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C FERRARIS; R S GRUVER; G GEORGE; L L DAVIDSON; C DESMOND ...

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ORIGINAL PAPER

Intimate Partner Violence and Determinants of HIV Seroconversion among Female Caregivers in Kwazulu-Natal, South Africa: Insights from the Asenze Longitudinal Study

Christopher M. Ferraris[1,2] · Rachel S. Gruver[3] · Gavin George[4] · Leslie L. Davidson[3,5] · Chris Desmond[6,7] · Anthony F. Santoro[1] · Sahba Besharati[8] · Justin Knox[1,9,10]

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Abstract

Intimate partner violence (IPV) has been associated with HIV seroconversion vulnerability, but few studies have examined multiple IPV types and HIV status. This study investigates exposure to various IPV types and HIV seroconversion among female caregivers in KwaZulu-Natal (KZN), South Africa, using longitudinal data (2008–2021) from the Asenze cohort study. We compared IPV exposure at baseline (Wave 1[W1]), sociodemographic, and psychosocial characteristics between women living with HIV (WLHIV) vs. HIV-negative at baseline; HIV-negative at baseline who seroconverted by Wave 3 (W3) vs. remaining HIV-negative, using chi-squared and t-tests. We also assessed seroconversion over time in the cohort. At W1, of 580 participants (WLHIV = 139, HIV-negative = 431), 42% reported any IPV. Considering both current and other partners, WLHIV reported higher exposure to threatening IPV (34% vs. 23%, $p = .005$) and multiple IPV types (32% vs. 23%, $p = .029$). From an other partner, WLHIV reported more physical IPV (32% vs. 21%, $p = .010$), any IPV (35% vs. 26%, $p = .049$), and multiple IPV types (23% vs. 15%, $p = .029$). No significant differences in IPV from a current partner were found between WLHIV and HIV-negative women. Those who seroconverted by W3 vs. remained HIV-negative at W3 did not differ on any IPV exposures. Women who seroconverted were younger (28.2 vs. 37.8, $p < .001$) and more likely to report hazardous drinking at W1 (13% vs. 3%, $p < .001$). The high levels of HIV seroconversion and IPV indicate a persistent HIV and IPV epidemic among female caregivers in KZN, necessitating expanded research and interventions.

Keywords HIV · Intimate partner violence · KwaZulu-Natal · Female caregivers

✉ Christopher M. Ferraris
christopher.ferraris@nyspi.columbia.edu

✉ Justin Knox
jrk2115@cumc.columbia.edu

[1] HIV Center for Clinical and Behavioral Studies, New York State Psychiatric Institute, Columbia University, New York, NY, USA

[2] School of Social Policy and Practice, University of Pennsylvania, Philadelphia, PA, USA

[3] Department of Epidemiology, Mailman School of Public Health, Columbia University, New York, NY, USA

[4] Health Economics and HIV and AIDS Research Division, University of KwaZulu-Natal, Durban, South Africa

[5] Department of Pediatrics, Columbia College of Physicians and Surgeons, Columbia University, New York, NY, USA

[6] Center for Rural Health, University of KwaZulu-Natal, Durban, South Africa

[7] School of Economics and Finance, University of the Witwatersrang, Johannesburg, South Africa

[8] Department of Psychology, School of Human and Community Development, University of Witwatersrand, Johannesburg, South Africa

[9] Columbia University Irvine Medical Center, New York, NY, USA

[10] Mailman School of Public Health, Columbia University, New York, NY, USA

Background

It is estimated that in South Africa, 7.8 million people are living with HIV (PLWH) [1]. Women comprise 65% of this total with nearly a quarter of women aged 15 to 49 living with HIV (WLHIV) [2]. Existing research has underscored intimate partner violence (IPV) as a key contributor to women's risk for HIV acquisition [3–5]. About a third (27%) of women in Southern sub-Saharan Africa reported ever experiencing IPV, and 14% reported experiencing IPV in the last year [6].

IPV could contribute to HIV vulnerability in multiple ways beyond the direct risk of forced sex. IPV is one factor in a larger context of unequal gender power dynamics and hegemonic gender roles that are associated with increased control of and violence towards women [7]. This limits women's agency and self-efficacy regarding when condoms can be used [8–10]. Stigma towards IPV is also a barrier to accessing and utilizing healthcare among women [11], limiting crucial opportunities for HIV testing, counseling, and prevention services. IPV can also have deleterious effects on mental health such as depression [12, 13], anxiety [14], and substance use [15, 16], all of which are themselves known risk factors for HIV acquisition [17, 18]. Despite the detrimental associations of IPV with HIV, mental health, substance use, and demographic factors associated with vulnerability, there remains a scarcity of research that explores these factors over time, with an exploration of IPV types (e.g. threatening, sexual, physical, any, multiple), within the same cohort.

