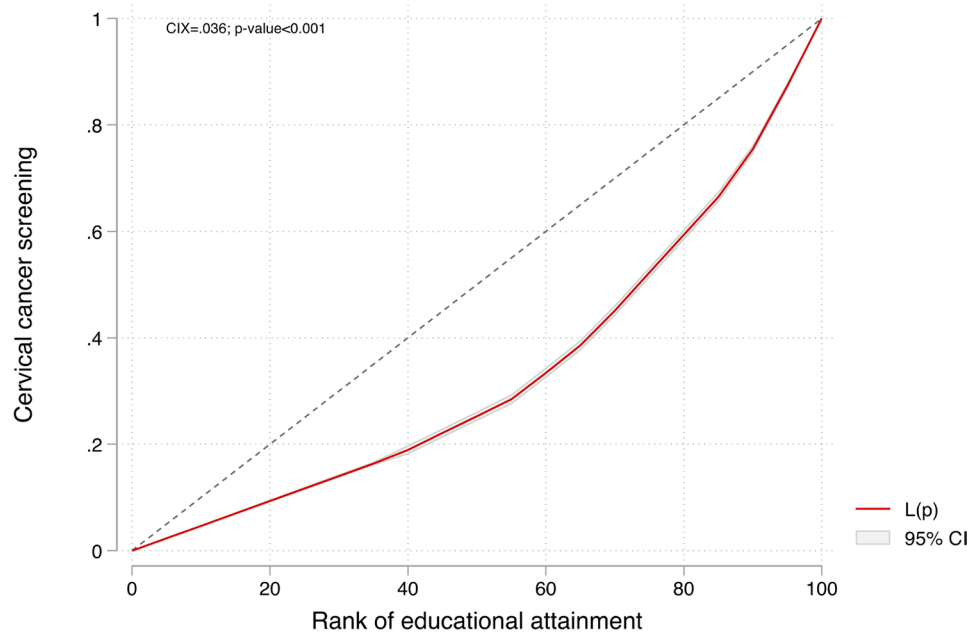

Fig. 4 Inequality in cervical cancer screening uptake by educational attainment in sub-Saharan Africa

