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Research

Spatial pattern and decomposition analysis of the place of residence and sexual violence among women with disabilities in sub-Saharan Africa

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Abstract

Background Sexual violence against women is highly pervasive worldwide and remains a major public health concern. Despite the global efforts to eliminate all forms of violence against women, recent estimates revealed that approximately 1 in 3 women have experienced physical or sexual violence in their lifetime, and women with disabilities have the greatest risk of sexual violence, particularly in Africa. Thus, this study investigates the spatial pattern and decomposition analysis of the place of residence and sexual violence among women with disabilities in sub-Saharan Africa.

Methods We used the most recent secondary data from demographic health surveys, including a disability module, conducted between 2013 and 2022 in 10 sub-Saharan African countries. The study sample comprised 16,517 women with disabilities. Spatial analysis was applied to identify patterns of sexual violence, and a multivariable Blinder-Oaxaca decomposition regression analysis was used to explore the disparities between place of residence and sexual violence. The analysis took into consideration the complex survey design, with results reported in terms of percentages and adjusted coefficients.

Results The spatial pattern of sexual violence among women with disabilities varies significantly across the sub-Saharan African countries included in the study, with prevalence rates ranging from 10 to 80%. The Democratic Republic of Congo reported the highest prevalence at 23%, while Mauritania reported 2%. No cases of sexual violence were reported in Nigeria and Chad. The analysis shows that the majority of the disparity in sexual violence (72.81%) is due to differences in characteristics, with 27.19% attributed to differences in coefficients. Overall, 79.77% of women with disabilities residing in rural areas reported experiencing sexual violence. Finally, the multivariable logistics regression shows that women with disabilities who were exposed to mass media exposure were associated with lower odds of experiencing sexual violence in urban areas [aOR = 0.69*; 95%(CI 0.49–0.97), $p < 0.05$] but with higher odds in rural areas [aOR = 1.26**; 95%(CI 1.08–1.47), $p < 0.01$].

Conclusions and recommendations The study reveals that women with disabilities in sub-Saharan Africa are vulnerable to sexual violence in both rural and urban areas, with a particularly high prevalence in rural regions. These findings are crucial for guiding the design and implementation of targeted interventions to combat sexual violence in the region.

Keywords Spatial pattern · Decomposition analysis · Place of residence · Sexual violence · Women with disabilities · Sub-Saharan Africa

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Abbreviations

SSA	Sub-Saharan Africa
DHS	Demographic health survey
HIV/AIDS	Human immunodeficiency virus / acquired immunodeficiency syndrome
INLA	Integrated nested laplace approximation
SDG	Sustainable development goals
WHO	World health organisation

1 Background

Sexual violence against women is highly pervasive worldwide and remains a major problem of public health concern [1], despite the global efforts to eliminate all forms of violence against women as enshrined in the Sustainable Development Goals (SDG), target 5.2 [2]. Recent estimates revealed that approximately 1 in 3 women have experienced physical or sexual violence in their lifetime [3], and women with disabilities have the greatest risk of sexual violence, particularly in sub-Saharan Africa (SSA) [4]. Aside from being a major human rights violation [1, 5], sexual violence predisposes women to various physical, psychological, sexual and reproductive health problems [6, 7] and thereby contributes to an increased burden of diseases and poor health outcomes among women with disabilities.

The World Health Organization [8] defines sexual violence as “any sexual act, attempt to obtain a sexual act, or other act directed against a person’s sexuality using coercion, by any person regardless of their relationship to the victim, in any setting”. Acts of sexual violence include rape, attempted rape, unwanted sexual touching and other non-contact sexual behaviours [8]. Sexual violence is predominantly targeted at women, most often by male intimate partners and non-intimate partners [9], affecting about 30% of women aged 15 years or above [3]. Whilst most women are at risk of sexual violence, those with disabilities are more vulnerable due to various physical, psychological, social, cultural and economic predispositions [5, 10, 11]. For instance, women with disabilities are more likely to rely on their partners, relatives, friends and other close acquaintances for financial support and assistance in activity performance, which exposes them to the risk of sexual violence [12, 13]. Limitations such as the inability to hear, see, communicate, understand or follow instructions [14], social isolation [15], limited capacity to consent or withdraw previous consent to sexual activity [16], lack of sexual education [17], and limited self-defence skills [18] also increase the risk of sexual violence among women with disabilities. Further, certain socio-cultural practices and myths, such as the belief that HIV/AIDS can be cured through sexual intercourse with a virgin, predispose women with disabilities to sexual violence since they are often presumed to be asexual and thus virgins [19, 20].

Sexual violence against women with disabilities has serious physical, psychological, sexual and reproductive health consequences for victims [6]. For example, the high prevalence of HIV infections among women with disabilities relative to those without disabilities in many countries in SSA has been associated with a higher rate of sexual violence against women with disabilities [4, 11, 21]. Also, when exposed to sexual violence, women with disabilities experience greater psychological health problems than those without disabilities [22]. Meanwhile, most cases of sexual violence against women are often not reported due to inadequate reporting systems, shame, fear of retaliation, victim blaming, mistreatment or fear of being socially ostracised [9]. The challenge of reporting becomes even more dire among women with disabilities due to their limited ability to communicate [14], high dependence on others, social prejudice and marginalisation [6]. For instance, sexual violence complaints from women with disabilities are often not taken seriously or are deemed to be absurd by institutions and individuals, including the judiciary, law enforcement agencies, healthcare workers, and teachers, among others [23].

Other factors linked with underreported sexual violence among women with disabilities in SSA could be due to systemic barriers within legal, healthcare, and community structures [23]. Many survivors face dismissal from law enforcement and judicial systems, while inadequate healthcare facilities fail to provide accessible support [14]. Social stigma, fear of retaliation, and victim-blaming further discourage reporting, especially for those with limited communication abilities or reliance on caregivers [14, 23]. Nevertheless, despite the human rights violations [5] and adverse health outcomes [6] associated with sexual violence against women with disabilities, the phenomenon remains largely understudied [24], particularly in SSA [4, 25]. Although previous studies in SSA investigated the impact of individual characteristics such as age, gender, wealth, and education on the risk of sexual violence among women [26–28], the influence of place of residence (rural versus urban) disparity on sexual violence remains barely studied. Whilst Tenaw et al. [29] reported that rural residency increases the risk of sexual violence among women with disabilities, the study was limited to a small

geographic area in Ethiopia. Thus, there is limited evidence on the influence of rural–urban residency on the risk of sexual violence among women with disabilities, particularly from a multi-country perspective. Therefore, investigating the spatial pattern and influence of place of residence on sexual violence among women with disabilities could provide reliable evidence which could be useful in designing and implementing gender evidence-based interventions and policies to effectively address the problem of sexual violence among women with disabilities in SSA.

