BMJ Open

Intimate Partner Violence among Women in South Africa: Disparities at the Intersection of Disability and HIV

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2021-054782
Article Type:	Original research
Date Submitted by the Author:	17-Aug-2021
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Keywords:	HIV & AIDS < INFECTIOUS DISEASES, EPIDEMIOLOGY, Health policy < HEALTH SERVICES ADMINISTRATION & MANAGEMENT

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Research Article

Disparities In Intimate Partner Violence at the Intersection of Disability and HIV among Women in South Africa: Results from a Cross-sectional Study

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Abstract

Objective: Previous research suggests a significant relationship between intimate partner violence (IPV) and HIV infection in women, and that the risk of IPV is heightened in women with disabilities. Women with disabilities, particularly those residing in low- and middle-income countries, may experience additional burdens that increase their vulnerability to IPV. We aimed to examine the effect of having both disability and HIV infection on the risk of IPV among women in South African.

Design: We used the 2016 South Africa Demographic Health Survey (SADHS) and calculated the prevalence of IPV and conducted modified Poisson regressions to estimate the unadjusted and adjusted risk ratios of experiencing IPV by disability and HIV status.

Participants: Our final analytic sample included 1,269 ever-partnered women, aged 18-49 years, who responded to the IPV module and received HIV testing.

Results: The prevalence of IPV was twice as high in women with disabilities with HIV infection compared to women without disabilities without HIV infection (21.2% vs. 50.1%). Our unadjusted regression analysis showed that compared to women without disabilities without HIV infection, women with disabilities with HIV infection had almost four times higher odds (OR=3.72, 95%CI: 1.27-10.9, p<0.05) of experiencing IPV. It appeared that women with disabilities with HIV infection experience compounded disparity. The effect was compounded, with the OR for the combination of disability status and HIV status equal to or more than the sum of each of the individual effects.

Conclusions: Women with disabilities and HIV infection experience exceptionally high risk of IPV in South Africa. Given that HIV infection and disability magnify each other's risks for IPV, targeted interventions to prevent IPV and to address the complex and varied needs of doubly marginalized populations of women with disabilities with HIV infection is critical.

Keywords: HIV; intimate partner violence; disability; women with disabilities; South Africa; Demographic Health Survey

Article Summary

Strengths and Limitations of this Study:

Strengths

- SADHS data used were nationally representative of South African women 18-49 years of age with a final analytic sample of 1,269 ever-partnered women.
- The outcome variables included exposure to IPV, including physical, sexual, and emotional violence, and combinations of these.
- Sociodemographic characteristics as covariates used in all our multivariate analyses were age (< 25 years, 25-34 years, 35+ years) education (no education, primary, secondary, higher), marital status (never married but partnered, currently or formerly married), number of dependent children (0, 1, 2, 3, 4 or more) and employment status (i.e., employed or unemployed). Household characteristics included household wealth quintile (lowest, second, third, fourth, highest) and residence (i.e., urban or rural).

Limitations

- **Limitations**
- The SADHS does not provide information about the duration, onset, and cause of disability - all of which may potentially impact the data's accuracy.
- The data were based on self-report and, thus, subject to potential recall and social desirability bias.
- Because this is a cross-sectional study, a cause and effect relationship could not be determined.
- The sample size was small and statistical power thus limited, especially as SADHS has a multi-stage sample and the design effect reduces statistical power for analyses.

Introduction

Violence against women is a pervasive, global public health problem (WHO, 2013).[1] Estimates suggest that more than a third of women aged 15 years and older have experienced intimate partner violence (IPV) including physical violence, sexual violence or sexual coercion, threats of violence, psychological aggression or emotional abuse by a current or former partner in their lifetimes.[2] While both men and women can perpetrate or suffer IPV, the burden and the consequences of IPV disproportionately affect women.[3]

The relationship between IPV and human immunodeficiency virus (HIV) among women has been a topic of intense research for three decades, with evidence suggesting a significant association between the two.[4-6] A review of 28 studies, a majority of which were conducted in low- and middle-income countries, found a significant association between IPV and HIV infection in women.[7] Similarly, data collected from 10 sub-Saharan African countries reported consistent and robust associations between HIV infection and risk of IPV in women.[4] Longitudinal research in South Africa has shown that HIV incidence is significantly elevated by exposure to IPV and controlling partner behaviour.[5] Further research has also shown that HIV incidence in women is elevated by exposure to rape[8] and child abuse.[9] Still, a majority of research to date has been conducted in high-income countries or among women considered to be at higher risk for HIV infection based on alcohol use or childhood exposure to sexual violence and trauma.[7] Subgroup analyses in a 2014 systematic review and meta-analysis found a stronger association between IPV and HIV in low-and-middle-income countries than in high-income countries, suggesting not only the importance of contextual factors in understanding risk for HIV infection but the need for research on the interface with diverse racial/ethnic samples residing in varied social, economic and geographic settings.[7]

While less attention overall has been paid to the association between disability and IPV in low-income settings, research conducted in high-income countries suggests that disability is both a risk marker and a consequence of IPV.[10, 11] Further, there is evidence from the United States to suggest that women with disabilities experience heightened risk for IPV given the passage of time.[12] Emerging research conducted from the Global South lends support to this association reporting significant disparities in risk for IPV between reproductive-aged women with and without disabilities.[13-19] A recent pooled analyses of data from women participating in IPV prevention research in seven African and Asian nations found a doubling in risk for past year IPV experienced by women with disabilities compared to their non-disabled counterparts.[20]

Despite the magnitude of violence experienced by both women with disabilities and women with HIV infection, the risk of IPV among women has not yet been examined at the intersection of disability and HIV infection. To address this gap, we conducted analyses of the nationally representative population-based

2016 South Africa Demographic and Health Survey (SADHS) to compare the prevalence of IPV among women with and without HIV infection in disabled and non-disabled groups.

We hypothesized that the combined effect of maternal disability status and maternal HIV status on the risk of IPV will be compounded, i.e., greater than either maternal disability status and maternal HIV status alone.

Methods

Data

We analyzed data from the 2016 South Africa Demographic and Health Surveys (SADHS). The SADHS is supported by the United States Agency for International Aid (USAID)[21] and provides up-to-date estimates of key demographic, socioeconomic, and health indicators in South Africa, including sexual and reproductive health in adults, infant and maternal mortality, child mortality, nutritional status, malaria, disability status, and biomarkers including HIV status. The SADHS employed a stratified two-stage sample survey design. In the first stage, primary sampling units (PSUs) or enumeration areas (EAs) in urban and rural areas were selected. In the second stage, a random sample of approximately 30 residential dwelling units (DUs) from each PSU was selected for the survey. Detailed information about survey design is available in the SADHS final survey reports.[21]

Sample

The SADHS data are nationally representative of women 15-49 years of age. A total of 8,514 women were interviewed in 2016 (see **Figure 1**). Of these, 4,003 ever-partnered women 18-49 years of age were selected to complete the IPV module. Of these, only 1,277 agreed to provide a blood specimen for HIV testing. We excluded women who refused to have their blood tested for HIV (n=2,726) or who had missing or inconclusive HIV test results (n=8). Our final analytic sample included 1,269 ever-partnered women, aged 18-49 years, who responded to the IPV module, and received HIV testing.

<Figure 1 about here>

Measures
Outcome variables

The outcome variables included exposure to IPV, including physical, sexual, and emotional violence, and combinations of these. Ever-partnered women aged 18 and older were asked if their current partner (among currently partnered women) or the most recent partner (among formerly partnered women) did the following to them in the past 12 months:

Physical violence: push you, shake you, or throw something at you; kick you, drag you, or beat you up; try to choke you or burn you on purpose; or threaten or attack you with a knife, gun, or any other weapon.

Sexual violence: physically force you to have sexual intercourse with him even when you did not want to, physically force you to perform any other sexual acts you did not want to, or force you with threats or in any other way to perform sexual acts you did not want to.
Emotional violence: say or do something to humiliate you in front of others, threaten to hurt or harm you or someone close to you, or insult you or make you feel bad about yourself.

We categorized women as having experienced IPV in the past 12 months if they answered yes to any of the questions relating to physical, sexual, or emotional violence. Women who answered no to all questions about physical, sexual, or emotional violence were categorized as not having experienced IPV in the past 12 months. We measured IPV as a binary variable (yes/no).

Exposure

Disability and HIV were considered as risk factors. Disability status is measured as a binary indicator (i.e., yes or no). We categorized women as having a disability if they reported "a lot of difficulty" or "cannot function at all" to any of the Washington Group Short Set of Questions on Disability[22] functional areas related to 1) seeing; 2) hearing; 3) communicating; 4) remembering; 5) walking and; 6) washing or dressing.

Exposure to HIV was measured as a binary variable indicating HIV infection (yes/no). Blood spot samples were collected from women age 15-49 who agreed to provide their blood for HIV testing. We created a new variable combining disability and HIV status. This variable included the following women cohorts: women without disabilities who are HIV-positive (cohort 1) women with disabilities who are HIV-negative (cohort 2), women with disabilities who are HIV-positive (cohort 3), and women without disabilities who are HIV-negative (reference group).

Covariates

We included the following sociodemographic characteristics as covariates in all our multivariate analyses: age (< 25 years, 25-34 years, 35+ years) education (no education, primary, secondary, higher), marital status (never married but partnered, currently or formerly married), number of dependent children (0, 1, 2, 3, 4 or more) and employment status (i.e., employed or unemployed). Household characteristics included household wealth quintile (lowest, second, third, fourth, highest) and residence (i.e., urban or rural).

Statistical Analysis

All analyses were weighted to account for complex survey design. Selected demographic and socioeconomic characteristics of women without disabilities who are HIV-positive (cohort 1), women with disabilities who are HIV-negative (cohort 2), women with disabilities who are HIV-positive (cohort 3), compared to women without disabilities who are HIV-negative (reference group) using the chi-square test for categorical and t-test for continuous variables.

The IPV indicator was analyzed as binary (yes/no) variables, coded such that higher prevalence indicated greater risk of experiencing IPV. We calculated the prevalence of IPV among women with and without disabilities stratified by HIV status. We conducted logistic regressions to estimate the unadjusted and adjusted odds ratios (with 95% confidence intervals) for IPV by disability and HIV status, with non-disabled HIV-negative women as the reference group. Multivariate models adjusted for the covariates described above. We used Stata (StataCorp LLC, College Station, TX) version 15 for all analyses, applying the *svy* commands to account for the complex sampling design of the SADHS, and a p-value <.05 was the accepted level of significance.

Because data are de-identified and publicly available, the Institutional Review Board approval was not required for this study.

Patient and Public Involvement

No patients were involved in this study.

Results

Table 1 presents the demographic and socioeconomic characteristics of women by disability and HIV status. Out of 1,269 women in our study sample, 832 had no disability and were HIV-negative (referent group); 393 had no disability and were HIV-positive (cohort 1); 26 had a disability and were HIV-negative (cohort 2) and; 14 had a disability and were HIV-positive (cohort 3).

Compared to women reporting no disability who were HIV-negative (referent group), non-disabled women with HIV infection (cohort 1) were, on average, more likely to be older, less educated, have more children, and more likely to be poor. Women reporting a disability who were without HIV infection (cohort 2) were more likely to be older and more likely to be employed than the referent group. Women reporting a disability who were HIV-positive (cohort 3) compared to the referent group were more likely to be older, less likely to be unemployed and poor.

In both HIV and non-HIV groups, women with disabilities were more likely to be older than their counterparts without disabilities. Compared to women without disabilities in non-HIV group, women with disabilities also had significantly more children. We did not find significant differences for all other remaining characteristics.

Table 1. Sample characteristics of ever-partnered women 18-49 years old by disability and HIV status, South Africa, N=1,269 (weighted percentages, SADHS 2016)

	No disability, no HIV (-/-) (N=832)	No disability & HIV (-/+) (N=393)	With disability, no HIV (+/-) (N=26)	With disability & HIV (+/+) (N=14)	p-value
Age	**referent**	**cohort 1**	**cohort 2**	**cohort 3**	a,b
<25	26.5	10.2	5.9	0.0	
25-34	34.5	47.4	24.2	52.3	
35+	39	42.4	69.9	47.7	
Age, Mean (SD)	31.8(9.0)	33.5(7.4)	38.4(8.0)	35.3(6.7)	a,b,c
Educational level					a
No education	1.6	2.1	2.1	5.0	
Primary	9.2	15	8.8	17.5	
Secondary	74	76.6	87.2	77.5	
Higher	15.2	6.3	1.9	0.0	
Marital status					
Never married but partnered	42.2	44.9	31.4	45.0	
Currently/formerly married	57.8	55.1	68.6	55.0	
Number of living children					a
None	17.1	12.6	3.7	9.4	
1	29.1	31.2	28.3	12.9	
2	25	26.2	8.2	18.8	
3	15.3	21.6	35.7	33.5	
4 and more	13.6	8.4	24.1	25.3	

Employed					b,c
No	60.9	60.3	32.2	85.3	
Yes	39.1	39.7	67.8	14.7	
Household wealth quintile					a,c
Lowest	19.9	21.6	19.3	45.8	
Second	21.5	26.8	7.8	24.8	
Third	21.2	29.2	26.4	19.9	
Fourth	18.5	12.5	27.6	6.7	
Highest	18.9	10.0	18.9	2.8	
Place of residence					
Urban	69.2	69.5	68.1	48.4	
Rural	30.8	30.5	31.9	51.6	

Source: South Africa Demographic and Health Surveys, 2016.

Notes: *p-values for differences, Chi2-test or t-test. Notes: a – indicates a statistically significant difference at p<0.05 between women without disabilities with no HIV (-/-) and women without disabilities with HIV (-/+) (cohort 1), b – indicates a statistically significant difference at p<0.05 between women without disabilities with no HIV (-/-) and women with disabilities with no HIV (+/-) (cohort 2), and c – indicates a statistically significant difference at p<0.05 between women without disabilities with no HIV (-/-) and women with disabilities with HIV (+/+) (cohort 3). Abbreviations: SD = standard deviation; HIV = human immunodeficiency virus.

