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Socioeconomic inequality in cervical cancer screening uptake among women in sub-Saharan Africa: a decomposition analysis of Demographic and Health Survey data

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ABSTRACT

Objective To examine socioeconomic inequalities in the use of cervical cancer screening among women in sub-Saharan Africa.

Design Secondary data from the Demographic and Health Survey data in sub-Saharan Africa.

Setting Sub-Saharan Africa.

Participants Women aged 15–64 years.

Outcome measures Socioeconomic inequalities in cervical cancer screening uptake and the pooled prevalence of cervical cancer screening.

Results The pooled prevalence of cervical cancer screening among women in sub-Saharan African countries was 10.51% (95% CI: 7.54% to 13.48%). Cervical cancer screening uptake showed a significant pro-rich distribution of wealth-related inequalities, with a weighted Erreygers normalised concentration index of 0.084 and an SE of 0.003 (p value <0.0001). This finding suggests that disparities in cervical cancer screening uptake among women are related to wealth. Decomposition analysis revealed that the wealth index, educational status, place of residence and media exposure were the most important factors contributing to this pro-rich socioeconomic inequality in cervical cancer screening.

Conclusion This study emphasises the importance of addressing modifiable factors such as improving educational opportunities, increasing media exposure accessibility in households and improving the country's economy to reduce wealth disparities and improve cervical cancer screening uptake among women.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Nationally representative data were used for each sub-Saharan African country, as was a large sample size.
⇒ The pooled prevalence of cervical screening uptake was employed.
⇒ Erreygers concentration index, curve and Wagstaff decomposition analyses are appropriate statistical models for demonstrating the extent and direction of socioeconomic inequality in cervical cancer screening.
⇒ A causal relationship cannot be established between cervical cancer screening and predictors because of the use of cross-sectional data.
⇒ Unable to investigate all variables because the nature of the data was secondary.

INTRODUCTION

Cancer has become the leading cause of death in both developing and developed countries.[1 2] Due to the increasing prevalence of risk factors, the burden of cancer has increased over time.[3] There has been a recent surge of non-communicable diseases, including cancer, in many low- and middle-income countries, which has led to a considerable economic burden.[4]

Cervical cancer is the fourth most common cancer in women, and globally, approximately 7.5% of cancer-related deaths among women are attributed to it.[5–7] Human papillomavirus (HPV) is one of the most common sexually transmitted infections worldwide. HPV has more than 130 low-risk and high-risk serotypes: high-risk serotypes (HPV 16, 18) can cause cancers such as cervical cancer, although low risk causes benign warts.[8] In women, HPV infection may become chronic, and precancerous lesions may progress to invasive cervical cancer.[6]

Cervical cancer is a prevalent public health concern and is among the leading causes of death among women globally.[9] In 2022, an estimated 661 044 women were diagnosed with cervical cancer, and approximately 350 000 deaths from the disease occurred worldwide; approximately 94% of women who died from cervical cancer were from low- and middle-income countries.[6 10] In sub-Saharan Africa (SSA), cervical cancer is the second leading cause of cancer in women, accounting for 22.5% of all cancer cases.

Moreover, approximately 117 316 women are diagnosed annually with the disease.[11] Additionally, cervical cancer is the most common cause of death among women in sub-Saharan African countries.[12] The disease burden in SSA is high because of a lack of accessible screening and treatment options, health system barriers, low levels of awareness and challenges with health-seeking behaviours, all of which increase the burden of cervical cancer high in sub-Saharan African countries.[13–15]

HPV vaccination and regular screening are recommended to reduce the burden of cervical cancer in low- and middle-income countries.[16] Cervical cancer screening aims to identify precancerous cervical lesions in healthy women before they progress to cancer,[17 18] thereby establishing it as one of the most effective strategies for cancer control. This screening method plays a crucial role in the early detection of cervical cancer, expands treatment options for affected women, and increases cancer survival rates.[19 20]

The WHO recommends cervical cancer screening every 5–10 years. Moreover, it encourages a minimum of two lifetime screens with a high-performance HPV test by the age of 35 and again by the age of 45.[6] In line with these recommendations, the Sustainable Development Goals aim to address universal health coverage, ensuring healthy lives and promoting well-being for all people.[21] Currently, the prevention, control and treatment of cervical cancer have become a worldwide public health priority.[22] Early detection of cancers leads to better prognoses and less costly treatment,[23 24] and cervical cancer screening, including the Papanicolaou (Pap) smear, has significantly reduced associated morbidity and mortality globally.[25]

Cervical cancer disproportionately affects poor, socially marginalised women around the world, which may be attributed to low cervical cancer screening uptake among poor populations. Previous evidence also indicated that cervical cancer screening was concentrated among wealthier women.[26] There are several sociodemographic characteristics that are linked to the uptake of cervical cancer screening, including age, marital status, place of residence and education level.[27–29]

Assuring equitable access to cervical cancer screening services is thus critical to decreasing the burden of cervical cancer in low- and middle-income countries. Therefore, this study aimed to assess the presence of socioeconomic inequality in the uptake of cervical cancer screening services among women and their contributors in SSA. We estimate the contribution of each of the determinants to socioeconomic inequality in the uptake of cancer screening services using the decomposition analysis proposed by Erreygers.[30] The results of this study will provide useful information for policymakers to address socioeconomic disparities in the uptake of cervical cancer screening services.

Table 1 Socioeconomic characteristics of women in a study of socioeconomic inequality in sub-Saharan Africa, 2024

Variable	Weighted frequency	Percentage (%)
Age		
15–24	53 306	38.13
25–34	43 359	31.01
35–44	31 413	22.47
>45	11 722	8.39
Residence		
Urban	66 747	47.74
Rural	73 054	52.26
Educational status		
No education	35 421	25.34
Primary	37 679	26.95
Secondary	56 160	40.17
Higher	10 539	7.54
Marital status		
Unmarried	42 785	30.60
Married	97 015	69.40
Employment status		
Not working	53 367	38.17
Working	86 434	61.83
Wealth Index		
Poorest	22 886	16.37
Poorer	24 936	17.84
Middle	27 056	19.35
Richer	30 684	21.95
Richest	34 236	24.49
Media exposure		
Yes	121 491	86.91
No	18 294	13.09
Income level of country		
Lower income	80 695	57.72
Lower-middle income	59 106	42.28

METHODS

Data source and sampling procedure

The data were collected through the Demographic and Health Survey (DHS) programme; more information about the surveys can be found in each country's DHS reports. The study participants were chosen using a multistage stratified sampling method. The first stage involved the random selection of Enumeration Areas, followed by the selection of households. Women in the chosen household were asked about their cervical cancer screening to determine their cervical screening uptake status. DHS contains a number of datasets, one of which we used in this study: the Individual Record (IR) file. Using the literature, we extracted data from the IR dataset and appended it with the STATA command 'append'. Data analysis commonly involves the appending of separate datasets. This results in a unified dataset that can be managed and analysed more efficiently within STATA. The study's final sample size was 139 801 women aged 15–64 years (online supplemental table 1).