2 Data and methods

2.1 Study design and participants

This study utilised the latest standardised data from the Demographic Health Survey (DHS) conducted in ten sub-Saharan African nations. The DHS is a national survey conducted in over 90 countries to collect crucial health indicators among individuals aged 15–49 [30]. Data for this research were sourced from the recode files for women and households, which are publicly accessible upon request [31]. The women’s recode file contains information on maternal, sexual, and reproductive health, while disability data were extracted from the household recode file. Only countries with available disability modules and complete responses for all relevant variables were included in the study [32].

The DHS employs a two-stage sampling process: primary survey units are first selected, followed by the random selection of participants from clusters within each country. For this study, women aged 15–49 with disabilities were eligible to participate in the disability module. Specifically, one woman with a disability from every third selected household was included [31, 33]. Participants were identified as having one or more disabilities based on the Washington Group Short Set of Disability Questions, which assess difficulties in seeing, hearing, speaking, and walking [34, 35]. The analysis included 16,157 weighted women with disabilities who provided complete data on educational status, sexual violence, and other relevant covariates.

Table 1 provides the sample sizes for various countries within the SSA included in the study. The DHS is recognised as a reliable secondary dataset and has been extensively used in research on sexual and reproductive health, including studies on sexual violence in SSA [36, 37]. Data for this study were accessed from the DHS website on February 23, 2024, following a request via <https://dhsprogram.com/data/available-datasets.cfm>.

2.2 Study variables

2.2.1 Study population variable

Women with disabilities were identified using the DHS disability module questionnaire. This questionnaire, answered by the household head, inquired about the disability status of women of reproductive age, specifically those aged 15–49. The questions were based on the Washington Group’s short set of disability questions, which address difficulties in seeing, walking, hearing, remembering, communicating, and self-care. The response options included “No difficulty,” “Some difficulty,” “A lot of difficulty,” and “Cannot do it at all.” This study concentrated on difficulties in seeing, hearing, speaking,

Table 1 Distribution of weighted eligible DHS in 10 sub-Saharan Africa countries

S/N	Country	Survey year	Sample size	Percentage
1	Nigeria	2017/2018	629	3.89
2	South Africa	2015/2016	836	5.17
3	Mali	2017/2018	947	5.86
4	Congo Democratic Republic	2013/2014	991	6.13
5	Kenya	2021/2022	1,404	8.69
6	Malawi	2015/2016	1,499	9.28
7	Chad	2014/2015	1,553	9.61
8	Rwanda	2019/2020	1,694	10.48
9	Mauritania	2019/2022	2,436	15.08
10	Uganda	2015/2016	4,168	25.80

and walking. Women with at least one functional difficulty in these areas from ten sub-Saharan African countries were included as women with disabilities [32, 35].

2.2.2 Outcome variable

The primary outcome of this study was sexual violence, and this was defined by asking women with disabilities if they have ever experienced any sexual violence. In the DHS, sexual violence included any of the following acts: ever been physically forced into unwanted sex or forced into unwanted sexual acts. The experience of any of the sexual acts qualified the respondent as having experienced sexual violence in the last 12 months. Therefore, sexual violence was constructed as a composite variable comprising of experience of any sexual violence. The responses were dichotomous; those who had not experienced sexual violence were coded as “0”, representing no, whilst those who had ever experienced sexual violence were coded as “1”, representing yes [36, 37]. The composite variable for sexual violence was constructed using a factor analysis score based on responses to two DHS-defined indicators: being physically forced into unwanted sex or forced into other unwanted sexual acts. This method captured the shared variance between these experiences, generating a latent variable that better represents the underlying construct of sexual violence [38].

2.2.3 Key independent variable

The key independent variable for this study was the type of place of residence. The type of place of residence was derived by categorising women with disabilities place of residence into urban and rural. The DHS categorisation of place of residence was used directly in this study [35].

2.3 Covariates

The covariates used in the multivariable analysis were chosen based on their importance in the existing literature [36, 37]. These covariates included age, educational level, marital status, wealth index, mass media exposure, sexual health knowledge, knowledge of contraceptive methods, community literacy level, community socio-economic level, and community knowledge of modern methods.

For the analysis, the ages of women with disabilities were grouped into three categories: 15–24, 25–34, and 35–49. Education levels were classified as no education, primary education, and secondary or higher education, whilst marital status was divided into never married, currently married, and formerly married. The wealth index was segmented into five groups: poorest, poorer, middle, richer, and richest. Mass media exposure was categorised as either no exposure or exposure to mass media. Sexual health knowledge and knowledge of contraceptive methods were classified as poor, moderate, and good. Additionally, community literacy level and community socio-economic level were classified as low, medium, and high [36, 37].

2.4 Statistical analyses

The data were analysed using both spatial and multivariable decomposition analysis. Using both spatial and multilevel decomposition analysis provides a comprehensive understanding of geographic variations and structural disparities in sexual violence. Spatial analysis identifies hotspots and country-level differences [39], while multilevel decomposition uncovers the key individual and community-level factors driving rural–urban disparities [40]. This combined approach enhances targeted interventions by addressing both regional risk patterns and systemic inequalities [39, 40].

2.5 Spatial analysis

Geospatial maps were created using a geostatistical model that treated observations as binary indicators based on a binomial probability distribution with a success probability p . This probability was linked to a random spatial term through a logit link function [41]. The spatial random term represented the spatial distribution of sexual violence data, assuming spatial dependence across different locations. This term was modelled using a Gaussian distribution with a zero mean and a spatially structured covariance matrix [39].