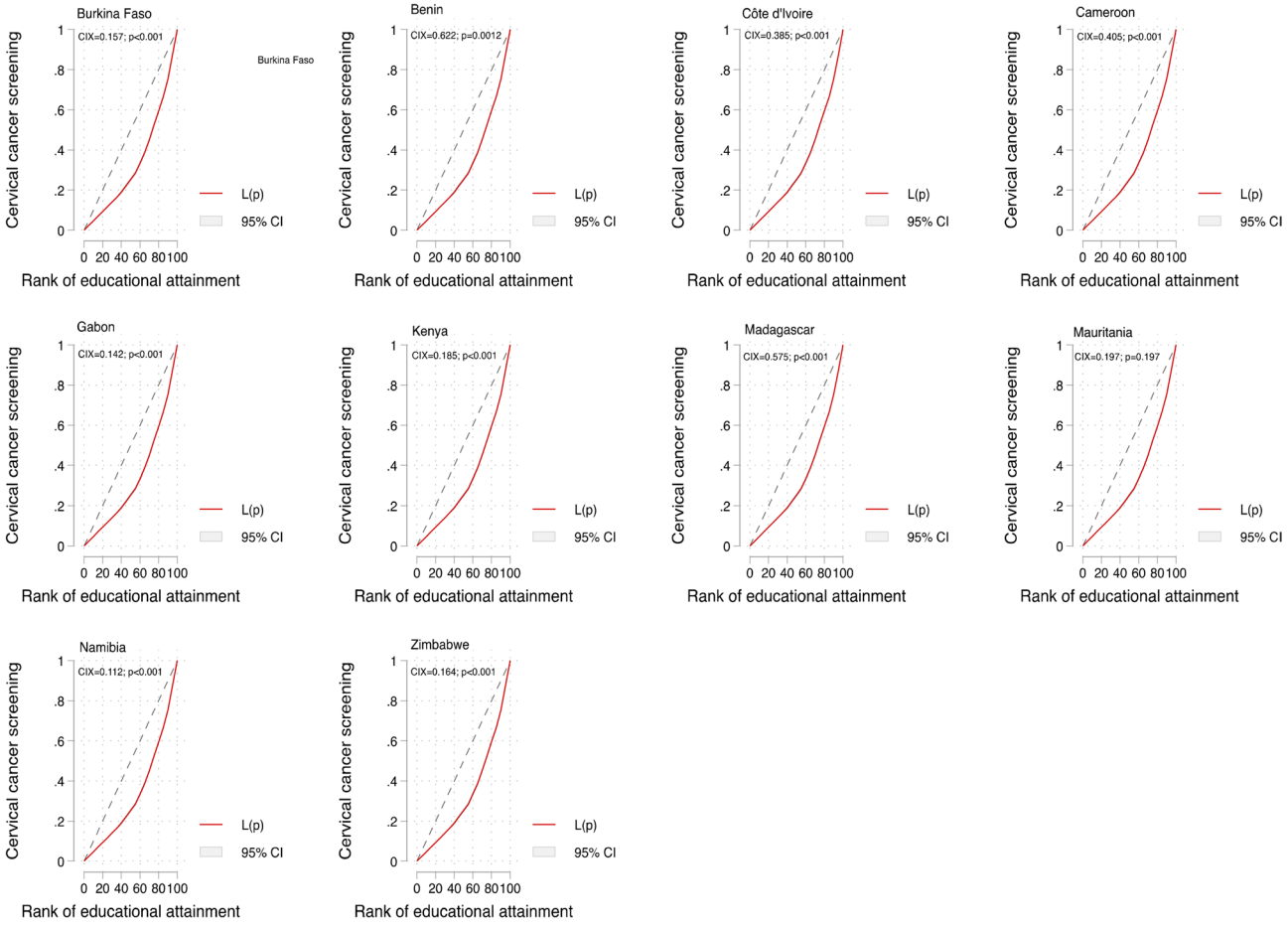

Fig. 5 Inequality in cervical cancer screening uptake by educational attainment across the ten countries in sub-Saharan Africa

Table 5 Educational attainment inequalities in cervical cancer screening uptake

Variable	Elasticity	Concentration index	Absolute contribution	Percentage contribution
Educational attainment				
No education	Reference			
Incomplete primary	0.025	−0.151	−0.004	−1.031
Complete primary	0.043	0.151	0.007	1.815
Incomplete secondary	0.091	0.478	0.043	12.048
Complete secondary	0.049	0.761	0.037	10.355
Higher	0.063	0.916	0.058	15.993
Women's age (years)				
30–34	Reference			
35–39				
40–44	0.033	−0.001	0.000	−0.011
45–49	0.051	−0.028	−0.001	−0.400
Marital status	0.044	−0.078	−0.003	−0.947
Never in union				
Married	Reference			
Cohabiting	−0.142	−0.048	0.007	1.878
Widowed	−0.021	−0.057	0.001	0.335
Divorced	−0.007	−0.071	0.000	0.134
Separated	−0.013	0.038	−0.001	−0.142
Current working status	−0.007	0.179	−0.001	−0.360
Not working	Reference			
Working	0.025	0.022	0.001	0.152
Parity				
Nulliparity	Reference			
Primiparity	0.005	0.325	0.002	0.422
Multiparity	0.075	0.147	0.011	3.046
Grandparity	0.010	−0.276	−0.003	−0.762
Ever had sex				
No	Reference			
Yes	0.574	−0.002	−0.001	−0.258
Exposed to watching television				
No	Reference			
Yes	0.048	0.220	0.011	2.943
Exposed to listening to radio				
No	Reference			
Yes	0.096	0.109	0.010	2.890
Exposed to reading newspaper or magazine				
No	Reference			
Yes	0.051	0.511	0.026	7.262
Wealth index				
Poorest	Reference			
Poorer	0.021	−0.203	−0.004	−1.162
Middle	0.016	−0.084	−0.001	−0.379
Richer	0.021	0.077	0.002	0.445
Richest	0.031	0.391	0.012	3.401
Place of residence				
Urban	Reference			
Rural	−0.018	−0.168	0.003	0.839
Residual Concentration index			−0.175	

that multiparous women may have had over time, providing opportunities for health education and promotion of preventive healthcare practices, including cervical cancer screening. Frequent interactions during antenatal and postnatal care visits facilitate discussions about screening and encourage uptake. Additionally, healthcare providers may prioritise screening interventions for women with higher parity due to their elevated risk of cervical cancer associated with multiple pregnancies and childbirths.

