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Who gets screened? Prevalence and determinants of cervical cancer screening among women aged 15–49 in Malawi and Zambia: a cross-sectional analysis of the 2024 Demographic and Health Surveys

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Abstract

Background:

Malawi and Zambia rank highly in cervical cancer burden globally. Despite establishing programs and interventions, cervical cancer screening remains low in the two countries. There is limited evidence on the national prevalence and predictors of cervical cancer screening in both countries. This study assessed the prevalence and factors associated with cervical cancer screening among women aged 15–49 in Malawi and Zambia, using nationally representative data.

Methods:

We conducted a secondary analysis of data from the 2024 Malawi and Zambia Demographic Health Surveys (DHS), including 17,981 women from Malawi and 11,609 women from Zambia aged 15–49 years. The outcome variable, cervical cancer screening, was assessed using participants' self-reported history of being screened by a healthcare professional. Descriptive statistics, including frequencies and percentages, were used to summarise participants' characteristics and estimate the weighted prevalence of cervical cancer screening. Both univariable and multivariable logistic regression analyses were performed to identify the factors associated with cervical cancer screening.

Results:

The weighted prevalence of cervical cancer screening was 29.7% (95% CI: 28.6, 30.7) in Malawi and 31.6% (95% CI: 30.5, 32.8) in Zambia. In both countries, screening prevalence was highest among women aged 40–49 years (43.4% in Malawi and 47.1% in Zambia), those in formal employment (35.9% and 45.0%, respectively), women living with HIV (WLHIV) (71.5% and 82.1%, respectively), and mobile phone owners (33.2% and 36.5%, respectively). In the multivariable analyses, women aged 40–49 years (aOR = 2.31, 95% CI: 1.89, 2.82) and those in the richest wealth quintile (aOR = 1.52, 95% CI: 1.26, 1.84) had higher odds of cervical cancer screening in Malawi. In Zambia, health insurance coverage (aOR = 1.54, 95% CI: 1.30, 1.83) and modern contraceptive use (aOR = 1.18, 95% CI: 1.06, 1.31) were associated with increased odds of screening. Conversely, HIV-negative women (aOR = 0.20, 95% CI: 0.17, 0.24) and smokers (aOR = 0.43, 95% CI: 0.25, 0.72) in Malawi, as well as Muslim women in Zambia (aOR = 0.34, 95% CI: 0.14, 0.82), had lower odds of undergoing cervical cancer screening.

Conclusion:

Cervical cancer screening uptake remains low in Malawi and Zambia, with less than one-third of women of reproductive age reporting having ever been screened. Older age, higher socioeconomic status, health insurance coverage, and modern contraceptive use were associated with increased screening uptake, while smoking and certain sociodemographic factors were associated with lower uptake. Targeted interventions addressing these disparities are needed to improve screening coverage and accelerate progress toward cervical cancer elimination.

Introduction

Cervical cancer is the fourth most common cancer among women globally, with approximately 660,000 new cases and 350,000 deaths reported worldwide in 2022 [1]. Over 90% of those mortalities occurred in low- and middle-income countries (LMICs) [2,3]. Notably, Africa bears a significant burden of the disease, being home to 18 of the top 20 countries with the highest cervical cancer burden worldwide [4]. The cancer is caused by oncogenic Human Papillomavirus (HPV) strains, with HPV types 16 and 18 accounting for about 70% of the causal effect [5,6].

Cervical cancer is preventable primarily through HPV vaccination, secondarily by screening for early detection of precancerous or cancerous lesions, and tertiarily through effective treatment [7]. The World Health Organization (WHO) recommends that cervical cancer screening for women in the general population should begin from age 30, then every 5 to 10 years until age 50 after two consecutive negative screen tests [8]. Screening for women living with HIV (WLHIV) should start from age 25, then every 3 to 5 years, until age 50 after the same conditions are met [8]. As per WHO, such screening should preferably be performed using HPV DNA testing, but visual inspection with acetic acid (VIA) or a Pap smear can be used until HPV DNA testing is established [8]. As such, cervical cancer screening forms part of the WHO's three-pronged Global Strategy towards the elimination of cervical cancer which was endorsed in 2020 [9]. The strategy aims to attain 90% HPV vaccination, 70% cervical cancer screening at least twice using HPV DNA testing, and 90% effective cervical pre-cancer or cancer treatment by 2030 [9,10].

Notwithstanding the mentioned recommendations and strategy, many eligible women have not been screened. By 2019, only 36% of women aged 30–49 had ever undergone cervical cancer screening globally [11]. Furthermore, approximately two-thirds of women aged 30–49 had never undergone cervical cancer screening [11]. Of the women aged 30–49, about 84% living in high-income, 48% in upper-middle-income, and only 11% in low-income countries had ever been screened[11]. Strikingly, studies report an overall cervical cancer screening prevalence of 8.5% to 19% among eligible women in Africa [12,13].

Malawi and Zambia are the second- and third-highest in global cervical cancer burden, respectively [1,14,15]. In 2022, Malawi had a cervical cancer morbidity of 70.9 per 100,000 women and a mortality of 54.1 per 100,000 women, while in Zambia the morbidity was 71.5 per 100, 000 women, whereas the mortality was 49.4 per 100,000 women [1,16]. Both countries have made concerted efforts to address the high burden of the disease in the past two decades. For instance, Malawi established the Malawi National Cervical Cancer Control Program (CECAP) in 2004, followed by subsequent national strategies targeting 80% screening coverage [17]. Similarly, in 2006, the Cervical Cancer Prevention Program in Zambia (CCPPZ) was established to spearhead cervical cancer

prevention strategies [18]. Despite these efforts, the screening uptake in both countries have remained suboptimal at only 26% [19] and 27% [20] among women aged 15–49 as of 2024. Bridging the screening gap requires targeted strategies to identify factors associated with screening, which could be the barriers to screening.

Previous studies in sub-Saharan Africa have identified several factors associated with cervical cancer screening uptake [21–26]. Socio-demographic and socio-economic factors included older age, higher educational attainment, formal employment, increasing wealth status, increasing parity, marital status, ethnicity, religion, residence type, and region. HIV status, history of sexually transmitted infections, health insurance coverage, healthcare utilization, and contraceptive use are some of the health and health status-related predictors. Lastly, lifestyle and media exposure-related covariates include smoking, watching the television (TV), listening to the radio, reading newspapers or magazines, and owning a mobile phone [21–26].

Despite the high burden of cervical cancer in both countries, the screening rates are low. That shortfall raises concerns regarding the timely detection and treatment of cervical cancer in the two countries, which most likely contributes to the huge burden and adverse outcomes from the disease. Although several studies have examined cervical cancer screening in Malawi and Zambia [27–32], existing evidence is limited by sub-national coverage [27,28], focus on specific populations such as women living with HIV [29], use of non-nationally representative data sources [30,31], and examination of a narrow set of determinants [32]. The limited evidence regarding the national prevalence and determinants of cervical cancer screening in both countries is thus warranted. Therefore, this study sought to examine the national level prevalence and factors associated with cervical cancer screening among women of reproductive age (15–49 years) in Zambia and Malawi using the 2024 Malawi and Zambia Demographic Health Surveys (DHS) datasets.