Table 2 Bivariable analysis of cervical cancer screening among women in SSA 2024

Variables	Cervical cancer screening		OR (95% CI)	P value
	Yes, n (%)	No, n (%)		
Women's age (years)				
15–24 (reff)	1890 (13.92)	51 416 (40.73)	(reff)	(reff)
25–34	4957 (36.51)	38 401 (30.42)	3.420 (3.23 to 3.61)	0.001
35–44	4764 (35.09)	26 648 (21.11)	4.650 (4.39 to 4.92)	0.001
>45	1965 (14.48)	9756 (7.73)	5.752 (5.38 to 6.14)	0.001
Religion				
Christian (reff)	2247 (16.55)	31 368 (24.85)	(reff)	(reff)
Muslim	2895 (21.32)	14 386 (11.40)	2.72 (2.56 to 2.89)	0.001
Others	8435 (62.13)	80 469 (63.75)	1.37 (1.30 to 1.44)	0.001
Residence				
Urban	8351 (61.50)	58 396 (46.26)	(reff)	(reff)
Rural	5226 (38.50)	67 827 (53.74)	1.77 (1.71 to 1.84)	0.001
Educational status				
No formal education (reff)	2071 (15.25)	33 350 (26.42)	(reff)	(reff)
Primary education	3007 (22.15)	34 671 (27.47)	1.44 (1.36 to 1.52)	0.001
Secondary education	5955 (43.86)	50.205 (39.78)	1.98 (1.87 to 2.08)	0.001
Higher education	2544 (18.74)	7995 (6.33)	5.32 (4.98 to 5.69)	0.001
Marital status				
Unmarried	2518 (18.54)	40 268 (31.90)	(reff)	(reff)
Married	11 060 (81.46)	85 955 (68.19)	2.05 (1.96 to 2.15)	0.001
Employment status				
Not working	3798 (27.98)	49 568 (39.27)	(reff)	(reff)
Working	9779 (72.02)	76 654 (60.73)	1.66 (1.59 to 1.73)	0.001
Wealth index				
Poorest	1064 (7.84)	21 822 (17.29)	(reff)	(reff)
Poorer	1701 (12.53)	23 235 (18.41)	1.46 (1.35 to 1.58)	0.001
Middle	2196 (16.17)	24 861 (19.70)	1.82 (1.70 to 1.96)	0.001
Richer	3319 (24.44)	27 365 (21.68)	2.59 (2.41 to 2.77)	0.001
Richest	5298 (39.02)	28 938 (22.93)	3.82 (3.58 to 4.08)	0.001
Media exposure				
Yes	10 004 (73.70)	3571 (26.30)	(reff)	(reff)
No	111 487 (88.33)	14 724 (11.67)	2.86 (2.74 to 2.99)	0.001
Health insurance coverage				
Yes	3475 (25.60)	21 409 (17.03)	(reff)	(reff)
No	10 103 (74.40)	104 732 (82.97)	0.62 (0.59 to 0.65)	0.001
Income level of country				
Lower income	10 235 (75.38)	70 460 (55.82)	(reff)	(reff)
Lower-middle	3342 (24.62)	55 763 (44.18)	0.37 (0.35 to 0.38)	0.001

SSA, sub-Saharan Africa.

Study variables and measurements

Dependent variable

The dependent variable was socioeconomic-related inequality in cervical cancer screening uptake among women in SSA. Cervical cancer screening uptake was classified as 'yes/no'. The respondents who had been examined or tested for cervical cancer were categorised, and those who had not were categorised as 'no'. Socioeconomic inequality in cervical cancer screening was demonstrated by using the covariance between cervical cancer screening uptake and the wealth index. Then, it was categorised as either pro-poor, pro-rich, or no inequality.

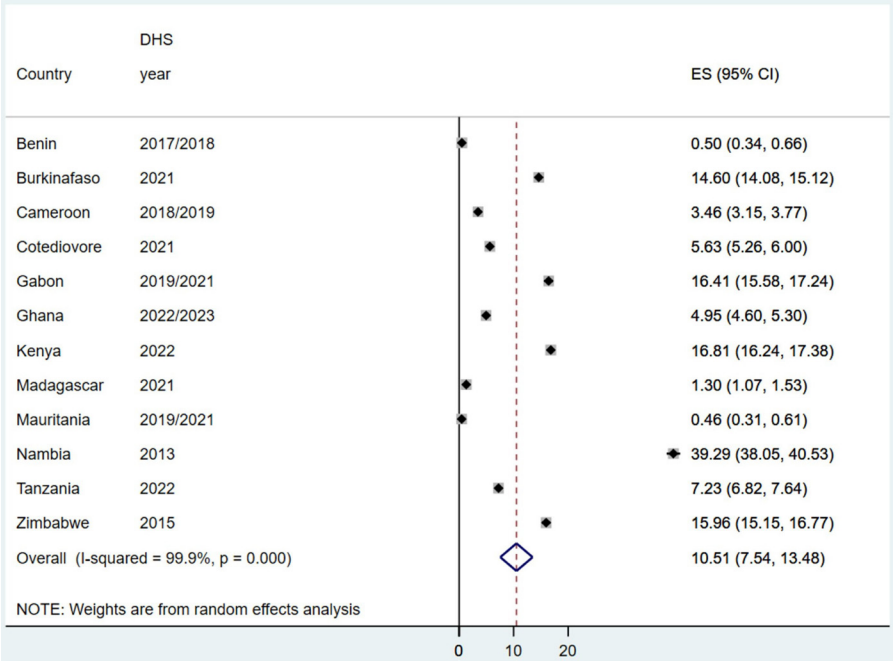

Figure 1 Forest plot depicting the pooled prevalence of cervical cancer screening uptake among women in SSA, 2024. DHS, Demographic and Health Survey; ES, Effective Size; SSA, sub-Saharan Africa.

