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# Sexual violence against ever-married reproductive-age women in East Africa: further analysis of recent demographic and health surveys

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## Abstract

**Background** Sexual violence is a violation of women's rights, resulting in significant physical and psychological challenges and adverse reproductive health outcomes. Addressing these issues demands urgent public health interventions and support systems to mitigate the profound impact on individuals and societies. Thus, this study aimed to assess sexual violence against ever-married reproductive-age women in East Africa.

**Methods** Data retrieved from the recent Demographic and Health Survey (DHS) of East African countries was used, and a weighted sample of 40,740 ever-married reproductive-age women was included. To identify factors associated with sexual violence, multilevel mixed-effects models utilizing robust Poisson regression were applied. Akaike's and Bayesian information criteria, as well as deviance, were utilized to compare the models. In the multivariable regression model, adjusted prevalence ratios (APR) with 95% confidence intervals (CI) were used to estimate the strength of association, with statistical significance set at a p-value < 0.05.

**Result** The pooled proportion of sexual violence among ever-married reproductive-age women in East Africa was 13.05% (95% CI: 12.74–13.36). The multivariable multilevel robust Poisson regression revealed that age at first cohabitation/marriage, having a primary educational level, being employed, residing in a female-headed household, having a husband/partner who drinks alcohol, and living in rural areas were positively associated with sexual violence. On the contrary, having secondary and higher educational levels and living in communities with a high proportion of uneducated women were negatively associated with sexual violence.

**Conclusion** Empowering girls and women through education reduces their vulnerability. Effective programs should prioritize workplace safety, financial independence, and robust legal protections against harassment and abuse. Raising awareness about the impact of alcohol abuse on relationships and the heightened risk of sexual violence is crucial. Moreover, enhancing access to support services and community networks, especially in rural areas, is essential for preventing and responding to sexual violence.

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**Keywords** Demographic and health survey, East Africa, Multilevel analysis, Sexual violence, Violence against women

## Introduction

Violence against women, such as sexual violence, is a major public health concern and a violation of women's basic human rights [1]. Sexual violence includes any sexual act or attempt to perform such acts without consent, as well as unwanted sexual advances and remarks, regardless of the relationship between the perpetrator and the victim or the setting in which it occurs [1, 2]. It is a form of domestic violence that mainly happens in the context of marriage or intimate relationships [3].

Worldwide, about one in three women, or 30%, have endured physical and/or sexual violence [1]. Estimates suggest that 27% of women aged 15–49 who have been in relationships have encountered physical, sexual, or both forms of intimate partner violence at some point in their lives [4]. In Africa, around 33% of women have experienced sexual violence at some stage [5], with sub-Saharan Africa seeing approximately 19% of women suffering sexual violence. East and West Africa, in particular, face a significant burden of different forms of intimate partner violence [6].

While intimate partner violence affects both men and women, women are more often the victims, typically at the hands of men they know. Those who suffer from sexual violence face a range of physical, social, mental, emotional, and sexual issues [7]. Sexual violence significantly impacts women's autonomy in reproductive decisions, increasing their vulnerability to sexually transmitted infections, psychological distress, and unintended pregnancies. Victims often endure suicidal tendencies, substance abuse, anxiety, and lasting trauma [8, 9]. During pregnancy, they are at greater risk of complications such as miscarriages, low birth weight, premature birth, and fetal growth issues [1, 10–12].

Factors such as place of residence, age, educational status, husband/partner educational level, employment status, healthcare decision-making, husband/partner's drug and alcohol abuse, sex of household head, and wealth index were identified to be associated with sexual violence in previous studies [1, 8, 13–17]. Despite individual studies, there remains a scarcity of exhaustive evidence concerning sexual violence against ever-married, reproductive-age women in East Africa. Therefore, the current study aimed to address this gap by conducting a comprehensive investigation using recent nationally representative data from East African countries. To address the limitations of previous studies, which often overlooked community-level factors associated with sexual violence and relied on small sample sizes, our study incorporated these variables and used larger sample sizes. This approach is essential for drawing more conclusive

insights at a national level. Consequently, this study aimed to assess the prevalence and factors associated with sexual violence against ever-married, reproductive-age women in East Africa. The findings will help advance strategies and policies to combat this issue. Additionally, it will enhance the understanding of country-specific variations in sexual violence, helping to prioritize interventions in high-risk areas and develop practical solutions to improve the safety and well-being of women in the region.