Implications for policy and practice

Our findings underscore a need for pro-poor cervical cancer screening programs and regimes to bridge the wealth-related inequalities that exist. Practically, this can be achieved by empowering women with livelihood skills. It also demands the inclusion of the cost of cervical cancer screening in national health insurance schemes. Other initiatives may include establishing community-based screening centers in underserved areas, the provision of subsidised or free screening services, and the development of culturally sensitive and linguistically appropriate educational materials to enhance awareness and encourage uptake among disadvantaged groups.

Strengths and limitations

This study is arguably the first in SSA to investigate socioeconomic inequalities in cervical cancer screening at the regional level. Thus, it contributes significantly to what is currently known about cervical cancer screening in SSA. The application of decomposition analysis provided insights into the factors contributing to socioeconomic inequalities. Furthermore, the two-stage sampling technique adopted in DHS data collection allows us to generalise the findings to women of reproductive age in SSA. Yet, there are some noteworthy limitations. We cannot establish a causal relationship for the factors associated with socioeconomic inequalities in screening uptake. Decomposition analysis assumes that the relationship between socioeconomic factors and healthcare outcomes is linear and additive, which may not always hold, given that women's decision to get screened is also influenced by wider socio-cultural factors that are beyond the scope of the present study.

Conclusion

Only 15.7% of women aged 30-49 in 10 sub-Saharan African countries have ever been screened for cervical cancer. Increasing age, higher parity, higher wealth index, ever-had sex, higher educational attainment, being employed, and being exposed to the media increased screening uptake. We conclude that there are pro-rich and pro-higher educational inequalities in the uptake of cervical cancer screening. Our findings indicate that even with presence of targeted intervention programmes, inequalities in cervical cancer screening uptake persist between the poor and rich woman, and between woman with low and high educational attainment. This highlights a pressing need for comprehensive reassessment and restructuring of existing cervical cancer screening campaigns and programs within SSA countries. These initiatives must prioritise accessibility and inclusivity, particularly targeting women from poorer households and with lower educational attainment levels. Reducing these inequalities requires the implementation of community-based awareness and education campaigns aimed at low-income and less educated women to increase their awareness of the essence of cervical cancer screening and the availability of services. Also, public health initiatives providing subsidised or free cervical cancer screening services should be expanded to women in rural and slum areas who are usually less educated and socioeconomically disadvantaged.

Abbreviations

AOR	Adjusted odds ratio
CI	Confidence interval
CIX	Concentration Index
DHS	Demographic and Health Survey
LMICs	Low-and middle-income countries
MEASURE DHS	Monitoring and Evaluation to Assess and Use Results Demographic and Health Surveys
PCA	Principal component Analysis
SSA	sub-Saharan Africa
STROBE	Strengthening the Reporting of Observational Studies in Epidemiology
WHO	World Health Organization

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Authors' contributions

RGA, JO, and BOA contributed to the study design and conceptualization. RGA and BOA performed the analysis. RGA, JO, MAE, AS, FGW, BOA, and FB drafted the initial draft. All the authors critically reviewed the manuscript for its intellectual content. All authors read and amended drafts of the paper and approved the final version. RGA had the final responsibility to submit for publication.

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Data availability

The data used for this study is freely available at http://dhsprogram.com/data/available-datasets.cfm.

Declarations

Ethics approval and consent to participate

No ethical clearance was sought for the study. Detailed information concerning the DHS data and ethical standards is available via http://goo.gl/ny8T6X.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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