The geostatistical inference was carried out using stochastic partial differential equations, which transformed the continuous spatial random process into a discretely indexed Gaussian Markov random field [41]. This technique allowed for a Bayesian approximation using the integrated nested Laplace approximation (INLA) [39, 41]. The spatial analysis was conducted using R software version 4.4.1 (R Foundation for Statistical Computing, Vienna, Austria).

2.6 Multivariable decomposition analysis

A pooled analysis was performed to examine the proportion of sexual violence among women with disabilities, with data categorised by place of residence and selected covariates. Following this, a chi-square (χ^2) test was used to explore the association between sexual violence and the selected covariates across various places of residence [40]. The prevalence of sexual violence among women with disabilities in the ten sub-Saharan African countries was depicted using graphs. For inferential analysis, multivariable logistic regression was utilised to determine the predictors of sexual violence, key independent variables and selected covariates [42]. Additionally, a multivariable non-linear decomposition model, like the Fairlie and Blinder-Oaxaca methods, was used to break down the disparity in sexual violence based on the place of residence where women with disabilities lived [43]. This model assessed the differences in sexual violence exposure between rural and urban women with disabilities, identifying the contribution of each covariate to these differences. The data utilised in this study were weighted and adjusted for the complex survey design, with the variance inflation factor showing no evidence of multicollinearity. All analyses were conducted using Stata software version 17.0 (Stata Corporation, College Station, TX, USA).

3 Results

3.1 Spatial pattern of sexual violence

The maps below illustrate the spatial variation in the prevalence of sexual violence among women with disabilities across various African countries, with red indicating higher rates (up to 80%) and blue indicating lower rates (as low as 10%). In the Democratic Republic of Congo, central regions show rates of 70–80%, while peripheral areas have lower rates of 20–30%. Similarly, Kenya has concentrated higher rates of 40–50% in the western region, with lower rates around 10–20% elsewhere. Malawi and Uganda also show significant concentrations in certain regions: central and southern Malawi have rates of 50–70%, while northern areas are around 20–30%; Uganda's central and southern regions show rates of 50–60%, with northern and western areas at 20–30%.

Mali and Mauritania generally display lower rates of sexual violence, mostly around 10–20%, except for a few areas in Mali where rates rise to 30–40%. Rwanda and South Africa exhibit scattered patterns: Rwanda's higher rates are approximately 40–50%, with lower rates at 10–20% in other areas; South Africa's central regions display rates of 60–70%, while large parts of the country show lower prevalence around 20–30%. These variations underscore the need for targeted public health interventions in regions with higher prevalence rates (Figs. 1 & 2).

3.2 Weighted country-level prevalence of sexual violence and place of residence

Figure 3 shows the prevalence of sexual violence and place of residence among women with disabilities in ten African countries. The data reveals that countries like Congo (23%) and Uganda (16%) have higher rates of sexual violence compared to others, such as Nigeria and Chad, which report 0% prevalence. Meanwhile, most women with disabilities reside in rural areas, particularly in Malawi (92%), Rwanda (80%), and Chad (74%). Conversely, a higher proportion lives in urban areas in Mauritania (56%), Nigeria (66%), and South Africa (61%).

Table 2 shows the relationship between various factors and sexual violence among women with disabilities in ten SSA countries. Type of residence is significant, with 79.77% of rural women with disabilities experiencing sexual violence compared to 20.23% of urban women. The age of the respondents shows that 54.89% of women with disabilities aged 25–34 experienced sexual violence, the highest among age groups. At the same time, educational level indicated that 63.62% of women with primary education experienced sexual violence, compared to only 1.20% with higher education, while marital status indicates that 45.32% of the ever-married women experienced sexual violence, and only 0.94% of the never-married women with disabilities ever experienced sexual violence.