## Methods

### Data source, study design, and participants

This study employed the most recent data from the Demographic and Health Survey (DHS), covering East African countries such as Burundi, Ethiopia, Kenya, Comoros, Madagascar, Malawi, Mozambique, and Rwanda between 2012 and 2022/23. The DHS is a nationally representative survey that uses a community-based cross-sectional study design to collect information on key health indicators. It employs a stratified two-stage cluster sampling method to select participants. Initially, target clusters are chosen from the sampling frame using probability proportional to size, ensuring representation from both urban and rural areas within each region. In the following stage, an equal number of clusters are selected with equal probability through systematic random sampling from the initially chosen clusters, again for both urban and rural areas within each region. In the second stage, households are systematically selected from each cluster. DHS methodology details are provided at: <https://dhsprogram.com/Methodology/index.cfm>.

This study included all reproductive-age ever-married women who disclosed experiencing sexual violence. However, reproductive-age women who had never been married or had missing data on the sexual violence variable were excluded from the study. The final analysis comprised a weighted sample of 40,740 reproductive-age ever-married women.

### Study variables

#### Dependent variable

The dependent variable in this study was the occurrence of sexual violence by a husband or partner. It was measured as the percentage of ever-married reproductive-age women who reported experiencing spousal sexual violence during their lifetime. This was determined based on whether women had encountered one or more instances of sexual violence perpetrated by their husbands or partners. If a woman answered 'yes' to any of the following situations: being physically forced to have sexual

intercourse against her will, being physically coerced to perform any other sexual acts against her will, or being forced to engage in unwanted sexual acts through threats or other means, she was deemed to have encountered sexual violence. Conversely, those who answered 'no' to all three situations were categorized as not having experienced sexual violence.

### **Independent variables**

To meet the study's objective and account for the hierarchical structure of the DHS data, the independent variables were categorized into individual-level and community-level factors. Women's age, age at first cohabitation/marriage, educational status, employment status, wealth index, sex of household head, women's decision-making autonomy, husband/partner's educational status, and husband/partner's alcohol consumption were considered as individual-level factors. Community-level factors consisted of place of residence, community-level educational status, and community poverty level.

**Community education level** The percentage of women who completed primary, secondary, and higher education in each cluster. The total of individual women's educational attainments shows the cluster's overall academic standing. The clusters are classified based on the national median value, dividing them into groups with higher and lower levels of educational attainment among women.

**Community poverty level** The percentage of poor and poorest women in the cluster is specified. The overall poverty status of a cluster is determined by aggregating the proportions of poor and poorest women. Then the women are categorized according to their poverty level relative to the national median value.

### **Data management and statistical analysis**

STATA version 17 statistical software was used to extract, recode, and analyze data. The data was weighted, considering sampling weight, primary sampling unit, and strata, to ensure representativeness and accommodate the sampling design in estimating standard errors. A multilevel mixed-effects Poisson regression model with robust error variance was fitted to identify factors significantly associated with sexual violence among ever-married women of reproductive age. Initially, a bi-variable multilevel robust Poisson regression analysis was performed, with all variables having a *p*-value below 0.20 considered potential candidates for the subsequent multivariable multilevel robust Poisson regression analysis.

After selecting variables for the multivariable analysis, four models were fitted to identify the best-fitted model. These models included: Model 0, or the null model, comprising solely the outcome variable to assess cluster

variation; Model 1, involving only individual-level variables; Model 2, consisting solely of community-level variables; and Model 3, or the full model, simultaneously integrating both individual and community-level variables. Model comparison was performed using Akaike's Information Criterion (AIC), Bayesian Information Criterion (BIC), Log-likelihood (LL), and Deviance (-2 Log-likelihood Ratio (-2LLR)) statistics. The model with the lowest values in all three comparison parameters was deemed the best-fitting model. The random variability between clusters was assessed using the Likelihood Ratio (LR) test, Intra-class Correlation Coefficient (ICC), and Median Odds Ratio (MOR). The variance inflation factor (VIF) was used to assess collinearity, and it was determined to be within a tolerable range. In the final model, the Adjusted Odds Ratio (AOR) with its 95% confidence interval (CI) was reported and variables with a *p*-value < 0.05 were considered statistically significant.

## **Result**

### **Study participant characteristics**

This study included a total weighted sample of 40,740 ever-married women of reproductive age. The majority (39.72%) were between the ages of 25–34 years, and 63.98% were employed. Additionally, 41.52% of the women were from rich households, 75.03% were rural residents, and 55.60% were from communities with a high level of poverty (Table 1).

