



# HIV infection risk among women in South Africa: assessing the roles of women's financial autonomy, sexual autonomy and intimate partner violence

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## Abstract

**Aim** To assess the inter-relationships between women's sexual autonomy (SA), financial autonomy (FA), and experience of intimate partner violence (IPV); and determine how these factors influence HIV infection risk.

**Subject and methods** This is a secondary analysis of the 2016 South-Africa Demographic and Health Survey. The study included all ever-partnered women aged 18–49 who were randomly selected for the domestic violence and HIV test modules. SA was measured from questions about women's ability to refuse sex or request condom use. FA was measured from questions about women's employment status, personal earnings, etc. IPV was measured from questions about women's experience of emotional, physical and/or sexual violence. Bivariate analyses were used to assess the inter-relationships between SA, FA and IPV, and their individual relationships with HIV. Lastly, a multiple logistic regression model assessed their mutually adjusted associations with HIV infection risk.

**Results** There was no apparent relationship between sexual and financial autonomy, but they were weakly inversely associated with IPV. In the bivariate analyses, all three variables were associated with HIV risk. However, in the mutually adjusted model, only SA and IPV remained associated with HIV risk. Low SA (AOR = 2.01, 95% CI 1.30 to 3.10,  $p = 0.006$ ) and exposure to sexual violence (AOR = 2.91, 95% CI 1.14 to 7.43,  $p = 0.03$ ) were associated with higher odds of HIV seropositivity.

**Conclusion** This study highlighted the important roles of SA and IPV on women's HIV risk, as well as the need for further research to clarify the role of FA.

**Keywords** HIV · Sexual autonomy · Intimate partner violence · Financial autonomy · Sub-Saharan Africa

## Introduction

Despite significant advancements in the global fight against HIV/AIDS in the past two decades, it remains highly prevalent in sub-Saharan Africa, with the Southern African region as the epicentre of the global HIV epidemic (Zakeyo and Nyashanu 2021). Whereas the global HIV prevalence in 2019 was 0.48%, the prevalence in South Africa towered at 14.25%, representing a 40-fold increase from a 0.35% prevalence in 1990 (Govender et al. 2021). Collectively,

the sub-Saharan African region accounts for 69% of all new HIV infections in the world, despite containing only 11% of the global population (Ramjee and Daniels 2013). Furthermore, HIV infection rates in sub-Saharan Africa are generally higher among women than men. For instance, the number of South African women aged >15 years living with HIV in 2020 was 4.84 million, compared to 2.49 million men of the same age group (Pillay and Johnson 2021). Similar gender disparities in HIV have been reported in other sub-Saharan African countries (Glynn et al. 2001; Ramjee and Daniels 2013). While some of this gender disparity is attributable to the greater anatomical susceptibility of women to HIV infection (Dellar et al. 2015; Yi et al. 2013), it has also been linked to patriarchal norms (Weiss et al. 2000), low female autonomy (Pettifor et al. 2004; Greig and Koopman 2003) and gender-based violence in sexual relationships (Dunkle et al. 2004).

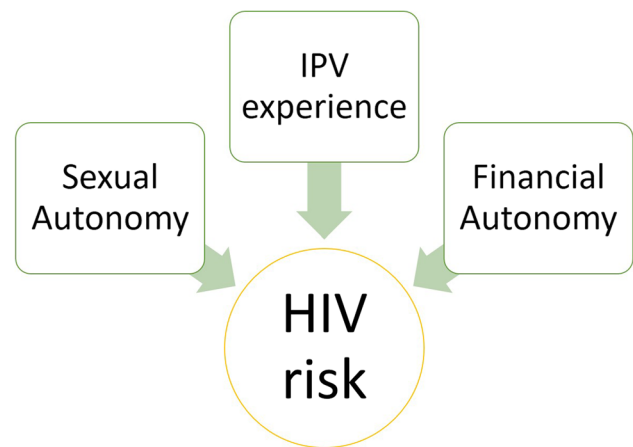
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Recent research has illuminated the roles of female autonomy (also known as sexual autonomy, women's autonomy, relationship power or sexual power) and intimate partner violence (IPV) on women's risk of contracting HIV. Studies from Botswana (Greig and Koopman 2003), Zambia (Glynn et al. 2001), Nigeria (Sano et al. 2018) and South Africa (Dunkle et al. 2004; Pettifor et al. 2004) have shown that women's HIV infection risk is significantly influenced by their autonomy within sexual relationships and their exposure to gender-based violence. These studies often measured women's autonomy using proxies such as safe sex negotiating ability, HIV knowledge, or risky sexual behaviour, with a focus on women's sexual autonomy within relationships (or their 'relationship power'). This metric of female autonomy measures men's controlling behaviours and women's ability to make decisions about sex, condom use and their own healthcare, often measured using the Sexual Relationship Power (SRP) scale (Pulerwitz et al. 2000). While SRP or sexual autonomy is a valid measure of women's autonomy, this construct largely ignores another important component of women's autonomy, which has been shown to influence their sexual behaviour and HIV risk – financial agency (Bermudez et al. 2022).