Independent variables

For the independent variables, women's age, religion, educational level, employment status, wealth index, media exposure, health insurance coverage, residence, and income level of the country were considered.

Socioeconomic status

The wealth index from the DHS dataset was used to measure socioeconomic status. The index used principal component analysis and was classified as poorest (wealth quintile 1), poorer (wealth quintile 2), middle (wealth quintile 3), richer (wealth quintile 4) or richest (wealth quintile 5).[31] Media exposure was created by aggregating the following three variables: listening to the radio, watching television and reading a newspaper are classified as 'yes' if a woman has had exposure to any of the three media sources and 'no' if she has not. Country income status was classified as low- or lower-middle-income on the basis of the list of economies classified by the World Bank in 2019.[32]

Data management and analysis

This study used DHS data from the official DHS measure website. DHS data in STATA format were cleaned, transformed and appended to generate favourable variables for the final analysis. STATA V.17 software was used to compute descriptive and analytical statistics for the data from 11 countries. The analyses used sampling weights to account for unequal sample selection probabilities and potential response rate differences. Pearson's χ^2 test was used to determine p values on the basis of the distribution of respondents' background characteristics, expressed as frequencies with percentages. The 'metan prop' STATA command was used to compute a pooled estimate of cervical cancer screening uptake among women in SSA. It was estimated using the proportion of cervical cancer screenings in each SSA, as well as the SE calculated from the proportion and sample size of each country.

The concentration curve[33] was used to visualise the presence of socioeconomic inequality; for some variables, it was prominent at some points compared with others, and the concentration index (CI) was used to measure and compare socioeconomic inequality in health variables.[34 35]

The CI ranges from −1 to +1 and is equal to two times the area between the concentration curve and the line of equity. The sign of CI indicates the direction of the relationship between cervical cancer screening uptake and income distribution (wealth status). A CI of 0 indicates that the distribution is proportional; a CI of 1 indicates that the richest person has all the health variables and a CI of −1 indicates that the poorest person has all the health variables.[36 37] However, in the present study, the outcome variable was binary (yes or no), and the bounds of C depended on the mean (μ) of the outcome variable and were not between 1 and −1. Thus, the bounds of C ranged from $\mu-1$ (lower bound) to $1-\mu$ (upper bound). To account for this, the current study employed the Erreygers normalised concentration index (ECI), which is a modified version of the CI.[30]

The ECI can be mathematically defined as follows:

$$\mathrm{ECI} = 4 \times \mu \times \mathrm{CI}(y)$$

$\mathrm{CI}(y)$ is the generalised CI and μ is the mean of cervical cancer screening uptake. In this study, the ECI was reported along with the SE. To graphically depict socioeconomic inequality in cervical cancer screening uptake,