Methods

Study setting and data source

Malawi and Zambia are two neighbouring African countries, with Malawi in southeastern Africa, bordered by Zambia to the west, which is in south-central Africa [33]. According to the 2018 and 2022 Population and Housing Censuses, Malawi and Zambia have populations of 21,201,635 and 19,693,423, respectively [34,35]. This study utilised data from the 2024 Malawi and Zambia DHS. In Malawi, data collection for the 2024 DHS involved three regions: Northern, Central, and Southern regions [19]. On the other hand, ten regions were involved in the 2024 Zambia DHS data collection: Central, Western, North Western, Eastern, Northern, Southern, Copperbelt, Luapula, Muchinga, and Lusaka regions [20].

Study design and sampling

We conducted a cross-sectional secondary analysis of the 2024 Malawi and Zambia DHS data. Both surveys used a two-stage stratified cluster sampling [19,20]. Stage 1 involved target cluster or enumeration area (EA) selection using probability proportional to rural and urban area sizes [19,20]. Entailed in stage 2 was systematic household sampling through mapping and listing households from each identified cluster using equal-probability [19,20]. More information about the 2024 Malawi and Zambia DHS is found elsewhere [19,20].

Study population and sample size

A sample of 21,587 Malawian and 13,951 Zambian women was considered; this study included 17,981 Malawian and 11,609 Zambian women aged 15–49 years after excluding missing observations on the outcome variables and covariates (wealth status, ethnicity, and HIV status for 2024 Malawi DHS; working status and HIV status for 2024 Zambia DHS) (Fig. 1).

Study variables

Outcome variable

The study's outcome variable was self-reported cervical cancer screening, which was assessed by asking women if a doctor or other health care provider ever tested them for cervical cancer, regardless of the screening test used [19,20]. The screening question had three responses in both surveys: 0 'no,' 1 'yes,' and 8 'don't know.' The three responses were recoded into a binary outcome variable: 'yes' was coded as 1 and labelled 'Screened,' while 'no' and 'don't know' were coded as 0 and labelled 'Unscreened.'

Explanatory variables

Twenty explanatory variables were included in the 2024 Malawi DHS analysis, and 19 in the 2024 Zambia DHS analysis. The variables were selected from the two DHS datasets based on existing literature [21–26], clinical relevance, and their availability in the datasets. Socio-demographic and socio-economic variables included age group, education level, working status, wealth status, marital status, parity, ethnicity, religion, residence, and region. Health and health status-related variables included HIV status, STI status, health insurance coverage, recent health facility visits, and contraceptive use. Lastly, lifestyle and media exposure-related variables included smoking status, radio listening frequency, TV watching frequency, newspaper or magazine reading frequency, and mobile phone ownership. The variables were coded the same for both DHS analyses, except where not applicable, such as the region, radio listening, TV watching, and newspaper or magazine reading frequency variables. Table 1 presents the operational definition of the explanatory variables.

Table 1
Summary of explanatory variables and their operational definition

Domain	Explanatory variable	Categories/Operational definition
Social-demographic and socio-economic factors	Age group	15–24, 25–29, 30–39, and 40–49
	Education level	No formal, primary, and secondary & higher
	Working status	**Malawi**: Not working, informal work, formal work, and other work **Zambia**: Not working, informal work, and formal work
	Wealth status	Poorest, poorer, middle, richer, and richest
	Marital status	Not in union and in union
	Parity	Nulliparous, 1 birth, 2 births, 3 births, and 4 + births
	Ethnicity (only applicable to **Malawi**)	Chewa, Tumbuka, Lomwe, Yao, Ngoni, other Malawi ethnicities, and other country ethnicities
	Religion	**Malawi**: Catholic, Protestant, other Christian, Muslim, and no & other religion **Zambia**: Christian, Muslim, and other
	Residence	Urban and rural
	Region	**Malawi**: Central, Northern, and Southern **Zambia**: Lusaka, Central, Copperbelt, Eastern, Luapula, Muchinga, Northern, North Western, Southern, and Western
Health and health status-related factors	HIV status	Positive, negative, and other (indeterminate/declined to answer/not received result)
	STI status	Negative and positive
	Health insurance coverage	Not covered and covered
	Recent health facility visits	No and yes
	Contraceptive use	None, traditional, and modern
Lifestyle and media exposure-related factors	Smoking status	Non-smoker and smoker
	Radio listening frequency	**Malawi**: Not at all, less than once a week, and at least once a week **Zambia**: Not at all, less than once a week, at least once a week, and almost every day
	Television (TV) watching frequency	**Malawi**: Not at all, less than once a week, and at least once a week **Zambia**: Not at all, less than once a week, at least once a week, and almost every day
	Newspaper or magazine reading frequency	**Malawi**: Not at all, less than once a week, and at least once a week **Zambia**: Not at all, less than once a week, at least once a week, and almost every day
	Mobile phone ownership	Do not own and own

Statistical analysis

All analyses were conducted using Stata version 17.0 (Stata Corporation, College Station, Texas), and data visualization was performed using R version 4.5.1. Frequencies and percentages were used to describe the sample characteristics, while weighted proportions and 95% confidence intervals (CIs) were used to estimate the cervical cancer screening prevalence. We performed weighted analyses using the "svy" command in Stata and applied the sample weights to account for the clustered sampling design. Moreover, univariable logistic regression analysis was used to assess the association between cervical cancer screening and each explanatory variable, yielding crude odds ratios (cOR) and 95% CIs. At a p-value of ≤ 0.25 in the univariable analyses, variables were considered for inclusion in the multivariable model, but some clinically relevant variables from previous studies were also included for adjustment, regardless of their p-values [36]. Before the predictor variables were included in the multivariable model, multicollinearity was assessed using the Variance Inflation Factors (VIF), and inverse VIF (1/VIF). Multivariable logistic regression analysis was performed, yielding adjusted odds ratios (aOR) and 95% CIs, which helped assess the association between the outcome variable and the explanatory variables. Statistical significance was evaluated at $p \leq 0.05$. Lastly, we performed the Archer–Lemeshow F-adjusted goodness-of-fit test to assess the goodness of fit of the multivariable logistic regression models.

We performed sensitivity analysis by fitting mixed effects multilevel logistic regression models, accounting for variation between clusters (Enumeration Areas). In the multilevel logistic regression analysis, two levels were accounted for, the first being individual level and the second community level. Subsequently, in both datasets, four sequential models were fitted; a null model excluding all variables, individual level variable model, community level factor model, and a full model combining individual and community-level variables. The interclass correlation coefficient (ICC) was used to assess the proportion of

variance in cervical cancer screening attributable to clustering, guiding multilevel logistic regression justification. Models' goodness of fit were assessed using the Akaike information criterion (AIC), Bayesian information criterion (BIC), and log likelihood ratio test (LRT).

Results

Sample Characteristics

We included 17,981 Malawian and 11,609 Zambian women after excluding those with missing data on any variables of interest. Most Malawian participants were aged 15–24 years (34.1%), primary level educated (61.5%), from the Chewa ethnic group (30.4%), rural dwellers (75.9%), HIV negative (92.1%), not covered by health insurance (98.8%), and non-smokers (99.3%). On the other hand, most of the Zambian participants were aged 15–24 (33.9%), informal workers (51.0%), Christians (99.3%), HIV negative (90.4%), not covered by health insurance (91.0%), and mobile phone owners (62.5%) (Table 2).