Table 2 presents the prevalence, unadjusted and adjusted odds ratios for risk of past year intimate partner violence among ever-partnered women age 18-49 by disability and HIV status. When comparing all cohorts to non-disabled women without HIV infection (referent), the prevalence of past year IPV was slightly higher for non-disabled women with HIV infection (cohort 1) (21.2 versus 27.2) and disabled women without HIV infection (cohort 2) (21.2 versus 26.7). The prevalence of past year IPV in disabled women with HIV infection (cohort 3) was more than two-fold higher (21.2 versus 50.1).

Despite higher odds ratios, results from our unadjusted and adjusted regression analyses showed that the risk of past year IPV between non-disabled women without HIV infection (referent) and our first two cohorts-non-disabled women with HIV infection (cohort 1) and disabled women without HIV infection (cohort 2)-did not reach statistically significant levels. However, the risk of past year IPV was high and statistically significant among women in our last cohort, disabled women with HIV infection (cohort 3), when compared to non-disabled women without HIV infection (referent). Results from our unadjusted regression analysis, showed that compared to non-disabled women without HIV infection (referent), disabled women with HIV infection (cohort 3) had almost four times higher odds (OR=3.72, 95% CI: 1.27 - 10.9, $p<0.05$) of experiencing IPV. Even after adjusting for women's sociodemographic characteristics, disabled women with HIV infection (cohort 3) still had more than three times higher odds (OR=3.02, 95% CI: 1.08 - 8.43, $p<0.05$) of experiencing past year IPV compared non-disabled women without HIV infection (referent).

Table 2. Percentages, unadjusted and adjusted odds ratios (with 95% confidence intervals) for risk of past year intimate partner violence among women 18-49 years old by disability and HIV status, South Africa, N=11,269

IPV	No disability, no HIV (-/-) (N=832)		No disability & HIV (-/+) (N=393)		Disability, no HIV (+/-) (N=26)		Disability & HIV (+/+) (N=14)	
	Referent		cohort 1		cohort 2		cohort 3	
Weighted %, (95%CI)	21.2	17.4-25.6	27.2	20.4-35.3	26.7	11.8-49.7	50.1	26.0-74.1
Unadjusted: OR, (95%CI)	Referent		1.39	0.88 - 2.20	1.35	0.48 - 3.82	3.72**	1.27 - 10.9
Adjusted[a]: OR, (95%CI)	Referent		1.31	0.82 - 2.09	1.60	0.58 - 4.45	3.02**	1.08 - 8.43

Source: South Africa Demographic and Health Surveys, 2016, *** p < 0.01, ** p < 0.05, * p < 0.1.

Notes: [a]Adjusted for age, education, marital status, number of living children, employment status, household wealth, and place of residence. Abbreviations: OR = odds ratio, CI = confidence interval, HIV = human immunodeficiency virus.

Discussion

To our knowledge, this is the first study examining the risk of past year IPV experienced by women with disabilities by HIV status in a representative cross-section of South African women. Our findings provide evidence that, in respect of disability and HIV, the vulnerabilities associated with heightened risk for IPV may be cumulative. In our adjusted analyses the odds ratios for IPV in disabled women with HIV infection compared to non-disabled women without HIV infection were more than three-fold higher. It appeared that among disabled women, having HIV infection compounded the disparities: with the Odds Ratios for the combination of disability status and HIV status equal to, or more than, the sum of each of the individual effects. While risk of IPV is known to be higher among disabled women[13, 20] and among women with HIV infection,[4, 7] ours is the first study to show compounded disparities for women living at the intersection of disability and HIV infection.

The sample of women with disabilities, but not HIV, compared to those without disabilities was very small. They reported a higher prevalence of IPV, and the adjusted odds ratio pointed to a 60% increased risk of IPV but was not statistically significant. This is likely to have been explained by the very small sample.

Consistent with previous research in low- and middle-income countries,[4, 7, 23-27] our findings showed a significantly higher prevalence of IPV among women with HIV infection without disability. However, we did not find a statistically significant increase in reports of IPV in women with HIV infection without disability compared to women without HIV infection, but again the adjusted OR was in the direction expected and suggested a 30% increased likelihood of IPV experienced by women with HIV and no disability. Previous South African research has generally found the increased risk in the region of 50%,[5] however this has been for the relationship between ever experience of more than one act of physical and/or sexual IPV and HIV serostatus, and it is possible that the lower odds ratio may be due the broader definition of IPV used in our analysis. Much of the past year IPV reported by the women was emotional abuse and exposure to this has not been shown to have as strong an association with HIV status as physical and sexual IPV.[28] We also note that the population in this study was older than in other South African studies and IPV incidence declines with age,[2] as well as age possibly impacting disclosure of IPV experience due to different personal and systems-level factors, which might explain the lack of statistically significant difference.

This study contributes to an emerging body of research examining IPV at the intersection of disability and HIV among women in low- and middle-income countries using nationally representative data. Further research, including longitudinal studies with a robust sample size is needed to examine the causal

pathways or mechanisms behind the observed compounding effect of disability and HIV infection on risk of IPV.

Our findings emphasize the need for increased attention to policy and practice efforts to prevent IPV among disabled women with HIV infection.

Limitations

There are several limitations to this study that are worth noting. First, the SADHS does not provide information about the duration, onset, and cause of disability - all of which may potentially impact the data's accuracy. Second, the data were based on self-report and, thus, subject to potential recall and social desirability bias. Third, because this is a cross-sectional study, a cause and effect relationship could not be determined. Fourthly, the sample size was small and statistical power thus limited, especially as SADHS has a multi-stage sample and the design effect reduces statistical power for analyses. Finally, because not all women age 18 and older were selected for HIV testing and received the IPV module,[21] the generalizability of the prevalence estimates is therefore unclear, and these results should be interpreted with caution.

Despite these limitations, this study is the first investigation of IPV at the intersection of disability and HIV among women in South Africa. The findings are highly relevant to researchers, policymakers, and non-governmental organizations working across various sectors to prevent IPV and address the needs and rights of women with disabilities, women with HIV infection, and the most vulnerable group of disabled women with HIV infection. Additional studies, with larger samples, are needed to determine the underlying mechanisms through which these markers have an additive effect on the risk of IPV.

Conclusions

Disabled women with HIV infection experience exceptionally high risk of IPV in South Africa. Given that disability and HIV status magnify each other's risks for IPV, targeted interventions to prevent IPV and to address the complex and varied needs of doubly marginalized populations of disabled women with HIV infection is critical.

Figure Legend:
Source: South Africa Demographic Health Survey (SADHS) 2016. Notes: HIV = human immunodeficiency virus; IPV = intimate partner violence

Funding Statement: This paper was produced with funding from Centers for Disease Control and Prevention (CDC), Division of Global HIV/AIDS & TB (DGHT) under Cooperative Agreement Number U2GGH001531. Its contents are solely the responsibility of Cardno and Brandeis University and do not necessarily represent the official views of CDC.

Competing Interest: Drs. Akobirshoev, Zandam, and Nandakumar report a grant from Cardno Emerging Markets, USA, Ltd., during the conduct of the study; Ms. Valentine and Drs. Jewkes, Blacher, and Mitra have no conflicts of interest to declare.

Author Contributions: Dr. Akobirshoev conceptualized and designed the study; conducted a formal analysis of the data and interpretation of the findings, and wrote the first draft of the manuscript; Dr. Zandam accessed and verified the underlying data, participated in the concept and design; analysis, and interpretation of data; and drafted or revised the manuscript; Drs. Valentine, Nandakumar, Jewkes, Blecher, and Mitra, participated in the concept and design; interpretation of the findings, and drafting or revising of the manuscript.

All authors approved the submitted version and have agreed both to be personally accountable for the author's own contributions and the accuracy and integrity of any part of the work.

Data Sharing Statement: Dataset available from National Department of Health (NDoH) SSASS, South African Medical Research Council (SAMRC), and ICF. South Africa Demographic and Health Survey 2016. 2019.

Acknowledgements: The authors thank Clare L. Hurley of Brandeis University for editing assistance.

Patient Consent for Publication: Not applicable

Ethics Approval: Not required.

Word Count: Introduction to Conclusions: 2,656

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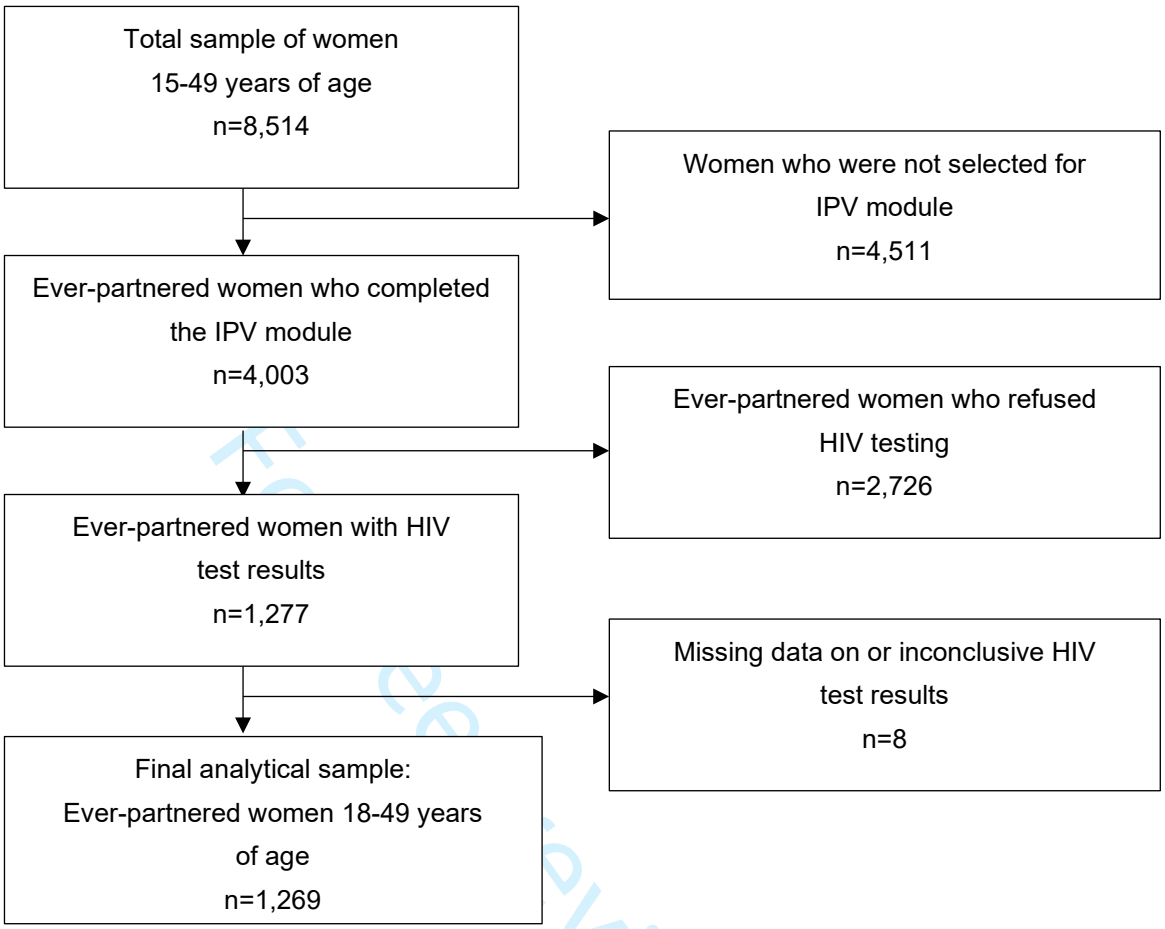

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	4-5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5-6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6
Bias	9	Describe any efforts to address potential sources of bias	13
Study size	10	Explain how the study size was arrived at	Fig 1
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	6-7
		(*b*) Describe any methods used to examine subgroups and interactions	6-7
		(*c*) Explain how missing data were addressed	5
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	6
		(*e*) Describe any sensitivity analyses	NA
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	7
		(c) Consider use of a flow diagram	Fig 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1 pages 8-9
		(b) Indicate number of participants with missing data for each variable of interest	NA
Outcome data	15*	Report numbers of outcome events or summary measures	Table 2 page 11
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 2 page 11
		(*b*) Report category boundaries when continuous variables were categorized	Table 1 page 8
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	NA
Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13
Generalisability	21	Discuss the generalisability (external validity) of the study results	13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Intimate Partner Violence among Women in South Africa: Disparities at the Intersection of Disability and HIV

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2021-054782.R1
Article Type:	Original research
Date Submitted by the Author:	16-Feb-2022
Complete List of Authors:	Akobirshoev, Ilhom; Brandeis University Heller School for Social Policy and Management, Valentine, Anne; Brandeis University Heller School for Social Policy and Management, Lurie Institute for Disability Policy Zandam, Hussaini; Brandeis University Heller School for Social Policy and Management, Lurie Institute for Disability Policy Nandakumar, Allyala; Brandeis University Heller School for Social Policy and Management Jewkes, Rachel; South African Medical Research Council, Gender and Health Division Blecher, Mark; National Treasury of South Africa Mitra, M; Brandeis University Heller School for Social Policy and Management, Lurie Institute for Disability Policy
Primary Subject Heading:	HIV/AIDS
Secondary Subject Heading:	Public health
Keywords:	HIV & AIDS < INFECTIOUS DISEASES, EPIDEMIOLOGY, Health policy < HEALTH SERVICES ADMINISTRATION & MANAGEMENT

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Research Article

Intimate Partner Violence among Women in South Africa: Disparities at the Intersection of Disability and HIV

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ABSTRACT

Objective: Previous research suggests a significant relationship between intimate partner violence (IPV) and HIV infection in women, and that the risk of IPV is heightened in women with disabilities. Women with disabilities, particularly those residing in low- and middle-income countries, may experience additional burdens that increase their vulnerability to IPV. We aimed to examine the effect of having disability and HIV infection on the risk of IPV among women in South African.

Design: Using the 2016 South Africa Demographic and Health Survey (SADHS), we calculated the prevalence of IPV and conducted modified Poisson regressions to estimate the unadjusted and adjusted risk ratios of experiencing IPV by disability and HIV status.

Participants: Our final analytic sample included 1,269 ever-partnered women, aged 18-49 years, who responded to the IPV module and received HIV testing.