Most research on this topic has centered on pregnant and postpartum women [19], adolescent girls and young women [20], and clinical sub-groups. Women in the general population, including those raising children, remain under-studied. A caregiver's responsibilities to a child may increase exposure to IPV or HIV due to economic dependence on a male partner, which is a well-documented risk factor [21, 22]. Prior research also suggests that WLHIV who were exposed to IPV had lower adherence and less likely to reach viral suppression [23]. Additionally, children witnessing IPV have been shown to have lower school performance and behavioral difficulties [24, 25]. In light of these findings, there remains a need to expand our knowledge of the burden of IPV and its association with HIV among caregiving women, especially settings like South Africa.

For this current study, we describe the various types of IPV that women providing childcare experienced; we then compared the prevalence of types of IPV among women who were living with HIV and those who were HIV-negative, and then among women who seroconverted over the course of the study and women who remained HIV-negative and assessing that HIV incidence over time. These analyses leveraged data collected across two timepoints (Waves) among a cohort of female caregivers of children in a peri-rural context in KwaZulu-Natal, the province of South Africa which has the highest HIV prevalence [1] and where a disproportionate number of women bear the burden of HIV [26]. The hypothesis of this study was that baseline IPV exposure would be significantly associated with later HIV seroconversion. The results will help us understand how IPV contributes to women's vulnerability to HIV in this setting.

Methods

Study Site and Design

This study leveraged data from female caregivers participating in the Asenze Cohort Study, a longitudinal epidemiologic study of child health, well-being, development and psychosocial functioning, which enrolled children 4–6 years old and their primary caregivers in 2008–2010. The primary caregivers were approached through a door-to-door household survey of five areas in the eThekwini District, KwaZulu-Natal, South Africa. This peri-urban district has experienced high rates of HIV, food insecurity, and unemployment [27–29]. Caregivers provided informed consent for themselves and for their child, as well as additional consent for HIV testing, which was obtained by trained counselors in accordance with South African national guidelines. Data were collected at three time points, or Waves: Wave 1 (W1) was carried out from 2008 to 2010; Wave 2 (W2) from 2010 to 2014; and Wave 3 (W3) from 2019 to 2021. This analysis used data from W1 to W3 of the Asenze cohort study, which was described in depth elsewhere [29, 30].

Eligibility and Sample

The Asenze study recruited 1437 primary caregivers in W1, with 1273 remaining in the study in W2, and 1040 in Wave 3. Eligibility for the Asenze study was at the child-level (all those residing in the study area, ages 4–6 years) with their primary caregivers being approached to enroll as well [29]. Children were the index participants in the cohort; if a child's primary caregiver changed (due to the death of the previous caregiver, changes to family living arrangements, etc.), the child's new caregiver replaced the previous caregiver in the next wave. The current study restricted analyses to primary female caregivers who participated in each of Asenze study waves 1, 2 and 3 whose HIV status was known (HIV-negative or WLHIV) and provided complete demographic data at W1 ($n = 580$; see measure below). The

sample of women with known HIV-negative status at W1 ($n=431$) was then further examined to document HIV seroconversion over time between W1 and W3 and assess group differences of women who seroconvert and women who had remained HIV-negative at W3.

Measures

Age, Sex, Education, Employment (W1 & W3)

Participants reported demographic variables at each wave, including age, highest education level attained and employment status/income source (only at W1 and W3). Participants reported their employment status by selecting from the following categories: formal employment (regular salary), informal employment (self-employed), piecework, pension income, government grants, or no income. At W1, data on participant sex was not collected but was inferred where possible based on their described relationship to the child (e.g., mother, grandmother, aunt, sister); participants reported their sex at W2 and W3. (We use the term 'sex' throughout; note that the Zulu language, which was used for the questionnaires, uses the same word for both 'sex' and 'gender'.)

HIV Prevalence and Incidence: Rapid HIV Testing and self-report (W1 & W3)

HIV status was determined through serologic testing and self-report at W1 and W3. All participants were asked self-report questions and offered HIV testing in private rooms at the Asenze Study offices, following a structured protocol that included pre- and post-test counseling and rapid testing with referrals to local clinics for all screening positive. In terms of self-report, participants were asked the following questions for self-report: "Have you ever tested for HIV before?", "When was your most recent HIV test?", and "Do you know your HIV status?". For this analysis, participants were classified as living with HIV (LHIV) if they tested positive (based on positive rapid test) or self-reported a positive status. This classification aligns with methods used in prior published research on this cohort [31].

Intimate Partner Violence: Experience of Intimate Partner Violence (W1 & W3)

At each wave, participants were asked to report their partnership status. Those who indicated having a current romantic or sexual partner were further asked whether they were currently living with that partner. At W1 and W3, a brief questionnaire, based on the WHO Violence Against Women measure [32] was administered to all participants regarding IPV. This questionnaire assessed if participants had ever (lifetime) had a partner, were living with a partner, had ever experienced IPV either with their current partner or any other partner. This questionnaire asked all participants yes/no questions that assessed participants' experiences with physical violence (e.g., ever pushed, shoved, or slapped), sexual violence (e.g., ever forced to have sex against your will), threats from a partner (e.g., ever threatened to harm you), and fear of a partner (e.g., are you afraid of your current partner?). Participants who reported experiencing any form of IPV were offered a referral to a local NGO specializing in support for IPV survivors and were provided with study contact information to access additional resources as needed.