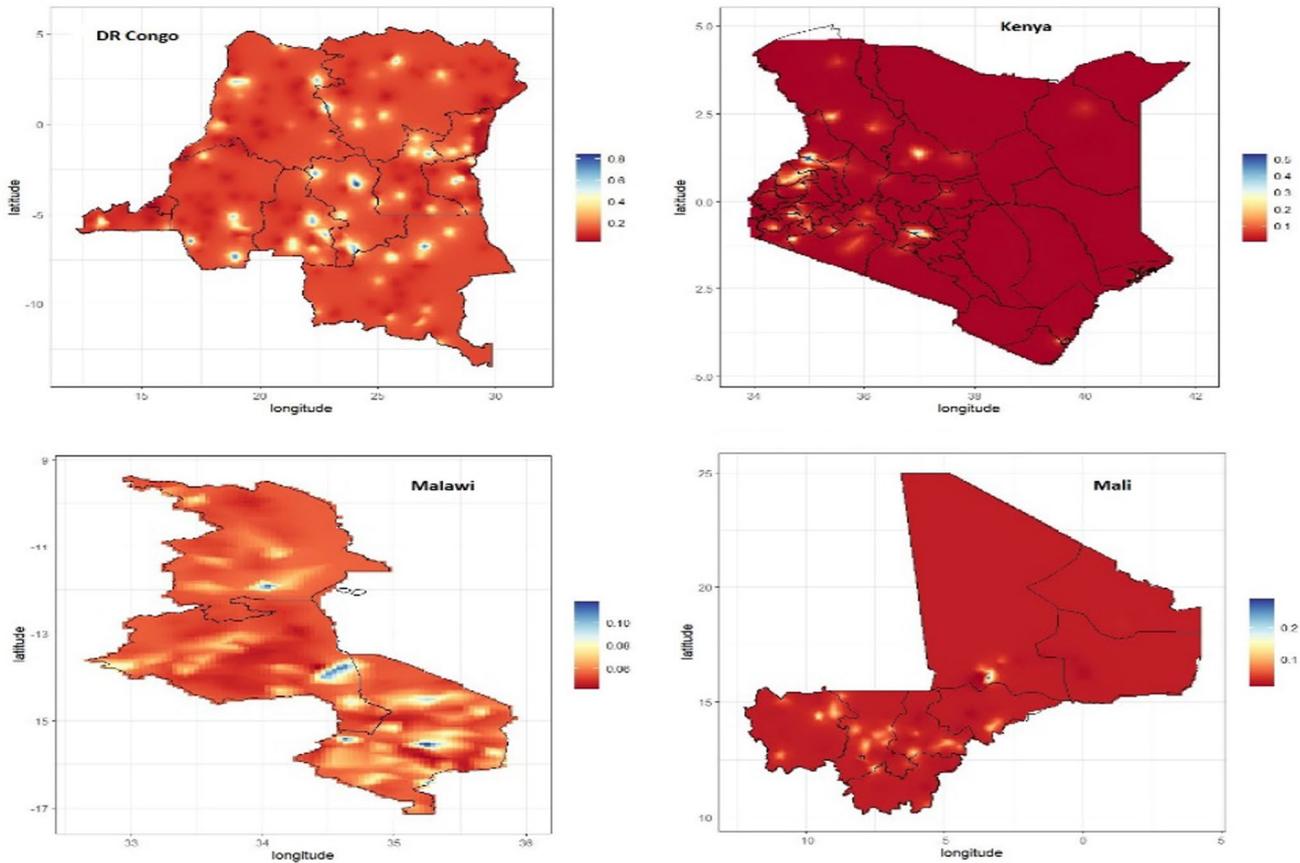


Fig. 1 Spatial pattern of sexual violence among women with disabilities in Dr Congo, Kenya, Malawi and Mali

The wealth index of the respondents shows that 28.26% of the poorest women and 7.90% of the richest women with disabilities experienced sexual violence. Furthermore, sexual health knowledge shows that 36.61% of women with good knowledge levels experienced sexual violence compared to 19.25% with poor knowledge. At the community level, medium literacy (40.70%) and low socio-economic levels (69.78%) are linked to increased sexual violence. All the included explanatory variables were significant to sexual violence among women with disabilities at $p < 0.05$ (Table 2).

Table 3 shows the relationship between various factors and place of residence among women with disabilities in ten SSA countries. Age distribution is similar, with 45.85% of urban and 44.82% of rural women aged 25–34, and 39.53% urban vs. 39.26% rural aged 35 & above. Educational attainment is higher in urban areas, with 43.17% having secondary and 9.57% higher education, compared to 15.69% and 2.09% in rural areas. Marital status differs, with 8.85% of urban women never married versus 4.77% in rural areas, and 32.63% of rural women ever married compared to 25.31% in urban areas. Wealth disparities are significant; 49.13% of urban residents are in the richest category versus 5.30% in rural areas, while 29.98% of rural women are in the poorest category compared to 5.24% in urban areas.

Mass media exposure is significantly higher in urban areas (86.20% vs. 60.84% in rural areas). Sexual health knowledge is better in urban areas, with 43.24% having good knowledge compared to 29.62% in rural areas. Urban women also have better knowledge of contraceptive methods, with 97.29% having good knowledge compared to 94.15% in rural areas. Community literacy levels are higher in urban areas, with 48.99% classified as high literacy compared to 21.93% in rural areas. Urban communities have higher socio-economic status, with 71.22% classified as high compared to 13.76% in rural areas.

All the included explanatory variables were significant, with the place of residence of women with disabilities at $p < 0.05$, except the age of respondents.

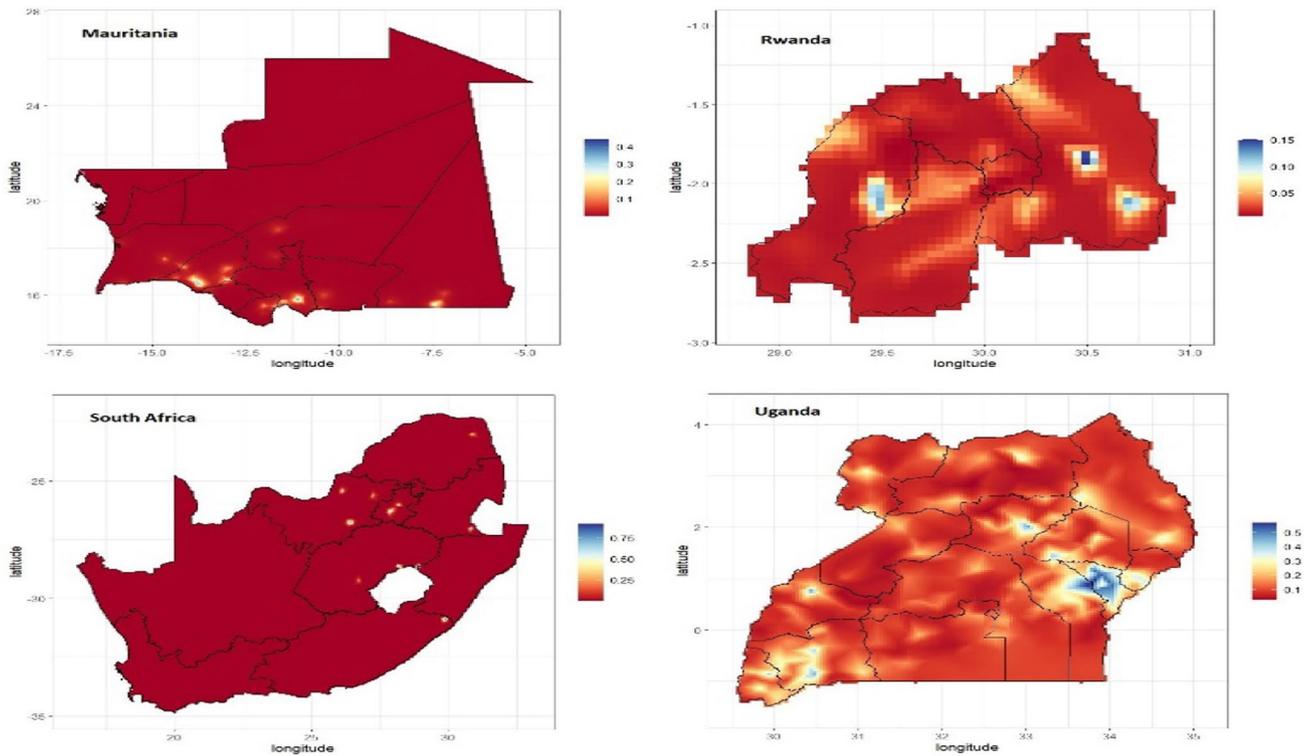


Fig. 2 Spatial pattern of sexual violence among women with disabilities in Mauritania, Rwanda, South Africa and Uganda