Results: The prevalence of IPV was twice as high in women with disabilities with HIV infection compared to women without disabilities without HIV infection (21.2% vs. 50.1%). Our unadjusted regression analysis showed that compared to women without disabilities without HIV infection, women with disabilities with HIV infection had almost four times higher odds (OR=3.72, 95%CI: 1.27-10.9, p<0.05) of experiencing IPV. It appeared that women with disabilities with HIV infection experience compounded disparity. The effect was compounded, with the OR for the combination of disability status and HIV status equal to or more than the sum of each of the individual effects.

Conclusions: Women with disabilities and HIV infection are at exceptionally high risk of IPV in South Africa. Given that HIV infection and disability magnify each other's risks for IPV, targeted interventions to prevent IPV and to address the complex and varied needs of doubly marginalized populations of women with disabilities with HIV infection is critical.

Keywords: HIV; intimate partner violence; disability; women with disabilities; South Africa; Demographic Health Survey

Article Summary

Strengths and Limitations of this Study:

Strengths

- SADHS data used were nationally representative of South African women 18-49 years of age with a final analytic sample of 1,269 ever-partnered women.
- The outcome variables included exposure to IPV, including physical, sexual, and emotional violence, and combinations of these.
- Sociodemographic characteristics as covariates used in all our multivariate analyses were age (18-25 years, 25-34 years, 35+ years) education (no education, primary, secondary, higher), marital status (never married but partnered, currently or formerly married), number of dependent children (0, 1, 2, 3, 4 or more) and employment status (i.e., employed or unemployed). Household characteristics included household wealth quintile (lowest, second, third, fourth, highest) and residence (i.e., urban or rural).

Limitations

- **Limitations**
- The SADHS does not provide information about the duration, onset, and cause of disability - all of which may potentially impact the data's accuracy.
- The data were based on self-report and, thus, subject to potential recall and social desirability bias.
- Because this is a cross-sectional study, a cause and effect relationship could not be determined.
- The sample size was small and statistical power thus limited, especially as SADHS has a multi-stage sample and the design effect reduces statistical power for analyses.

INTRODUCTION

Violence against women is a pervasive, global public health problem (WHO, 2013).[1] Estimates suggest that more than a third of women aged 15 years and older have experienced intimate partner violence (IPV) including physical violence, sexual violence or sexual coercion, threats of violence, psychological aggression or emotional abuse by a current or former partner in their lifetimes.[2] While both men and women can perpetrate or suffer IPV, the burden and the consequences of IPV disproportionately affect women.[3]

The relationship between IPV and human immunodeficiency virus (HIV) among women has been a topic of intense research for three decades, with evidence suggesting a significant association between the two.[4-6] A review of 28 studies, a majority of which were conducted in low- and middle-income countries, found a significant association between IPV and HIV infection in women.[7] Similarly, data collected from 10 sub-Saharan African countries reported consistent and robust associations between HIV infection and risk of IPV in women.[4] Longitudinal research in South Africa has shown that HIV incidence is significantly elevated by exposure to IPV and controlling partner behaviour.[5] Further research has also shown that HIV incidence in women is elevated by exposure to rape[8] and child abuse.[9] Still, a majority of research to date has been conducted in high-income countries or among women considered to be at higher risk for HIV infection based on alcohol use or childhood exposure to sexual violence and trauma.[7] Subgroup analyses in a 2014 systematic review and meta-analysis found a stronger association between IPV and HIV infection in low-and-middle-income countries than in high-income countries, suggesting not only the importance of contextual factors in understanding risk for HIV infection but also the need for research on the interface with diverse populations residing in varied social, economic and geographic settings.[7]

While less attention has been paid to the association between disability and IPV in low-income settings, research conducted in high-income countries suggests that disability is both a risk marker and a consequence of IPV.[10,11] Evidence from the United States suggests that women with disabilities experience heightened risk for IPV given the passage of time.[12] Emerging research conducted from the Global South has suggested significant disparities in risk for IPV between reproductive-aged women with and without disabilities.[13-19] A recent pooled analyses of data from women participating in IPV prevention research in seven African and Asian nations found a doubling in risk for past year IPV experienced by women with disabilities compared to their non-disabled counterparts.[20]

Despite the magnitude of violence experienced by both women with disabilities and women with HIV infection, the risk of IPV among women has not yet been examined at the intersection of disability and HIV infection. To address this gap, we conducted an exploratory data analysis of the nationally representative population-based 2016 South Africa Demographic and Health

Survey (SADHS) to compare the prevalence of IPV among women with and without HIV infection in disabled and non-disabled groups. We hypothesized that the combined effect of maternal disability status and maternal HIV status on the risk of IPV will be compounded, i.e., greater than either maternal disability status and maternal HIV status alone.

METHODS

Data

We analyzed data from the 2016 South Africa Demographic and Health Surveys (SADHS). The SADHS is supported by the United States Agency for International Aid (USAID)[21] and provides up-to-date estimates of key demographic, socioeconomic, and health indicators in South Africa, including sexual and reproductive health in adults, infant and maternal mortality, child mortality, nutritional status, malaria, disability status, and biomarkers including HIV status. The SADHS employed a stratified two-stage sample survey design. In the first stage, primary sampling units (PSUs) or enumeration areas (EAs) in urban and rural areas were selected. In the second stage, a random sample of approximately 30 residential dwelling units (DUs) from each PSU was selected for the survey. Detailed information about survey design is available in the SADHS final survey reports.[21]

Sample

The SADHS data are nationally representative of women 15-49 years of age. A total of 8,514 women were interviewed in 2016 (see **Figure 1**). Of these, 4,003 ever-partnered women 18-49 years of age were selected to complete the IPV module. Among these women, only 1,277 agreed to provide a blood specimen for HIV testing. In this study, we excluded women who refused to have their blood tested for HIV (n=2,726) or who had missing or inconclusive HIV test results (n=8). Our final analytic sample included 1,269 ever-partnered women, aged 18-49 years, who responded to the IPV module, and received HIV testing.

<Insert Figure 1 about here>

Measures

Outcome variables

The outcome variables included exposure to IPV. Following prior studies,[4,13] we measured IPV using standard DHS domestic violence module pertaining to physical, sexual, and emotional violence, and combinations of these. Ever-partnered women aged 18 and older were asked if their current partner (among

currently partnered women) or the most recent partner (among formerly partnered women) did the following to them in the past 12 months:

Physical violence: push you, shake you, or throw something at you; kick you, drag you, or beat you up; try to choke you or burn you on purpose; or threaten or attack you with a knife, gun, or any other weapon.
Sexual violence: physically force you to have sexual intercourse with him even when you did not want to, physically force you to perform any other sexual acts you did not want to, or force you with threats or in any other way to perform sexual acts you did not want to.
Emotional violence: say or do something to humiliate you in front of others, threaten to hurt or harm you or someone close to you, or insult you or make you feel bad about yourself.

We categorized women as having experienced IPV in the past 12 months if they answered yes to any of the questions relating to physical, sexual, or emotional violence. Women who answered no to all questions about physical, sexual, or emotional violence were categorized as not having experienced IPV in the past 12 months. We measured IPV as a binary variable (yes/no).[4,13]

Exposure

Disability and HIV were considered as risk factors. Similar to earlier studies,[13] disability status is measured as a binary indicator (i.e., yes or no). We categorized women as having a disability if they reported "a lot of difficulty" or "cannot function at all" to any of the Washington Group Short Set of Questions on Disability[22] functional areas related to 1) seeing; 2) hearing; 3) communicating; 4) remembering; 5) walking and; 6) washing or dressing.

Exposure to HIV was measured as a binary variable indicating HIV infection (yes/no). Blood spot samples were collected from women ages 15-49 who agreed to provide their blood for HIV testing. We created a new variable combining disability and HIV status. This variable included the following women cohorts: women without disabilities who are HIV-positive (cohort 1) women with disabilities who are HIV-negative (cohort 2), women with disabilities who are HIV-positive (cohort 3), and women without disabilities who are HIV-negative (reference group). Of note, although HIV is a chronic disease and a potentially disabling condition it not considered to be a disability in this study.

Covariates

We included the following sociodemographic characteristics as covariates in all our multivariate analyses: age (< 25 years, 25-34 years, 35+ years) education (no education, primary, secondary, higher), marital status (never married but partnered, currently or formerly married), number of dependent children (0, 1, 2, 3, 4 or more) and employment status (i.e., employed, or unemployed). Household

characteristics included household wealth quintile (lowest, second, third, fourth, highest) and residence (i.e., urban, or rural).

Statistical Analysis

All analyses were weighted to account for complex survey design. Selected demographic and socioeconomic characteristics of women without disabilities who are HIV-positive (cohort 1), women with disabilities who are HIV-negative (cohort 2), women with disabilities who are HIV-positive (cohort 3), compared to women without disabilities who are HIV-negative (reference group) using the chi-square test for categorical and t-test for continuous variables.

The IPV indicator was analyzed as binary (yes/no) variables, coded such that higher prevalence indicated greater risk of experiencing IPV. We calculated the prevalence rates of IPV with respective 95%CI for the study cohorts and compared them to the study reference group using the chi-square test. We also conducted logistic regressions to estimate the unadjusted and adjusted odds ratios (with 95% confidence intervals) for IPV by disability and HIV status, with non-disabled HIV-negative women as the reference group. Multivariate models adjusted for the covariates described above. We used Stata (StataCorp LLC, College Station, TX) version 15 for all analyses, applying the *svy* commands to account for the complex sampling design of the SADHS, and a p-value <.05 was the accepted level of significance.

Because data are de-identified and publicly available, the Institutional Review Board approval was not required for this study. No patients were involved in this study.

RESULTS

Table 1 presents the demographic and socioeconomic characteristics of women by disability and HIV status. Out of 1,269 women in our study sample, 832 had no disability and were HIV-negative (referent group); 393 had no disability and were HIV-positive (cohort 1); 26 had a disability and were HIV-negative (cohort 2) and; 18 had a disability and were HIV-positive (cohort 3).

Compared to women reporting no disability who were HIV-negative (referent group), non-disabled women with HIV infection (cohort 1) were, on average, more likely to be older, less educated, have more children, and more likely to be poor. Women reporting a disability who were without HIV infection (cohort 2) were more likely to be older and more likely to be employed than the referent group. Women reporting a disability who were HIV-positive (cohort 3) compared to the referent group were more likely to be older, less likely to be unemployed and poor.

In both HIV and non-HIV groups, women with disabilities were more likely to be older than their counterparts without disabilities. Compared to women without disabilities in non-HIV group, women with disabilities also had significantly more children. We did not find significant differences for all other remaining characteristics.

Table 1. Sample characteristics of ever-partnered women 18-49 years old by disability and HIV status, South Africa, N=1,269 (weighted percentages, SADHS 2016)

	No disability, no HIV (-/-) (N=832)	No disability & HIV (-/+) (N=393)	With disability, no HIV (+/-) (N=26)	With disability & HIV (+/+) (N=18)	p-value
Age	**referent**	**cohort 1**	**cohort 2**	**cohort 3**	a,b
18-25	26.5	10.2	5.9	0.0	
25-34	34.5	47.4	24.2	52.3	
35+	39	42.4	69.9	47.7	
Age, Mean (SD)	31.8(9.0)	33.5(7.4)	38.4(8.0)	35.3(6.7)	a,b,c
Educational level					a
No education	1.6	2.1	2.1	5.0	
Primary	9.2	15	8.8	17.5	
Secondary	74	76.6	87.2	77.5	
Higher	15.2	6.3	1.9	0.0	
Marital status					
Never married but partnered	42.2	44.9	31.4	45.0	
Currently/formerly married	57.8	55.1	68.6	55.0	
Number of living children					a
None	17.1	12.6	3.7	9.4	
1	29.1	31.2	28.3	12.9	
2	25	26.2	8.2	18.8	
3	15.3	21.6	35.7	33.5	
4 and more	13.6	8.4	24.1	25.3	
Employed					b,c

No	60.9	60.3	32.2	85.3	
Yes	39.1	39.7	67.8	14.7	
Household wealth quintile					a,c
Lowest	19.9	21.6	19.3	45.8	
Second	21.5	26.8	7.8	24.8	
Third	21.2	29.2	26.4	19.9	
Fourth	18.5	12.5	27.6	6.7	
Highest	18.9	10.0	18.9	2.8	
Place of residence					
Urban	69.2	69.5	68.1	48.4	
Rural	30.8	30.5	31.9	51.6	

Source: South Africa Demographic and Health Surveys, 2016.

Notes: *p-values for differences, Chi2-test or t-test. Notes: a – indicates a statistically significant difference at p<0.05 between women without disabilities with no HIV (-/-) and women without disabilities with HIV (-/+) (cohort 1), b – indicates a statistically significant difference at p<0.05 between women without disabilities with no HIV (-/-) and women with disabilities with no HIV (+/-) (cohort 2), and c – indicates a statistically significant difference at p<0.05 between women without disabilities with no HIV (-/-) and women with disabilities with HIV (+/+) (cohort 3). Abbreviations: SD = standard deviation; HIV = human immunodeficiency virus.

Table 2 presents the prevalence rates for past year intimate partner violence among ever-partnered women ages 18-49 by disability and HIV status. When comparing all cohorts to non-disabled women without HIV infection (referent), although the prevalence of past year IPV was slightly higher for non-disabled women with HIV infection (cohort 1) (21.3 versus 29.1, n.s.) and disabled women without HIV infection (cohort 2) (21.3 versus 29.2, n.s.), these differences were not statistically significant. The prevalence of past year IPV in disabled women with HIV infection (cohort 3) was more than two-fold higher (21.3 versus 51.6, $p<0.05$) and it was statistically significant.