Table 2
Sample Characteristics

Variable	Malawi (N = 17,981)	Zambia (N = 11,609)
n (%) n (%)		
Age group	6,135 (34.1)	3,932 (33.9)
15–24	3,206 (17.8)	2,112 (18.2)
25–29	5,092 (28.3)	3,351 (28.9)
30–39	3,548 (19.7)	2,214 (19.1)
40–49		
Education level	1,175 (6.5)	799 (6.9)
No formal	11,060 (61.5)	4,763 (41.0)
Primary	5,746 (32.0)	6,047 (52.1)
Secondary & higher		
Working status	6,162 (34.3)	4,802 (41.4)
Not working	8,076 (44.9)	5,923 (51.0)
Informal work	2,188 (12.2)	884 (7.6)
Formal work	1,555 (8.7)	N/A
Other		
Wealth status	3,070 (17.1)	2,321 (20.0)
Poorest	2,995 (16.7)	2,297 (19.8)
Poorer	3,221 (17.9)	2,385 (20.5)
Middle	3,619 (20.1)	2,349 (20.2)
Richer	5,076 (28.2)	2,257 (19.4)
Richest		
Marital status	6,028 (33.5)	4,544 (39.1)
Not in union	11,953 (66.5)	7,065 (60.9)
In union		
Parity	2,260 (12.6)	1,868 (16.1)
Nulliparous	3,877 (21.6)	2,256 (19.4)
1 birth	3,382 (18.8)	1,798 (15.5)
2 births	2,577 (14.3)	1,578 (13.6)
3 births	5,885 (32.7)	4,109 (35.4)
4 + births		
Ethnicity	5,461 (30.4)	
Chewa	2,012 (11.2)	
Tumbuka	3,602 (20.0)	
Lomwe	1,894 (10.5)	
Yao	2,018 (11.2)	
Ngoni	2,936 (16.3)	
Other Malawi ethnicities	58 (0.3)	
Other country ethnicities		
N/A = Category not applicable in that country		

Variable	Malawi (N = 17,981)	Zambia (N = 11,609)
Religion (Malawi:)	2,525 (14.0)	11,531 (99.3)
Catholic	7,003 (39.0)	44 (0.4)
Protestant	6,249 (34.8)	34 (0.3)
Other Christian	2,094 (11.7)	
Muslim	110 (0.6)	
No & other religion		
Religion (Zambia):		
Christian		
Muslim		
Other		
Residence	4,328 (24.1)	5,136 (44.2)
Urban	13,653 (75.9)	6,473 (55.8)
Rural		
Region (Malawi):	5,585 (31.1)	1,480 (12.8)
Central	3,845 (21.4)	1,378 (11.9)
Northern	8,551 (47.6)	1,284 (11.1)
Southern		1,291 (11.1)
Region (Zambia):		1,007 (8.7)
Lusaka		822 (7.1)
Central		996 (8.6)
Copperbelt		947 (8.2)
Eastern		1,419 (12.2)
Luapula		985 (8.5)
Muchinga		
Northern		
North Western		
Southern		
Western		
HIV status	1,359 (7.6)	1,035 (8.9)
Positive	16,557 (92.1)	10,498 (90.4)
Negative	65 (0.4)	76 (0.7)
Other		
STI status	16,903 (94.0)	11,153 (96.1)
Negative	1,078 (6.0)	456 (3.9)
Positive		
Health insurance coverage	17,760 (98.8)	10,565 (91.0)
Not covered	221 (1.2)	1,044 (9.0)
Covered		
Recent health facility visits	5,247 (29.2)	2,559 (22.0)
No	12,734 (70.8)	9,050 (78.0)
Yes		
Contraceptive use	7,273 (40.5)	6,262 (53.9)
N/A = Category not applicable in that country		

Variable	Malawi (N = 17,981)	Zambia (N = 11,609)
None	373 (2.1)	375 (3.2)
Traditional	10,335 (57.5)	4,972 (42.8)
Modern		
Smoking status	17,854 (99.3)	11,478 (98.9)
Non-smokers	127 (0.7)	131 (1.1)
Smokers		
Radio listening frequency	10,695 (59.5)	6,812 (58.7)
Not at all	2,901 (16.1)	865 (7.5)
Less than once a week	4,385 (24.4)	2,040 (17.6)
At least once a week	N/A	1,892 (16.3)
Almost every day		
TV watching frequency	14,056 (78.2)	7,363 (63.4)
Not at all	1,504 (8.4)	440 (3.8)
Less than once a week	2,421 (13.5)	1,039 (9.0)
At least once a week	N/A	2,767 (23.8)
Almost every day		
Newspaper or magazine reading frequency	15,259 (84.9)	10,026 (86.4)
Not at all	1,640 (9.1)	626 (5.4)
Less than once a week	1,082 (6.0)	687 (5.9)
At least once a week	N/A	270 (2.3)
Almost every day		
Mobile phone ownership	9,253 (51.5)	4,357 (37.5)
Do not own	8,728 (48.5)	7,252 (62.5)
Own		
N/A = Category not applicable in that country		

Prevalence of Cervical Cancer Screening

The overall weighted prevalence of cervical cancer screening was 29.7% (95% CI: 28.6, 30.7) in Malawi and 31.6% (95% CI: 30.5, 32.8) in Zambia. Zambia's Western (38.6%) and Malawi's Southern (36.4%) regions had the highest screening prevalence (Fig. 2).

In Malawi, the prevalence of cervical cancer screening was highest among participants who were: aged 40–49 years (43.4%), in the richest wealth quintile (36.8%), from the Lomwe ethnic group (40.2%), urban dwellers (38.3%), HIV positive (71.5%), covered by health insurance (48.3%), and non-smokers (29.7%). The highest prevalence was among women: aged 40–49 years (47.1%), working formally (45.0%), with 3 births (40.5%), living in urban areas (38.1%), living with HIV (82.1%), covered by health insurance (48.1%), using modern contraceptives (35.0%), and owning mobile phones (36.5%) in Zambia (Table 3).