Women's financial autonomy/agency has been defined as a woman's capacity to personally earn income and manage her earnings independently of her partner (Bermudez et al. 2022). Distinct from sexual autonomy, financial agency also has a significant potential to influence women's sexual behaviour and HIV infection risk. Within the economic context of sub-Saharan Africa, women have identified money as a driving force for engaging in sex and forming sexual relationships (MacPhail and Campbell 2001; Stoebenau et al. 2016; Varga 2003). Indeed, multiple HIV prevention interventions targeted at women have been focused on providing financial empowerment through cash transfers, personal savings accounts and financial literacy (Baird et al. 2012; De Walque et al. 2012; Pronyk et al. 2008). Women have also indicated that they feel more powerful in relationships when they have economic independence (Harvey et al. 2002). A qualitative study among South African women identified financial agency as a potential mechanism for HIV risk reduction, but this theory has yet to be empirically tested (Bermudez et al. 2022). As such, the primary aim and novelty of this study is to assess the independent role of women's financial autonomy on their HIV risk, treating this exposure as distinct from the widely studied sexual autonomy. This is illustrated in Fig. 1. This conceptual illustration is not a formal directed acyclic graph (DAG) and intentionally ignores the complex inter-relationships between the three exposures, as well as the influence of other external factors.

Intimate partner violence (IPV) (also referred to as domestic violence) has also been identified as an independent risk factor for HIV infection among women, and



**Fig. 1** Simple depiction of the independent influences of women's sexual autonomy, financial autonomy and experience of intimate partner violence on their HIV infection risk

this association is intricately linked to female autonomy (Dunkle et al. 2004; Jewkes et al. 2006). In a longitudinal study among reproductive-aged women in the Eastern Cape province of South Africa, Jewkes et al. (2010) reported that exposure to violence resulted in 51% greater risk of contracting HIV (incidence rate ratio 1.51, 95% CI 1.04 to 2.22). Similarly, the United Nations Programme on HIV/AIDs notes that women who experience IPV are 50% more likely to acquire HIV than women who do not (Zegeye et al. 2022). Jewkes et al. (2010) further explain that the mechanism of this relationship is related to female autonomy. Specifically, female power inequity in sexual relationships may result in a higher potential for emotional and physical violence and a lower capacity to negotiate safe sex and condom use (Zegeye et al. 2022). This could in turn, translate into a greater risk for HIV infection among women (Bermudez et al. 2022; Sano et al. 2018; Ung et al. 2014).

However, contrary evidence from Ghana suggests that, while women's sexual autonomy is negatively associated with experiencing physical violence, greater female financial autonomy is associated with an increased risk of experiencing domestic violence (Tenkorang 2018). This is probably because women's economic independence challenges traditional gender roles of men as primary providers for the household, resulting in a higher potential for domestic violence (Tenkorang 2018). This positive relationship between women's financial autonomy and their risk of domestic violence has also been reported in Asian contexts (Krishnan et al. 2010; Paul 2016; Rocca et al. 2009). As such, while assessing the association of female autonomy with HIV infection risk, it is necessary to independently consider financial and sexual autonomy due to their potentially different relationships with IPV and HIV risk.

Using a nationally representative sample of ever partnered (currently or previously had a partner or husband) women aged 18 to 49 years in South Africa, this study examines the interrelationship between sexual autonomy, financial autonomy and intimate partner violence. The study further assesses the association between these three exposures and women's HIV infection risk, as confirmed by a temporally prospective HIV bioassay test. We hypothesize that, as with previous studies, female sexual autonomy would be inversely associated with women's HIV infection risk. Examining the role of financial autonomy on HIV risk constitutes a novelty of this study, given the lack of evidence on this subject. We expect to observe a similar inverse relationship as with sexual autonomy, although a direct relationship is also possible. By attempting to disentangle the intricate relationships between these two distinct aspects of female autonomy, IPV and HIV risk, this study will provide valuable insights into gender equity dynamics in sub-Saharan Africa, and potentially inform the design of more effective contextual and individual-level interventions for female HIV risk reduction.

## Methods

### Design and data source

This is a cross-sectional study involving a secondary analysis of data from the 2016 South Africa Demographic and Health Survey (SADHS). The 2016 SADHS was executed as a collaboration between Statistics South Africa and the South African Medical Research Council (SAMRC), with technical support from Inner City Fund International (ICF) through The Demographic and Health Survey (DHS) Program of the United States Agency for International Development (USAID). Financial support for the SADHS 2016 was provided by the government of South Africa through the National Department of Health (NDoH), the SAMRC, the Global Fund to Fight AIDS, Tuberculosis and Malaria, the European Union, the United Nations Children's Fund, and the United Nations Population Fund (NDoH et al. 2019). The DHS are a series of nationally representative surveys that use a standardized design to obtain internationally comparable demographic and primary healthcare data.