### **The proportion of sexual violence in East Africa**

The pooled proportion of sexual violence among ever-married reproductive-age women in East Africa was 13.05% (95% CI: 12.74–13.36). Among the countries, Mozambique had the largest proportion at 60.7%, whereas Comoros had the smallest at 1.84% (Table 2).

### **Random effect analysis and model comparison**

Although the ICC value was below 10%, the significant LR test indicated that a mixed-effect logistic regression model was more suitable than classical regression models. The LR test ( $X^2=123.74$ , *p*-value < 0.001) supported the choice of the generalized linear mixed-effects model (GLMM) over the basic model. In terms of model comparison, Model 3, which incorporated both individual and community-level variables, had the lowest AIC, BIC, and deviance values, making it the best-fit model (Table 3).

### **Factors associated with sexual violence**

The multivariable multilevel robust Poisson regression analysis identified several statistically significant factors associated with sexual violence, including age at first cohabitation/marriage, women's educational level, employment status, sex of the household head, husband/

**Table 1** Individual & community-level characteristics of the study participants ( $n=40,740$ )

Variable	Weighted frequency (%)	Ever experienced sexual violence	
		No (%)	Yes (%)
<b>Individual level characteristics</b>			
<b>Age</b>			
15–24	8,669 (21.28)	7,608 (87.76)	1,061 (12.24)
25–34	16,183 (39.72)	13,942 (86.15)	2,241 (13.85)
35–49	15,888 (39.00)	13,644 (85.88)	2,244 (14.12)
<b>Age at 1st cohabitation/marriage</b>			
< 15	8,001 (19.64)	7,014 (87.67)	987 (12.33)
15–19	16,664 (40.90)	14,067 (84.41)	2,597 (15.59)
20–25	11,685 (28.68)	10,158 (86.93)	1,527 (13.07)
> 25	4,390 (10.77)	3,955 (90.09)	435 (9.91)
<b>Educational level</b>			
No formal education	10,972 (26.93)	9,388 (85.56)	1,584 (14.44)
Primary	17,834 (43.78)	15,060 (84.45)	2,774 (15.55)
Secondary	9,002 (22.10)	7,991 (88.76)	1,011 (11.24)
Higher	2,932 (7.20)	2,755 (93.97)	177 (6.03)
<b>Employment status</b>			
Not employed	14,675 (36.02)	13,284 (90.52)	1,391 (9.48)
Employed	26,065 (63.98)	21,910 (84.06)	4,155 (15.94)
<b>Wealth index</b>			
Poor	15,768 (38.70)	13,380 (84.85)	2,388 (15.15)
Middle	8,056 (19.77)	6,888 (85.51)	1,168 (14.49)
Rich	16,916 (41.52)	14,925 (88.23)	1,991 (11.77)
<b>Sex of household head</b>			
Male	29,505 (72.42)	25,702 (87.11)	3,803 (12.89)
Female	11,235 (27.58)	9,492 (84.48)	1,743 (15.52)
<b>Decision-making autonomy (<math>n=34,227</math>)</b>			
Autonomous	3,833 (11.20)	3,327 (86.80)	506 (13.20)
Not autonomous	30,394 (88.80)	26,707 (87.87)	3,687 (12.13)
<b>Husband/partner's educational level (<math>n=34,316</math>)</b>			
No formal education	8,280 (24.13)	7,217 (87.16)	1,063 (12.84)
Primary	14,374 (41.89)	12,282 (85.44)	2,092 (14.56)
Secondary	8,135 (23.71)	7,303 (89.77)	832 (10.23)
Higher	3,527 (10.28)	3,342 (94.75)	185 (5.25)
<b>Husband/partner drinks alcohol</b>			
No	24,470 (60.06)	22,373 (91.43)	2,097 (8.57)
Yes	16,270 (39.94)	12,820 (78.80)	3,450 (21.20)
<b>Community level characteristics</b>			
<b>Place of residence</b>			
Urban	10,173 (24.97)	9,117 (89.62)	1,056 (10.38)
Rural	30,567 (75.03)	26,077 (85.31)	4,490 (14.69)
<b>Community educational level</b>			
Low proportion of uneducated women	8,054 (19.77)	6,974 (86.58)	1,080 (13.42)
High proportion of uneducated women	32,686 (80.23)	28,220 (86.34)	4,466 (13.66)
<b>Community poverty level</b>			
Low proportion of poor women	18,088 (44.40)	15,684 (86.71)	2,404 (13.29)
High proportion of poor women	22,652 (55.60)	19,510 (86.13)	3,142 (13.87)

partner alcohol consumption, place of residence, and community educational status.