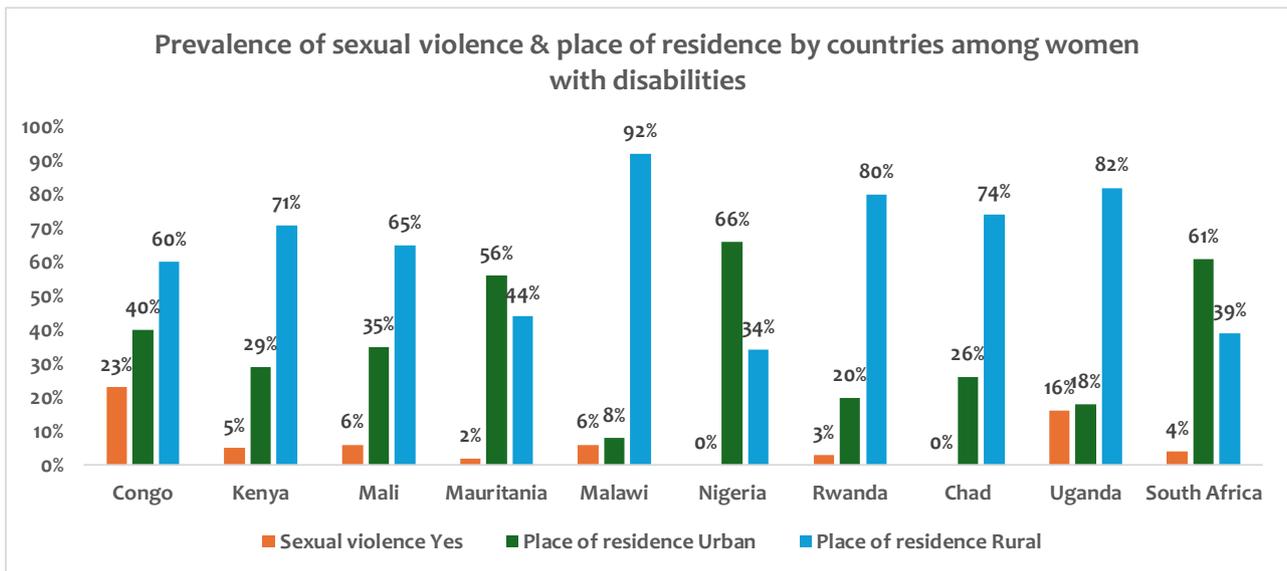


Fig. 3 Weighted country-level prevalence of sexual violence and place of residence among women with disabilities in ten sub-Saharan Africa countries

3.3 Multivariable logistics regression of sexual violence and place of residence on the explanatory variables

Table 4 presents the results of a multivariable logistic regression analysis examining the association between sexual violence and place of residence among women with disabilities. Age of respondents shows that women with disabilities aged 35 and above were significantly less likely to experience sexual violence compared to those aged

Table 2 Weighted prevalence of sexual violence among women with disabilities by key explanatory variables in ten SSA countries

Variables (n = 16,517)	Frequency(%)	Sexual violence		p-value (χ^2)
		No	Yes	
Composite variable				
Type of residence				
Urban	5,029(31.13)	32.04	20.23	p < 0.001
Rural	11,128(68.87)	67.96	79.77	
Other explanatory				
Age of respondents				
15–24	2,506(15.51)	15.49	15.71	p < 0.001
25–34	7,294(45.14)	44.33	54.89	
35 & above	6,357(39.35)	40.18	29.41	
Educational level				
No education	3,992(24.71)	25.57	14.32	p < 0.001
Primary	7,535(46.64)	45.22	63.62	
Secondary	3,917(24.24)	24.52	20.86	
Higher	714(4.42)	4.69	1.20	
Marital status				
Never married	976(6.04)	6.47	0.94	p < 0.001
Currently married	10,277(63.61)	64.43	53.75	
Ever married	4,905(30.35)	29.10	45.32	
Wealth index				
Poorest	3,600(22.28)	21.78	28.26	p < 0.001
Poorer	3,245(20.09)	19.64	25.44	
Middle	3,101(19.19)	19.13	19.89	
Richer	3,151(19.50)	19.58	18.50	
Richest	3,061(18.94)	19.87	7.90	
Mass media exposure				
No	5,051(31.26)	31.20	31.97	p < 0.05 (0.03)
Yes	11,106(68.74)	68.80	68.03	
Sexual health knowledge				
Poor	4,041(25.01)	25.49	19.25	p < 0.001
Moderate	6,645(41.13)	40.88	44.14	
Good	5,470(33.86)	33.63	36.61	
Contraceptives methods knowledge				
Poor	720(4.46)	4.59	2.82	p < 0.001
Moderate	67(0.41)	0.43	0.81	
Good	15,370(95.13)	94.97	97.00	
Community levels				
Community literacy level				
Low	5,357(33.15)	33.25	31.97	p < 0.05 (0.03)
Medium	5,896(36.49)	36.14	40.70	
High	4,904(30.35)	30.61	27.32	
Community socio-economic level				
Low	9,985(61.80)	61.13	69.78	p < 0.001
Medium	1,059(6.56)	6.46	7.69	
High	5,113(31.64)	32.41	22.53	
Community knowledge of contraceptive				
Low	15,048(93.14)	92.57	100.00	p < 0.001
Medium	527(3.26)	3.53	0.00	
High	582(3.60)	3.90	0.00	

Table 2 (continued)

(χ^2) = Chi-square

Table 3 Weighted frequency and percentage of explanatory variables by place of residence among women with disabilities in ten SSA countries