### Sampling and participants

A detailed description of the SADHS 2016 methodology is provided in the published country report (NDoH et al. 2019). Briefly, the SADHS 2016 followed a stratified two-stage sampling design. Each of the nine South African provinces was initially stratified into urban, farm and traditional areas, yielding 26 sampling strata (Western Cape produced only two sub-strata). Next, a probability-proportional-to-size

sampling of 750 primary sampling units (PSUs) was carried out, followed by a systematic sampling of 20 dwelling units (DUs) from each PSU. All women aged 15–49 who were either permanent residents of the selected households or overnight visitors, were eligible for interviews with the Women's Questionnaire. Furthermore, one woman aged 18 years or more in all selected households was selected for a module on domestic violence, and half of the DUs were randomly selected for biomarker collection (including a blood sample for HIV testing) (NDoH et al. 2019). After participants signed consent forms, 8514 women were successfully interviewed, yielding a response rate of 86% (NDoH et al. 2019). For the current study, the subset of ever-partnered women (currently or previously had a partner or husband) who participated in the domestic violence module and had conclusive HIV tests was used. This amounted to 729 women aged 18 to 49.

### Outcome variable

The HIV outcome is a binary variable indicating HIV serostatus status (i.e. positive or negative). Blood spot samples were collected from every individual in the random subset of households selected for biomarker collection, on a fully informed and voluntary basis. The blood samples were first analysed with an enzyme-linked immunosorbent assay (ELISA) test, then all positive samples and 5% of the negative ones were retested with a different ELISA. Concordant positive results on both ELISAs were finally subjected to a confirmatory rapid test (NDoH et al. 2019). All women with inconclusive results were excluded from the current study.

### Explanatory variables

Three primary explanatory variables were used in this study: sexual autonomy, financial autonomy and experience of intimate partner violence (IPV). Consistent with previous studies, sexual autonomy was defined as the ability to refuse sexual relations and/or to request that partners use a condom before intercourse, whether in marital or non-marital relationships (Closson et al. 2019; Jewkes et al. 2006). This was measured from responses to two questions women were asked: 'Can you refuse sexual demand from your husband/partner?' and 'Can you ask your husband/partner to use a condom?' A summative sexual autonomy index was created by assigning each woman a score of 1 for a 'yes' response to each of these questions, and a score of 0 for a 'no' response. This resulted in an ordinal sexual autonomy scale with scores of 0, 1 and 2 corresponding to low, medium and high sexual autonomy, respectively.

Financial autonomy has been defined in previous studies among women in South Africa and Ghana as both the capacity to personally earn income and decide how earned

income is managed, saved or spent (Bermudez et al. 2022; Tenkorang 2018). Accordingly, financial autonomy was measured from responses to four questions asking women if they: were engaged in paid employment in the past 12 months; have a personal bank account; earn more than their partner; and decide how their earnings are spent, independent of their partner. A summative financial autonomy index was created by assigning each woman a score of 1 for an affirmative response to each of these items and 0 for a negative response. The assigned scores were summed up to obtain a financial autonomy index, which was divided into tertiles, yielding an ordinal financial autonomy scale with three levels corresponding to low, medium and high financial autonomy, respectively.

Experience of intimate partner violence (IPV) was measured using responses to questions in the Domestic Violence module of the DHS, which assess whether women had ever experienced emotional, physical and/or sexual violence from their current or most recent husband/partner (yes/no). For emotional violence, women were asked if their partner ever humiliated, verbally insulted, threatened to harm, or made them feel bad. For physical violence, they were asked if their partner ever pushed, shook, slapped, punched, kicked, dragged, tried to strangle or burn them, threatened or attacked them with a knife or gun, or twisted their arm or hair. Sexual violence included whether the partner ever physically forced sex or other sexual acts when not wanted by the woman. This information was collected from one randomly selected woman in each household, with no one else in the household aware that this was done.

Four categories of IPV experience were created from the binary responses to these questions: ‘No IPV experience’, ‘Emotional violence only’, ‘Physical (but no sexual) violence’, and ‘Sexual violence’. Note that most women in the physical and sexual violence categories also experienced emotional violence, and 70% of women in the sexual violence category also experienced physical violence. Thus, the categories may be viewed as ordinal levels of IPV experience. This categorization was chosen to obtain a manageable number of informative groups; avoid positivity violations (empty or sparsely filled cells) in the analysis; and enable comparisons with previous studies (Durevall and Lindskog 2015; Harling et al. 2010). The main analysis controlled for potential confounders identified through a review of the pertinent literature (Closson et al. 2019; Dunkle et al. 2004; Jewkes et al. 2006). These include women’s educational attainment (ordinal with four levels – less than primary, completed primary, completed secondary, and any tertiary education), age (continuous, in years) and marital status (nominal with two levels – ever or never married). Others are rural/urban residence; household wealth (ordinal – five quintiles); more than one sexual partners in the past 12 months (dichotomous); and being in an age-disparate relationship ( $\geq 10$  years younger than partner – dichotomous).