Table 3 presents the unadjusted and adjusted odds ratios for risk of past year intimate partner violence among ever-partnered women age 18-49 by disability and HIV status. Despite higher odds ratios, results from our unadjusted and adjusted regression analyses showed that the risk of past year IPV between non-disabled women without HIV infection (referent) and our first two cohorts-non-disabled women with HIV infection (cohort 1) and disabled women without HIV infection (cohort 2)-did not reach statistically significant levels. However, the risk of past year IPV was high and statistically significant among women in our last cohort, disabled women with HIV infection (cohort 3), when compared to non-disabled women without HIV infection (referent). Results from our unadjusted regression analysis, showed that compared to non-disabled women without HIV infection (referent), disabled women with HIV infection (cohort 3) had almost four times higher odds (OR=3.94, 95% CI: 1.42 - 10.9, $p<0.01$) of experiencing IPV. Even after adjusting for women's sociodemographic characteristics, disabled women with HIV infection (cohort 3) still had three times higher odds (OR=3.00, 95% CI: 1.09 - 8.24, $p<0.05$) of experiencing past year IPV compared non-disabled women without HIV infection (referent).

Table 2. Weighted prevalence rates (with 95% confidence intervals) for past year intimate partner violence among women 18-49 years old, by disability and HIV status, South Africa, N=1,269

Intimate Partner Violence (IPV)	No disability, no HIV (-/-) (N=832)		No disability & HIV (-/+) (N=393)		Disability, no HIV (+/-) (N=26)		Disability & HIV (+/+) (N=18)		P-value
	Referent		cohort 1		cohort 2		cohort 3		
Weighted %, (95%CI)	21.3	17.9-25.2	29.1	21.5-38.0	29.2	13.8-51.3	51.6	28.1-74.4	c

Source: South Africa Demographic and Health Surveys, 2016

Notes: a – indicates a statistically significant difference at p<0.05 between women without disabilities with no HIV (-/-) and women without disabilities with HIV (-/+) (cohort 1), b – indicates a statistically significant difference at p<0.05 between women without disabilities with no HIV (-/-) and women with disabilities with no HIV (+/-) (cohort 2), and c – indicates a statistically significant difference at p<0.05 between women without disabilities with no HIV (-/-) and women with disabilities with HIV (+/+) (cohort 3). Abbreviations: CI = confidence interval, HIV = human immunodeficiency virus.

Table 3. Unadjusted and adjusted odds ratios (with 95% confidence intervals) for risk of past year intimate partner violence among women 18-49 years old by disability and HIV status, South Africa, N=1,269

Intimate Partner Violence (IPV)	No disability, no HIV (-/-) (N=832)	No disability & HIV (-/+) (N=393)		Disability, no HIV (+/-) (N=26)		Disability & HIV (+/+) (N=18)	
	Referent group	cohort 1		cohort 2		cohort 3	
Unadjusted: OR, (95%CI)	1.00	1.51	0.95 - 2.41	1.52	0.57 - 4.03	3.94**	1.42 - 10.93
Adjusted[a]: OR, (95%CI)	1.00	1.31	0.82 - 2.09	1.60	0.58 - 4.45	3.00*	1.09 - 8.24

Source: South Africa Demographic and Health Surveys, 2016, *** p < 0.001, ** p < 0.01, * p < 0.05

Notes: [a]Adjusted for age, education, marital status, number of living children, employment status, household wealth, and place of residence. Abbreviations: OR = odds ratio, CI = confidence interval, HIV = human immunodeficiency virus.

DISCUSSION

To our knowledge, this is the first study examining the risk of past year IPV experienced by women with disabilities by HIV status in a representative cross-section of South African women. Our findings provide evidence that, in respect of disability and HIV, the vulnerabilities associated with heightened risk for IPV may be compounded. In our adjusted analyses the odds ratios for IPV in disabled women with HIV infection compared to non-disabled women without HIV infection were more than three-fold higher. Among disabled women, having HIV infection compounded the disparities: with the Odds Ratios for the combination of disability status and HIV status equal to, or more than, the sum of each of the individual effects. While risk of IPV is known to be higher among disabled women[13,20] and among women with HIV infection,[4,7] ours is the first study to show compounded disparities for women living at the intersection of disability and HIV infection. This finding provides empirical evidence for Crenshaw's intersectionality theory,[23,24] in that, women are often disadvantaged by multiple sources of marginalization, including, their gender identity, disability status, and other identity markers that do not exist independently from each other and that each interacts with the other leading to a complex convergence of marginalization. Findings from our study suggest that marginalization of South African women stemming from their disability status and HIV positive status is likely to result in compounded risk for IPV, i.e., greater than the effect of disability status or HIV positive status alone.

The sample of women with disabilities, but not HIV, compared to those without disabilities was very small. Although they reported a higher prevalence of IPV, the unadjusted and adjusted odds ratio of IPV risk were not statistically significant. This is likely to have been explained by the very small sample.

Consistent with previous research in low- and middle-income countries,[4,7,25-29] our findings showed a significantly higher prevalence of IPV among women with HIV infection without disability. However, we did not find a statistically significant increase in reports of IPV in unadjusted and adjusted regression analysis. Previous South African research has generally found a statistically significant increased risk,[5] however this has been for the relationship between ever experience of more than one act of physical and/or sexual IPV and HIV serostatus. Much of the past year IPV reported by the women was emotional abuse and exposure to this has not been shown to have as strong an association with HIV status as physical and sexual IPV.[30] We also note that the population in this study was older than in other South African studies and IPV incidence declines with age,[2] as well as age possibly impacting disclosure of IPV experience due to different personal and systems-level factors, which might explain the lack of statistically significant difference.

This study contributes to an emerging body of research examining IPV at the intersection of disability and HIV among women in low- and middle-income countries using nationally representative data. Further research, including longitudinal studies with a robust sample size is needed to examine the causal pathways or mechanisms behind the observed compounding effect of disability and HIV infection on risk of IPV.

Our findings emphasize the need for increased attention to policy and practice efforts to prevent IPV among disabled women with HIV infection. And that disability status is an important consideration in designing and implementing violence and HIV prevention and intervention services.

Limitations

There are several limitations to this study that are worth noting. First, the SADHS does not provide information about the duration, onset, and cause of disability - all of which may potentially impact the data's accuracy. Second, the data were based on self-report and, thus, subject to potential recall and social desirability bias. Third, because this is a cross-sectional study, a cause and effect relationship could not be determined. Fourthly, the sizes of the study cohorts were unequal and rather small for the two study cohorts (N=26 for cohort 2 and N=18 for cohort 3, respectively), which can limit the statistical power and increase Type I error rates.[31] However, unequally sized cohorts are common in social science and maybe the result of survey's multi-stage random sampling design and the retrospective nature of creation of the study cohorts. Finally, because not all women age 18 and older were selected for HIV testing and received the IPV module,[21] the generalizability of the prevalence estimates is therefore unclear, and these results should be interpreted with caution.

Despite these limitations, this study is the first exploratory investigation of IPV at the intersection of disability and HIV among women in South Africa. The findings are highly relevant to researchers, policymakers, and non-governmental organizations working across various sectors to prevent IPV and address the needs and rights of women with disabilities, women with HIV infection, and the most vulnerable group of disabled women with HIV infection. Additional studies, with larger and equally sized samples, are needed to replicate our exploratory study and examine whether having a disability and having HIV positive status have a compounding effect on the risk of IPV. Future research should also include qualitative data from women with both disability and HIV to better understand risks and needs of these doubly marginalized, reproductive age women.

CONCLUSIONS

Disabled women with HIV infection experience exceptionally high risk of IPV in South Africa. Given that disability and HIV status magnify each other's risks for IPV, targeted interventions to prevent IPV and to address the complex and varied

needs of doubly marginalized populations of disabled women with HIV infection is critical.

Figure Legend:
Source: South Africa Demographic Health Survey (SADHS) 2016. Notes: HIV = human immunodeficiency virus; IPV = intimate partner violence

Funding Statement: This paper was produced with funding from Centers for Disease Control and Prevention (CDC), Division of Global HIV/AIDS & TB (DGHT) under Cooperative Agreement Number U2GGH001531. Its contents are solely the responsibility of Cardno and Brandeis University and do not necessarily represent the official views of CDC.

Competing Interest: Drs. Akobirshoev, Zandam, and Nandakumar report a grant from Cardno Emerging Markets, USA, Ltd., during the conduct of the study; Ms. Valentine and Drs. Jewkes, Blacher, and Mitra have no conflicts of interest to declare.

Author Contributions: Dr. Akobirshoev conceptualized and designed the study; conducted a formal analysis of the data and interpretation of the findings, and wrote the first draft of the manuscript; Dr. Zandam accessed and verified the underlying data, participated in the concept and design; analysis, and interpretation of data; and drafted or revised the manuscript; Drs. Valentine, Nandakumar, Jewkes, Blecher, and Mitra, participated in the concept and design; interpretation of the findings, and drafting or revising of the manuscript.

All authors approved the submitted version and have agreed both to be personally accountable for the author's own contributions and the accuracy and integrity of any part of the work.

Data Sharing Statement: Dataset available from National Department of Health (NDoH) SSASS, South African Medical Research Council (SAMRC), and ICF. South Africa Demographic and Health Survey 2016. 2019.

Acknowledgements: The authors thank Clare L. Hurley of Brandeis University for editing assistance.

Patient Consent for Publication: Not applicable

Ethics Approval: Not required.

Word Count: Introduction to Conclusions: 2,879

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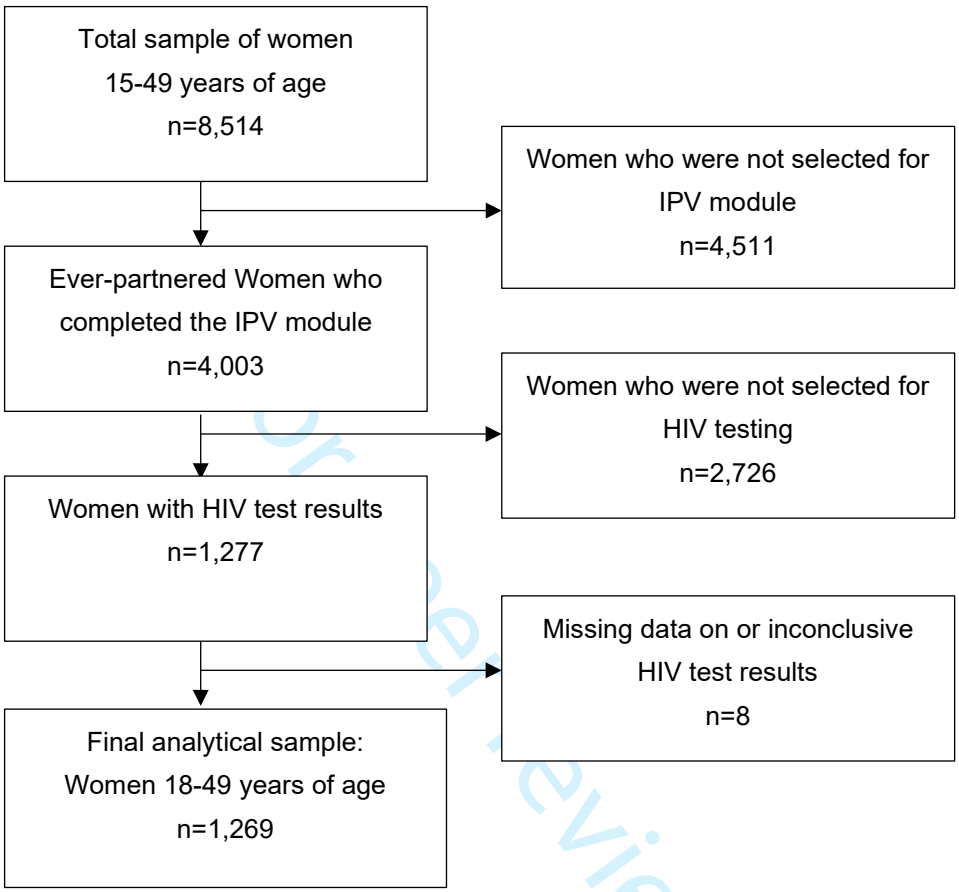
Figure 1. Analytic Sample Selection, South Africa Demographic and Health Survey (SADHS) 2016.



STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	4-5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5-6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6
Bias	9	Describe any efforts to address potential sources of bias	13
Study size	10	Explain how the study size was arrived at	Fig 1
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	6-7
		(*b*) Describe any methods used to examine subgroups and interactions	6-7
		(*c*) Explain how missing data were addressed	5
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	6
		(*e*) Describe any sensitivity analyses	NA
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	7
		(c) Consider use of a flow diagram	Fig 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1 pages 8-9
		(b) Indicate number of participants with missing data for each variable of interest	NA
Outcome data	15*	Report numbers of outcome events or summary measures	Table 2 page 11
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 2 page 11
		(*b*) Report category boundaries when continuous variables were categorized	Table 1 page 8
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	NA
Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13
Generalisability	21	Discuss the generalisability (external validity) of the study results	13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Intimate Partner Violence among Women in South Africa: Disparities at the Intersection of Disability and HIV

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2021-054782.R2
Article Type:	Original research
Date Submitted by the Author:	27-Jun-2022
Complete List of Authors:	Akobirshoev, Ilhom; Brandeis University Heller School for Social Policy and Management, Valentine, Anne; Brandeis University Heller School for Social Policy and Management, Lurie Institute for Disability Policy Zandam, Hussaini; Brandeis University Heller School for Social Policy and Management, Lurie Institute for Disability Policy Nandakumar, Allyala; Brandeis University Heller School for Social Policy and Management Jewkes, Rachel; South African Medical Research Council, Gender and Health Division Blecher, Mark; National Treasury of South Africa Mitra, M; Brandeis University Heller School for Social Policy and Management, Lurie Institute for Disability Policy
Primary Subject Heading:	HIV/AIDS
Secondary Subject Heading:	Public health
Keywords:	HIV & AIDS < INFECTIOUS DISEASES, EPIDEMIOLOGY, Health policy < HEALTH SERVICES ADMINISTRATION & MANAGEMENT

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Research Article

Intimate Partner Violence among Women in South Africa: Disparities at the Intersection of Disability and HIV

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Abstract

Objective: Previous research suggests a significant relationship between intimate partner violence (IPV) and HIV infection in women, and that the risk of IPV is heightened in women with disabilities. Women with disabilities, particularly those residing in low- and middle-income countries, may experience additional burdens that increase their vulnerability to IPV. We aimed to examine the association between having disability and HIV infection and the risk of IPV among women in South African.