Explanatory variable	Place of residence		p-value (χ^2)
	Urban	Rural	
	Frequency (%)	Frequency (%)	
Variables (n = 16,517)			
Age of respondents			
15–24	14.62	15.91	p > 0.05 (0.34)
25–34	45.85	44.82	
35 & above	39.53	39.26	
Educational level			
No education	16.36	28.48	p < 0.001
Primary	30.90	53.75	
Secondary	43.17	15.69	
Higher	9.57	2.09	
Marital status			
Never married	8.85	4.77	p < 0.001
Currently married	65.83	62.60	
Ever married	25.31	32.63	
Wealth index			
Poorest	5.24	29.98	p < 0.001
Poorer	5.27	26.78	
Middle	11.74	22.56	
Richer	28.62	15.38	
Richest	49.13	5.30	
Mass media exposure			
No	13.80	39.16	p < 0.001
Yes	86.20	60.84	
Sexual health knowledge			
Poor	20.37	27.11	p < 0.001
Moderate	36.39	43.27	
Good	43.24	29.62	
Contraceptives methods knowledge			
Poor	2.64	5.28	p < 0.001
Moderate	0.07	0.57	
Good	97.29	94.15	
Community literacy level			
Low	14.46	41.60	p < 0.001
Medium	36.55	36.47	
High	48.99	21.93	
Community socio-economic level			
Low	26.06	77.95	p < 0.001
Medium	2.72	9.29	
High	71.22	13.76	
Community knowledge of contraceptive			
Low	92.44	93.45	p < 0.001
Medium	3.11	3.33	
High	4.44	3.22	

Table 3 (continued)(χ^2) = Chi-square

15–24, both in urban [aOR = 0.60**; 95%(CI 0.40–0.90)] and rural areas [aOR = 0.71**; 95%(CI 0.58–0.88)]. Educational level reveals that rural women with primary education were significantly more likely to experience sexual violence compared to those with no education [aOR = 1.99***; 95%(CI 1.65–2.42)], while urban women showed no significant differences.

Table 4 Multivariable logistic regression of sexual violence and place of residence among women with disabilities by explanatory variables

Variable (n = 16,517) Explanatory variable	Place of residence	
	Urban aOR [95% CI]	Rural aOR [95% CI]
Age of respondents		
15–24	Reference	
25–34	1.06[0.73–1.53]	1.06[0.88–1.28]
35 & above	0.60**[0.40–0.90]	0.71**[0.58–0.88]
Educational level		
No education	Reference	
Primary	1.46[0.93–2.31]	1.99***[1.65–2.42]
Secondary	1.55[0.96–2.50]	1.31*[0.99–1.71]
Higher	0.35[0.12–1.05]	1.12[0.60–2.11]
Marital status		
Never married	Reference	
Currently married	6.75**[2.10–21.73]	8.81***[3.89–19.97]
Ever married	16.00***[4.98–51.40]	12.30***[5.42–27.91]
Wealth index		
Poorest	Reference	
Poorer	0.90[0.48–1.69]	0.96[0.81–1.14]
Middle	0.71[0.40–1.23]	0.70***[0.57–0.85]
Richer	0.89[0.54–1.47]	0.66**[0.52–0.84]
Richest	0.40**[0.22–0.72]	0.37***[0.23–0.60]
Mass media exposure		
No	Reference	
Yes	0.69*[0.49–0.97]	1.26**[1.08–1.47]
Sexual health knowledge		
Poor	Reference	
Moderate	0.77[0.54–1.10]	1.64***[1.35–1.99]
Good	0.99[0.69–1.42]	1.74***[1.42–2.13]
Contraceptives methods knowledge		
Poor	Reference	
Moderate	1.00	3.93*[1.18–13.08]
Good	0.99[0.34–2.86]	2.51**[1.35–4.66]
Community levels		
Community literacy level		
Low	Reference	
Medium	1.02[0.67–1.54]	1.04[0.89–1.22]
High	1.12[0.73–1.73]	1.07[0.88–1.30]
Community socio-economic level		
Low	Reference	
Medium	0.82[0.38–1.76]	0.96[0.75–1.23]
High	1.33[0.93–1.88]	0.99[0.78–1.26]
Community knowledge of contraceptive		
Low	Reference	
Medium	1.0	1.0
High	1.0	1.0
Pseudo R^2	0.08 (4,650)	0.05 (10,776)

Table 4 (continued)* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; 1.0 = no data; R^2 value in bracket ()

Marital status shows that currently married women with disabilities were significantly more likely to experience sexual violence compared to never-married women, with higher odds in rural areas [aOR = 8.81***; 95%(CI 3.89–19.97)] than in urban areas [aOR = 6.75**; 95%(CI 2.10–21.73)]. Ever-married women had even higher odds in both rural [aOR = 12.30***; 95%(CI 5.42–27.91)] and urban areas [aOR = 16.00***; 95%(CI 4.98–51.40)].

Mass media exposure was associated with lower odds of experiencing sexual violence in urban areas [aOR = 0.69*; 95%(CI 0.49–0.97)] but with higher odds in rural areas [aOR = 1.26**; 95%(CI 1.08–1.47)]. Sexual health knowledge showed that good sexual health knowledge was associated with higher odds of experiencing sexual violence in rural areas [aOR = 1.74***; 95%(CI 1.42–2.13)] but not significantly in urban areas.

The wealth index indicates that the richest women had significantly lower odds of experiencing sexual violence in both urban [aOR = 0.40**; 95%(CI 0.22–0.72)] and rural areas [aOR = 0.37***; 95%(CI 0.23–0.60)]. Community literacy and socio-economic levels did not show significant associations in either urban or rural areas.

The model fit pseudo- R^2 values indicate that the model explains 5% of the variance in sexual violence for rural women with disabilities and 8% for urban women with disabilities among women with disabilities in ten SSA countries.

3.4 Multivariable decomposition of disparity in sexual violence between urban and rural areas

The majority of the disparity (72.81%) in sexual violence among women with disabilities is due to differences in characteristics (E), with 27.19% attributed to differences in coefficients (C). Among significant findings, women aged 35 or above contribute 3.31% to the disparity due to characteristics, while their coefficients show a positive contribution of 0.68%. Primary education significantly influences the disparity, contributing 6.78% due to characteristics and 0.40% due to coefficients. Currently, married women contribute -5.50% due to characteristics and 0.23% due to coefficients, indicating a lower likelihood of experiencing sexual violence compared to never-married women.

Ever-married women contribute 6.27% to the disparity due to characteristics, while their coefficients contribute -0.52%. Mass media exposure contributes 2.53% due to coefficients, with no significant contribution due to characteristics. Moderate sexual health knowledge adds 2.56% to the disparity due to coefficients, while good sexual health knowledge adds 2.19%.