## Statistical analyses

First, the sociodemographic, sexual and other attributes of the women included in the study were described by computing weighted frequencies across categories. For this analysis, the DHS sampling weights for the subset of women randomly selected for HIV testing (corrected for non-participation) were applied. Secondly, the relationships between IPV, financial autonomy and sexual autonomy were assessed using chi-squared tests. Thirdly, the bivariate associations of these exposures and other women’s characteristics with the outcome (HIV risk) were assessed using chi-squared tests and bivariate logistic regression. Lastly and most importantly, a multivariate logistic regression model was used to determine how these three exposures relate to women’s HIV risk while adjusting for potential confounders (educational attainment, age, marital status, rural/urban residence, household wealth, risky sexual behaviour, and being in an age-disparate relationship).

To account for within-cluster correlations inherent in the DHS design, cluster-robust standard errors were computed for the regression models (Jayatilake et al. 2011; Ogbodo and Onyekwum, 2023). Similar to Durevall and Lindskog (2015) and Harling et al. (2010), the sampling weights were not used in the main analyses because their effects are unclear when subsamples are analysed. Diagnostic statistical tests were further conducted to assess whether the assumptions of logistic regression were satisfied by the multivariate model (including the assumptions of a linear relationship between the logit of the outcome and the continuous predictors, absence of multicollinearity across predictors, independence of observations and the absence of influential outliers). The results of these diagnostic analyses are provided in the supplementary material. All analyses were conducted using R statistical software (version 4.2.2), and p values  $< 0.05$  were taken as statistically significant.

## Results

Table 1 shows the weighted sociodemographic and other characteristics of ever-partnered women aged 18–49 in the 2016 South Africa DHS. On average, respondents were 35.8 years of age (standard deviation 7.7 years). The majority had less than secondary education (62.4%); were currently married (57.5%); resided in urban areas (70.3%); and were not gainfully employed in the past year (51.1%). Most of the women could refuse sex with their partners (64.2%) and ask their partners to use condoms (68.3%). Approximately

**Table 1** Weighted sociodemographic and other characteristics of ever-partnered women aged 18–49 in the South Africa DHS, 2016

Characteristics ( <i>N</i> = 737)	Weighted frequency (%)
<b>Education</b>	
Less than primary	9.0
Completed primary	53.4
Completed secondary	23.3
Tertiary	14.3
<b>Age</b>	
18 to 29 years	28.4
30 to 39 years	41.5
40 to 49 years	30.1
<b>Residence</b>	
Urban	70.3
Rural	29.7
<b>Marital status</b>	
Ever married	68.3
Never married (cohabiting with partner)	31.7
<b>Household wealth (quintiles)</b>	
Highest	18.0
High	15.9
Middle	24.7
Low	21.7
Lowest	19.7
<b>Financial autonomy</b>	
Worked in the past year	47.9
Has a personal bank account	56.0
Earns more than partner	11.7
Independently decides how her earnings are spent	11.5
<b>Sexual autonomy</b>	
Can refuse sex	64.2
Can ask partner to use a condom	68.3
<b>Intimate partner violence</b>	
No violence experience	76.1
Emotional violence only	7.6
Physical (but no sexual) violence	13.6
Sexual violence <sup>†</sup>	2.7
<b>Sexual history</b>	
Age at sexual debut <15 years	6.6
More than 1 sexual partner in the past year	3.2
In an age-disparate relationship (≥10 years younger than partner)	16.9
Tested positive for HIV	30.6

<sup>†</sup>70% of women in this category also experienced physical violence

17% of the women were 10 years younger than their partners. In addition, over 16% of the women had experienced physical and/or sexual violence, and 30.6% of all women tested positive for HIV.

**Table 2** Associations of IPV experience with female financial and sexual autonomy among ever-partnered women aged 18–49 in the South Africa DHS, 2016

	Intimate partner violence [ <i>n</i> (%)]				P-value <sup>‡</sup>
	None	Emotional only	Physical	Sexual	
<b>Financial autonomy</b>					
High	176 (78.2)	21 (9.3)	23 (10.2)	5 (2.2)	
Medium	199 (75.1)	21 (7.9)	36 (13.6)	9 (3.4)	
Low	171 (71.5)	27 (11.3)	32 (13.4)	9 (3.8)	0.61
<b>Sexual autonomy</b>					
High	211 (77.3)	19 (7.0)	34 (12.5)	9 (3.3)	
Medium	176 (77.9)	24 (10.1)	32 (13.4)	6 (2.5)	
Low	159 (72.9)	26 (11.9)	25 (11.5)	8 (3.7)	0.61

NB, row percentages are presented; <sup>‡</sup>p-value calculated with Pearson's chi-squared test

### Relationships between the main explanatory variables

The bivariate analyses presented in Table 2 showed no significant associations between IPV and women's sexual and financial autonomies (p-values for Pearson's chi-squared ( $\chi^2$ ) tests = 0.61 in both cases). For instance, the proportion of women that have experienced no IPV increases across the financial autonomy levels (71.5% → 75.1% → 78.2%), but a  $\chi^2$  test for trends was not significant ( $p = 0.10$ ). The same applies for other categories.