Table 3
Prevalence of cervical cancer screening

Variable	Malawi	Zambia
% [95% CI] % [95% CI]		
Age group	16.9 [15.8, 18.1]	15.4 [14.2, 16.8]
15–24	26.5 [24.7, 28.4]	28.8 [26.6, 31.1]
25–29	37.6 [35.8, 39.5]	41.9 [40.0, 43.9]
30–39	43.4 [41.1, 45.7]	47.1 [44.5, 49.6]
40–49		
Education level	29.4 [26.3, 32.7]	26.6 [22.7, 30.8]
No formal	29.3 [28.1, 30.5]	30.1 [28.4, 31.8]
Primary	30.6 [29.0, 32.2]	33.4 [31.9, 34.8]
Secondary & higher		
Working status	25.7 [24.3, 27.1]	25.8 [24.2, 27.4]
Not working	30.6 [29.2, 32.1]	34.2 [32.6, 35.9]
Informal work	35.9 [33.3, 38.5]	45.0 [41.2, 48.9]
Formal work	32.4 [29.4, 35.5]	N/A
Other		
Wealth status	23.5 [21.8, 25.4]	21.1 [19.2, 23.2]
Poorest	26.3 [24.5, 28.2]	24.8 [22.6, 27.1]
Poorer	28.5 [26.6, 30.5]	31.6 [29.2, 34.0]
Middle	32.2 [30.2, 34.3]	36.8 [34.1, 39.5]
Richer	36.8 [34.8, 38.8]	39.4 [37.3, 41.7]
Richest		
Marital status	27.4 [26.1, 28.8]	28.3 [26.8, 29.9]
Not in union	30.8 [29.5, 32.0]	33.8 [32.3, 35.4]
In union		
Parity	12.5 [10.8, 14.4]	14.3 [12.7, 16.1]
Nulliparous	21.2 [19.7, 22.8]	26.1 [24.0, 28.3]
1 birth	28.5 [26.7, 30.5]	33.7 [31.1, 36.5]
2 births	36.5 [34.1, 38.9]	40.5 [37.8, 43.2]
3 births	38.7 [37.0, 40.5]	38.9 [37.0, 40.8]
4 + births		
Ethnicity	23.8 [22.1, 25.6]	
Chewa	24.1 [21.4, 27.1]	
Tumbuka	40.2 [37.9, 42.4]	
Lomwe	27.5 [24.5, 30.7]	
Yao	30.6 [27.9, 33.5]	
Ngoni	33.6 [31.4, 35.9]	
Other Malawi ethnicities	18.8 [9.8, 33.1]	
Other country ethnicities		
Religion (Malawi):	29.0 [26.6, 31.4]	31.7 [30.5, 32.9]
Catholic	30.6 [29.1, 32.3]	16.6 [8.4, 30.2]
Protestant	30.2 [28.7, 31.8]	32.3 [18.0, 50.9]
N/A = Category not applicable in that country		

Variable	Malawi	Zambia
Other Christian	26.9 [24.1, 29.9]	
Muslim	23.0 [15.3, 32.9]	
No & other religion		
Religion (Zambia):		
Christian		
Muslim		
Other		
Residence	38.3 [36.2, 40.5]	38.1 [36.4, 39.8]
Urban	27.8 [26.7, 29.0]	24.9 [23.3, 26.5]
Rural		
Region (Malawi):	23.7 [22.1, 25.4]	37.3 [34.7, 40.1]
Central	24.3 [22.0, 26.8]	30.3 [27.3, 33.5]
Northern	36.4 [34.9, 38.0]	36.1 [32.1, 40.3]
Southern		26.0 [22.3, 30.0]
Region (Zambia):		25.4 [21.8, 29.3]
Lusaka		27.4 [23.7, 31.4]
Central		27.5 [24.1, 31.3]
Copperbelt		19.8 [16.4, 23.7]
Eastern		34.0 [31.1, 37.1]
Luapula		38.6 [34.3, 43.0]
Muchinga		
Northern		
North Western		
Southern		
Western		
HIV status	71.5 [68.3, 74.5]	82.1 [79.1, 84.7]
Positive	26.5 [25.5, 27.5]	26.5 [25.3, 27.6]
Negative	24.5 [14.6, 38.2]	33.8 [22.6, 47.1]
Other		
STI status	29.4 [28.3, 30.4]	31.5 [30.3, 32.6]
Negative	34.8 [31.3, 38.4]	36.5 [31.8, 41.6]
Positive		
Health insurance coverage	29.5 [28.4, 30.5]	29.8 [28.6, 31.0]
Not covered	48.3 [40.0, 56.7]	48.1 [44.8, 51.4]
Covered		
Recent health facility visits	26.7 [25.0, 28.4]	27.0 [24.8, 29.3]
No	31.0 [29.8, 32.2]	33.0 [31.7, 34.3]
Yes		
Contraceptive use	26.4 [25.0, 27.8]	29.1 [27.8, 30.4]
None	36.4 [30.2, 43.2]	29.7 [24.6, 35.3]
Traditional	31.7 [30.4, 33.0]	35.0 [33.3, 36.9]
Modern		
Smoking status	29.7 [28.7, 30.8]	31.6 [30.4, 32.7]
N/A = Category not applicable in that country		

Variable	Malawi	Zambia
Non-smokers	20.3 [13.3, 29.7]	39.1 [30.5, 48.5]
Smokers		
Radio listening frequency	28.8 [27.6, 30.1]	28.2 [26.8, 29.6]
Not at all	30.5 [28.6, 32.5]	38.1 [34.9, 41.4]
Less than once a week	31.2 [29.4, 33.1]	33.0 [30.6, 35.5]
At least once a week	N/A	38.8 [36.5, 41.2]
Almost every day		
TV watching frequency	28.5 [27.4, 29.6]	28.1 [26.6, 29.5]
Not at all	34.1 [30.9, 37.4]	30.9 [26.0, 36.3]
Less than once a week	35.5 [33.1, 37.9]	33.6 [30.5, 36.8]
At least once a week	N/A	38.9 [36.9, 41.0]
Almost every day		
Newspaper or magazine reading frequency	29.4 [28.3, 30.5]	31.0 [29.8, 32.3]
Not at all	32.0 [29.3, 34.7]	36.0 [32.0, 40.2]
Less than once a week	29.3 [26.2, 32.6]	35.2 [31.1, 39.5]
At least once a week	N/A	35.9 [29.7, 42.5]
Almost every day		
Mobile phone ownership	26.7 [25.4, 28.0]	22.5 [21.0, 24.1]
Do not own	33.2 [31.8, 34.6]	36.5 [35.1, 37.9]
Own		
N/A = Category not applicable in that country		

Factors Associated with Cervical Cancer Screening

In Malawi, women aged 40–49 years and those with secondary and higher education had 2.31 times (aOR: 2.31, 95% CI: 1.89, 2.82) and 41% (aOR: 1.41, 95% CI: 1.16, 1.71) higher odds of cervical cancer screening compared to those aged 15–24 and with no formal education, respectively. Compared to women in the poorest wealth quintile and nulliparous, women in the richest wealth quintile and with 4 + births had 52% (aOR: 1.52, 95% CI: 1.26, 1.84) and 2.66 times (aOR: 2.66, 95% CI: 2.05, 3.47) increased screening odds of screening. The likelihood of screening for cervical cancer increased by 25% (aOR: 1.25, 95% CI: 1.06, 1.48) and 84% (aOR: 1.84, 95% CI: 1.60, 2.12) among women from the Lomwe ethnic group and those residing in the Southern region, vis-à-vis Chewa and Central region women. Health insurance coverage and visiting a health facility in the last 12 months increased the screening chances by 73% (aOR: 1.73, 95% CI: 1.17, 2.55) and 24% (aOR: 1.24, 95% CI: 1.11, 1.37), compared to the lack of health insurance coverage and failure to visit a health facility in the last 12 months. Modern contraceptive users and women watching TV less than once a week were 14% (aOR: 1.14, 95% CI: 1.03, 1.25) and 23% (aOR: 1.23, 95% CI: 1.03, 1.47) more likely to screen for cervical cancer as opposed to contraceptive non users and women not watching TV, respectively. In comparison to non-readers, newspaper or magazine readers doing so less than once a week had 17% (aOR: 1.17, 95% CI: 1.00, 1.36) increased odds of screening. On the contrary, rural dwellers, HIV negative women, and smokers were 30% (aOR: 0.70, 95% CI: 0.60, 0.82), 80% (aOR: 0.20, 95% CI: 0.17, 0.24), and 57% (aOR: 0.43, 95% CI: 0.25, 0.72) less likely to screen for cervical cancer compared to urban dwellers, WLHIV, and non-smokers, respectively (Table 4).