Design: Using the 2016 South Africa Demographic and Health Survey (SADHS), we calculated the prevalence of IPV and conducted modified Poisson regressions to estimate the unadjusted and adjusted risk ratios of experiencing IPV by disability and HIV status.

Participants: Our final analytic sample included 1,269 ever-partnered women, aged 18-49 years, who responded to the IPV module and received HIV testing.

Results: The prevalence of IPV was twice as high in women with disabilities with HIV infection compared to women without disabilities without HIV infection (21.2% vs. 50.1%). Our unadjusted regression analysis showed that compared to women without disabilities without HIV infection, women with disabilities with HIV infection had almost four times higher odds (OR=3.72, 95%CI: 1.27-10.9, p<0.05) of experiencing IPV. It appeared that women with disabilities with HIV infection experience compounded disparity. The association was compounded, with the OR for the combination of disability status and HIV status equal to or more than the sum of each of the individual ORs.

Conclusions: Women with disabilities and HIV infection are at exceptionally high risk of IPV in South Africa. Given that HIV infection and disability magnify each other's risks for IPV, targeted interventions to prevent IPV and to address the complex and varied needs of doubly marginalized populations of women with disabilities with HIV infection is critical.

Keywords: HIV; intimate partner violence; disability; women with disabilities; South Africa; Demographic Health Survey

Article Summary

Strengths and Limitations of this Study:

Strengths

- SADHS data used were nationally representative of South African women 18-49 years of age with a final analytic sample of 1,269 ever-partnered women.
- The outcome variables included exposure to IPV, including physical, sexual, and emotional violence, and combinations of these.
- Sociodemographic characteristics as covariates used in all our multivariate analyses were age (18-25 years, 25-34 years, 35+ years) education (no education, primary, secondary, higher), marital status (never married but partnered, currently or formerly married), number of dependent children (0, 1, 2, 3, 4 or more) and employment status (i.e., employed or unemployed). Household characteristics included household wealth quintile (lowest, second, third, fourth, highest) and residence (i.e., urban or rural).

Limitations

- **Limitations**
- The SADHS does not provide information about the duration, onset, and cause of disability - all of which may potentially impact the data's accuracy.
- The data were based on self-report and, thus, subject to potential recall and social desirability bias.
- Because this is a cross-sectional study, a cause and effect relationship could not be determined.
- The sample size was small and statistical power thus limited, especially as SADHS has a multi-stage sample and the design effect reduces statistical power for analyses.

Introduction

Violence against women is a pervasive, global public health problem (WHO, 2013).[1] Estimates suggest that more than a third of women aged 15 years and older have experienced intimate partner violence (IPV) including physical violence, sexual violence or sexual coercion, threats of violence, psychological aggression or emotional abuse by a current or former partner in their lifetimes.[2] While both men and women can perpetrate or suffer IPV, the burden and the consequences of IPV disproportionately affect women.[3]

The relationship between IPV and human immunodeficiency virus (HIV) among women has been a topic of intense research for three decades, with evidence suggesting a significant association between the two.[4-6] A review of 28 studies, a majority of which were conducted in low- and middle-income countries, found a significant association between IPV and HIV infection in women.[7] Similarly, data collected from 10 sub-Saharan African countries reported consistent and robust associations between HIV infection and risk of IPV in women.[4] Longitudinal research in South Africa has shown that HIV incidence is significantly elevated by exposure to IPV and controlling partner behaviour.[5] Further research has also shown that HIV incidence in women is elevated by exposure to rape[8] and child abuse.[9] Still, a majority of research to date has been conducted in high-income countries or among women considered to be at higher risk for HIV infection based on alcohol use or childhood exposure to sexual violence and trauma.[7] Subgroup analyses in a 2014 systematic review and meta-analysis found a stronger association between IPV and HIV infection in low-and-middle-income countries than in high-income countries, suggesting not only the importance of contextual factors in understanding risk for HIV infection but also the need for research on the interface with diverse populations residing in varied social, economic and geographic settings.[7]

While less attention has been paid to the association between disability and IPV in low-income settings, research conducted in high-income countries suggests that disability is both a risk marker and a consequence of IPV.[10,11] Evidence from the United States suggests that women with disabilities experience heightened risk for IPV given the passage of time.[12] Emerging research conducted from the Global South has suggested significant disparities in risk for IPV between reproductive-aged women with and without disabilities.[13-19] A recent pooled analyses of data from women participating in IPV prevention research in seven African and Asian nations found a doubling in risk for past year IPV experienced by women with disabilities compared to their non-disabled counterparts.[20]

Despite the magnitude of violence experienced by both women with disabilities and women with HIV infection, the risk of IPV among women has not yet been examined at the intersection of disability and HIV infection. To address this gap, we conducted an exploratory data analysis of the nationally representative population-based 2016 South Africa Demographic and Health

Survey (SADHS) to compare the prevalence of IPV among women with and without HIV infection in disabled and non-disabled groups.

Methods

Data

We analyzed data from the 2016 South Africa Demographic and Health Surveys (SADHS).[21] The SADHS is supported by the United States Agency for International Aid (USAID)[22] and provides up-to-date estimates of key demographic, socioeconomic, and health indicators in South Africa, including sexual and reproductive health in adults, infant and maternal mortality, child mortality, nutritional status, malaria, disability status, and biomarkers including HIV status. The SADHS employed a stratified two-stage sample survey design. In the first stage, primary sampling units (PSUs) or enumeration areas (EAs) in urban and rural areas were selected. In the second stage, a random sample of approximately 30 residential dwelling units (DUs) from each PSU was selected for the survey. Detailed information about survey design is available in the SADHS final survey reports.[22]

Sample

The SADHS data are nationally representative of women 15-49 years of age. A total of 8,514 women were interviewed in 2016 (see **Figure 1**). Of these, 4,003 ever-partnered women 18-49 years of age were selected to complete the IPV module. Among these women, only 1,277 agreed to provide a blood specimen for HIV testing. In this study, we excluded women who refused to have their blood tested for HIV (n=2,726) or who had missing or inconclusive HIV test results (n=8). Our final analytic sample included 1,269 ever-partnered women, aged 18-49 years, who responded to the IPV module, and received HIV testing.

[Insert Figure 1 here]

Measures

Outcome variables

The outcome variables included exposure to IPV. Following prior studies,[4,13] we measured IPV using standard DHS domestic violence module pertaining to physical, sexual, and emotional violence, and combinations of these. Ever-partnered women aged 18 and older were asked if their current partner (among currently partnered women) or the most recent partner (among formerly partnered women) did the following to them in the past 12 months:

Physical violence: push you, shake you, or throw something at you; kick you, drag you, or beat you up; try to choke you or burn you on purpose; or threaten or attack you with a knife, gun, or any other weapon.
Sexual violence: physically force you to have sexual intercourse with him even when you did not want to, physically force you to perform any other sexual acts you did not want to, or force you with threats or in any other way to perform sexual acts you did not want to.
Emotional violence: say or do something to humiliate you in front of others, threaten to hurt or harm you or someone close to you, or insult you or make you feel bad about yourself.

We categorized women as having experienced IPV in the past 12 months if they answered yes to any of the questions relating to physical, sexual, or emotional violence. Women who answered no to all questions about physical, sexual, or emotional violence were categorized as not having experienced IPV in the past 12 months. We measured IPV as a binary variable (yes/no).[4,13]

Exposure

Disability and HIV were considered as risk factors. Similar to earlier studies,[13] disability status is measured as a binary indicator (i.e., yes or no). We categorized women as having a disability if they reported "a lot of difficulty" or "cannot function at all" to any of the Washington Group Short Set of Questions on Disability[23] functional areas related to 1) seeing; 2) hearing; 3) communicating; 4) remembering; 5) walking and; 6) washing or dressing.

Exposure to HIV was measured as a binary variable indicating HIV infection (yes/no). Blood spot samples were collected from women age 15-49 who agreed to provide their blood for HIV testing. We created a new variable combining disability and HIV status. This variable included the following women cohorts: women without disabilities who are HIV-positive (cohort 1) women with disabilities who are HIV-negative (cohort 2), women with disabilities who are HIV-positive (cohort 3), and women without disabilities who are HIV-negative (reference group). Of note, although HIV is a chronic disease and a potentially disabling condition it not considered to be a disability in this study.

Covariates

We included the following sociodemographic characteristics as covariates in all our multivariate analyses: age (< 25 years, 25-34 years, 35+ years) education (no education, primary, secondary, higher), marital status (never married but partnered, currently or formerly married), number of dependent children (0, 1, 2, 3, 4 or more) and employment status (i.e., employed, or unemployed). Household characteristics included household wealth quintile (lowest, second, third, fourth, highest) and residence (i.e., urban, or rural).

Statistical Analysis

All analyses were weighted to account for complex survey design. Selected demographic and socioeconomic characteristics of women without disabilities who are HIV-positive (cohort 1), women with disabilities who are HIV-negative (cohort 2), women with disabilities who are HIV-positive (cohort 3), compared to women without disabilities who are HIV-negative (reference group) using the chi-square test for categorical and t-test for continuous variables.

The IPV indicator was analyzed as binary (yes/no) variables, coded such that higher prevalence indicated greater risk of experiencing IPV. We calculated the prevalence rates of IPV with respective 95%CI for the study cohorts and compared them to the study reference group using the chi-square test. We also conducted logistic regressions to estimate the unadjusted and adjusted odds ratios (with 95% confidence intervals) for IPV by disability and HIV status, with non-disabled HIV-negative women as the reference group. Multivariate models adjusted for the covariates described above. We used Stata (StataCorp LLC, College Station, TX) version 15 for all analyses, applying the *svy* commands to account for the complex sampling design of the SADHS, and a p-value <.05 was the accepted level of significance.

Because data are de-identified and publicly available, the Institutional Review Board approval was not required for this study. No patients were involved in this study.

Results

Table 1 presents the demographic and socioeconomic characteristics of women by disability and HIV status. Out of 1,269 women in our study sample, 832 had no disability and were HIV-negative (referent group); 393 had no disability and were HIV-positive (cohort 1); 26 had a disability and were HIV-negative (cohort 2) and; 18 had a disability and were HIV-positive (cohort 3).

Compared to women reporting no disability who were HIV-negative (referent group), non-disabled women with HIV infection (cohort 1) were, on average, more likely to be older, less educated, have more children, and more likely to be poor. Women reporting a disability who were without HIV infection (cohort 2) were more likely to be older and more likely to be employed than the referent group. Women reporting a disability who were HIV-positive (cohort 3) compared to the referent group were more likely to be older, less likely to be unemployed and poor.

In both HIV and non-HIV groups, women with disabilities were more likely to be older than their counterparts without disabilities. Compared to women without disabilities in non-HIV group, women with disabilities also had significantly more children. We did not find significant differences for all other remaining characteristics.

Table 1. Sample characteristics of ever-partnered women 18-49 years old by disability and HIV status, South Africa, N=1,269 (weighted percentages, SADHS 2016)

	No disability, no HIV (-/-) (N=832)	No disability & HIV (-/+) (N=393)	With disability, no HIV (+/-) (N=26)	With disability & HIV (+/+) (N=18)	p-value
Age	**referent**	**cohort 1**	**cohort 2**	**cohort 3**	a,b
18-25	26.5	10.2	5.9	0.0	
25-34	34.5	47.4	24.2	52.3	
35+	39	42.4	69.9	47.7	
Age, Mean (SD)	31.8(9.0)	33.5(7.4)	38.4(8.0)	35.3(6.7)	a,b,c
Educational level					a
No education	1.6	2.1	2.1	5.0	
Primary	9.2	15	8.8	17.5	
Secondary	74	76.6	87.2	77.5	
Higher	15.2	6.3	1.9	0.0	
Marital status					
Never married but partnered	42.2	44.9	31.4	45.0	
Currently/formerly married	57.8	55.1	68.6	55.0	
Number of living children					a
None	17.1	12.6	3.7	9.4	
1	29.1	31.2	28.3	12.9	
2	25	26.2	8.2	18.8	
3	15.3	21.6	35.7	33.5	
4 and more	13.6	8.4	24.1	25.3	
Employed					b,c

No	60.9	60.3	32.2	85.3	
Yes	39.1	39.7	67.8	14.7	
Household wealth quintile					a,c
Lowest	19.9	21.6	19.3	45.8	
Second	21.5	26.8	7.8	24.8	
Third	21.2	29.2	26.4	19.9	
Fourth	18.5	12.5	27.6	6.7	
Highest	18.9	10.0	18.9	2.8	
Place of residence					
Urban	69.2	69.5	68.1	48.4	
Rural	30.8	30.5	31.9	51.6	

Source: South Africa Demographic and Health Surveys, 2016. [21]

Notes: *p-values for differences, Chi2-test or t-test. Notes: a – indicates a statistically significant difference at p<0.05 between women without disabilities with no HIV (-/-) and women without disabilities with HIV (-/+) (cohort 1), b – indicates a statistically significant difference at p<0.05 between women without disabilities with no HIV (-/-) and women with disabilities with no HIV (+/-) (cohort 2), and c – indicates a statistically significant difference at p<0.05 between women without disabilities with no HIV (-/-) and women with disabilities with HIV (+/+) (cohort 3). Abbreviations: SD = standard deviation; HIV = human immunodeficiency virus.

Table 2 presents the prevalence rates for past year intimate partner violence among ever-partnered women age 18-49 by disability and HIV status. When comparing all cohorts to non-disabled women without HIV infection (referent), although the prevalence of past year IPV was slightly higher for non-disabled women with HIV infection (cohort 1) (21.3 versus 29.1, n.s.) and disabled women without HIV infection (cohort 2) (21.3 versus 29.2, n.s.), these differences were not statistically significant. The prevalence of past year IPV in disabled women with HIV infection (cohort 3) was more than two-fold higher (21.3 versus 51.6, $p<0.05$) and it was statistically significant.