Household Index: Assets, Food Security (W1 & W3)

Participants completed a questionnaire on household characteristics including land ownership, possession of durable goods, and household dwelling (building material, sources of drinking water, type of toilet facility, and main source of cooking fuel). This information was used to construct a household asset index variable, following the approach of the Demographic and Health Survey's Wealth Index [33] and previously used in other Asenze publications [25, 33]. It is reported here in tertiles based on the full Asenze cohort population. Food insecurity was assessed by asking a single question "How many days in the last month has your family run out of food completely", where any answer >0 was classified as food insecure.

Mental Health: Client Diagnostic Questionnaire (CDQ) (W1 & W3)

The CDQ was developed and validated in the US to screen for mental health disorders in high HIV prevalence populations and is one of the few brief screening tools to be delivered by non-mental health professions among PLWH [34]. It was also validated in the Asenze study [35] and was administered to participants in all three waves. Modules utilize DSM-IV criteria and screen for major depression syndrome, other depression, panic, generalized anxiety, and post-traumatic stress disorder (PTSD) to determine the presence or absence of a disorder [35]. The module on psychosis was excluded due to its very low prevalence within this sample. For this analysis, as supported by the validation study in the Asenze cohort, we created a dichotomous

variable indicating the presence of any mental health disorder (including PTSD, major depression, other depression, panic disorder, or generalized anxiety) versus no disorder.

Alcohol Use: AUDIT-C (W1 & W3)

Caregivers completed the WHO Alcohol Use Disorders Identification Test (AUDIT), a brief screening tool that assesses alcohol intake and has been validated and used in multiple South African settings [36]. This analysis used the AUDIT-C, a briefer version using only the first 3 items of the AUDIT, which measures frequency of drinking, quantity of drinking (on average) and frequency of binge drinking. AUDIT-C scores can range from 0 to 12. scores ≥ 3 were categorized as hazardous drinking [37, 38].

Statistical Analyses

The objectives of our analyses were to (1) identify the IPV-related correlates of HIV status among the sample at W1, while also including sociodemographic, and mental health correlates; (2) describe HIV incidence between W1 and W3 among the women without HIV at W1; and (3) investigate the IPV, sociodemographic, and mental health correlates among women who seroconverted and those who remained negative by W3.

The demographic variables–relationship to child, age, education, income source, household asset index and CDQ and AUDIT-C were described for the total sample and separately based on HIV status. Differences between HIV status groups on all sociodemographic and mental health variables were evaluated using *t*-tests for continuous variables and chi-squared tests for categorical variables. Participants missing data on demographic, mental health and alcohol variables are reported in the tables but were excluded from statistical tests.

We also investigated the prevalence of IPV for the total sample and separately based on HIV status. IPV was categorized by current partner, other partner(s), and any partner (current or other), and further examined by type, including threatened IPV by partner, physical IPV, sexual IPV, any type of IPV (one or more of threatened, physical, or sexual IPV), and multiple types of IPV (two or more of threatened, physical, or sexual IPV). Group differences were assessed via *t*-tests and chi-square analyses.

HIV prevalence was calculated at Wave 1 and, among the group HIV-negative at Wave 1, HIV incidence was calculated at Wave 3, demonstrating seroconversion rates over time.

The same sociodemographic, mental health, and IPV variables used to assess differences at W1 between the HIV status groups were used at W3 to assess differences between the subsample of women living without HIV at Wave 1 who seroconverted during study participation and those who remained negative. Group differences were assessed via *t*-tests and chi-square analyses (Table 1).

Results

Participant Eligibility and HIV Incidence Throughout the Waves

The Fig. 1. flow chart demonstrates that, of all unchanged caregivers who completed W1 to W3, there was a total sample of 596. Sixteen participants were excluded from this analysis as 9 were male and 7 female caregivers had unknown HIV status. A total sample of 580 yielded 149 WLHIV participants and 431 participants who were HIV-negative. At W1, 64% ($n=375$) of HIV statuses were determined through testing, identifying 37 participants living with HIV (WLHIV) and 333 HIV-negative individuals, while the remaining statuses were based on self-report ($n=210$). By W3, 42% of the overall sample ($n=242/580$) were WLHIV, while 56% ($n=322$) remained HIV-negative; 3% ($n=16$) were excluded from further analyses due to unknown W3 HIV status (Table 3). At W3, HIV status was determined for a total of 580 participants. Of these, 491 participants (85%) self-reported their HIV status, while 89 participants underwent HIV testing. Among those tested, 3 participants were identified as living with HIV, 79 participants were confirmed to be HIV-negative, and 4 results were indeterminate. Of the participants who were HIV-negative at W1, 75% ($n=322$) remained HIV-negative, whereas 22%% ($n=93$) of those negative at W1 had seroconverted; 16 (4%) lacked valid HIV data at Wave 3 and were excluded from Wave 3 analyses.