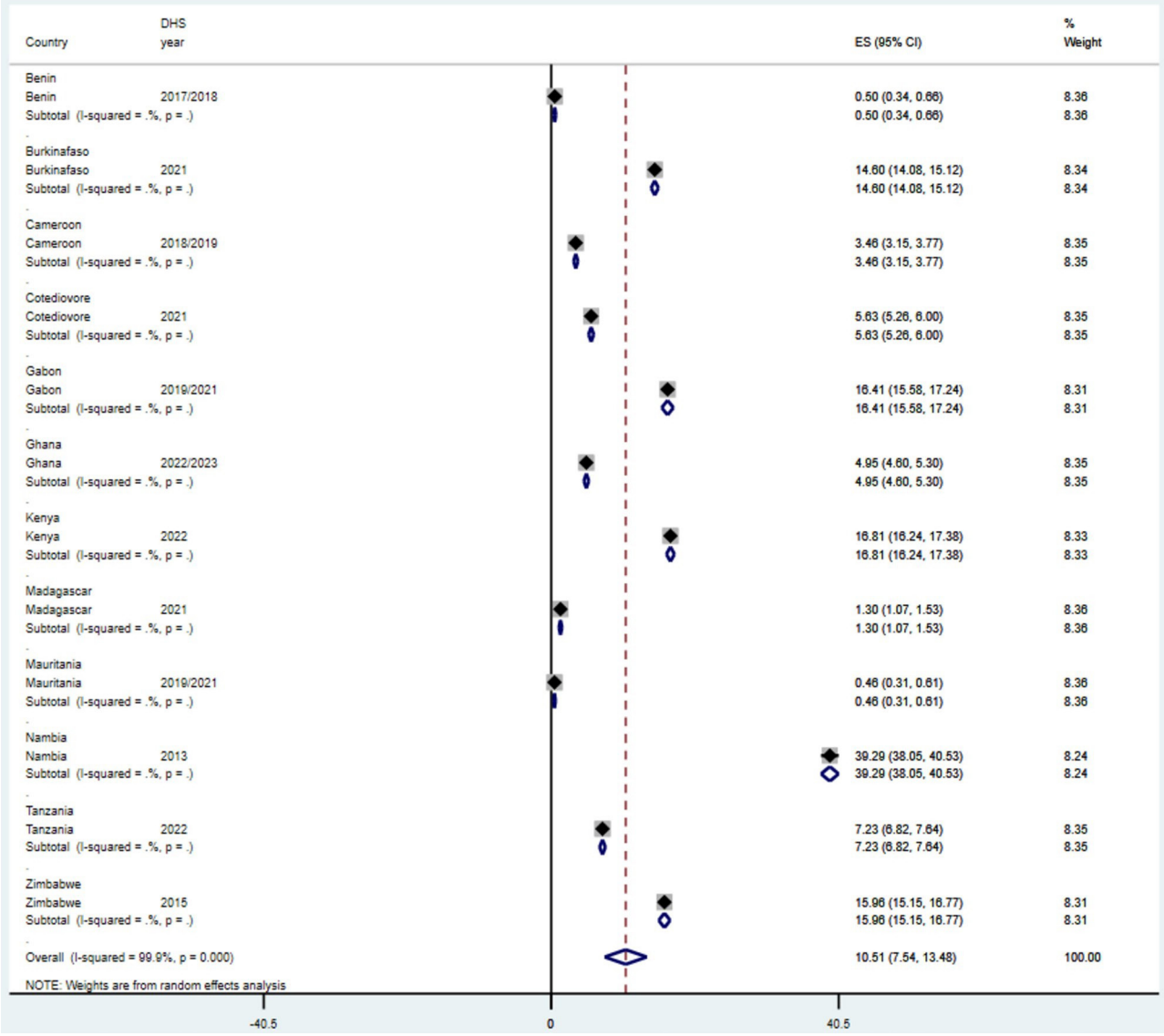

Figure 2 Subgroup analysis of cervical cancer screening among women in SSA by country. DHS, Demographic and Health Survey; ES, Effective Size; SSA, sub-Saharan Africa.

concentration curves plot the cumulative percentage of cervical cancer screening uptake (Y-axis) against the cumulative share of the population ranked by the wealth index, beginning with the poorest and ending with the richest (X-axis).[30]

The ECI would be a 45°-line run from the bottom left corner to the top right corner, indicating that there is no inequality (ECI=0). Furthermore, the concentration curve above and below the equality line (45°) indicated that the health variable is disproportionately concentrated between poor (pro-poor or ECI <0) and rich (pro-rich or ECI >0) individuals.[30 38] Visual inspection of a concentration curve can reveal whether it lies above or below the line of equality. To determine the statistical significance of the difference between the concentration curve and the line of perfect equality (45° or diagonal line), the ECI and p value were computed.

A decomposition of the ECI was performed to determine the relative contributions of various factors to socioeconomic disparities in cervical cancer screening uptake.[30 38 39] A linear additive regression model of health outcomes (y) was used.[30]

$$y = +\sum_k \beta_k X_k + \in$$

The concentration index for y, CI, is given as:

$$y = \sum_k \left(\frac{\beta_k \bar{X}_k}{\mu} \right) C_k + \frac{gc_\in}{\mu}$$

where 'y' is the health outcome variable (in this study, socioeconomic-related inequality of cervical cancer screening uptake), X_k is a set of socioeconomic determinants of cervical cancer screening uptake, α is the intercept, β_k is the coefficient of X_k, μ is the mean of y, $\bar{X}_k$ is the mean of X_k, C_k is the CI for X_k, $gc_\in$ is the generalised

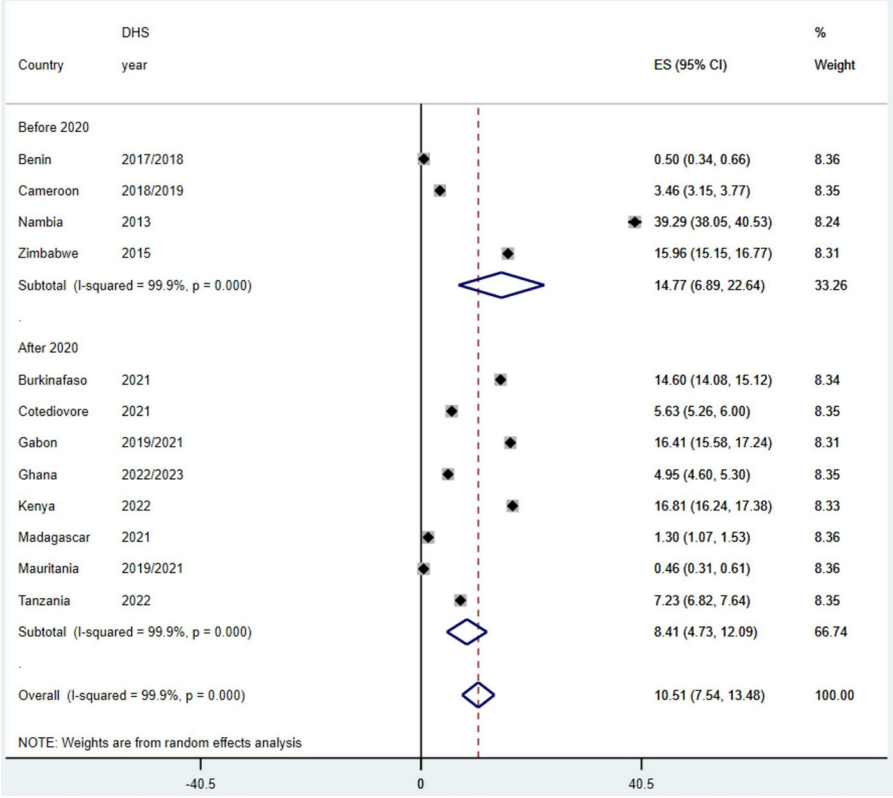

Figure 3 Subgroup analysis of cervical cancer screening among women in SSA by year. DHS, Demographic and Health Survey; ES, Effective Size; SSA, sub-Saharan Africa.

CI for the error term ($\in$), and $\frac{\beta_k \bar{X}_k}{\mu}$ is the elasticity of y with respect to $\bar{X}_k$.[39 40]

Patient and public involvement

The public/patient was not involved in the design, conduct, reporting or dissemination plans of this review.

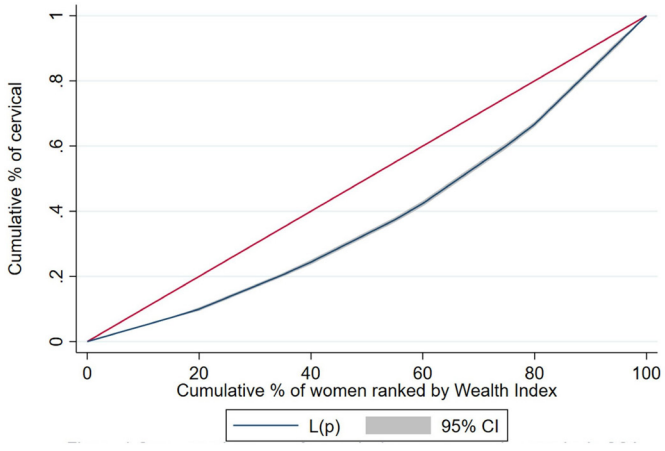

Figure 4 Concentration curve for cervical cancer screening uptake in SSA. SSA, sub-Saharan Africa.