Table 3 presents the unadjusted and adjusted odds ratios for risk of past year intimate partner violence among ever-partnered women age 18-49 by disability and HIV status. Despite higher odds ratios, results from our unadjusted and adjusted regression analyses showed that the risk of past year IPV between non-disabled women without HIV infection (referent) and our first two cohorts-non-disabled women with HIV infection (cohort 1) and disabled women without HIV infection (cohort 2)-did not reach statistically significant levels. However, the risk of past year IPV was high and statistically significant among women in our last cohort, disabled women with HIV infection (cohort 3), when compared to non-disabled women without HIV infection (referent). Results from our unadjusted regression analysis, showed that compared to non-disabled women without HIV infection (referent), disabled women with HIV infection (cohort 3) had almost four times higher odds (OR=3.94, 95% CI: 1.42 - 10.9, $p<0.01$) of experiencing IPV. Even after adjusting for women's sociodemographic characteristics, disabled women with HIV infection (cohort 3) still had three times higher odds (OR=3.00, 95% CI: 1.09 - 8.24, $p<0.05$) of experiencing past year IPV compared non-disabled women without HIV infection (referent).

Table 2. Weighted prevalence rates (with 95% confidence intervals) for past year intimate partner violence among women 18-49 years old, by disability and HIV status, South Africa, N=1,269

Intimate Partner Violence (IPV)	No disability, no HIV (-/-) (N=832)		No disability & HIV (-/+) (N=393)		Disability, no HIV (+/-) (N=26)		Disability & HIV (+/+) (N=18)		P-value
	Referent		cohort 1		cohort 2		cohort 3		
Weighted %, (95%CI)	21.3	17.9-25.2	29.1	21.5-38.0	29.2	13.8-51.3	51.6	28.1-74.4	c

Source: South Africa Demographic and Health Surveys, 2016[21]

Notes: a – indicates a statistically significant difference at p<0.05 between women without disabilities with no HIV (-/-) and women without disabilities with HIV (-/+) (cohort 1), b – indicates a statistically significant difference at p<0.05 between women without disabilities with no HIV (-/-) and women with disabilities with no HIV (+/-) (cohort 2), and c – indicates a statistically significant difference at p<0.05 between women without disabilities with no HIV (-/-) and women with disabilities with HIV (+/+) (cohort 3). Abbreviations: CI = confidence interval, HIV = human immunodeficiency virus.

Table 3. Unadjusted and adjusted odds ratios (with 95% confidence intervals) for risk of past year intimate partner violence among women 18-49 years old by disability and HIV status, South Africa, N=1,269

Intimate Partner Violence (IPV)	No disability, no HIV (-/-) (N=832)	No disability & HIV (-/+) (N=393)		Disability, no HIV (+/-) (N=26)		Disability & HIV (+/+) (N=18)	
	Referent group	cohort 1		cohort 2		cohort 3	
Unadjusted: OR, (95%CI)	1.00	1.51	0.95 - 2.41	1.52	0.57 - 4.03	3.94**	1.42 - 10.93
Adjusted[a]: OR, (95%CI)	1.00	1.31	0.82 - 2.09	1.60	0.58 - 4.45	3.00*	1.09 - 8.24

Source: South Africa Demographic and Health Surveys, 2016, [21] *** p < 0.001, ** p < 0.01, * p < 0.05.

Notes: [a]Adjusted for age, education, marital status, number of living children, employment status, household wealth, and place of residence. Abbreviations: OR = odds ratio, CI = confidence interval, HIV = human immunodeficiency virus.

Discussion

To our knowledge, this is the first study examining the risk of past year IPV experienced by women with disabilities by HIV status in a representative cross-section of South African women. Our findings provide evidence that, in respect of disability and HIV, the vulnerabilities associated with heightened risk for IPV may be compounded. In our adjusted analyses the odds ratios for IPV in disabled women with HIV infection compared to non-disabled women without HIV infection were more than three-fold higher. Among disabled women, having HIV infection compounded the disparities: with the Odds Ratios for the combination of disability status and HIV status equal to, or more than, the sum of each of the individual ORs. While risk of IPV is known to be higher among disabled women[13,20] and among women with HIV infection,[4,7] ours is the first study to show compounded disparities for women living at the intersection of disability and HIV infection. This finding provides empirical evidence for Crenshaw's intersectionality theory,[24,25] in that, women are often disadvantaged by multiple sources of marginalization, including, their gender identity, disability status, and other identity markers that do not exist independently from each other and that each interacts with the other leading to a complex convergence of marginalization. Findings from our study suggest that marginalization of South African women stemming from their disability status and HIV positive status is likely to result in compounded risk for IPV, i.e., greater than the risk of disability status or HIV positive status alone.

The sample of women with disabilities, but not HIV, compared to those without disabilities was very small. Although they reported a higher prevalence of IPV, the unadjusted and adjusted odds ratio of IPV risk were not statistically significant. This is likely to have been explained by the very small sample.

Consistent with previous research in low- and middle-income countries,[4,7,26-30] our findings showed a significantly higher prevalence of IPV among women with HIV infection without disability. However, we did not find a statistically significant increase in reports of IPV in unadjusted and adjusted regression analysis. Previous South African research has generally found a statistically significant increased risk,[5] however this has been for the relationship between ever experience of more than one act of physical and/or sexual IPV and HIV serostatus. Much of the past year IPV reported by the women was emotional abuse and exposure to this has not been shown to have as strong an association with HIV status as physical and sexual IPV.[31] We also note that the population in this study was older than in other South African studies and IPV incidence declines with age,[2] as well as age possibly impacting disclosure of IPV experience due to different personal and systems-level factors, which might explain the lack of statistically significant difference.

This study contributes to an emerging body of research examining IPV at the intersection of disability and HIV among women in low- and middle-income countries using nationally representative data. Further research, including longitudinal studies with a robust sample size is needed to examine the causal pathways or mechanisms behind the observed compounding associations between disability and HIV infection on risk of IPV.

Our findings emphasize the need for increased attention to policy and practice efforts to prevent IPV among disabled women with HIV infection. And that disability status is an important consideration in designing and implementing violence and HIV prevention and intervention services.

Limitations

There are several limitations to this study that are worth noting. First, the SADHS does not provide information about the duration, onset, and cause of disability - all of which may potentially impact the data's accuracy. Second, the data were based on self-report and, thus, subject to potential recall and social desirability bias. Third, because this is a cross-sectional study, a cause and effect relationship could not be determined. Fourthly, the sizes of the study cohorts were unequal and rather small for the two study cohorts (N=26 for cohort 2 and N=18 for cohort 3, respectively), which can limit the statistical power and increase Type I error rates.[32] However, unequally sized cohorts are common in social science and maybe the result of survey's multi-stage random sampling design and the retrospective nature of creation of the study cohorts. Results from our post hoc power analysis showed that statistical power reached ~28% for cohort 2 and ~86% for cohort 1 when compared to the reference group (N=832). Finally, because not all women age 18 and older were selected for HIV testing and received the IPV module,[22] the generalizability of the prevalence estimates is therefore unclear, and these results should be interpreted with caution.

Despite these limitations, this study is the first exploratory investigation of IPV at the intersection of disability and HIV among women in South Africa. The findings are highly relevant to researchers, policymakers, and non-governmental organizations working across various sectors to prevent IPV and address the needs and rights of women with disabilities, women with HIV infection, and the most vulnerable group of disabled women with HIV infection. Additional longitudinal studies, with larger and equally sized samples, are needed to replicate our exploratory study and examine whether having a disability and having HIV positive status have a compounding effect on the risk of IPV. Future research should also include qualitative data from women with both disability and HIV to better understand risks and needs of these doubly marginalized, reproductive age women.

Conclusions

Disabled women with HIV infection experience exceptionally high risk of IPV in South Africa. Given that disability and HIV status magnify each other's risks for IPV, targeted interventions to prevent IPV and to address the complex and varied needs of doubly marginalized populations of disabled women with HIV infection is critical.

Figure Legend: Figure 1. Analytic Sample Selection, South Africa Demographic and Health Survey (SADHS) 2016. Source: South Africa Demographic Health Survey (SADHS) 2016. Notes: HIV = human immunodeficiency virus; IPV = intimate partner violence

Funding Statement: This paper was produced with funding from Centers for Disease Control and Prevention (CDC), Division of Global HIV/AIDS & TB (DGHT) under Cooperative Agreement Number U2GGH001531. Its contents are solely the responsibility of Cardno and Brandeis University and do not necessarily represent the official views of CDC.

Competing Interest: Drs. Akobirshoev, Zandam, and Nandakumar report a grant from Cardno Emerging Markets, USA, Ltd., during the conduct of the study; Ms. Valentine and Drs. Jewkes, Blacher, and Mitra have no conflicts of interest to declare.

Author Contributions: Dr. Akobirshoev conceptualized and designed the study; conducted a formal analysis of the data and interpretation of the findings, and wrote the first draft of the manuscript; Dr. Zandam accessed and verified the underlying data, participated in the concept and design; analysis, and interpretation of data; and drafted or revised the manuscript; Drs. Valentine, Nandakumar, Jewkes, Blecher, and Mitra, participated in the concept and design; interpretation of the findings, and drafting or revising of the manuscript.

All authors approved the submitted version and have agreed both to be personally accountable for the author's own contributions and the accuracy and integrity of any part of the work.

Data Sharing Statement: Dataset available from National Department of Health (NDoH) SSASS, South African Medical Research Council (SAMRC), and ICF. South Africa Demographic and Health Survey 2016.[21]

Acknowledgements: The authors thank Clare L. Hurley of Brandeis University for editing assistance.

Patient Consent for Publication: Not applicable

Ethics Approval: Not required.

Word Count: Introduction to Conclusions: 2,656

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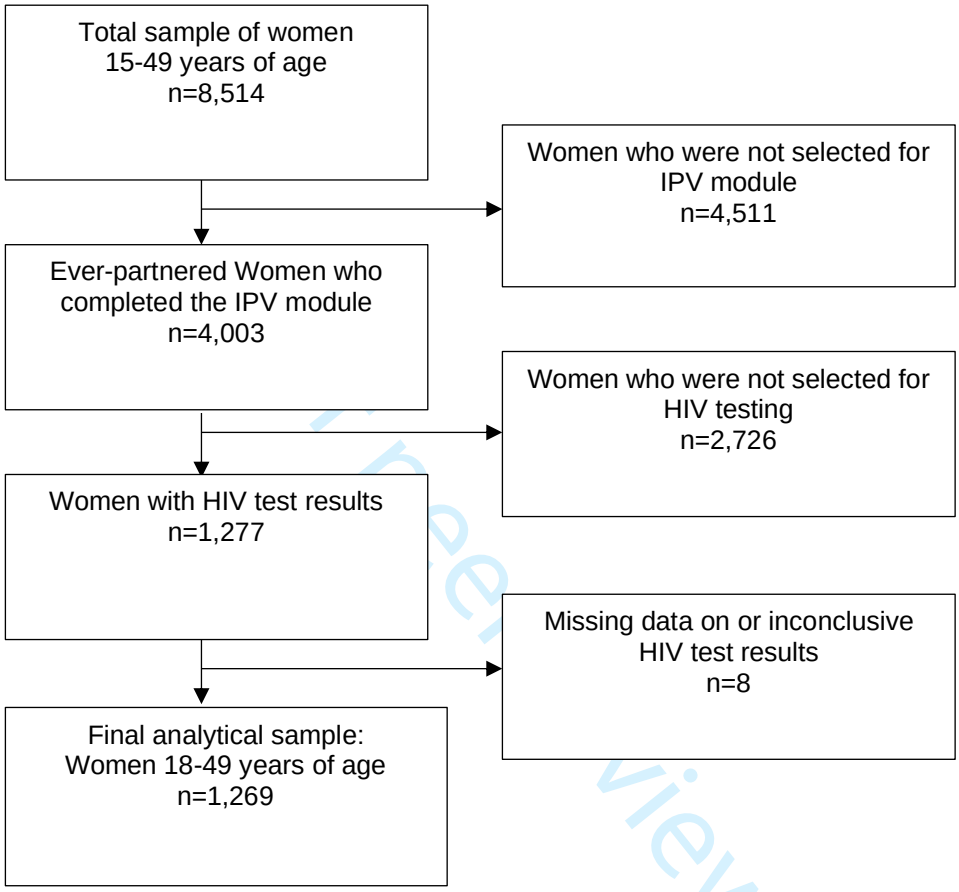
Figure 1. Analytic Sample Selection, South Africa Demographic and Health Survey (SADHS) 2016.



South Africa Demographic Health Survey (SADHS) 2016.[21] Notes: HIV = human immunodeficiency virus; IPV = intimate partner violence

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	4-5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5-6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6
Bias	9	Describe any efforts to address potential sources of bias	13
Study size	10	Explain how the study size was arrived at	Fig 1
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	6-7
		(*b*) Describe any methods used to examine subgroups and interactions	6-7
		(*c*) Explain how missing data were addressed	5
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	6
		(*e*) Describe any sensitivity analyses	NA
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	7
		(c) Consider use of a flow diagram	Fig 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1 pages 8-9
		(b) Indicate number of participants with missing data for each variable of interest	NA
Outcome data	15*	Report numbers of outcome events or summary measures	Table 2 page 11
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 2 page 11
		(*b*) Report category boundaries when continuous variables were categorized	Table 1 page 8
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	NA
Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13
Generalisability	21	Discuss the generalisability (external validity) of the study results	13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Disparities in Intimate Partner Violence among Women at the Intersection of Disability and HIV status in South Africa: cross sectional study

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2021-054782.R3
Article Type:	Original research
Date Submitted by the Author:	16-Aug-2022
Complete List of Authors:	Akobirshoev, Ilhom; Brandeis University Heller School for Social Policy and Management, Valentine, Anne; Brandeis University Heller School for Social Policy and Management, Lurie Institute for Disability Policy Zandam, Hussaini; Brandeis University Heller School for Social Policy and Management, Lurie Institute for Disability Policy Nandakumar, Allyala; Brandeis University Heller School for Social Policy and Management Jewkes, Rachel; South African Medical Research Council, Gender and Health Division Blecher, Mark; National Treasury of South Africa Mitra, M; Brandeis University Heller School for Social Policy and Management, Lurie Institute for Disability Policy
Primary Subject Heading:	HIV/AIDS
Secondary Subject Heading:	Public health
Keywords:	HIV & AIDS < INFECTIOUS DISEASES, EPIDEMIOLOGY, Health policy < HEALTH SERVICES ADMINISTRATION & MANAGEMENT

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Research Article

Disparities in Intimate Partner Violence among Women at the Intersection of Disability and HIV status in South Africa: cross sectional study

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Abstract

Objective: Previous research suggests a significant relationship between intimate partner violence (IPV) and HIV infection in women and that the risk of IPV is heightened in women with disabilities. Women with disabilities, particularly those residing in low- and middle-income countries, may experience additional burdens that increase their vulnerability to IPV. We aimed to examine the association between having disability and HIV infection and the risk of IPV among women in South Africa.