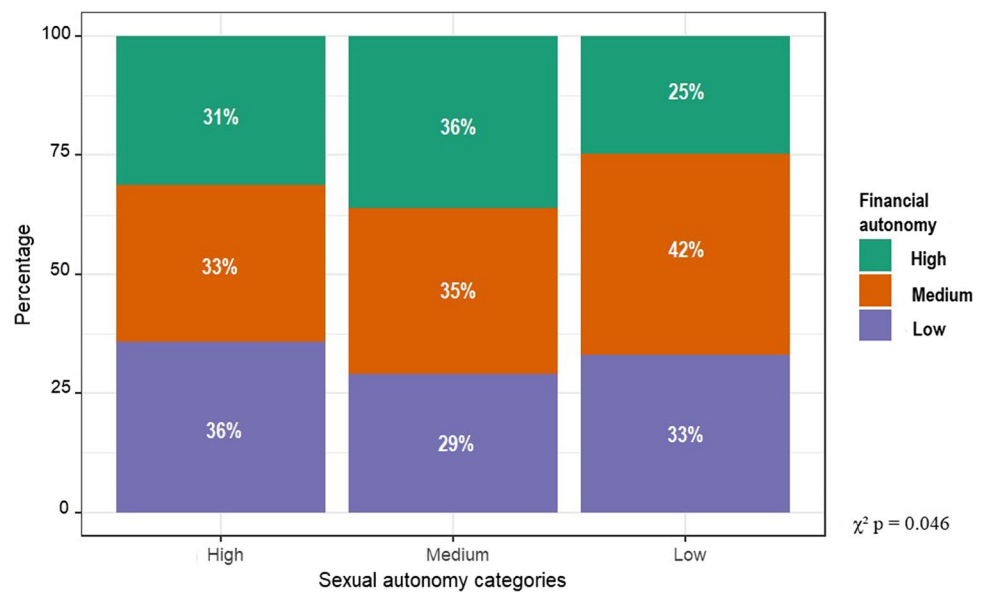
On the other hand, the tests for association between women's sexual and financial autonomy showed a marginally significant association ( $\chi^2 p = 0.046$ ), although the direction of this association is not apparent. As shown in Fig. 1, low financial autonomy (blue) is most prevalent among women with high sexual autonomy (36%), suggesting an inverse association. Conversely, high financial autonomy (green) is least prevalent among women with low sexual autonomy (25%), suggesting a direct association. As such, a clear relationship between both types of female autonomy is not immediately apparent. In addition, a correlation test using the continuous sexual and financial autonomy indices indicated an extremely weak positive correlation (Pearson  $r = 0.02$ ) (Fig. 2).

### Bivariate associations with HIV risk

Table 3 shows the results of bivariate analyses between women's characteristics and HIV infection risk. Educational attainment was strongly associated with HIV risk, with a greater crude risk among university-educated women compared to women with less than primary education (OR = 2.31, 95% CI 1.19 to 4.51). Similarly, women in the poorest households were more likely to be HIV positive than those



**Fig. 2** Segmented bar plot showing the relationship between sexual autonomy and financial autonomy among women aged 18–49 in the 2016 South Africa DHS



in the highest wealth quintile (OR = 4.20, 95% CI 2.03 to 8.69). Compared to ever-married women, those who had never been married were more likely to be HIV positive (OR = 1.96, 95% CI 1.42 to 2.71). For the correlates of financial autonomy, women who did not earn more than their partners were 85% more likely to be HIV positive than those who did (OR = 1.85, 95% CI 1.05 to 3.26). Similarly, women who did not unilaterally decide how their earnings were spent were more likely to be HIV positive than those who did (OR = 1.66, 95% CI 1.01, 2.72). Using the financial autonomy tertiles, women with medium (OR = 1.47, 95% CI 0.99 to 2.16) and low (OR = 1.40, 95% CI 0.93 to 2.11) financial autonomy were more likely to be HIV positive than those with high financial autonomy, although this association is non-significant ( $\chi^2 p = 0.12$ ).