Sociodemographic, Mental Health, and IPV Correlates of HIV Status at W1

At Baseline (Wave 1), 26% of participants ($n=149/580$) were living with HIV. Participants were 34.8 years old, on average, with WLHIV significantly younger than those not living with HIV (M = 32, vs. M = 36, $p=.003$) (see Table 1). The majority of the larger sample identified as the child's mother (78%), with 87% of WLHIV identifying as the mother vs. 75% of HIV-negative women ($p=.012$). In terms of income sources, 46% of both groups were receiving government grants as their primary source of income with WLHIV being significantly more likely to be receiving government grants (52% vs. 44%, $p=.0479$). Aside from age, relationship to the child, and income source, there were no significant differences by sociodemographic characteristics.

Table 1 Association between caregiver characteristics at baseline (Wave 1; 2008–2010) and subsequent HIV acquisition (Wave 3; 2019–2021) among analytic sample of female caregivers[a] who were HIV-negative at baseline in the Asenze study, KwaZulu-Natal, South Africa (*N*=415)

Wave 1 characteristics	Total HIV-negative at W1 & known HIV status at W3 (*N*=415)	Acquired HIV by Wave 3 (*N*=93)	Remained HIV-Negative at Wave 3 (*N*=322)	Chi-squared test comparing acquired HIV and remained HIV-negative groups	
				Test statistic (DF)	*p*-value
Age	M=35.6 SD=12.0	M=28.2 SD=7.4	M=37.8 SD=12.2	t=7.2 (413)	0.000*
Relationship to Child	***n (%)***	***n (%)***	***n (%)***	$X^2(DF)$	***p*-value**
Mother	315 (76%)	84 (90%)	231 (72%)	21.7 (2)	0.000*
Grandmother	71 (17%)	1 (1%)	70 (22%)		
Other	29 (7%)	8 (9%)	21 (7%)		
Education	***n (%)***	***n (%)***	***n (%)***	$X^2(DF)$	***p*-value**
Grade 1–5	61 (15%)	6 (6%)	55 (17%)	12.5 (3)	0.006*
Grade 6–8	61 (15%)	12 (13%)	49 (15%)		
Grade 9–12	198 (48%)	61 (66%)	137 (43%)		
More than Grade 12	15 (4%)	5 (5%)	10 (3%)		
Missing[b]	80 (19%)	9 (10%)	71 (22%)	--	--
Income Source	***n (%)***	***n (%)***	***n (%)***	$X^2(DF)$	***p*-value**
Formal (Regular Salary)	33 (8%)	6 (7%)	27 (8%)	11.4 (5)	0.044*
Informal (Self-Employed)	22 (5%)	2 (2%)	20 (6%)		
Piece work	57 (14%)	22 (24%)	35 (11%)		
Pension	4 (1%)	0 (0%)	4 (1%)		
Government Grants	180 (43%)	46 (49%)	134 (42%)		
No Income	45 (11%)	9 (10%)	36 (11%)		
Missing[b]	74 (18%)	8 (9%)	66 (21%)	--	--
Household Asset Index+	***n (%)***	***n (%)***	***n (%)***	$X^2(DF)$	***p*-value**
Lowest third of all Asenze households	132 (32%)	36 (39%)	96 (30%)	4.9 (2)	0.088
Middle	124 (30%)	30 (32%)	94 (29%)		
Top third of all Asenze households	155 (37%)	26 (28%)	129 (40%)		
Missing[b]	4 (1%)	1 (1%)	3 (1%)	--	--
Client Diagnostic Questionnaire Screen	***n (%)***	***n (%)***	***n (%)***	$X^2(DF)$	***p*-value**
Any mental health disorder	120 (29%)	29 (31%)	91 (28%)	0.3 (1)	0.608
No disorder	293 (71%)	64 (69%)	229 (71%)		
Missing[b]	2 (0.5%)	0 (0%)	2 (1%)	--	--
AUDIT-C.	***n (%)***	***n (%)***	***n (%)***	$X^2(DF)$	***p*-value**
No hazardous drinking	371 (89%)	77 (83%)	294 (91%)	12.2 (1)	0.000*
Hazardous drinking (≥3)	23 (6%)	12 (13%)	11 (3%)		
Missing[b]	21 (5%)	4 (4%)	17 (5%)	--	--

[a]Analytic sample for this table: Female caregivers who participated in Waves 1–3 of the Asenze study, were HIV-negative at Wave 1, and had valid HIV status data at Wave 3. [b]Participants missing data on demographic, mental health and alcohol variables are reported in the tables but were excluded from statistical tests

In terms of education, more than half of the total sample reported a 9th grade level or higher (53%). Regarding household assets, 34% of participants in this sample fell into the lowest third of all Asenze households, 30% in the middle, and 36% in the top third of all Asenze households, with no difference by HIV status. 29% of the sample screened positive for a mental health disorder, and a majority (88%) reported no hazardous drinking, with no differences by HIV status.