Design: Using the 2016 South Africa Demographic and Health Survey (SADHS), we calculated the prevalence of IPV and conducted modified Poisson regressions to estimate the unadjusted and adjusted risk ratios of experiencing IPV by disability and HIV status.

Participants: Our final analytic sample included 1,269 ever-partnered women aged 18-49 years, who responded to the IPV module and received HIV testing.

Results: The prevalence of IPV was twice as high in women with disabilities with HIV infection compared to women without disabilities without HIV infection (21.2% vs. 50.1%). Our unadjusted regression analysis showed that compared to women without disabilities without HIV infection, women with disabilities with HIV infection had almost four times higher odds (OR=3.72, 95%CI: 1.27-10.9, p<0.05) of experiencing IPV. It appeared that women with disabilities with HIV infection experience compounded disparity. The association was compounded, with the OR for the combination of disability status and HIV status equal to or more than the sum of each of the individual ORs.

Conclusions: Women with disabilities and HIV infection are at exceptionally high risk of IPV in South Africa. Given that HIV infection and disability magnify each other's risks for IPV, targeted interventions to prevent IPV and to address the complex and varied needs of doubly marginalized populations of women with disabilities with HIV infection are critical.

Keywords: HIV; intimate partner violence; disability; women with disabilities; South Africa; Demographic Health Survey

Article Summary

Strengths and Limitations of this Study:

Strengths

- SADHS data used were nationally representative of South African women 18-49 years of age with a final analytic sample of 1,269 ever-partnered women.
- The outcome variables included exposure to IPV, including physical, sexual, and emotional violence, and combinations of these.
- Sociodemographic characteristics as covariates used in all our multivariate analyses were age (18-25 years, 25-34 years, 35+ years) education (no education, primary, secondary, higher), marital status (never married but partnered, currently or formerly married), number of dependent children (0, 1, 2, 3, 4 or more) and employment status (i.e., employed or unemployed). Household characteristics included household wealth quintile (lowest, second, third, fourth, highest) and residence (i.e., urban or rural).

Limitations

- **Limitations**
- The SADHS does not provide information about the duration, onset, and cause of disability - all of which may potentially impact the data's accuracy.
- The data were based on self-report and, thus, subject to potential recall and social desirability bias.
- Because this is a cross-sectional study, a cause and effect relationship could not be determined.
- The sample size was small and statistical power thus limited, especially as SADHS has a multi-stage sample and the design effect reduces statistical power for analyses.

Introduction

Violence against women is a pervasive, global public health problem (WHO, 2013).[1] Estimates suggest that more than a third of women aged 15 years and older have experienced intimate partner violence (IPV) including physical violence, sexual violence or sexual coercion, threats of violence, psychological aggression or emotional abuse by a current or former partner in their lifetimes.[2] While both men and women can perpetrate or suffer IPV, the burden and the consequences of IPV disproportionately affect women.[3]

The relationship between IPV and human immunodeficiency virus (HIV) among women has been a topic of intense research for three decades, with evidence suggesting a significant association between the two.[4-6] A review of 28 studies, a majority of which were conducted in low- and middle-income countries, found a significant association between IPV and HIV infection in women.[7] Similarly, data collected from 10 sub-Saharan African countries reported consistent and robust associations between HIV infection and risk of IPV in women.[4] Longitudinal research in South Africa has shown that HIV incidence is significantly elevated by exposure to IPV and controlling partner behaviour.[5] Further research has also shown that HIV incidence in women is elevated by exposure to rape[8] and child abuse.[9] Still, a majority of research to date has been conducted in high-income countries or among women considered to be at higher risk for HIV infection based on alcohol use or childhood exposure to sexual violence and trauma.[7] Subgroup analyses in a 2014 systematic review and meta-analysis found a stronger association between IPV and HIV infection in low-and-middle-income countries than in high-income countries, suggesting not only the importance of contextual factors in understanding risk for HIV infection but also the need for research on the interface with diverse populations residing in varied social, economic and geographic settings.[7]

While less attention has been paid to the association between disability and IPV in low-income settings, research conducted in high-income countries suggests that disability is both a risk marker and a consequence of IPV.[10,11] Evidence from the United States suggests that women with disabilities experience heightened risk for IPV given the passage of time.[12] Emerging research conducted from the Global South has suggested significant disparities in risk for IPV between reproductive-aged women with and without disabilities.[13-19] A recent pooled analyses of data from women participating in IPV prevention research in seven African and Asian nations found a doubling in risk for past year IPV experienced by women with disabilities compared to their non-disabled counterparts.[20]

Despite the magnitude of violence experienced by both women with disabilities and women with HIV infection, the risk of IPV among women has not yet been examined at the intersection of disability and HIV infection. To address this gap, we conducted an exploratory data analysis of the nationally representative population-based 2016 South Africa Demographic and Health

Survey (SADHS) to compare the prevalence of IPV among women with and without HIV infection in disabled and non-disabled groups.

Methods

Data

We analyzed data from the 2016 South Africa Demographic and Health Surveys (SADHS).[21] The SADHS is supported by the United States Agency for International Aid (USAID)[22] and provides up-to-date estimates of key demographic, socioeconomic, and health indicators in South Africa, including sexual and reproductive health in adults, infant and maternal mortality, child mortality, nutritional status, malaria, disability status, and biomarkers including HIV status. The SADHS employed a stratified two-stage sample survey design. In the first stage, primary sampling units (PSUs) or enumeration areas (EAs) in urban and rural areas were selected. In the second stage, a random sample of approximately 30 residential dwelling units (DUs) from each PSU was selected for the survey. Detailed information about survey design is available in the SADHS final survey reports.[22]

Sample

The SADHS data are nationally representative of women 15-49 years of age. A total of 8,514 women were interviewed in 2016 (see **Figure 1**). Of these, 4,003 ever-partnered women 18-49 years of age were selected to complete the IPV module. Among these women, only 1,277 agreed to provide a blood specimen for HIV testing. In this study, we excluded women who refused to have their blood tested for HIV (n=2,726) or who had missing or inconclusive HIV test results (n=8). Our final analytic sample included 1,269 ever-partnered women, aged 18-49 years, who responded to the IPV module, and received HIV testing.

[Insert Figure 1 here]

Measures

Outcome variables

The outcome variables included exposure to IPV. Following prior studies,[4,13] we measured IPV using standard DHS domestic violence module pertaining to physical, sexual, and emotional violence, and combinations of these. Ever-partnered women aged 18 and older were asked if their current partner (among currently partnered women) or the most recent partner (among formerly partnered women) did the following to them in the past 12 months:

Physical violence: push you, shake you, or throw something at you; kick you, drag you, or beat you up; try to choke you or burn you on purpose; or threaten or attack you with a knife, gun, or any other weapon.

Sexual violence: physically force you to have sexual intercourse with him even when you did not want to, physically force you to perform any other sexual acts you did not want to, or force you with threats or in any other way to perform sexual acts you did not want to.
Emotional violence: say or do something to humiliate you in front of others, threaten to hurt or harm you or someone close to you, or insult you or make you feel bad about yourself.

We categorized women as having experienced IPV in the past 12 months if they answered yes to any of the questions relating to physical, sexual, or emotional violence. Women who answered no to all questions about physical, sexual, or emotional violence were categorized as not having experienced IPV in the past 12 months. We measured IPV as a binary variable (yes/no).[4,13]

Exposure

Disability and HIV were considered as risk factors. Similar to earlier studies,[13] disability status is measured as a binary indicator (i.e., yes or no). We categorized women as having a disability if they reported "a lot of difficulty" or "cannot function at all" to any of the Washington Group Short Set of Questions on Disability[23] functional areas related to 1) seeing; 2) hearing; 3) communicating; 4) remembering; 5) walking and; 6) washing or dressing.

Exposure to HIV was measured as a binary variable indicating HIV infection (yes/no). Blood spot samples were collected from women age 15-49 who agreed to provide their blood for HIV testing. We created a new variable combining disability and HIV status. This variable included the following women cohorts: women without disabilities who are HIV-positive (cohort 1) women with disabilities who are HIV-negative (cohort 2), women with disabilities who are HIV-positive (cohort 3), and women without disabilities who are HIV-negative (reference group). Of note, although HIV is a chronic disease and a potentially disabling condition it not considered to be a disability in this study.

Covariates

We included the following sociodemographic characteristics as covariates in all our multivariate analyses: age (< 25 years, 25-34 years, 35+ years) education (no education, primary, secondary, higher), marital status (never married but partnered, currently or formerly married), number of dependent children (0, 1, 2, 3, 4 or more) and employment status (i.e., employed, or unemployed). Household characteristics included household wealth quintile (lowest, second, third, fourth, highest) and residence (i.e., urban, or rural).

Statistical Analysis

All analyses were weighted to account for complex survey design. Selected demographic and socioeconomic characteristics of women without disabilities who are HIV-positive (cohort 1), women with disabilities who are HIV-negative (cohort 2), women with disabilities who are HIV-positive (cohort 3), compared to women

without disabilities who are HIV-negative (reference group) using the chi-square test for categorical and t-test for continuous variables.

The IPV indicator was analyzed as binary (yes/no) variables, coded such that higher prevalence indicated greater risk of experiencing IPV. We calculated the prevalence rates of IPV with respective 95%CI for the study cohorts and compared them to the study reference group using the chi-square test. We also conducted logistic regressions to estimate the unadjusted and adjusted odds ratios (with 95% confidence intervals) for IPV by disability and HIV status, with non-disabled HIV-negative women as the reference group. Multivariate models adjusted for the covariates described above. We used Stata (StataCorp LLC, College Station, TX) version 15 for all analyses, applying the *svy* commands to account for the complex sampling design of the SADHS, and a p-value <.05 was the accepted level of significance.

Because data are de-identified and publicly available, the Institutional Review Board approval was not required for this study. No patients were involved in this study.

Patient and public Involvement

Given that this article was based on a retrospective analysis of secondary data from SADHS, no patients or subjects were directly involved in this study. However, two of our co-authors are from South Africa, including Rachel Jewkes from the South Africa Medical Research Council and Mark Blecher from the National Treasury of South Africa. We plan to widely disseminate the paper's findings to members of the public in South Africa and globally via the author's institutions' respective communication and social media platforms (e.g., Twitter, Facebook, LinkedIn, ResearchGate, Academia, etc.)

Results

Table 1 presents the demographic and socioeconomic characteristics of women by disability and HIV status. Out of 1,269 women in our study sample, 832 had no disability and were HIV-negative (referent group); 393 had no disability and were HIV-positive (cohort 1); 26 had a disability and were HIV-negative (cohort 2) and; 18 had a disability and were HIV-positive (cohort 3).

Compared to women reporting no disability who were HIV-negative (referent group), non-disabled women with HIV infection (cohort 1) were, on average, more likely to be older, less educated, have more children, and more likely to be poor. Women reporting a disability who were without HIV infection (cohort 2) were more likely to be older and more likely to be employed than the referent group. Women reporting a disability who were HIV-positive (cohort 3) compared to the referent group were more likely to be older, less likely to be unemployed and poor.

In both HIV and non-HIV groups, women with disabilities were more likely to be older than their counterparts without disabilities. Compared to women without disabilities in non-HIV group, women with disabilities also had significantly more

children. We did not find significant differences for all other remaining characteristics.

Table 1. Sample characteristics of ever-partnered women 18-49 years old by disability and HIV status, South Africa, N=1,269 (weighted percentages, SADHS 2016)

	No disability, no HIV (-/-) (N=832)	No disability & HIV (-/+) (N=393)	With disability, no HIV (+/-) (N=26)	With disability & HIV (+/+) (N=18)	p-value
Age	**referent**	**cohort 1**	**cohort 2**	**cohort 3**	a,b
18-25	26.5	10.2	5.9	0.0	
25-34	34.5	47.4	24.2	52.3	
35+	39	42.4	69.9	47.7	
Age, Mean (SD)	31.8(9.0)	33.5(7.4)	38.4(8.0)	35.3(6.7)	a,b,c
Educational level					a
No education	1.6	2.1	2.1	5.0	
Primary	9.2	15	8.8	17.5	
Secondary	74	76.6	87.2	77.5	
Higher	15.2	6.3	1.9	0.0	
Marital status					
Never married but partnered	42.2	44.9	31.4	45.0	
Currently/formerly married	57.8	55.1	68.6	55.0	
Number of living children					a
None	17.1	12.6	3.7	9.4	
1	29.1	31.2	28.3	12.9	
2	25	26.2	8.2	18.8	
3	15.3	21.6	35.7	33.5	
4 and more	13.6	8.4	24.1	25.3	
Employed					b,c

No	60.9	60.3	32.2	85.3	
Yes	39.1	39.7	67.8	14.7	
Household wealth quintile					a,c
Lowest	19.9	21.6	19.3	45.8	
Second	21.5	26.8	7.8	24.8	
Third	21.2	29.2	26.4	19.9	
Fourth	18.5	12.5	27.6	6.7	
Highest	18.9	10.0	18.9	2.8	
Place of residence					
Urban	69.2	69.5	68.1	48.4	
Rural	30.8	30.5	31.9	51.6	

Source: South Africa Demographic and Health Surveys, 2016. [21]

Notes: *p-values for differences, Chi2-test or t-test. Notes: a – indicates a statistically significant difference at p<0.05 between women without disabilities with no HIV (-/-) and women without disabilities with HIV (-/+) (cohort 1), b – indicates a statistically significant difference at p<0.05 between women without disabilities with no HIV (-/-) and women with disabilities with no HIV (+/-) (cohort 2), and c – indicates a statistically significant difference at p<0.05 between women without disabilities with no HIV (-/-) and women with disabilities with HIV (+/+) (cohort 3). Abbreviations: SD = standard deviation; HIV = human immunodeficiency virus.