On the other hand, sexual autonomy appears to be strongly associated with HIV risk in the bivariate analysis ( $\chi^2 p = 0.003$ ). Women with low sexual autonomy were 64% more likely to be HIV positive than those with high sexual autonomy (OR = 1.64, 95% CI 1.11 to 2.42). Specifically, the inability to refuse a sex request from one's partner (OR = 1.43, 95% CI 1.06 to 1.95) or request condom use (OR = 1.49, 95% CI 1.07 to 2.07) were associated with higher odds of HIV seropositivity. IPV experience was also associated with HIV risk, with exposure to sexual violence associated with 190% greater odds of HIV seropositivity compared to no IPV exposure (OR = 2.90, 95% CI 1.28 to 6.52). Regarding sexual behaviour, sexual debut at <15 years was associated with doubled odds of HIV seropositivity (OR = 2.04, 95% CI 1.14 to 3.67). Similarly, being at least 10 years younger than one's partner was associated with 58% higher odds of being HIV-positive, on average (OR = 1.58, 95% CI 1.08 to 2.31). There was only weak evidence of

an association between having multiple sexual partners and HIV risk (OR = 1.23, 95% CI 0.53, 2.86,  $\chi^2 p = 0.63$ ).

### Multivariate analysis

Table 4 shows the results of the mutually adjusted logistic regression analysis. Here, sexual autonomy and IPV remained significantly associated with HIV infection risk, while financial autonomy was not. Specifically, women with low sexual autonomy were twice as likely to be HIV seropositive than women with high sexual autonomy (OR = 2.01, 95% CI 1.30 to 3.10,  $p = 0.006$ ). Conversely, no material difference in HIV risk was found between the financial autonomy tertiles. For IPV, exposure to sexual violence remained associated with 191% greater odds of HIV seropositivity compared to no IPV exposure (OR = 2.91, 95% CI 1.14 to 7.43,  $p = 0.03$ ). The model diagnostics test results (supplementary material) showed that the assumptions of logistic regression analysis are satisfied by this model.

### Discussion

While a number of studies have assessed the role of female sexual autonomy on HIV infection risk (Dunkle et al. 2004; Pettifor et al. 2004), no previous study has explored the role of financial autonomy – an important driver of sexual behaviour among sub-Saharan African women (Stoebenau et al. 2016; Varga 2003). In the bivariate analysis, both financial and sexual autonomy appeared to be associated with HIV risk, although this relationship was not statistically significant for financial autonomy. However, in the multivariate model, only sexual autonomy was associated with HIV

**Table 3** Crude associations of sociodemographic and other characteristics with HIV risk among ever-partnered women aged 18–49 in the South Africa DHS, 2016

CHARACTERISTIC (N=737)	n HIV positive / n in group	% HIV positive	Crude OR (95% CI)	p-value <sup>‡</sup>
<b>Sociodemographic attributes</b>				
Education – Tertiary	16/75	21.3%	1.00	
Education – Completed secondary	35/153	22.9%	1.09 (0.58, 2.07)	
Education – Completed primary	152/405	37.5%	2.22 (1.25, 3.91)	
Education – Less than primary	37/96	38.5%	2.31 (1.19, 4.51)	0.0007
Age – 18 to 29 years	51/173	29.5%	1.00	
Age – 30 to 39 years	115/305	37.7%	1.45 (0.99, 2.11)	
Age – 40 to 49 years	74/251	29.5%	1.00 (0.66, 1.51)	0.07
Residence – Urban	118/380	31.1%	1.00	
Residence – Rural	122/349	35.0%	1.19 (0.89, 1.60)	0.26
Marital status – Ever married	141/501	28.1%	1.00	
Marital status – Never married	99/228	43.4%	1.96 (1.42, 2.71)	<0.00001
Household wealth – Richest	10/85	11.8%	1.00	
Household wealth – Rich	36/123	29.3%	3.10 (1.46, 6.61)	
Household wealth – Middle	70/194	36.1%	4.23 (2.11, 8.49)	
Household wealth – Poor	68/171	39.8%	4.96 (2.44, 10.06)	
Household wealth – Poorest	56/156	35.9%	4.20 (2.03, 8.69)	0.0001
<b>Financial autonomy</b>				
High autonomy	62/225	27.6%	1.00	
Medium autonomy	95/265	35.8%	1.47 (0.99, 2.16)	
Low autonomy	83/239	34.7%	1.40 (0.93, 2.11)	0.12
Was gainfully employed in the past year	102/324	31.5%	1.00	
Was not gainfully employed in the past year	138/405	34.1%	1.12 (0.82, 1.54)	0.46
Has a personal bank account	120/396	30.3%	1.00	
Does not have a personal bank account	120/333	36.0%	1.30 (0.94, 1.79)	0.10
Earns more than partner	16/73	21.9%	1.00	
Does not earn more than partner	224/656	34.1%	1.85 (1.05, 3.26)	0.03
Independently decides how her earnings are spent	20/84	23.8%	1.00	
Partner jointly or fully decides how her earnings are spent	220/645	34.1%	1.66 (1.01, 2.72)	0.06
<b>Sexual autonomy</b>				
High autonomy	83/273	30.4%	1.00	
Medium autonomy	66/238	27.7%	0.88 (0.59, 1.30)	
Low autonomy	91/218	41.7%	1.64 (1.11, 2.42)	0.003
Can refuse sex	136/455	29.9%	1.00	
Cannot refuse sex	104/274	38.0%	1.43 (1.06, 1.95)	0.03
Can ask partner to use a condom	143/479	29.9%	1.00	
Cannot ask partner to use a condom	97/250	38.8%	1.49 (1.07, 2.07)	0.01
<b>Intimate partner violence</b>				
No violence experience	169/546	31.0%	1.00	
Emotional violence only	29/69	42.0%	1.62 (0.95, 2.76)	
Physical violence	29/91	31.9%	1.04 (0.64, 1.71)	
Sexual violence <sup>†</sup>	13/23	56.5%	2.90 (1.28, 6.57)	0.02
<b>Sexual history</b>				
Age at sexual debut ≥15years	218/684	31.9%	1.00	
Age at sexual debut <15years	22/45	48.9%	2.04 (1.14, 3.67)	0.02
Not in an age-disparate relationship (≥10yrs)	182/589	30.9%	1.00	
In an age-disparate relationship (≥10yrs)	58/140	41.4%	1.58 (1.08, 2.31)	0.02
More than 1 sexual partner in the past year	9/24	37.5%	1.00	
Only 1 sexual partner in the past year	231/705	32.8%	1.23 (0.53, 2.86)	0.63