At W1, nearly half (42%) of this study's sample reported having experienced any form of IPV, with 46% of WLHIV experiencing any form of IPV (see Table 2). 26% of the total sample reported experiencing multiple forms of IPV with either their current or an other partner. When comparing the two groups, women who were HIV negative were more likely to be living with their current partner (53% vs. 38%, $p=.008$). In terms of IPV from a current partner, there were no differences between the two groups, but WLHIV were

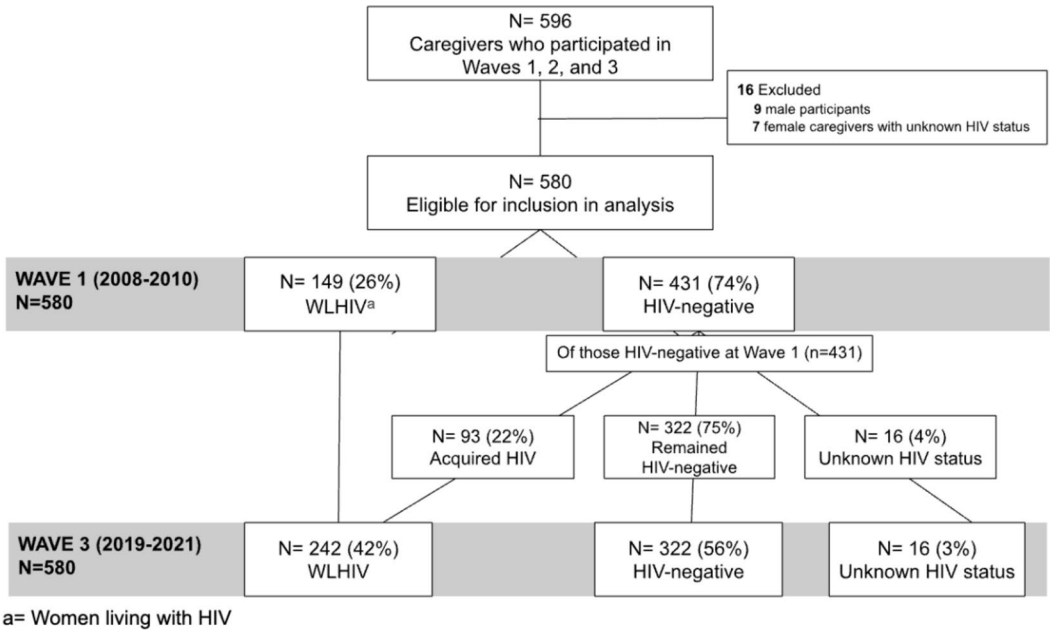


Fig. 1 Flow of eligible female caregivers through the study spanning eligibility to HIV status in Wavw 1 (2008-2010) and Wave 3 (2019-2021)

more likely than women without HIV to report having ever experienced physical IPV with an other partner (32% vs. 21%, $p=.010$), multiple forms of IPV with an other partner (23% vs. 15%, $p=.029$), and any type of IPV with an other partner (35% vs. 26%, $p=.049$). Considering overall experiences of IPV with any partner (i.e., with either current or other partners), WLHIV were more likely to report having been threatened by their partner, than those not living with HIV (34% vs. 23%, $p=.005$) and more likely to report experiencing multiple forms of IPV (32% vs. 23%, $p=.029$).

Wave 1 Sociodemographic, Mental Health, and IPV Correlates of HIV Seroconversion at W3

In comparing the women who seroconverted from W1 to W3 ($n=93$) and the women who remained HIV-negative by W3 ($n=322$), there were several sociodemographic differences (Table 3). Women who seroconverted were significantly younger (mean age=28.2, vs. 37.8,); more likely to be the child's mother (90% vs. 72%, $p=<0.001$); and more likely to have reported hazardous drinking in Wave 1 (13% vs. 3%, $p=<0.001$). Those who seroconverted also differed from those who did not on their primary income source ($p=.044$). Most notably, the overall distribution of employment types differed significantly between women who seroconverted and those who did not ($p=.044$), with a higher proportion of women who seroconverted reporting piece work as their primary income source (24%) compared to those who did not (11%). The groups differed by education level, in particular, those who remained HIV-negative more likely to only have a Grade 1–5 education (6% vs. 17%, $p=.006$). There were no significant differences found in household asset index or the screen for a mental health disorder.

Table 4 outlines differences in IPV exposures at baseline between the two groups of participants. Women who remained HIV-negative at Wave 3 were more likely to having been living with a partner (63% vs. 22%, $p=<0.001$) in Wave 1. Across the range of IPV categories, there were no statistically significant differences between those who remained negative with those who seroconverted. 42% of women who acquired HIV between Waves 1 and 3, and 39% of those who remained HIV negative, reported ever experiencing any form of IPV at Wave 1. Around a third of both groups (36% of those who acquired HIV and 33% of those who remained negative) reported that they had ever experienced physical IPV at Wave 1.