Table 2 presents the prevalence rates for past year intimate partner violence among ever-partnered women age 18-49 by disability and HIV status. When comparing all cohorts to non-disabled women without HIV infection (referent), although the prevalence of past year IPV was slightly higher for non-disabled women with HIV infection (cohort 1) (21.3 versus 29.1, n.s.) and disabled women without HIV infection (cohort 2) (21.3 versus 29.2, n.s.), these differences were not statistically significant. The prevalence of past year IPV in disabled women with HIV infection (cohort 3) was more than two-fold higher (21.3 versus 51.6, $p<0.05$) and it was statistically significant.

Table 3 presents the unadjusted and adjusted odds ratios for risk of past year intimate partner violence among ever-partnered women age 18-49 by disability and HIV status. Despite higher odds ratios, results from our unadjusted and adjusted regression analyses showed that the risk of past year IPV between non-disabled women without HIV infection (referent) and our first two cohorts-non-disabled women with HIV infection (cohort 1) and disabled women without HIV infection (cohort 2)-did not reach statistically significant levels. However, the risk of past year IPV was high and statistically significant among women in our last cohort, disabled women with HIV infection (cohort 3), when compared to non-disabled women without HIV infection (referent). Results from our unadjusted regression analysis, showed that compared to non-disabled women without HIV infection (referent), disabled women with HIV infection (cohort 3) had almost four times higher odds (OR=3.94, 95% CI: 1.42 - 10.9, $p<0.01$) of experiencing IPV. Even after adjusting for women's sociodemographic characteristics, disabled women with HIV infection (cohort 3) still had three times higher odds (OR=3.00, 95% CI: 1.09 - 8.24, $p<0.05$) of experiencing past year IPV compared non-disabled women without HIV infection (referent).

Table 2. Weighted prevalence rates (with 95% confidence intervals) for past year intimate partner violence among women 18-49 years old, by disability and HIV status, South Africa, N=1,269

Intimate Partner Violence (IPV)	No disability, no HIV (-/-) (N=832)		No disability & HIV (-/+) (N=393)		Disability, no HIV (+/-) (N=26)		Disability & HIV (+/+) (N=18)		P-value
	Referent		cohort 1		cohort 2		cohort 3		
Weighted %, (95%CI)	21.3	17.9-25.2	29.1	21.5-38.0	29.2	13.8-51.3	51.6	28.1-74.4	c

Source: South Africa Demographic and Health Surveys, 2016[21]

Notes: a – indicates a statistically significant difference at p<0.05 between women without disabilities with no HIV (-/-) and women without disabilities with HIV (-/+) (cohort 1), b – indicates a statistically significant difference at p<0.05 between women without disabilities with no HIV (-/-) and women with disabilities with no HIV (+/-) (cohort 2), and c – indicates a statistically significant difference at p<0.05 between women without disabilities with no HIV (-/-) and women with disabilities with HIV (+/+) (cohort 3). Abbreviations: CI = confidence interval, HIV = human immunodeficiency virus.

Table 3. Unadjusted and adjusted odds ratios (with 95% confidence intervals) for risk of past year intimate partner violence among women 18-49 years old by disability and HIV status, South Africa, N=1,269

Intimate Partner Violence (IPV)	No disability, no HIV (-/-) (N=832)	No disability & HIV (-/+) (N=393)		Disability, no HIV (+/-) (N=26)		Disability & HIV (+/+) (N=18)	
	Referent group	cohort 1		cohort 2		cohort 3	
Unadjusted: OR, (95%CI)	1.00	1.51	0.95 - 2.41	1.52	0.57 - 4.03	3.94**	1.42 - 10.93
Adjusted[a]: OR, (95%CI)	1.00	1.31	0.82 - 2.09	1.60	0.58 - 4.45	3.00*	1.09 - 8.24

Source: South Africa Demographic and Health Surveys, 2016, [21] *** p < 0.001, ** p < 0.01, * p < 0.05.

Notes: [a]Adjusted for age, education, marital status, number of living children, employment status, household wealth, and place of residence. Abbreviations: OR = odds ratio, CI = confidence interval, HIV = human immunodeficiency virus.

Discussion

To our knowledge, this is the first study examining the risk of past year IPV experienced by women with disabilities by HIV status in a representative cross-section of South African women. Our findings provide evidence that, in respect of disability and HIV, the vulnerabilities associated with heightened risk for IPV may be compounded. In our adjusted analyses the odds ratios for IPV in disabled women with HIV infection compared to non-disabled women without HIV infection were more than three-fold higher. Among disabled women, having HIV infection compounded the disparities: with the Odds Ratios for the combination of disability status and HIV status equal to, or more than, the sum of each of the individual ORs. While risk of IPV is known to be higher among disabled women[13,20] and among women with HIV infection,[4,7] ours is the first study to show compounded disparities for women living at the intersection of disability and HIV infection. This finding provides empirical evidence for Crenshaw's intersectionality theory,[24,25] in that, women are often disadvantaged by multiple sources of marginalization, including, their gender identity, disability status, and other identity markers that do not exist independently from each other and that each interacts with the other leading to a complex convergence of marginalization. Findings from our study suggest that marginalization of South African women stemming from their disability status and HIV positive status is likely to result in compounded risk for IPV, i.e., greater than the risk of disability status or HIV positive status alone.

The sample of women with disabilities, but not HIV, compared to those without disabilities was very small. Although they reported a higher prevalence of IPV, the unadjusted and adjusted odds ratio of IPV risk were not statistically significant. This is likely to have been explained by the very small sample.

Consistent with previous research in low- and middle-income countries,[4,7,26-30] our findings showed a significantly higher prevalence of IPV among women with HIV infection without disability. However, we did not find a statistically significant increase in reports of IPV in unadjusted and adjusted regression analysis. Previous South African research has generally found a statistically significant increased risk,[5] however this has been for the relationship between ever experience of more than one act of physical and/or sexual IPV and HIV serostatus. Much of the past year IPV reported by the women was emotional abuse and exposure to this has not been shown to have as strong an association with HIV status as physical and sexual IPV.[31] We also note that the population in this study was older than in other South African studies and IPV incidence declines with age,[2] as well as age possibly impacting disclosure of IPV experience due to different personal and systems-level factors, which might explain the lack of statistically significant difference.

This study contributes to an emerging body of research examining IPV at the intersection of disability and HIV among women in low- and middle-income countries using nationally representative data. Further research, including longitudinal studies with a robust sample size is needed to examine the causal pathways or mechanisms behind the observed compounding associations between disability and HIV infection on risk of IPV.

Our findings emphasize the need for increased attention to policy and practice efforts to prevent IPV among disabled women with HIV infection. And that disability status is an important consideration in designing and implementing violence and HIV prevention and intervention services.

Limitations

There are several limitations to this study that are worth noting. First, the SADHS does not provide information about the duration, onset, and cause of disability - all of which may potentially impact the data's accuracy. Second, the data were based on self-report and, thus, subject to potential recall and social desirability bias. Third, because this is a cross-sectional study, a cause and effect relationship could not be determined. Fourthly, the sizes of the study cohorts were unequal and rather small for the two study cohorts (N=26 for cohort 2 and N=18 for cohort 3, respectively), which can limit the statistical power and increase Type I error rates.[32] However, unequally sized cohorts are common in social science and maybe the result of survey's multi-stage random sampling design and the retrospective nature of creation of the study cohorts. Results from our post hoc power analysis showed that statistical power reached ~28% for cohort 2 and ~86% for cohort 1 when compared to the reference group (N=832). Finally, because not all women age 18 and older were selected for HIV testing and received the IPV module,[22] the generalizability of the prevalence estimates is therefore unclear, and these results should be interpreted with caution.

Despite these limitations, this study is the first exploratory investigation of IPV at the intersection of disability and HIV among women in South Africa. The findings are highly relevant to researchers, policymakers, and non-governmental organizations working across various sectors to prevent IPV and address the needs and rights of women with disabilities, women with HIV infection, and the most vulnerable group of disabled women with HIV infection. Additional longitudinal studies, with larger and equally sized samples, are needed to replicate our exploratory study and examine whether having a disability and having HIV positive status have a compounding effect on the risk of IPV. Future research should also include qualitative data from women with both disability and HIV to better understand risks and needs of these doubly marginalized, reproductive age women.

Conclusions

Disabled women with HIV infection experience exceptionally high risk of IPV in South Africa. Given that disability and HIV status magnify each other's risks for IPV, targeted interventions to prevent IPV and to address the complex and varied needs of doubly marginalized populations of disabled women with HIV infection is critical.

Figure Legend: Figure 1. Analytic Sample Selection, South Africa Demographic and Health Survey (SADHS) 2016. Source: South Africa Demographic Health Survey (SADHS) 2016. Notes: HIV = human immunodeficiency virus; IPV = intimate partner violence

Funding Statement: This paper was produced with funding from Centers for Disease Control and Prevention (CDC), Division of Global HIV/AIDS & TB (DGHT) under Cooperative Agreement Number U2GGH001531. Its contents are solely the responsibility of Cardno and Brandeis University and do not necessarily represent the official views of CDC.

Competing Interest: Drs. Akobirshoev, Zandam, and Nandakumar report a grant from Cardno Emerging Markets, USA, Ltd., during the conduct of the study; Ms. Valentine and Drs. Jewkes, Blacher, and Mitra have no conflicts of interest to declare.

Author Contributions: Dr. Akobirshoev conceptualized and designed the study; conducted a formal analysis of the data and interpretation of the findings, and wrote the first draft of the manuscript; Dr. Zandam accessed and verified the underlying data, participated in the concept and design; analysis, and interpretation of data; and drafted or revised the manuscript; Drs. Valentine, Nandakumar, Jewkes, Blecher, and Mitra, participated in the concept and design; interpretation of the findings, and drafting or revising of the manuscript.

All authors approved the submitted version and have agreed both to be personally accountable for the author's own contributions and the accuracy and integrity of any part of the work.

Data Sharing Statement: Dataset available from National Department of Health (NDoH) SSASS, South African Medical Research Council (SAMRC), and ICF. South Africa Demographic and Health Survey 2016. 2019.

Acknowledgements: The authors thank Clare L. Hurley of Brandeis University for editing assistance.

Patient Consent for Publication: Not applicable

Ethics Approval: Not required.

Word Count: Introduction to Conclusions: 2,656

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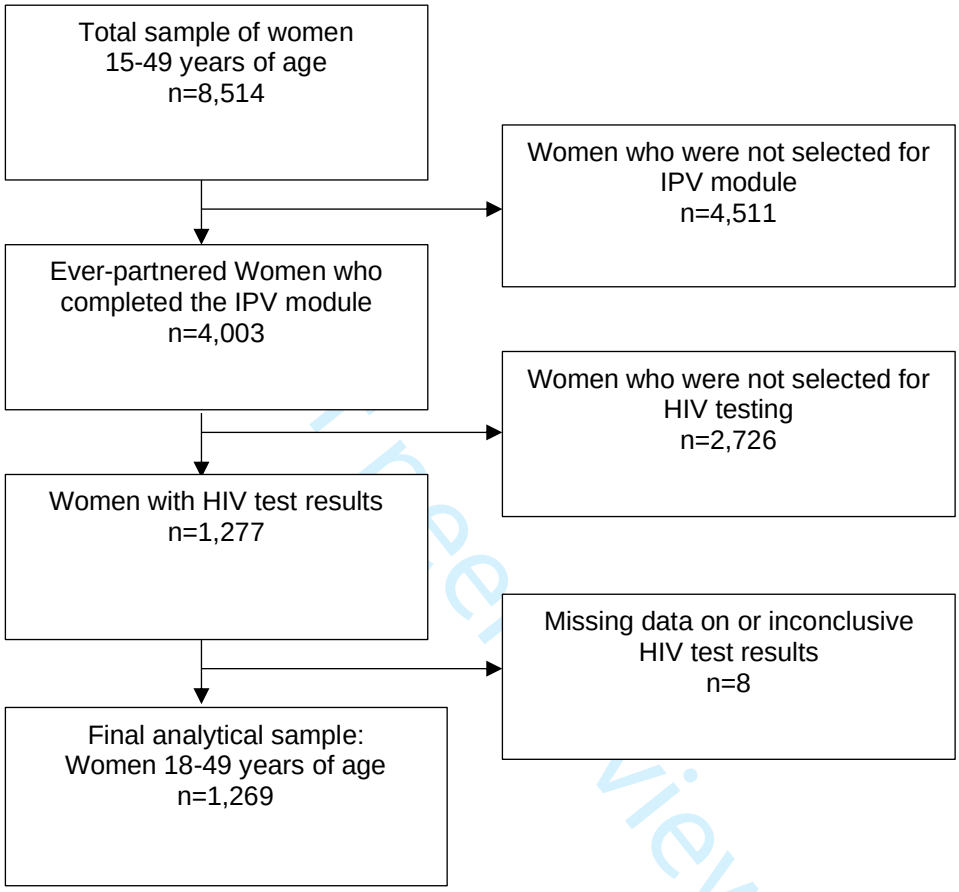
Figure 1. Analytic Sample Selection, South Africa Demographic and Health Survey (SADHS) 2016.



South Africa Demographic Health Survey (SADHS) 2016.[21] Notes: HIV = human immunodeficiency virus; IPV = intimate partner violence

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	4-5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5-6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6
Bias	9	Describe any efforts to address potential sources of bias	13
Study size	10	Explain how the study size was arrived at	Fig 1
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	6-7
		(*b*) Describe any methods used to examine subgroups and interactions	6-7
		(*c*) Explain how missing data were addressed	5
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	6
		(*e*) Describe any sensitivity analyses	NA
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	7
		(c) Consider use of a flow diagram	Fig 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1 pages 8-9
		(b) Indicate number of participants with missing data for each variable of interest	NA
Outcome data	15*	Report numbers of outcome events or summary measures	Table 2 page 11
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 2 page 11
		(*b*) Report category boundaries when continuous variables were categorized	Table 1 page 8
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	NA
Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13
Generalisability	21	Discuss the generalisability (external validity) of the study results	13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.