In Zambia, the odds of cervical cancer screening increased by 2.62 times (aOR: 2.62, 95% CI: 2.11, 3.26) and 23% (aOR: 1.23, 95% CI: 1.01, 1.49) among women aged 40–49 years and having formal work relative to those aged 15–24 and not working, respectively. Compared to women in the poorest wealth quintile and the nulliparous, those in the richest wealth quintile and para 3 had 42% (aOR: 1.42, 95% CI: 1.05, 1.93) and 2.42 times (aOR: 2.42, 95% CI: 1.90, 3.07) higher odds of screening. Residing in the Western region and being covered by health insurance increased the screening likelihood by 78% (aOR: 1.78, 95% CI: 1.35, 2.34) and 54% (aOR: 1.54, 95% CI: 1.30, 1.83) compared to residing in Lusaka and not being covered by health insurance. Women having a health facility visit in the last 12 months and using modern contraceptives had 17% (aOR: 1.17, 95% CI: 1.02, 1.34) and 18% (aOR: 1.18, 95% CI: 1.06, 1.31) higher screening odds relative to those not visiting health a facility recently and not using contraceptives. Relative to radio non-listeners and mobile phone non-owners, women who listened to radio almost every day and owned mobile phones were 28% (aOR: 1.28, 95% CI: 1.13, 1.46) and 24% (aOR: 1.24, 95% CI: 1.10, 1.40) more likely to screen for cervical cancer. Conversely, versus Christians, urban dwellers, and WLHIV, Muslims, rural dwellers, and HIV negative women had 66% (aOR: 0.34, 95% CI: 0.14, 0.82), 28% (aOR: 0.72, 95% CI: 0.60, 0.85), and 89% (aOR: 0.11, 95% CI: 0.09, 0.13) decreased odds of cervical cancer screening, respectively (Table 4).

Table 4
Factors associated with cervical cancer screening

Variable	Malawi		Zambia	
	Bivariate	Multivariable	Bivariate	Multivariable
	cOR [95% CI]	aOR [95% CI]	cOR [95% CI]	aOR [95% CI]
Age group				
15–24	Ref	Ref	Ref	Ref
25–29	1.77 [1.58, 1.98] ***	1.27 [1.11, 1.46] **	2.21 [1.94, 2.52] ***	1.47 [1.26, 1.71] ***
30–39	2.96 [2.66, 3.29] ***	1.86 [1.57, 2.20] ***	3.95 [3.51, 4.45] ***	2.23 [1.86, 2.68] ***
40–49	3.76 [3.35, 4.22] ***	2.31 [1.89, 2.82] ***	4.87 [4.24, 5.59] ***	2.62 [2.11, 3.26] ***
Education level				
No formal	Ref	Ref	Ref	Ref
Primary	1.00 [0.86, 1.16]	1.39 [1.18, 1.65] ***	1.19 [0.96, 1.47]	1.15 [0.92, 1.45]
Secondary & higher	1.06 [0.90, 1.25]	1.41 [1.16, 1.71] ***	1.38 [1.11, 1.72] **	1.18 [0.92, 1.51]
Working status				
Not working	Ref	Ref	Ref	Ref
Informal work	1.28 [1.17, 1.40] ***	1.06 [0.95, 1.17]	1.50 [1.35, 1.67] ***	1.05 [0.94, 1.18]
Formal work	1.62 [1.42, 1.84] ***	1.13 [0.97, 1.31]	2.36 [1.98, 2.81] ***	1.23 [1.01, 1.49] *
Other	1.39 [1.19, 1.61] ***	1.15 [0.98, 1.36]	N/A	N/A
Wealth status				
Poorest	Ref	Ref	Ref	Ref
Poorer	1.16 [1.02, 1.31] *	1.08 [0.94, 1.24]	1.23 [1.05, 1.44] **	1.13 [0.95, 1.34]
Middle	1.29 [1.13, 1.48] ***	1.15 [0.99, 1.33]	1.72 [1.47, 2.02] ***	1.38 [1.14, 1.67] **
Richer	1.55 [1.36, 1.76] ***	1.39 [1.20, 1.60] ***	2.17 [1.83, 2.57] ***	1.42 [1.10, 1.82] **
Richest	1.89 [1.66, 2.15] ***	1.52 [1.26, 1.84] ***	2.43 [2.09, 2.83] ***	1.42 [1.05, 1.93] *
Marital status				
Not in union	Ref	Ref	Ref	Ref
In union	1.18 [1.08, 1.28] ***	1.02 [0.93, 1.12]	1.29 [1.18, 1.42] ***	0.95 [0.84, 1.08]
Parity				
Nulliparous	Ref	Ref	Ref	Ref
1 birth	1.89 [1.55, 2.30] ***	2.16 [1.75, 2.65] ***	2.12 [1.77, 2.53] ***	2.10 [1.72, 2.56] ***
2 births	2.80 [2.33, 3.35] ***	2.44 [1.97, 3.02] ***	3.05 [2.52, 3.68] ***	2.36 [1.88, 2.96] ***
3 births	4.02 [3.34, 4.83] ***	2.82 [2.21, 3.59] ***	4.07 [3.40, 4.88] ***	2.42 [1.90, 3.07] ***
4 + births	4.43 [3.71, 5.29] ***	2.66 [2.05, 3.47] ***	3.81 [3.23, 4.49] ***	2.14 [1.67, 2.74] ***
Ethnicity (Malawi only – not collected in Zambia DHS)				
Chewa	Ref	Ref	N/A	N/A
Tumbuka	1.02 [0.85, 1.22]	0.93 [0.74, 1.16]	N/A	N/A
Lomwe	2.15 [1.88, 2.45] ***	1.25 [1.06, 1.48] **	N/A	N/A
Yao	1.21 [1.01, 1.45] *	0.79 [0.64, 0.98] *	N/A	N/A
Ngoni	1.41 [1.21, 1.65] ***	1.06 [0.91, 1.24]	N/A	N/A
Other Malawi ethnicities	1.62 [1.41, 1.86] ***	1.08 [0.91, 1.28]	N/A	N/A
Other country ethnicities	0.74 [0.35, 1.59]	0.53 [0.25, 1.13]	N/A	N/A
Religion – Malawi (Catholic = ref)				

Ref = Reference category | N/A = Category not applicable / not collected in that country's DHS | * p < 0.05, ** p < 0.01, *** p < 0.001