Discussion

Among a sample of 580 female caregivers of children in rural KwaZulu-Natal, South Africa, we found a high overall prevalence of IPV (42%) reported at baseline (2008–2010) across both WLHIV and HIV-negative women. Furthermore, 36% of all women in the study experienced physical IPV (41% among WLHIV) and 26% had experienced multiple forms of IPV with their current or other partners. Comparing WLHIV and HIV-negative women at W1, we found no difference on reported IPV from a current partner, but WLHIV were more likely to report certain types of IPV. From a partner other than their current partner,

Table 2 Characteristics of analytic sample of female caregivers[a] by HIV status at wave 1 (2008–2010) in the Asenze study, KwaZulu-Natal, South Africa (*N* = 580)

Wave 1 characteristics	Total (*N* = 580)	Living with HIV (*N* = 149)	HIV-Negative (*N* = 431)	Chi-squared test comparing HIV + and HIV-neg groups	
				Test statistic (DF)	*p*-value
Age	M = 34.8 SD = 11.3	M = 32.4 SD = 8.4	M = 35.6 SD = 12.0	t = -3.0 (578)	0.003*
Relationship to Child	***n (%)***	***n (%)***	***n (%)***	***X^2(DF)***	***p*-value**
Mother	454 (78%)	129 (87%)	325 (75%)	8.9 (2)	0.012*
Grandmother	88 (15%)	12 (8%)	76 (18%)		
Other	38 (7%)	8 (5%)	30 (7%)		
Education	***n (%)***	***n (%)***	***n (%)***	***X^2(DF)***	***p*-value**
Grade 5 or less	78 (13%)	13 (9%)	65 (15%)	6.9 (3)	0.074
Grade 6–8	86 (15%)	25 (17%)	61 (14%)		
Grade 9–12	288 (50%)	82 (55%)	206 (48%)		
More than Grade 12	18 (3%)	2 (1%)	16 (4%)		
Missing[c]	110 (19%)	27 (18%)	83 (19%)	--	--
Income Source	***n (%)***	***n (%)***	***n (%)***	***X^2(DF)***	***p*-value**
Formal (Regular Salary)	46 (8%)	11 (7%)	35 (8%)	4.5 (5)	0.479
Informal (Self-Employed)	32 (6%)	10 (7%)	22 (5%)		
Piece work	76 (13%)	17 (11%)	59 (14%)		
Pension	4 (1%)	0 (0%)	4 (1%)		
Government Grants	267 (46%)	78 (52%)	189 (44%)		
No Income	57 (10%)	12 (8%)	45 (10%)		
Missing	98 (17%)	21 (14%)	77 (18%)	--	--
Household Asset Index+	***n (%)***	***n (%)***	***n (%)***	***X^2(DF)***	***p*-value**
Lowest third of all Asenze households	197 (34%)	60 (40%)	137 (32%)	4.0 (2)	0.135
Middle	172 (30%)	44 (30%)	128 (30%)		
Top third of all Asenze households	207 (36%)	45 (30%)	162 (38%)		
Missing[c]	4 (1%)	0 (0%)	4 (1%)	--	--
Client Diagnostic Questionnaire (CDQ) Screen	***n (%)***	***n (%)***	***n (%)***	***X^2(DF)***	***p*-value**
Any mental health disorder	167 (29%)	44 (30%)	123 (29%)	0.1 (1)	0.771
No disorder	409 (71%)	103 (69%)	306 (71%)		
Missing[c]	4 (1%)	2 (1%)	2 (0.4%)	--	--
AUDIT-C[a.]	***n (%)***	***n (%)***	***n (%)***	***X^2(DF)***	***p*-value**
No hazardous drinking	509 (88%)	124 (83%)	385 (89%)	2.6 (1)	0.110
Hazardous drinking (≥3)	39 (7%)	14 (9%)	25 (6%)		
Missing[c]	32 (6%)	11 (7%)	21 (5%)	--	--

[a]Analytic sample for this table: Female caregivers who participated in Waves 1–3 of the Asenze study and had valid HIV status data at Wave 1

[b]Participants missing data on demographic, mental health and alcohol variables are reported in the tables but were excluded from statistical tests

WLHIV were more likely to report physical IPV (32% vs. 21% among those HIV-negative), any type of IPV (physical, sexual, or threatening) (35% vs. 26%), and multiple types of IPV (23% vs. 15%). From any partner overall (current and/or other partner combined) WHLHIV were more likely to report threatening IPV (34% vs. 23%) and multiple types of IPV (32% vs. 23%). Comparing women who acquired HIV between W1 and W3 with those who remained HIV-negative at W3, we did not find any differences in exposure to IPV across any form of IPV or partner type.