n = number of women; ‡p-values calculated with chi-squared test; †70% of women in this category also experienced physical violence

**Table 4** Mutually adjusted associations of women's sexual autonomy, financial autonomy and IPV experience with HIV risk among ever-partnered women aged 18–49 in the South Africa DHS, 2016

Variable	OR (95% CI)	p-value
Sexual autonomy		
High (RC)	1.0	–
Medium	0.98 (0.65, 1.49)	0.93
Low	2.01 (1.30, 3.10)	0.001
Financial autonomy		
High (RC)	1.0	–
Medium	1.31 (0.85, 2.01)	0.22
Low	1.04 (0.66, 1.66)	0.86
IPV		
No violence (RC)	1.0	–
Emotional violence only	1.53 (0.88, 2.67)	0.14
Physical violence	1.00 (0.58, 1.72)	0.99
Sexual violence <sup>†</sup>	2.91 (1.14, 7.43)	0.03

RC – Reference category. All variables are mutually adjusted. In addition, this model adjusted for women's educational attainment, age (linear and quadratic terms), marital status, residence, household wealth (quintiles), and having >1 sexual partners in the past year. <sup>†</sup>70% of women in this category also experienced physical violence

risk. Similar to previous studies (Durevall and Lindskog 2015; Jewkes et al. 2006; Jewkes et al. 2010; Teitelman et al. 2016), our study further showed a strong association of IPV experience with HIV risk, with a near-tripling of HIV risk among women exposed to sexual violence in this population. However, unlike Tenkorang (2018), we did not observe a direct relationship between financial autonomy and IPV experience in this study. Indeed, financial autonomy appeared to be inversely related to the risk of experiencing IPV, similar to sexual autonomy.

This study makes two important contributions to the knowledge on this subject. First, it strengthens the existing evidence about the pivotal role of sexual autonomy on women's risk of contracting HIV, whether independently or through its relationship with IPV experience. As such, interventions that improve women's sexual autonomy should be prioritized in efforts to limit HIV infection among women. This includes a range of individual-level and contextual gender equality initiatives such as girl child education, female empowerment initiatives, and community-based campaigns to upend patriarchal norms. Secondly, this study initiates the conversation about the potential role of women's financial autonomy on their HIV infection risk. Our results suggest that financial autonomy is not significantly associated with women's HIV risk, and may consequently not be a productive target for interventions among women in sub-Saharan Africa. While this may seem counter-intuitive, there is some empirical evidence suggesting the ineffectuality of financial empowerment interventions for reducing women's HIV

risk in this context. In a randomized controlled trial conducted among 2399 couples in rural Tanzania, conditional cash transfers failed to reduce the incidence of HIV after 12 months (RR = 1.03, 95% CI 0.74 to 1.32) (De Walque et al. 2012). However, the converse effect was observed in a similar cash transfer initiative among never-married women aged 13 to 22 years in Malawi, where HIV risk markedly decreased after 18 months (Adjusted OR = 0.36, 95% CI 0.14 to 0.91) (Baird et al. 2012). As such, there is a possibility that any effect of financial autonomy differs by women's age groups – an analysis which was not possible in this study due to sample size limitations. In essence, further research is needed to explore the role of financial autonomy on women's HIV risk, using samples that are large enough to permit the assessment of this relationship within women's age groups.