Variable	Malawi		Zambia	
	Bivariate	Multivariable	Bivariate	Multivariable
	cOR [95% CI]	aOR [95% CI]	cOR [95% CI]	aOR [95% CI]
Catholic	Ref	Ref		
Protestant	1.08 [0.94, 1.24]	1.05 [0.90, 1.21]		
Other Christian	1.06 [0.93, 1.21]	1.08 [0.94, 1.25]		
Muslim	0.90 [0.75, 1.09]	0.98 [0.80, 1.21]		
No & other religion	0.73 [0.44, 1.22]	0.82 [0.46, 1.49]		
Religion – Zambia (Christian = ref)				
Christian			Ref	Ref
Muslim			0.43 [0.20, 0.93] *	0.34 [0.14, 0.82] *
Other			1.03 [0.47, 2.23]	1.31 [0.58, 2.95]
Residence				
Urban	Ref	Ref	Ref	Ref
Rural	0.62 [0.56, 0.69] ***	0.70 [0.60, 0.82] ***	0.54 [0.48, 0.60] ***	0.72 [0.60, 0.85] ***
Region – Malawi (Central = ref)				
Central	Ref	Ref		
Northern	1.04 [0.88, 1.22]	0.97 [0.78, 1.19]		
Southern	1.85 [1.65, 2.07] ***	1.84 [1.60, 2.12] ***		
Region – Zambia (Lusaka = ref)				
Lusaka			Ref	Ref
Central			0.73 [0.61, 0.88] **	1.00 [0.81, 1.23]
Copperbelt			0.95 [0.77, 1.17]	1.03 [0.80, 1.33]
Eastern			0.59 [0.47, 0.74] ***	1.10 [0.84, 1.45]
Luapula			0.57 [0.45, 0.72] ***	0.95 [0.72, 1.26]
Muchinga			0.63 [0.50, 0.79] ***	1.13 [0.88, 1.46]
Northern			0.64 [0.51, 0.79] ***	1.28 [1.01, 1.64] *
Northwestern			0.41 [0.32, 0.54] ***	0.66 [0.50, 0.87] **
Southern			0.86 [0.72, 1.03]	1.33 [1.08, 1.63] **
Western			1.05 [0.85, 1.31]	1.78 [1.35, 2.34] ***
HIV status				
Positive	Ref	Ref	Ref	Ref
Negative	0.14 [0.12, 0.17] ***	0.20 [0.17, 0.24] ***	0.08 [0.07, 0.09] ***	0.11 [0.09, 0.13] ***
Other	0.13 [0.07, 0.25] ***	0.16 [0.08, 0.34] ***	0.11 [0.06, 0.20] ***	0.15 [0.09, 0.27] ***
STI status				
Negative	Ref	Ref	Ref	Ref
Positive	1.28 [1.09, 1.51] **	1.10 [0.92, 1.32]	1.25 [1.02, 1.55] *	1.16 [0.91, 1.47]
Health insurance coverage				
Not covered	Ref	Ref	Ref	Ref
Covered	2.24 [1.60, 3.13] ***	1.73 [1.17, 2.55] **	2.18 [1.90, 2.51] ***	1.54 [1.30, 1.83] ***
Recent health facility visits				
No	Ref	Ref	Ref	Ref
Ref = Reference category | N/A = Category not applicable / not collected in that country's DHS | * p < 0.05, ** p < 0.01, *** p < 0.001				

Variable	Malawi		Zambia	
	Bivariate	Multivariable	Bivariate	Multivariable
	cOR [95% CI]	aOR [95% CI]	cOR [95% CI]	aOR [95% CI]
Yes	1.24 [1.12, 1.37] ***	1.24 [1.11, 1.37] ***	1.33 [1.18, 1.51] ***	1.17 [1.02, 1.34] *
Contraceptive use				
None	Ref	Ref	Ref	Ref
Traditional	1.60 [1.21, 2.11] **	1.11 [0.83, 1.49]	1.03 [0.79, 1.33]	0.84 [0.65, 1.10]
Modern	1.29 [1.19, 1.41] ***	1.14 [1.03, 1.25] **	1.32 [1.20, 1.44] ***	1.18 [1.06, 1.31] **
Smoking status				
Non-smokers	Ref	Ref	Ref	Ref
Smokers	0.60 [0.36, 1.00] *	0.43 [0.25, 0.72] **	1.39 [0.95, 2.04]	1.11 [0.75, 1.65]
Radio listening frequency				
Not at all	Ref	Ref	Ref	Ref
Less than once a week	1.08 [0.98, 1.20]	0.98 [0.87, 1.11]	1.56 [1.34, 1.82] ***	1.26 [1.05, 1.50] *
At least once a week	1.12 [1.01, 1.24] *	0.93 [0.83, 1.04]	1.25 [1.11, 1.41] ***	1.09 [0.96, 1.25]
Almost every day	N/A	N/A	1.62 [1.44, 1.82] ***	1.28 [1.13, 1.46] ***
TV watching frequency				
Not at all	Ref	Ref	Ref	Ref
Less than once a week	1.30 [1.12, 1.51] **	1.23 [1.03, 1.47] *	1.15 [0.89, 1.47]	0.96 [0.71, 1.29]
At least once a week	1.38 [1.24, 1.54] ***	1.14 [0.98, 1.34]	1.30 [1.11, 1.52] **	0.99 [0.82, 1.20]
Almost every day	N/A	N/A	1.63 [1.46, 1.82] ***	1.02 [0.87, 1.19]
Newspaper or magazine reading frequency				
Not at all	Ref	Ref	Ref	Ref
Less than once a week	1.13 [0.98, 1.29]	1.17 [1.00, 1.36] *	1.25 [1.04, 1.51] *	1.08 [0.88, 1.34]
At least once a week	1.00 [0.85, 1.16]	1.03 [0.86, 1.24]	1.21 [1.00, 1.46] *	1.09 [0.88, 1.35]
Almost every day	N/A	N/A	1.24 [0.93, 1.66]	1.09 [0.79, 1.49]
Mobile phone ownership				
Do not own	Ref	Ref	Ref	Ref
Own	1.37 [1.26, 1.48] ***	1.02 [0.93, 1.12]	1.98 [1.79, 2.18] ***	1.24 [1.10, 1.40] ***
Ref = Reference category | N/A = Category not applicable / not collected in that country's DHS | * p < 0.05, ** p < 0.01, *** p < 0.001				

Model Diagnostics

The mean VIFs for the Malawi and Zambia analyses were 1.41 and 1.55, respectively, indicating no high multicollinearity among the independent variables of either analysis [37] (Supplementary Table 1, Supplementary Table 2). Besides, in both analyses, model 3 (full model) had Archer–Lemeshow F-adjusted goodness-of-fit test p-values of 0.7836 (Malawi) and 0.7970 (Zambia), indicating the full models fitted the data well [38].

Sensitivity Analysis

Similar to the multivariable logistic regression analysis, the full models in both countries were the best models in the mixed-effects multilevel logistic regression analysis. Besides, the results of the multilevel logistic regression analysis were consistent with those obtained in the standard multivariable logistic regression analysis. The ICC of Malawi's null model was 8.85%, while that of Zambia's null model was 10.47%. Malawi's ICC being less than 10% meant there was a good but not excellent between-cluster variation in cervical cancer screening, implying that most of the variation in the outcome variable was within-cluster [39] (Supplementary Table 3, Supplementary Table 4).