The proportion of sexual violence was 28% higher (APR=1.28, 95% CI: 1.17–1.40) for women who entered their first cohabitation or marriage between the ages of

15–19 and 19% higher (APR=1.19, 95% CI: 1.08–1.32) for women who did so between the ages of 20–25, compared to women who first cohabited or married at age 25 or older. Women with a primary educational level had an 8% higher (APR=1.08, 95% CI: 1.01–1.15) proportion of

**Table 2** Sexual violence among ever-married reproductive-age women in East Africa ( $n=40,740$ )

Country	Year of survey	Sexual violence	
		No (%)	Yes (%)
Burundi	2016-17	4,894 (74.64)	1,663 (25.36)
Ethiopia	2016	4,018 (89.90)	451 (10.10)
Kenya	2022	10,131 (88.40)	1,330 (11.60)
Comoros	2012	2,173 (98.16)	41 (1.84)
Madagascar	2021	4,945 (89.43)	584 (10.57)
Malawi	2015-16	4,029 (80.84)	955 (19.16)
Mozambique	2022-23	3,566 (93.30)	256 (6.70)
Rwanda	2019-20	1,437 (84.38)	266 (15.62)

sexual violence, while women with secondary and higher educational levels had 17% (APR=0.83, 95% CI: 0.76–0.90) and 56% (APR=0.44, 95% CI: 0.37–0.52) lower proportions of sexual violence, respectively. Compared to unemployed women, employed women had a 49% greater (APR=1.49, 95% CI: 1.41–1.60) proportion of sexual violence. Female-headed households had a 15% higher (APR=1.15, 95% CI: 1.09–1.21) proportion of sexual violence compared to male-headed households. Women with husband/partner who drinks alcohol had a 2.4 times greater proportion of sexual violence as compared to their counterparts (APR=2.43, 95% CI: 2.29–2.56). The proportion of sexual violence was 10% higher among rural residents in contrast to urban residents (APR=1.10, 95% CI: 1.02–1.19). Moreover, women living in communities with a high proportion of uneducated women had a 13% lower proportion of sexual violence compared to those living in communities with a low proportion of uneducated women (APR=0.87, 95% CI: 0.81–0.94). (Table 4).

## Discussion

This study highlighted sexual violence among ever-married reproductive-age women, based on nationally representative data from East African demographic and health surveys. In this study, the proportion of sexual violence among ever-married reproductive-age women in East Africa was 13.05%. Factors such as age at first cohabitation/marriage, women's educational level, employment status, sex of the household head, husband/partner alcohol consumption, place of residence, and community

educational status were significantly associated with sexual violence.

This study revealed that a proportion of sexual violence of 13.05% (95% CI: 12.74–13.36). This finding is higher than studies done in Haiti (10.5%) [18], Myanmar (3.8%) [19], Liberia (6.56%) [20], Nigeria (3%) [21], and a study on 26 sub-Saharan African countries in 2020 (8.7%) [22]. However, the proportion of sexual violence in this study was lower than a systematic review and meta-analysis of 9 cross-sectional studies in Africa (33%) [5]. These discrepancies can be attributed to several factors, including variations in study methodologies, differences in definitions of sexual violence, cultural and societal influences, and variations in the characteristics of the populations being studied.

The proportion of sexual violence was higher for women who entered their first cohabitation or marriage between the ages of 15–19 and 20–25, compared to women who first cohabited or married at age 25 or older. This can be justified by the fact that women who marry at an early age often experience greater power imbalances and dependency within relationships. They may lack the maturity and experience needed to effectively protect themselves, thereby increasing the risk of sexual violence. On the other hand, older women often possess greater independence and higher levels of education, which enhance their ability to negotiate and assert their rights within the household. These factors together reduce their vulnerability to violence [23–25].