RESULTS

Sociodemographic characteristics of women in SSA

A total of 139 801 women were included in this study. More than one-third (38.13%) of the women were aged 15–24 years, with a median age of 28 years (IQR: 16), and more than half of the women (52.26%) were rural residents. Approximately 40.17% had completed secondary school, and 24.49% came from the richest households. The majority (69.40%) of the women were married, and 58% of the sub-Saharan African countries included in the study had a lower income (tables 1 and 2).

Pooled prevalence of cervical cancer screening uptake among women in SSA

The pooled prevalence of cervical cancer screening among women in sub-Saharan African countries was 10.51% (95% CI: 7.54% to 13.48%) (figure 1). We conduct subgroup analysis by year and country. The results of the subgroup analysis by country revealed that cervical screening was high in Namibia (39%), followed by Kenya and Gabon (16.81% and 16.41%, respectively); Mauritania had the lowest percentage (0.46%) (figure 2). Moreover, the subgroup analysis by year revealed that screening for cervical cancer was high before 2020: 14.77% (95% CI: 6.89% to 22.64%) (figure 3).

Socioeconomic inequality of cervical cancer screening

The wealth-related inequality of cervical cancer screening using the weighted ECI was 0.084, with an SE of 0.0037 (p value <0.0001). This finding shows that cervical cancer

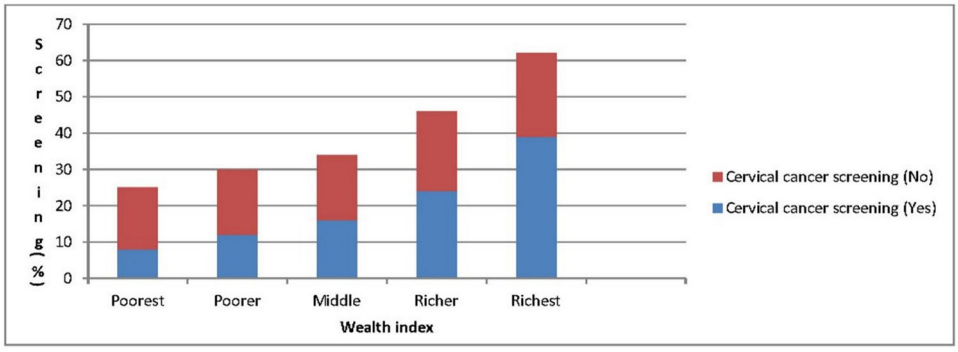

Figure 5 Bar-graph for socioeconomic inequality of cervical cancer screening uptake among women in SSA, 2024. SSA, sub-Saharan Africa.

screening is disproportionately concentrated among the rich (pro-rich). Correspondingly, the concentration curve revealed that the concentration of cervical cancer screening was above the line of equality, which indicated that the distribution of cervical cancer screening was concentrated in rich households (pro-rich distribution) (figures 4 and 5). The analysis of educational status-related inequality in cervical cancer screening uptake using the weighted ECI yielded a result of 0.080, with an SE of 0.0035 (p value <0.0001). This finding indicates that cervical cancer screening uptake was disproportionately higher among women with higher education. Additionally, the concentration curve revealed that the graph of cervical cancer screening uptake was above the line of equality, suggesting that the uptake was concentrated among women with higher education (figure 6).

Decomposing socioeconomic-related inequalities in cervical cancer screening

Income-related inequality in cervical cancer screening was shown after assessment using the CI and curve. After the Erreygers normalised the CI, a decomposition analysis was conducted to understand the determinant factors that contribute to socioeconomic inequality, the CI, the coefficient, elasticity and the percentage contribution.

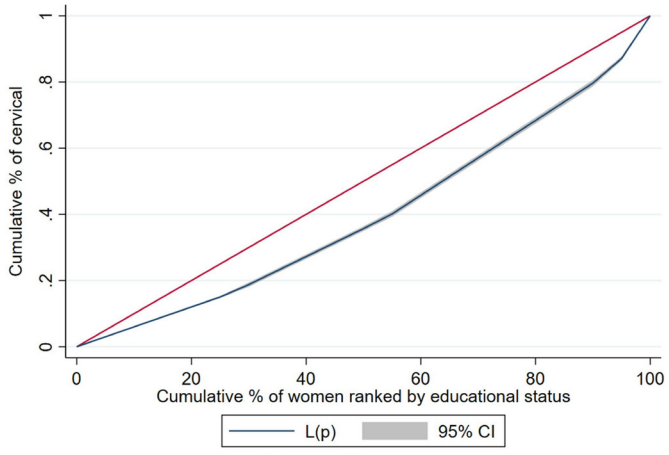

Figure 6 Concentration curve of educational status inequality of cervical cancer screening uptake in SSA, 2024. SSA, sub-Saharan Africa.

The sensitivity of cervical cancer screening for each factor was elasticity. The direction and degree of socioeconomic disparities in cervical cancer screening with respect to specific explanatory variables are depicted by the CI for each variable. By calculating the absolute contribution, which involves multiplying the elasticity of each factor by its CI, the degree of inequality to which the explanatory variables have contributed can be determined. The percentage contribution signifies the contribution of each variable to the overall CI (table 3).

In this study, educational level was the primary contributing factor to overall socioeconomic inequality in cervical cancer screening, accounting for 33.18% of the variation. This was followed by the residence and wealth indices, which contributed 25.45% and 19.33%, respectively, to the observed inequality. Moreover, 8.19% of pro-rich inequalities in cervical cancer screening among women were explained by media exposure.

DISCUSSION

Cervical cancer incidence and mortality rates are notably high in sub-Saharan African countries, which are attributed to significant disparities caused by inadequate access to cervical screening and treatment services, as well as socioeconomic factors. Recognising and reducing avoidable socioeconomic disparities and other factors that influence cervical cancer screening are important steps toward eliminating cervical cancer in SSA. The purpose of this study was to determine the pooled estimate, socioeconomic disparities in cervical cancer screening, and factors that influence it among women in SSA.