Discussion

This study explored the prevalence and factors associated with cervical cancer screening among women aged 15–49 years in Malawi and Zambia. The estimated overall prevalence of cervical cancer screening prevalence was 29.7% in Malawi and 31.6% in Zambia. The screening prevalence in both countries was slightly lower than the global prevalence of 36% for women aged 30–49 and higher than the African regional prevalence of up to 19% for eligible women

[11–13]. The estimated prevalence is also higher than the cervical cancer screening prevalence in other African countries, such as Côte d'Ivoire (7.7%) and Tanzania (7%) [21,22]. The higher prevalence of cervical cancer screening in Malawi and Zambia than in most other African countries could be explained by targeted national cervical cancer control programs and non-government organizations (NGOs) efforts in response to the high disease burden in the two countries [40]. Those programs and efforts are geared toward cervical cancer elimination and have a special focus on cervical cancer screening and treatment, driving a relatively higher screening prevalence in the two countries [40].

The likelihood of cervical cancer screening in both countries increased down the age groups, with higher age groups highly likely to screen compared to women aged 15–24 years. Previous studies in similar settings had similar findings [22,23,25,26]. Women in higher age groups feel more at risk of cervical cancer than those in lower age groups, prompting them to seek screening services [22,23]. Additionally, women in higher age groups may have greater financial capacity to pay for screening services than those in the lower age groups [22,23,26]. In Malawi, there was a positive association between cervical cancer screening and education level. Educated women were more likely to screen for cervical cancer than those without formal education, consistent with previous LMICs studies [21–26]. Education exposes women to more income-generating opportunities and a better understanding of risk factors, benefits of early screening, and dangers of late or no screening, which those not formally educated miss out on [21,22]. Therefore, educated women tend to be more open to screening for cervical cancer than those without education.

Our study found that formally working women in Zambia had increased odds of cervical cancer screening compared to those not working. Previous studies in Tanzania [22,26] and Kenya [23,25] had corresponding findings. Formal employment earns women income they can use to cover transport costs, service fees, and health insurance premiums that enable cervical cancer screening [23,25]. Increasing wealth status was found to increase the chances of cervical cancer screening compared to being in the poorest wealth quintile. Women in the richer and the richest wealth quintiles in Malawi, as well as those in the middle, richer, and richest quintiles in Zambia had increased cervical cancer screening odds, consistent with previous African studies [21–26]. Higher socio-economic status enables women to afford covering the financial costs of cervical cancer screening, unlike low wealth status [22,23]. In both countries, health insurance coverage was found to be promotive of cervical cancer screening compared to not being covered. Previous studies in SSA reported increased odds of cervical cancer screening with health insurance coverage [21,22,24,25]. Having health insurance coverage offers financial risk protection, including payment of screening fees, enhancing screening uptake [21,26].

Women with high parity in both countries had increased odds of cervical cancer screening compared to nulliparous women. Previous studies in Tanzania and Kenya found that multiparous women are more likely to screen for cervical cancer than nulliparous ones [22,23]. Multiparous women, having many contacts with healthcare workers during previous hospital visits, such as antenatal and other follow-up visits, are more likely to receive health education on the need to screen for cervical cancer [23]. In both Malawi and Zambia, visiting a health facility in the last 12 months was associated with higher chances of cervical cancer screening than not, a finding consistent with previous African studies [21,23–26]. Women who visit health facilities frequently gain enhanced health literacy on cervical cancer screening from healthcare workers, a benefit that those who rarely visit health facilities are likely to miss [21,26].

Women living in Malawi's Southern region had a higher likelihood of cervical cancer screening than those living in the Central region. The regional variation in screening could also explain ethnic disparities that we found, where women from the Lomwe and Yao ethnic groups had an increased probability of screening for cervical cancer relative to Chewa women. Most Yao and Lomwe women reside in Malawi's Southern region [41]. The Southern region has the highest HIV/AIDS prevalence, and consequently, a higher concentration of NGOs offering integrated HIV treatment and cervical cancer screening services, driving the higher likelihood of screening [42]. In Zambia, however, women residing in the Northern, Southern, and Western regions had increased chances, with those from the North Western region having reduced chances of screening for cervical cancer, in contrast to those living in Lusaka. The Northern, Southern, and Western regions have among the highest fertility rates, with Lusaka having the lowest rates [43]. Therefore, the women living in the former regions have higher parities and consequently, a higher likelihood of health education on cervical cancer screening during birth-related hospital visits than Lusaka's [23]. However, the North Western region has the lowest proportion of employed persons, suggesting that financial barriers to cervical cancer screening could be resulting in the lower screening odds [44]. Rural-dwelling women in both countries had a decreased possibility of screening for cervical cancer relative to urban-living women. Previous studies in Tanzania found rural dwellers to be less likely to screen for cervical cancer vis-à-vis urban dwellers [22,26]. Rural areas have limited access to health services, including cervical cancer screening, and rural dwellers tend to be less educated and health literate, inclining toward cultural beliefs that possibly discourage screening [26].

In both countries, HIV negative women had reduced cervical cancer screening chances compared to WLHIV. Previous studies in Tanzania and Kenya found HIV negative women to have less cervical cancer screening possibility compared to those who tested positive [22,23]. Education offered by healthcare workers during multiple hospital visits WLHIV make for check-ups and drug refills enlightens them on their higher risk of cervical cancer, increasing their screening uptake than HIV negative women [22]. Additionally, WHO recommends a lower age starting at 25 years and an increased frequency of every 3–5 years for cervical cancer screening of WLHIV, compared to women in the general population's recommended screening starting age of 30 years and frequency of every 5–10 years [8], promoting enhanced screening uptake among WLHIV. The odds of cervical cancer screening increased by 14% in Malawi and 18% in Zambia among modern contraceptive users compared to non-users. A study conducted in Kenya found women using modern contraceptives to have increased cervical cancer screening chances compared to women using no contraceptives [23]. Women using modern contraceptives have a higher likelihood of more hospital visits, translating into a higher probability of health education from healthcare workers that promotes screening [23]. Besides, modern contraceptives like intrauterine devices (IUDs) are associated with more opportunities for cervical cancer screening because the cervix is accessible during insertion and removal, increasing the screening odds [45].

In Zambia, religious disparities in cervical cancer screening were noted, with Muslim women showing decreased odds of screening relative to Christian women. The pattern could be attributed to the staunch modesty and privacy of Islamic women, which does not liberally allow the invasive nature of cervical cancer screening, especially by male healthcare workers [24]. In Malawi, smokers had reduced chances of cervical cancer screening compared to non-smokers. A study conducted in Tanzania found smokers to have higher cervical cancer screening odds than non-smokers, citing smokers' heightened risk perception of cervical cancer that drives screening, findings which contrasted ours [22]. The rare findings in our study could be attributed to smokers' fatalistic attitudes toward their health, lack of awareness, and lower perceived risk of cervical cancer in some settings [46].

Women who watched TV and read newspapers or magazines in Malawi were more likely to have cervical cancer screening than those who did not watch TV or read newspapers or magazines, respectively. In Zambia, radio listening and mobile phone ownership were found to increase the odds of cervical cancer screening compared to not listening to the radio and not owning a mobile phone. Previous studies in Tanzania [22], Kenya [23], and Ghana [24] found that exposure to media, such as TV, radio, newspapers, magazines, and mobile phones, increased the chances of cervical cancer screening. Enhanced cervical cancer awareness and sensitization through various media explains the increased screening odds [23,24].