In this study, women with a primary educational level had a higher proportion of sexual violence, while women with secondary and higher educational levels had lower a proportion of sexual violence. Similar findings were reported in studies that revealed higher education levels were associated with a decreased risk of sexual violence, while studies also indicated that women with lower education levels are at greater risk of experiencing sexual violence [16, 26–28]. This could be because higher education levels are associated with increased awareness of legal rights and available support systems, leading to a decreased risk of sexual violence. In contrast, Lower levels of education can restrict women's access to economic, literacy, and social resources, potentially fostering

**Table 3** Model comparison and random effect results

Parameters	Null model	Model 1	Model 2	Model 3
ICC (95%CI)	3.26 (2.51, 4.24)	3.29 (2.49, 4.32)	3.33 (2.56, 4.31)	3.24 (2.46, 4.26)
LR test	LR test vs. logistic model: $X^2 = 106.53$ Prob > $X^2 = 0.0000$			
Log-likelihood	-17,304.38	-16,227.22	-17,255.99	-15,794.33
Deviance	34,608.76	32,454.44	34,511.98	31,588.66
AIC	34,612.77	32,484.44	34,521.99	31,638.65
BIC	34,630.19	32,615.09	34,565.54	31,856.41

Abbreviations: ICC, Intraclass correlation coefficient; AIC, Akaike's Information Criterion; BIC, Bayesian Information Criterion; LR, Log-likelihood Ratio.

**Table 4** Multilevel analysis of factors associated with sexual violence against ever-married reproductive-age women in East Africa ( $n = 40,740$ )

	Model 1 APR (95%CI)	Model 2 APR (95%CI)	Model 3 APR (95%CI)
<b>Individual level characteristics</b>			
<b>Age</b>			
15–24	1		1
25–34	1.02 (0.96, 1.09)		1.01 (0.95, 1.08)
35–49	0.97 (0.91, 1.05)		0.96 (0.89, 1.03)
<b>Age at 1st cohabitation/marriage</b>			
> 25	1		1
< 15	1.06 (0.96, 1.18)		1.05 (0.95, 1.17)
15–19	1.29 (1.18, 1.42)		1.28 (1.17, 1.40)*
20–25	1.21 (1.09, 1.33)		1.19 (1.08, 1.32)*
<b>Educational level</b>			
No formal education	1		1
Primary	1.10 (1.04, 1.17)		1.08 (1.01, 1.15)*
Secondary	0.85 (0.78, 0.93)		0.83 (0.76, 0.90)*
Higher	0.45 (0.38, 0.54)		0.44 (0.37, 0.52)*
<b>Employment status</b>			
Not employed	1		1
Employed	1.51 (1.42, 1.61)		1.49 (1.41, 1.60)*
<b>Wealth index</b>			
Poor	1		1
Middle	1.02 (0.95, 1.09)		1.02 (0.95, 1.09)
Rich	0.95 (0.89, 1.01)		0.99 (0.92, 1.06)
<b>Sex of household head</b>			
Male	1		1
Female	1.15 (1.09, 1.21)		1.15 (1.09, 1.21)*
<b>Husband/partner drinks alcohol</b>			
No	1		1
Yes	2.42 (2.29, 2.55)		2.43 (2.29, 2.56)*
<b>Community level characteristics</b>			
<b>Place of residence</b>			
Urban		1	1
Rural		1.34 (1.24, 1.45)	1.10 (1.02, 1.19)*
<b>Community educational level</b>			
Low proportion of uneducated women		1	1
High proportion of uneducated women		1.00 (0.93, 1.08)	0.87 (0.81, 0.94)*
<b>Community poverty level</b>			
Low proportion of poor women		1	1
High proportion of poor women		1.00 (0.93, 1.08)	0.96 (0.91, 1.03)

Notes: \*significant at  $p < 0.05$  in adjusted regression analysis, 1=Reference

Abbreviations: APR: Adjusted prevalence ratio; CI: Confidence interval

acceptance of male dominance and control within relationships as influenced by traditional gender norms [29, 30].

Compared to unemployed women, employed women had a higher proportion of sexual violence this finding is supported by a study [16] another study similarly found that women with financial independence were more likely to encounter sexual violence [31]. Women earning money can be seen as a threat to male dominance in patriarchal families, disrupting the traditional power

structure. When women start earning money, they often gain independence and awareness of their rights, potentially challenging gender norms. In response, husbands may react with increased violence to maintain their authority [32, 33].

Consistent with studies [34, 35], this study showed that women with a husband or partner who drinks alcohol experienced a greater proportion of sexual violence compared to those with a husband or partner who does not drink alcohol. A possible explanation is that alcohol

impairs judgment and diminishes inhibitions, which can lead to harmful actions like sexual assault. Additionally, alcohol abuse can escalate existing relationship conflicts and magnify power imbalances within couples, thereby raising the risk of sexual violence.