The findings of the current study revealed that the overall pooled prevalence of cervical cancer screening among women in sub-Saharan African countries was 10.51%. This number is lower than that reported in studies conducted in Malaysia[41] and China-Canadian.[42] The possible reason for the lower uptake of cervical cancer screening in SSA could be due to poor access to screening facilities, sociocultural influences and socioeconomic determinates.[43] The findings from the subgroup analysis revealed that cervical screening was high in Namibia (39%) and lowest in Mauritania (0.46%). The differences

Table 3 Contributing factors of socioeconomic inequality in cervical cancer screening in sub-Saharan Africa 2024

Variables	Coefficient	Elasticity	Concentration index	Absolute contribution	% contribution
Women's age					
15–24 (reff)					
25–34*	0.0752	0.0245	0.0160	0.0015	1.8638
35–44*	0.1205	0.0249	−0.0056	−0.0005	−0.6647
>45*	0.1724	0.0105	−0.0588	−0.0024	−2.9259
Subtotal					**−1.7268**
Religion					
Christian (reff)					
Muslim*	0.0610	0.0074	0.0052	0.0001	0.1839
Others*	0.0218	0.0204	0.0126	0.0010	1.2181
Subtotal					**1.4020**
Residence					
Urban*	−0.0178	−0.0168	−0.3206	0.0216	**25.4574**
Rural (reff)					
Educational status					
No formal education (reff)					
Primary education*	0.0163	0.0039	−0.1280	−0.0020	−2.3787
Secondary education*	0.0473	0.0205	0.1684	0.0138	16.3056
Higher education*	0.1196	0.0073	0.5549	0.0163	19.2593
Subtotal					**33.1862**
Marital status					
Unmarried (reff)					
Married*	−0.0206	−0.0085	0.1153	−0.0039	**−4.6227**
Employment status					
Not working (reff)					
Working*	0.0049	−0.0019	−0.0017	0.0001	**0.0161**
Wealth index					
Poorest (reff)					
Poorer*	0.0196	0.0036	−0.4942	−0.0072	−8.4941
Middle*	0.0257	0.0044	−0.1223	−0.0021	−2.5793
Richer*	0.0301	0.0056	0.2907	0.0066	7.7932
Richest*	0.0292	0.0063	0.7551	0.0191	22.6175
Subtotal					**19.3373**
Media exposure					
Yes*	0.0352	0.0043	0.4018	0.0069	**8.1965**
No (reff)					
Health insurance coverage					
Yes*	−0.0537	−0.0438	−0.0254	0.0044	**5.2593**
No (reff)					
Income level of country					
Lower income (reff)	–	–	–	–	–
Lower-middle income*	−0.0743	0.0559	0.0145	0.0032	**3.8435**

*P value <0.005.

in cervical cancer screening rates between Namibia and Mauritania can be largely attributed to disparities in healthcare infrastructure, public awareness, government policies, cultural factors and economic conditions. Namibia has established comprehensive screening programmes and public health campaigns that effectively educate women about the importance of cervical cancer prevention, supported by stronger healthcare funding

and international partnerships.[44] In contrast, Mauritania faces challenges such as limited healthcare access, lower levels of public awareness and cultural stigmas that hinder women's participation in screening initiatives.[45] Moreover, the results of the subgroup analysis according to year revealed that cervical cancer screening is high before 2020 than after 2020. The possible reason could be attributed to the COVID-19 pandemic, which disrupted healthcare services and created a fear of visiting medical facilities.[46] Additionally, persistent barriers such as limited access to healthcare, socioeconomic challenges, lack of awareness and cultural stigmas further exacerbate the situation.[47]

This study revealed that cervical cancer screening uptake in SSA was disproportionately concentrated among wealthy households. According to studies, the uptake of cervical cancer screening is unequal, with poorer women receiving less screening and richer women receiving more screening.[48 49] One possible explanation is that the poorest women may struggle financially, which is a hurdle to accessing cervical cancer screening.[50] Moreover, this finding can be explained by Michael Grossman's theories on health capital and healthcare utilisation. Grossman posits that health is a form of capital that individuals invest in, meaning that wealthier individuals typically have more resources for preventive care, such as screenings. Higher socioeconomic status is associated with greater demand for healthcare services because of improved access, health literacy, and the ability to recognise the long-term benefits of preventive measures. As a result, pro-rich individuals are more likely to attend screenings, navigating barriers such as cost and transportation more effectively. This disparity highlights the structural inequities in healthcare access and reinforces the idea that economic factors significantly influence health outcomes.[51]

In the decomposition analysis, several factors contributed to the rich socioeconomic inequalities in cervical cancer screening. Educational status, residence, wealth index, and media exposure were the major contributors.

Educational status was found to be an important and major contributor to the overall socioeconomic disparities in cervical cancer screening (33.18%). This finding is in line with those of India[49] and Iran.[52] One possible explanation is that education is associated with better access to and utilisation of healthcare services, such as cervical cancer screening.[53 54]

Residence was also a significant contributor to socioeconomic inequality in cervical cancer screening (25.45%). This finding is supported by another study conducted in Nepal.[55] This could be explained by the fact that the provision of cervical cancer screening services may be hampered in rural areas compared with urban areas due to the lack of screening centres within walking distance, limited transportation options and the cost of transportation.[56 57] Furthermore, because information sources are more accessible in urban areas, residents may have more opportunities to access health information, potentially leading to differences in screening utilisation rates between urban and rural populations. Likewise, women from urban areas may have higher educational levels than their counterparts.

This finding revealed that the wealth index was the other contributor to socioeconomic inequality in cervical cancer screening (19.33%). Previous studies in India[49] and Iran[52] have also highlighted that the wealth index has a positive association with cervical cancer screening uptake. The global distribution of cervical cancer screening and the burden of cervical cancer among economically disadvantaged women remain inexplicable. One possible explanation for this phenomenon could be the financial constraints faced by the poorest women, which, in turn, impedes their access to cervical cancer screening and treatment services.[50]

Media exposure significantly contributed to socioeconomic inequality in cervical cancer screening (8.19%). This finding is consistent with a study from Nepal.[58] The reason could be that exposure to media provides health information, which may enhance women's understanding of and approach to using healthcare services such as screening.[59]

Strengths and limitations

The use of weighted nationally representative data for each sub-Saharan African country, as well as a large sample size, is the strength of this study. Furthermore, the ECI, curve and Wagstaff decomposition analyses are appropriate statistical models for demonstrating the extent and direction of socioeconomic inequality in cervical cancer screening uptake across households ranging from poor to wealthy. However, readers should be aware of the study's limitations, due to the cross-sectional nature of the study; we cannot establish causal or temporal inferences. To evaluate the causal and long-term associations between socioeconomic inequality and cervical cancer screening, future research will need to use longitudinal data.