Strengths and Limitations

Our study used the 2024 Malawi and Zambia DHS data, which are nationally representative, making our findings generalisable. Besides, we not only included all women eligible for cervical cancer screening, but also those of lower ages between 15 and 24 years. However, the study had several limitations. First, the cross-sectional design of the study limits causal inference. Second, the variable used to construct the outcome variable was self-reported, making it prone to recall bias that could lead to over- or under-reporting. Finally, the final sample size was reduced due to missing data on some variables of interest. Nevertheless, this study provides valuable insights regarding the uptake of cervical cancer screening in both countries, using the latest nationally representative dataset.

Policy Implications and Recommendations

Our study found a relatively low prevalence of cervical cancer screening in both Malawi and Zambia, compared to set targets and considering the high burden of the disease. It also unearthed several determinants associated with such prevalence, spanning across socio-demographic, socio-economic, health, health status, lifestyle, and media exposure themes. The findings call for improved cervical cancer awareness, especially targeting younger, Malawi's Chewa, Muslim, rural, Malawi's North western region, and smoking women. Cervical cancer screening awareness creation should be intensified in media such as radio, television, newspapers, magazines, and short message service (SMS). Our study's findings also call for women's economic empowerment in terms of education and employment opportunities. Lastly, improved healthcare systems are critical. Given that Zambia has a national health insurance scheme, it should ensure the inclusion of terms that favour women, especially those of low socio-economic status, while Malawi, which has none yet, should consider including such terms while developing one in future. The findings also highlight the need to integrate HIV treatment and contraceptive services with cervical cancer screening services to enhance screening of vulnerable women. Such integration can help reduce missed opportunities for screening by leveraging routine points of contact with women who are already accessing reproductive healthcare, resulting in improved screening coverage, streamlined service delivery, and increased early detection of precancerous lesions among women at elevated risk. To increase the chances of screening associated with contact with the healthcare workers, community outreach programs are essential, especially in rural areas and Malawi's Central and Zambia's North western regions. During such programs, healthcare workers can educate the community regarding cervical cancer, the benefits of regular screening, the risks of not screening, and possibly conduct cervical cancer screening, which would greatly enhance screening uptake and coverage.

Conclusion

Only slightly above a quarter of Malawian and Zambian women have been screened for cervical cancer. Associated factors also reveal concerning trends, unearthing systemic failures in awareness and health system infrastructure. Targeted interventions addressing these broader areas are needed to hasten cervical cancer screening and slow the morbidity and mortality linked to cervical cancer. The policymakers, governmental actors, non-governmental actors, healthcare workers, and communities in both countries need to act swiftly by addressing the gaps in awareness and the health system, and effectively addressing the identified determinants of the comparatively low cervical cancer screening.

Abbreviations

1/VIF
Inverse VIF
AIC
Akaike Information Criterion
aOR
Adjusted Odds Ratio
BIC
Bayesian Information Criterion
CCPPZ
Cervical Cancer Prevention Program in Zambia
CECAP
Cervical Cancer Control Program
CI

Confidence Interval
cOR
Crude Odds Ratio
DHS
Demographic Health Survey
EAs
Enumeration Areas
HIV
Human Immunodeficiency Virus
HPV
Human Papillomavirus
ICC
Interclass Correlation Coefficient
IR
Individual Recode
IUDs
Intrauterine Devices
LLRT
Log-likelihood Ratio Test
LMICs
Low- and Middle-Income Countries
MLA
Multi-level Analysis
N/A
Not Applicable
NGOs
Non-government Organizations
SMS
Short Message Service
STI
Sexually Transmitted Infection
TV
Television
VIA
Visual Inspection with Acetic Acid
VIF
Variance Inflation Factors
WHO
World Health Organization
WLWH
Women Living with HIV

Declarations

Ethical Approval and participation consent

The 2024 Malawi and Zambia DHS data are publicly available. As such, ethical approval for this study was not sought. Instead, a project proposal was submitted to the DHS program, which then granted permission to download and use the Individual Recode (IR) datasets for both countries. No individual or household names or addresses were either in the dataset or used during the study.

Consent for Publication

Not applicable

Availability of Data and Materials

Data used in this study can be accessed from the DHS Program website at https://dhsprogram.com/data/available-datasets.cfm

Competing Interests

We declare no competing interests.

Funding

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Authors' Contributions

JOO and CA conceived the study. LN, CN, DNK, CMM, NMN, IM, CA, and JOO supervised the study under the Kuza Mentorship Program. DMM analysed the data with inputs from NAO, LN, CN, DNK, CMM, NMN, IM, CA, and JOO. DMM wrote the first draft of the manuscript, which was subsequently revised by NAO, LN, CN, DNK, CMM, NMN, IM, CA, and JOO. All the authors critically read and reviewed the manuscript, after which DMM incorporated the suggestions and corrections. All the authors approved the final manuscript for publication.

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Figures

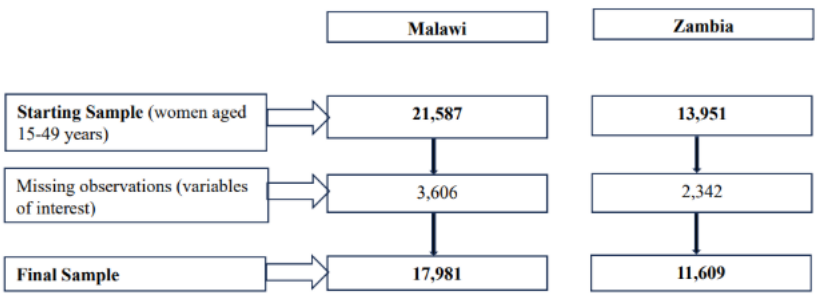


Figure 1

Sample flow chart

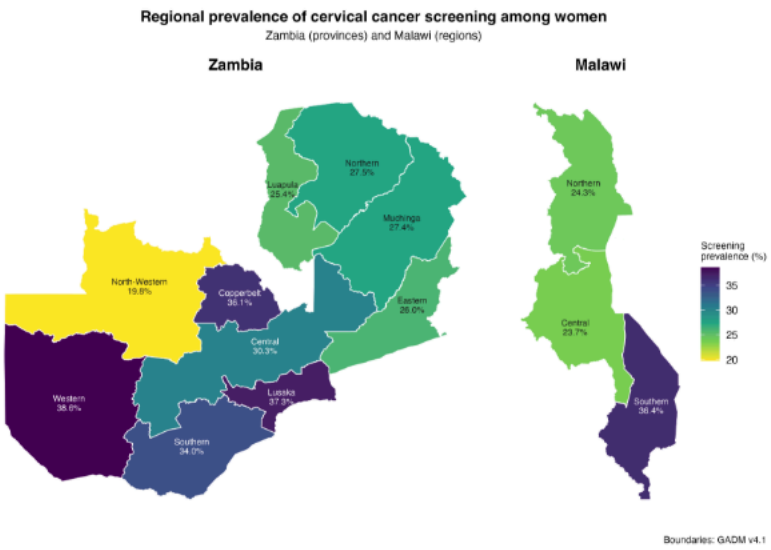


Figure 2

Regional cervical cancer screening prevalence

Supplementary Files

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- SupplementaryMaterial.pdf