Besides financial autonomy, other factors that appeared to influence women's HIV risk in this study include educational attainment, household wealth and being in age-disparate sexual relationships. Previous evidence from South Africa suggested that women's sexual negotiating power is compromised in age-disparate relationships (Closson et al. 2019). Another study among women in Botswana revealed that men are more likely to refuse to use condoms when there is an age difference of up to 10 years between them and their female partners (Langen 2005). Similarly, in our study, women in age-disparate relationships were 25% more likely to have low sexual autonomy ( $\chi^2 p = 0.047$ ) and 58% more likely to test positive for HIV (OR = 1.58, 95% CI 1.08 to 2.31) than women who were not in age-disparate relationships. This shows an inherent negative consequence of the patriarchal norms in many sub-Saharan African societies, which encourages women to seek older partners for not just economic but also social, physical and psychological benefits (Leclerc-Madlala 2008; Wamoyi et al. 2018). It also highlights the need for an overhaul of these inimical archaic ideals.

Women's education and household wealth are other important factors that could influence women's autonomy, and consequently, HIV risk. In a validation of the South African adaptation of the Sexual Relationship Power Scale, education and household wealth ranked highly among the factors associated with higher sexual power among young women (Closson et al. 2019). In another multi-level study in Botswana, HIV prevalence was positively correlated with women's education, which was used as a proxy for women's empowerment (Greig and Koopman 2003). Similarly, in our study, women's education was associated with sexual autonomy ( $\chi^2 p = 0.057$ ) and strongly associated with HIV risk ( $\chi^2 p = 0.0007$ ). Household wealth was also marginally associated with sexual power ( $\chi^2 p = 0.07$ ) and strongly associated with HIV risk ( $\chi^2 p = 0.0001$ ). In general, these factors constitute avenues for interventions aimed at reducing women's HIV risk in sub-Saharan African contexts.



This study has important limitations. The data used are from the year 2016, which may be viewed as relatively old. However, it represents the most recent Demographic and Health Survey conducted in South Africa to date, and it is unlikely that this negatively influenced the validity or applicability of the study's inferences. Secondly, although HIV infection status was newly diagnosed following the interviews, the cross-sectional design of the study limits its ability to establish the temporality sequence of the exposures and the HIV infection. Thirdly, most of the data used were self-reported from interviews, which may make the study susceptible to measurement error. However, any misreporting of IPV experience in this study is more likely to take the form of under-reporting (for fear of reaction from abusive partners), thereby biasing our results towards the null. Another limitation is the relatively small sample size used for this analysis, which prohibited potentially insightful subgroup analyses (e.g. younger women aged 18–29). Important strengths of this study include the use of clinically confirmed HIV serostatus as the outcome; the relatively novel assessment of financial autonomy as an exposure distinct from sexual autonomy; and the use of a representative sample of ever-partnered South African women aged 18–49.

## Conclusion

This study has reiterated the important roles of sexual autonomy and IPV on women's HIV risk. As a new contribution, the study further suggests the absence of a significant independent role of financial autonomy on women's HIV infection risk. Since HIV remains considerably prevalent in sub-Saharan Africa – especially among women – there is a need for ongoing research examining the determinants of this elevated HIV risk, with a view to informing the design of effective interventions. On this note, the author recommends the design of further studies to clarify the role of women's financial autonomy on the risk of HIV infection, particularly within various women's age groups.

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1007/s10389-023-01991-5>.

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**Author's contributions** The sole author was responsible for the study conceptualization, design, statistical analysis, and the writing and review of the manuscript.

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**Data availability** All data used for this study are freely obtainable from the DHS program database (<https://dhsprogram.com/data/Access-Instructions.cfm>). The DHS program requires that researchers register on the website before submitting data requests. The DHS program would normally review all data requests within 2 working days, and demands that all requested data be used strictly for the proposed study.

**Code availability** All R statistical code used for this analysis are provided at the GitHub repository here: <https://github.com/pharmstev/HIV-DHS.git>

## Declarations

**Ethics approval** Ethical clearance for the current Demographic and Health Survey (DHS) was obtained from the Institutional Review Board of ORC Macro International Inc., as well as Ethics Boards of the South African National Department of Health (NDoH) and South African Medical Research Council (SAMRC). The DHS follows the standards for ensuring the protection of respondents' privacy. Inner City Fund International ensures that the survey complies with the United States Department of Health and Human Services' regulations for the respect of human subjects. Since this was a secondary analysis, no further ethical approval was required. Further information about the DHS data usage and ethical standards is available at <http://goo.gl/ny8T6X> (accessed on 17 February 2023).

**Consent to participate** Informed consent was obtained from all participants of this DHS survey. For participants aged below 18 years, parental informed written consent was obtained.

**Consent for publication** Not Applicable.

**Conflicts of interest** The author has no relevant financial or non-financial interests to disclose.

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