Community literacy levels show that medium literacy contributes 0.78% due to characteristics, and high literacy contributes 0.20% due to coefficients. Community socioeconomic levels indicate that high socio-economic levels contribute -0.09% due to characteristics and -0.99% due to coefficients. Finally, community knowledge of contraceptives shows no significant contribution due to either characteristics or coefficients (Table 5).

4 Discussion

This study aimed to investigate the spatial pattern and influence of place of residence on sexual violence among women with disabilities in SSA. The study found varied prevalences of sexual violence among women with disabilities across the various African countries, with Congo DR (23%) and Uganda (16%) recording the highest prevalence, while Nigeria and Chad recorded 0% prevalence. The spatial patterns showed the non-uniform distribution of sexual violence across the countries, with some areas recording as much as 80% prevalence while others recorded less than 10%. Factors that significantly contributed to the disparities in sexual violence among women with disabilities in rural and urban areas include age, educational level, marital status, mass media exposure, sexual health knowledge, and wealth index.

In this study, we observed varied inter-country and intra-country prevalence of sexual violence among women with disabilities across the SSA countries surveyed. Although there are limited multi-country studies on the prevalence of sexual violence among women with disabilities in SSA, a previous study in Cameroon and Burundi also reported disparities in the prevalence of sexual violence among disabled women in the countries [4]. Variations in settings and sociocultural factors could have contributed to the observed differences in the prevalence of sexual violence among women with disabilities in the present study. For instance, the highest prevalence recorded in Congo DR (23%) could be attributed to the protracted civil war in the country, which continues to predispose many women, particularly those with disabilities, to sexual violence [44, 45]. Whilst women with disabilities have a higher risk of sexual violence in any setting [5], their vulnerability becomes even greater in chaotic environments such as conflict zones [46], which highlights the need for increased awareness creation and protection of women with disabilities from sexual violence in such areas. Whilst the zero prevalence of sexual violence among women with disabilities recorded in Nigeria and Chad may be pleasing, it also highlights the possibility of underreporting, which calls for further studies to investigate the phenomenon in these countries. Studies in both countries have documented high levels of sexual coercion among women and have linked this issue to various intersecting factors, such as conflict, political unrest, and resource scarcity [47–49]. Additionally, the measurement of sexual violence among women with disabilities may not have been adequately captured, potentially leading to an underestimation of this critical issue [50].

Table 5 Multivariable decomposition of associated factors with sexual violence inequality between urban and rural residence

Variable (n = 16,517)	Difference due to characteristics (E)		Difference due to coefficient (C)		
	Characteristics	Coefficient	Percentage (%)	Coefficient	Percentage (%)
The total disparity percentage explained			72.81		27.19
Age of respondents					
15–24	Reference			Reference	
25–34	0.00003	0.58		– 0.00032	– 0.12
35 & above	0.00007**	3.31		0.00196	0.68
Educational level					
No education	Reference			Reference	
Primary	0.00971***	6.78		0.00101	0.40
Secondary	– 0.00550**	– 2.68		– 0.00465	– 1.37
Higher	– 0.00096	– 0.75		0.00244	1.45
Marital status					
Never married	Reference			Reference	
Currently married	– 0.00418***	– 5.50		0.00366	0.23
Ever married	0.00998***	6.27		– 0.00261	– 0.52
Wealth index					
Poorest	Reference			Reference	
Poorer	– 0.00045	– 0.45		0.00021	0.33
Middle	1.0	– 3.49		– 0.00031	– 0.24
Richer	1.0	1.0		– 0.00362	– 1.41
Richest	1.0	1.0		– 0.00123	– 0.23
Mass media exposure					
No	Reference			Reference	
Yes	1.0			0.01572**	2.53
Sexual health knowledge					
Poor	Reference			Reference	
Moderate	1.0			0.00861**	2.56
Good	1.0			0.00725*	2.19
Contraceptives methods knowledge					
Poor	Reference			Reference	
Moderate	1.0	1.0		1.0	1.0
Good	1.0	1.0		1.0	1.0
Community levels					
Community literacy level					
Low	Reference			Reference	
Medium	0.00000	0.78		0.00075	0.31
High	– 0.00074	– 0.46		0.00071	0.20
Community socio-economic level					
Low	Reference			Reference	
Medium	0.00002	0.07		0.00030	0.67
High	– 0.00036	– 0.09		– 0.00436	– 0.99
Community knowledge of contraceptive					
Low	Reference			Reference	
Medium	1.0	1.0		1.0	1.0
High	1.0	1.0		1.0	1.0

Table 5 (continued)* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; 1.0 = no data

Contrary to the findings of previous studies, which reported an increased risk of sexual violence among adult women with disabilities relative to young women [29, 51, 52], our findings showed that women with disabilities aged 35 years or above were less likely to experience sexual violence compared to those aged 15–24 years in both

rural and urban areas. The disparities in findings could be attributed to the differences in scope and settings of the present study relative to the previous studies. For instance, whereas the study by Tenwaz et al. [29] was limited to disabled women in a small geographic region in Ethiopia, that of Mailhot et al. [51] was a meta-analysis of several studies in both low- and middle-income and high-income countries. Thus, the current findings provide more reliable evidence of the association between age and sexual violence among women with disabilities in SSA.

Meanwhile, our findings support Martin et al. [53], who reported that young women with disabilities have an increased likelihood of sexual violence than adult women. The increased risk of sexual violence among young women with disabilities in both rural and urban areas in SSA could be attributed to factors such as over-dependence on others for financial and physical support [24, 54], social isolation [55], lack of sexual autonomy and decision-making capacity [56], and the absence of physical and legal protection systems [57]. Therefore, there is a need for measures that promote the well-being of young women with disabilities in SSA to safeguard them from sexual violence.

Although some previous studies found that lower educational attainment increases the risk of sexual violence among women [27, 54, 58], others reported the opposite [59, 60]. In this study, we found that disabled women with primary education were more likely to experience sexual violence compared to those with no education in rural areas only, with no significant difference observed in urban areas. Whilst education enhances women's sexual autonomy and the ability to negotiate for safer sex [61], it may also predispose some women to sexual violence and abuse as they try to assert their sexual autonomy and rights due to the prevailing socio-cultural norms in most African settings [62], particularly in rural areas [27]. Alternatively, the current findings may be influenced by the increased willingness of women with primary education to report sexual violence compared to those with no education, as evidence shows that women with disabilities with no education in rural areas are more reluctant to disclose sexual violence due to fear, shame and lack of understanding of their sexual right [63].