Female-headed households had a higher proportion of sexual violence compared to male-headed households. The rationale could be that female-led households might experience elevated risks as societal norms around female submissiveness can lead to assertiveness in some women, potentially causing relational tensions and increasing the risk of sexual violence. These households are particularly vulnerable due to cultural expectations, which can exacerbate relational conflicts and further heighten the danger of sexual violence [36].

Another significant factor associated with sexual violence was place of residence. In contrast to urban residents, the proportion of sexual violence was higher among rural residents. This finding aligns with a study [17] and studies [16, 37] showed that women residing in urban areas were less likely to encounter sexual violence than those living in rural areas. This could be attributed to widespread harmful cultural norms and traditions, insufficient legal provisions, limited access to legal services, unequal power dynamics, and a low level of awareness about sexual violence in rural areas [38]. Moreover, urban women typically have greater access to media and awareness of legal rights, shared by their partners, which likely contributes to the lower proportion of sexual violence in urban areas.

Moreover, the findings of this study revealed that in communities where there is a higher proportion of uneducated women, there appears to be a lower proportion of sexual violence compared to communities with a lower proportion of uneducated women. This may be attributed to the underreporting in communities with lower education levels, possibly due to stigma, fear of reprisal, or lack of awareness regarding sexual violence. Consequently, despite potentially higher occurrences of sexual violence, the reported rates may remain lower.

### Strengths and limitations of the study

The study utilized DHS data, ensuring robustness in its findings through standardized data collection procedures. By employing weighted data, the study accurately reflected national demographic trends. Utilizing the latest DHS data enhanced the study's relevance. However, its cross-sectional design limited its ability to establish causal relationships. Respondent's reliance on memory may introduce potential recall bias, particularly in recalling past events. Pre-existing factors such as family background, beliefs, or values may influence the likelihood of experiencing sexual violence. Social desirability bias during data collection, especially concerning sensitive topics

like sexual violence, may have influenced respondents' reporting accuracy, affecting prevalence estimates.

### Conclusion

In conclusion, factors such as age at first cohabitation/marriage, women's educational level, employment status, sex of the household head, husband/partner alcohol consumption, place of residence, and community educational status were significantly associated with sexual violence against ever-married reproductive-age women in East Africa. To address this, it is crucial to provide education and support while encouraging girls and women to pursue education to empower themselves and reduce their vulnerability. Programs should focus on ensuring workplace safety, promoting financial independence, and strengthening legal protections against harassment and abuse. Improving access to support services and community networks is essential, particularly in rural areas, to prevent and respond to sexual violence effectively. Additionally, raising awareness about the impact of alcohol abuse on relationships and the associated risk of sexual violence is imperative.

The findings from this study are crucial for governments and policymakers in formulating strategies and policies to combat sexual violence.

### Abbreviations

AIC	Akaike's Information Criterion
APR	Adjusted Prevalence Ratio
BIC	Bayesian Information Criterion
CI	Confidence Intervals
DHS	Demographic and Health Survey
EAs	Enumeration Areas
ICC	Intra-class correlation
LR	Log-likelihood Ratio

### Acknowledgements

We gratefully acknowledge the Measure DHS program for granting on-request open access to its dataset.

### Author contributions

YMN conceptualized the study and drafted the manuscript. YMN, BLS, MM, BMF, ZAA, MMB, AAA, and HAA participated in the analysis, critically reviewed the draft manuscript, and wrote the final version. All authors read and approved the final manuscript.

### Funding

This study received no specific funding from any funding agency.

### Data availability

The data is available online and can be accessed at the Measure DHS website: <http://www.measuredhs.com>.

### Declarations

#### Ethical approval and consent to Participate

As this study involved secondary analysis of publicly available survey data from the MEASURE DHS program and did not involve direct interaction with the participants, ethical approval and participant consent were not required. We obtained permission to download and use the data from <http://www.dhsprogram.com>. The data files did not include any personal identifiers such as names or addresses. The data were used solely for this registered study and were not shared outside the group of co-researchers.

**Consent for publication**

Not applicable.

**Competing interests**

The authors declare no competing interests.

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Received: 28 June 2024 / Accepted: 19 September 2024

Published online: 29 September 2024

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