The prevalence of IPV that we observed is higher than has been reported in previous studies in South African [3, 6, 9, 39] which speaks to the potential new contributions this study makes among a sample of female caregivers in an LMIC and specifically in a peri-urban setting. Prior research has identified large variations in the distribution of IPV within South African provinces [40]. These conclusions warrant further efforts to characterize IPV at local and sub-Province levels, especially in non-urban settings. Adding to this urgency is the fact that interventions to prevent and address IPV are severely lacking, broadly, in the South African context [18]. Increased community-based IPV screening, support, and interventions are crucial given that IPV stigma and partner control may impact health seeking behaviors (e.g., attending clinic appointments) [41, 42] and that detection of IPV in clinical settings has been minimal

Table 3 Cross-sectional association between IPV exposure and HIV status at wave 1 (2008–2010) among analytic sample of female caregivers[a] in the Asenze study, KwaZulu-Natal, South Africa (*N* = 580)

IPV exposure (Wave 1)	Total (*N* = 580)	Living with HIV (*N* = 149)	HIV-Neg. (*N* = 431)	Chi squared test comparing HIV + and HIV-neg groups	
	n/*N* (%)	*n*/*N* (%)	*n*/*N* (%)	X^2 (DF)	*p*-value
Have Current Partner	475/577 (82%)	115/146 (79%)	360/431 (84%)	1.7(1)	0.193
Exposure to IPV with current partner (N = 475)					
Living with Partner	233/475 (49%)	44/115 (38%)	189/360 (53%)	7.1(1)	0.008*
Afraid of partner	22/475 (5%)	6/115 (5%)	16/360 (4%)	0.1(1)	0.731
Threatening IPV	66/473 (14%)	21/114 (18%)	45/359 (13%)	2.5(1)	0.114
Physical IPV	108/470 (23%)	27/115 (23%)	81/355 (23%)	0.02(1)	0.884
Sexual IPV	45/473 (10%)	13/115 (11%)	32/358 (9%)	0.6(1)	0.452
Any form of IPV	132/468 (28%)	34/114 (30%)	98/354 (28%)	0.2(1)	0.659
Multiple forms of IPV	69/473 (15%)	20/115 (17%)	49/358 (14%)	1.0(1)	0.328
Exposure to IPV with another partner[b] (N = 493)					
Threatening IPV	86/489 (18%)	31/135 (23%)	55/354 (16%)	3.7(1)	0.054
Physical IPV	117/488 (24%)	43/134 (32%)	74/354 (21%)	6.7(1)	0.010*
Sexual IPV	46/485 (9%)	12/133 (9%)	34/352 (10%)	0.05(1)	0.838
Any form of IPV	140/487 (29%)	47/133 (35%)	93/354 (26%)	3.9(1)	0.049*
Multiple forms of IPV	83/486 (17%)	31/134 (23%)	52/352 (15%)	4.8(1)	0.029*
Exposure to IPV with any partner (current or other[b]) (N = 577)					
Threatening IPV	147/573 (26%)	50/145 (34%)	97/428 (23%)	7.9(1)	0.005*
Physical IPV	204/573 (36%)	60/145 (41%)	144/428 (34%)	2.8(1)	0.093
Sexual IPV	82/568 (14%)	20/143 (14%)	62/425 (15%)	0.03(1)	0.859
Any form of IPV	239/574 (42%)	67/145 (46%)	172/429 (40%)	1.7(1)	0.197
Multiple forms of IPV	146/571 (26%)	47/145 (32%)	99/426 (23%)	4.8(1)	0.029*

[a]Analytic sample for this table: Female caregivers who participated in Waves 1, 2 and 3 of the Asenze study and had valid HIV status data at Wave 1. [b]"Another partner" or "other partner" IPV refers to intimate partner violence participants experienced from any partner other than their current partner

[43]. A recent systematic review indicated that predictors of successful interventions included participatory group learning, community-driven and informed interventions, and engaging male partners [44].

Despite the well-established connection between IPV and HIV seroconversion [44, 45], our study did not find statistically significant differences in IPV exposure between women who seroconverted during the study and those who did not, contrary to our hypothesis. Along with the understanding that IPV has large variations within provinces [40], the connection between those IPV exposures and HIV could vary, with certain contexts experiencing stronger associations.

HIV incidence among the subsample of HIV-negative women shows that 22% of HIV-negative women at W1 seroconverted to become HIV-positive by W3 (~ 13 years). It is important to note that this occurred from 2008 to 2021, during a period of significantly enhanced access to antiretroviral therapy (ART) and pre-exposure prophylaxis (PrEP) within KwaZulu-Natal province [46]. While these biomedical interventions have been scaled up at a provincial level and are available within the broader context where these women reside, the persistent high incidence suggests that many women may not be fully benefiting from these interventions. This highlights the complex interplay of contextual and structural factors influencing HIV treatment and prevention efforts in the region. Further research is urgent and warranted to better understand the vulnerability among women providing care to children in this setting and examine the facilitators and challenges to them accessing PrEP and ART.