Whilst previous studies reported an increased risk of sexual violence among unmarried women with disabilities [64] and those without disabilities [65], our findings revealed that disabled women who are currently married have higher odds of experiencing sexual violence in both urban and rural areas, with greater odds observed in rural areas. Besides, ever-married women had the highest odds of experiencing sexual violence in both rural and urban areas. Although we are unclear about the increased vulnerability of married women with disabilities to sexual violence, evidence shows that current and former intimate partners, especially husbands, are the main perpetrators of sexual violence against women with disabilities [53, 66]. Also, the increased burden of sexual violence observed among currently married women in rural areas could be due to overdependence on partners, limited access to support services [6], and socio-cultural norms that tolerate violence against women [67].

Further, we observed that mass-media exposure was associated with lower odds of sexual violence among women with disabilities in urban areas but with higher odds in rural areas. Although mass media is important in delivering critical information to people, it may also expose users to distorted reality, including acts that condone violent sexual behaviour against women [68, 69]. Thus, given that adequate media literacy is important in reducing the negative impact of mass media exposure on sexual violence among women [70], we argue that women with disabilities in rural areas may perhaps have limited media literacy, which could increase their risk of sexual violence. Nonetheless, further studies are required to improve our understanding of this phenomenon, especially by examining the role of media literacy on the risk of sexual violence among women with disabilities in rural and urban areas. Also, we found higher odds of sexual violence among disabled women with good sexual health knowledge in rural areas but not in urban areas. This could be attributed to the limited availability of support systems to prevent sexual violence among women with disabilities in rural areas [71]. Meanwhile, contrary to the current findings, Tenaw et al. [29] reported that disabled women with limited information on sexuality were more likely to experience sexual violence than those with adequate sexual information.

Our findings also revealed that women with disabilities in the richest wealth index were significantly less likely to experience sexual violence in both rural and urban areas. Evidence suggests that an increase in wealth reduces financial and material dependence on others and thereby reduces women's exposure to sexual violence [46]. Besides, Opoku et al. [72] reported that women with disabilities who require assistance tend to become victims of sexual violence and abuse from persons who try to assist them. However, Contrary to the current findings, Kwagala and Galande [73] reported that poor, disabled women were less likely to experience sexual violence than the rich, albeit in an intimate relationship. Perhaps poverty is a risk factor for non-partner sexual violence but not partner sexual violence [74].

5 Strengths and limitations

The current study used the most recent nationally representative datasets in ten countries in SSA to examine the patterns and disparities in the place of residence and sexual violence among women with disabilities. Thus, the findings provide reliable data in guiding and comparing future studies. Nonetheless, the study has some limitations. First, although evidence shows that women with cognitive disabilities have the greatest risk of sexual violence than women with other forms of disabilities [4, 75], the current study did not segregate respondents by disability type, which needs to be considered when interpreting our findings. Also, the sensitive nature of the topic (sexual violence) and the stigma associated with it may lead to participants' response bias, which could result in an underestimation of the phenomenon. Due to the cross-sectional design of the current study, we are unable to infer causality but only report on the associations between the variables. Finally, the findings from this study should be interpreted with caution and not generalised to other settings.

6 Policy and practical implications

The current study provides valuable insight for policy and practical application. First, the study shows varied inter-country and intra-country prevalence of sexual violence against women with disabilities. Therefore, there is a need for increased awareness creation and protection of women with disabilities from sexual violence, particularly in areas or countries with high prevalence, such as the Congo Democratic Republic. Second, the findings show increased vulnerability of young women to sexual violence in both rural and urban areas. This highlights the need for interventions such as financial and material support for young women with disabilities to minimise their dependence on others and safeguard them from sexual violence. Also, aside from the need to empower educated women with disabilities in rural areas through sexual violence awareness creation to reduce their vulnerability, attention must be paid to those with no education in those areas since they may be underreporting sexual violence. Further, the increased risk of sexual violence among married women in both rural and urban areas calls for measures that improve community awareness and knowledge of marital sexual violence against persons with disabilities. Besides, it is important to promote media literacy and educate women with disabilities on the available support systems for victims of sexual violence, particularly in rural areas.

7 Conclusion and recommendations

Findings from this study highlight the occurrences and factors influencing the disparity and distribution of sexual violence among women with disabilities in rural and urban areas across ten countries in sub-Saharan Africa. These findings are important in designing and implementing targeted interventions to address sexual violence among women with disabilities in sub-Saharan Africa, especially in areas with high burdens. Among the disabled women in both rural and urban areas, interventions should be targeted at those who are young, those married or previously married, and those from poor households. Also, interventions required to address the high burden of sexual violence in rural areas should pay much attention to those with primary education, those exposed to mass media, and those with good sexual health knowledge. Finally, future research could broaden the geographical scope or examine how specific regional factors, such as conflict and post-conflict settings, influence the risk of sexual violence among women with disabilities. Additionally, incorporating variables such as ethnicity and religion as explanatory factors could provide deeper insights into the socio-cultural dynamics that shape these experiences.

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Author contributions OAB and CO conceived and designed the study. OAB and AM drafted the background and discussion sections, whilst OAB wrote the methodology and conducted the analysis. OAB and EG carried out the spatial analysis whilst OAB and MP performed the decomposition analysis. CO supervised the overall study development and critically reviewed the manuscript for intellectual content. All authors read and approved the final version of the manuscript before submission.

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Data availability The datasets utilised in this study can be accessed at <https://dhsprogram.com/data/available-datasets.cfm>.

Declarations

Ethics approval and consent to participate Since the authors of this manuscript did not collect the data, we sought permission from the MEASURE DHS website and access to the data was provided after our intent for the request was assessed and approved on the 13th of February 2024. Each SSA country's committee and the ethics Boards of partner organisations, such as the Ministries of Health, ethically accept the DHS surveys. This research was conducted in accordance with the Declaration of Helsinki [76]. The women who were interviewed in all the included countries gave either written or verbal consent to participate during each of the surveys in each country.

Consent for publication Not applicable.

Competing interests The authors declare no competing interests.

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