CONCLUSION

The cervical cancer screening rate among women in SSA is low, and there are significant wealth-related disparities in screening rates. These disparities are influenced by factors such as educational status, place of residence, wealth index and media exposure. Addressing these inequalities requires focusing on disadvantaged women and their contributing factors.

To increase cervical cancer screening among women in SSA, policymakers and other stakeholders should work with other sectors and prioritise modifiable factors such as improving access to education and household media exposure. For sub-Saharan African countries with lower income levels, a long-term plan is needed to improve individual household economic conditions and the wealth index. Interventions to increase cervical cancer screening uptake should also consider supporting marginalised groups, such as rural residents, to achieve a more equitable approach.

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REFERENCES

1 Bray F, Laversanne M, Weiderpass E, *et al*. The ever-increasing importance of cancer as a leading cause of premature death worldwide. *Cancer* 2021;127:3029–30.
2 Sung H, Ferlay J, Siegel RL, *et al*. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. *CA Cancer J Clin* 2021;71:209–49.
3 Jiwnani S, Penumadu P, Ashok A, *et al*. Lung Cancer Management in Low and Middle-Income Countries. *Thorac Surg Clin* 2022;32:383–95.
4 Giang NH, Oanh TTM, Anh Tuan K, *et al*. Is Health Insurance Associated with Health Service Utilization and Economic Burden of Non-Communicable Diseases on Households in Vietnam? *Health Syst & Reform* 2020;6:e1619065.
5 McCree R, Giattas MR, Sahasrabuddhe VV, *et al*. Expanding Cervical Cancer Screening and Treatment in Tanzania: Stakeholders' Perceptions of Structural Influences on Scale-Up. *Oncologist* 2015;20:621–6.
6 World Health Organisation. Cervical cancer Key facts. 2022.
7 Vu M, Yu J, Awolude OA, *et al*. Cervical cancer worldwide. *Curr Probl Cancer* 2018;42:457–65.
8 Forster AS. The human papillomavirus immunisation programme and sexual behaviour: UCL (University College London). 2011.
9 Chirwa GC. Explaining socioeconomic inequality in cervical cancer screening uptake in Malawi. *BMC Public Health* 2022;22:1376.
10 Bray F, Laversanne M, Sung H, *et al*. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin* 2024;74:229–63.
11 World Health Organisation Africa Region. Cervical cancer in Africa Fact Sheet. 2020.
12 Dzinamarira T, Moyo E, Dzobo M, *et al*. Cervical cancer in sub-Saharan Africa: an urgent call for improving accessibility and use of preventive services. *Int J Gynecol Cancer* 2023;33:592–7.
13 Menon M, Krantz E, Casper C. Correlates of cervical cancer screening from four Sub-Saharan African (SSA) countries: Results from the Demographic Health Survey (DHS)—2013-2015. *J C O* 2017;35:e18006. Available: https://www.researchgate.net/publication/327481834_Correlates_of_cervical_cancer_screening_from_four_Sub-Saharan_African_SSA_countries_Results_from_the_Demographic_Health_Survey_DHS-2013-2015
14 Campos NG, Tsu V, Jeronimo J, *et al*. To expand coverage, or increase frequency: Quantifying the tradeoffs between equity and efficiency facing cervical cancer screening programs in low-resource settings. *Int J Cancer* 2017;140:1293–305.
15 Jemal A, Bray F, Center MM, *et al*. Global cancer statistics. *CA Cancer J Clin* 2011;61:69–90.
16 Hull R, Mbele M, Makhafola T, *et al*. Cervical cancer in low and middle-income countries. *Oncol Lett* 2020;20:2058–74.
17 Health WHOR, Organisation WH, Diseases WHOC, Promotion H. Comprehensive cervical cancer control: a guide to essential practice: World Health Organisation. 2006.
18 Gebregziabher D, Berhanie E, Birhanu T, *et al*. Correlates of cervical cancer screening uptake among female under graduate students of Aksum University, College of Health Sciences, Tigray, Ethiopia. *BMC Res Notes* 2019;12:520.
19 Arbyn M, Weiderpass E, Bruni L, *et al*. Estimates of incidence and mortality of cervical cancer in 2018: a worldwide analysis. *Lancet Glob Health* 2020;8:e191–203.
20 Ba DM, Ssentongo P, Musa J, *et al*. Prevalence and determinants of cervical cancer screening in five sub-Saharan African countries: A population-based study. *Cancer Epidemiol* 2021;72:S1877-7821(21)00047-3.
21 Ban K. Sustainable development goals. 2016;37:18–9.
22 Dalla V, Panagiotopoulou E-K, Deltsidou A, *et al*. Level of Awareness Regarding Cervical Cancer Among Female Syrian Refugees in Greece. *J Cancer Educ* 2022;37:717–27.
23 El Saghir NS, Soto Pérez de Celis E, Fares JE, *et al*. Cancer Care for Refugees and Displaced Populations: Middle East Conflicts and Global Natural Disasters. *Am Soc Clin Oncol Educ Book* 2018;38:433–40.
24 Anderson BO, Cazap E, El Saghir NS, *et al*. Optimisation of breast cancer management in low-resource and middle-resource countries: executive summary of the Breast Health Global Initiative consensus, 2010. *Lancet Oncol* 2011;12:387–98.
25 Ng E, Wilkins R, Fung MFK, *et al*. Cervical cancer mortality by neighbourhood income in urban Canada from 1971 to 1996. *CMAJ* 2004;170:1545–9.
26 McKinnon B, Harper S, Moore S. Decomposing income-related inequality in cervical screening in 67 countries. *Int J Public Health* 2011;56:139–52.
27 Ekane GEH, Obinchemti TE, Nguefack CT, *et al*. Pap Smear Screening, the Way Forward for Prevention of Cervical Cancer? A Community Based Study in the Buea Health District, Cameroon. *OJOG* 2015;05:226–33.
28 Tassang A, Halle-Ekane G, Enow-Orock G, *et al*. Cervical Cancer Screening in a Low–Resource Setting: Buea-Cameroon. *Int Res J Oncol* 2020;3:47–55.

29 Fru CN, Andrew T, Cho FN, *et al*. Socio-economic Determinants Influencing Cervical Cancer Screening in Buea: A Cross-Sectional Study. *IJTDH* 2020;41:14–22.
30 Erreygers G. Correcting the concentration index. *J Health Econ* 2009;28:504–15.
31 Vyas S, Kumaranayake L. Constructing socio-economic status indices: how to use principal components analysis. *Health Policy Plan* 2006;21:459–68.
32 World Bank. World Bank list of economies, 2019. Available: https://hupo.org/resources/Documents/World%20Bank%20list%20of%20economies%20(June%202019).pdf
33 Kakwani NC. Income inequality and poverty: World Bank New York. 1980.
34 Gwatkin D, Rutstein S, Johnson K, *et al*. *Initial country-level information about socioeconomic differences in health, nutrition and population*. Washington, DC: World Bank, 2003.
35 Kakwani N, Wagstaff A, van Doorslaer E. Socioeconomic inequalities in health: Measurement, computation, and statistical inference. *J Econom* 1997;77:87–103.
36 Debie A, Lakew AM, Tamirat KS, *et al*. Complete vaccination service utilization inequalities among children aged 12-23 months in Ethiopia: a multivariate decomposition analyses. *Int J Equity Health* 2020;19:65:65:.
37 Wagstaff A, O'Donnell O, Doorslaer E, *et al*. *Analysing health equity using household survey data: a guide to techniques and their implementation*. World Bank Publications, 2007.
38 Wagstaff A. The bounds of the concentration index when the variable of interest is binary, with an application to immunization inequality. *Health Econ* 2005;14:429–32.
39 Wagstaff A, van Doorslaer E, Watanabe N. On decomposing the causes of health sector inequalities with an application to malnutrition inequalities in Vietnam. *J Econom* 2003;112:207–23.
40 Mezmur M, Navaneetham K, Letamo G, *et al*. Socioeconomic inequalities in the uptake of maternal healthcare services in Ethiopia. *BMC Health Serv Res* 2017;17:367.
41 Gan DEH, Dahlui M. Cervical screening uptake and its predictors among rural women in Malaysia. *Singapore Med J* 2013;54:163–8.
42 Hislop TG, Deschamps M, Teh C, *et al*. Facilitators and barriers to cervical cancer screening among Chinese Canadian women. *Can J Public Health* 2003;94:68–73.
43 Mantula F, Toefy Y, Sewram V. Barriers to cervical cancer screening in Africa: a systematic review. *BMC Public Health* 2024;24:525.
44 Jhpiego. Eliminating Cervical Cancer in Namibia. 2021.
45 Mohamed Brahim S, Zein E, Houmeida A, *et al*. *General oncology care in Mauritania. Cancer in the Arab World*. Singapore: Springer Singapore, 2022:149–61.
46 World Health Organisation. Cancer services disrupted by up to 50% in all countries reporting: a deadly impact of COVID-19. 2021.
47 Yimer NB, Mohammed MA, Solomon K, *et al*. Cervical cancer screening uptake in Sub-Saharan Africa: a systematic review and meta-analysis. *Public Health (Fairfax)* 2021;195:105–11.
48 Mukem S, Meng Q, Sriplung H, *et al*. Low Coverage and Disparities of Breast and Cervical Cancer Screening in Thai Women: Analysis of National Representative Household Surveys. *Asian Pac J Cancer Prev* 2015;16:8541–51.
49 Sen S, Khan PK, Wadasadawala T, *et al*. Socio-economic and regional variation in breast and cervical cancer screening among Indian women of reproductive age: a study from National Family Health Survey, 2019-21. *BMC Cancer* 2022;22:1279.
50 Tiruneh FN, Chuang K-Y, Ntenda PAM, *et al*. Individual-level and community-level determinants of cervical cancer screening among Kenyan women: a multilevel analysis of a Nationwide survey. *BMC Womens Health* 2017;17::109.
51 Grossman M. *On the concept of health capital and the demand for health. Determinants of health: an economic perspective*. Columbia University Press, 2017:6–41.
52 Amin R, Kolahi A-A, Jahanmehr N, *et al*. Disparities in cervical cancer screening participation in Iran: a cross-sectional analysis of the 2016 nationwide STEPS survey. *BMC Public Health* 2020;20:1594.
53 Idowu A, Olowookere SA, Fagbemi AT, *et al*. Determinants of Cervical Cancer Screening Uptake among Women in Ilorin, North Central Nigeria: A Community-Based Study. *J Cancer Epidemiol* 2016;2016:6469240.
54 Stefan DC. Cancer Care in Africa: An Overview of Resources. *J Glob Oncol* 2015;1:30–6.
55 Ranabhat S, Tiwari M, Dhungana G, *et al*. Association of knowledge, attitude and demographic variables with cervical Pap smear practice in Nepal. *Asian Pac J Cancer Prev* 2014;15:8905–10.
56 Cunningham MS, Skrastins E, Fitzpatrick R, *et al*. Cervical cancer screening and HPV vaccine acceptability among rural and urban women in Kilimanjaro Region, Tanzania. *BMJ Open* 2015;5:e005828.
57 Mupepi SC, Sampselle CM, Johnson TRB. Knowledge, attitudes, and demographic factors influencing cervical cancer screening behavior of Zimbabwean women. *J Womens Health (Larchmt)* 2011;20:943–52.
58 Lamichhane B, Adhikari B, Poudel L, *et al*. Factors associated with uptake of breast and cervical cancer screening among Nepalese women: Evidence from Nepal Demographic and Health Survey 2022. *PLOS Glob Public Health* 2024;4:e0002971.
59 Tamang TM. Factors associated with completion of continuum of Care for Maternal Health in Nepal. IUSSP XXVIII International Population Conference, Cape Town, South Africa. 2017.