In terms of sociodemographic and psychosocial factors, among caregivers at W1, we found that WLHIV were more likely to be younger than HIV negative women. At W3, among the women who seroconverted and those who remained without HIV, we found younger age, being the biological mother, not having a formal salary, and higher rates of hazardous drinking to be associated with acquiring HIV during the study timeline. These findings are consistent with prior research that found younger age to be a risk factor for HIV acquisition among women in South Africa [47], that lower socioeconomic status (employment type) is a risk factor [48, 49], and that drinking is associated with high HIV risk [50]. These findings necessitate efforts to direct HIV prevention efforts to younger women, in lower socioeconomic statuses who might engage in substance or alcohol use.

This study has certain limitations, including a high number of participants declining serological HIV testing in favor of self-reported results, which precluded the use of rigorous, objective measures such as laboratory confirmation of seroconversion or validation of self-reported HIV infection.

Table 4 Association between caregiver IPV exposure at baseline (Wave 1; 2008–2010) and subsequent HIV acquisition (Wave 3; 2019–2021) among analytic sample of female caregivers[a] who were HIV-negative at baseline in the Asenze study, KwaZulu-Natal, South Africa (*N*=415)

	Total HIV-negative at W1 & known HIV status at W3 (*N*=415)	Acquired HIV by Wave 3 (*N*=93)	Remained HIV-Negative at Wave 3 (*N*=322)	Chi-squared test comparing acquired HIV and remained HIV-negative groups	
IPV exposure (Wave 1)	*n*/*N* (%)	*n*/*N* (%)	*n*/*N* (%)	X^2 (DF)	*p*-value
Have current partner	346/415 (83%)	83/93 (89%)	263/322 (82%)	3.0 (1)	0.084
Exposure to IPV with current partner (N=346)					
Living with partner	184/346 (53%)	18/83 (22%)	166/263 (63%)	43.5 (1)	0.000*
Afraid of partner	16/346 (5%)	3/83 (4%)	13/263 (5%)	0.3 (1)	0.615
Threatening IPV	43/345 (12%)	9/83 (11%)	34/262 (13%)	0.3 (1)	0.608
Physical IPV	79/341 (23%)	17/81 (21%)	62/260 (24%)	0.3 (1)	0.594
Sexual IPV	32/344 (9%)	4/81 (5%)	28/263 (11%)	2.4 (1)	0.122
Any form of IPV	96/340 (28%)	19/81 (23%)	77/259 (30%)	1.2 (1)	0.274
Multiple forms of IPV	47/344 (14%)	9/81 (11%)	38/263 (14%)	0.6 (1)	0.444
Exposure to IPV with another partner[b] (N=340)					
Threatening IPV	51/339 (15%)	13/85 (15%)	38/254 (15%)	0.01 (1)	0.941
Physical IPV	69/339 (20%)	18/86 (21%)	51/253 (20%)	0.02 (1)	0.878
Sexual IPV	31/337 (9%)	6/86 (7%)	25/251 (10%)	0.7 (1)	0.414
Any form of IPV	86/339 (25%)	23/86 (27%)	63/253 (25%)	0.1 (1)	0.734
Multiple forms of IPV	48/337 (14%)	11/85 (13%)	37/252 (15%)	0.2 (1)	0.545
Exposure to IPV with any partner (current or other[b]) (N=413)					
Threatening IPV	92/412 (22%)	22/91 (24%)	70/321 (22%)	0.2 (1)	0.632
Physical IPV	138/412 (34%)	33/91 (36%)	105/321 (33%)	0.4 (1)	0.526
Sexual IPV	59/409 (14%)	9/91 (10%)	50/318 (16%)	2.0 (1)	0.166
Any form of IPV	164/413 (40%)	39/92 (42%)	125/321 (39%)	0.4 (1)	0.551
Multiple forms of IPV	94/410 (23%)	20/91 (22%)	74/319 (23%)	0.1 (1)	0.984

[a]Analytic sample for this table: Female caregivers who participated in Waves 1–3 of the Asenze study, were HIV-negative at Wave 1, and had valid HIV status data at Wave 3. [b]"Another partner" or "other partner" IPV refers to intimate partner violence participants experienced from any partner other than their current partner

The authors did aim to conduct a sensitivity analysis with status subgroups (serologic vs. self-report), however there were too few participants with test data at W3 to conduct a valid analysis. Of note, recent studies undertaken in South African, have determined that self-reported HIV status were reliable [51, 52]. Although this study benefitted from being conducted in a general population of child caregivers, aiding with generalizability, the drop-out rate over time (28%) means that analyses at W3 might be biased, as participants might have seroconverted and died between W1 and W3 (average of 13 years). Further, IPV could have impacted retention among women, as women might have been prevented from attending study visits due to IPV or may have died from IPV.

This study is further limited by its reliance on bivariate analyses, which did not account for potential confounding factors such as mental health disorders. Because factors such as mental health may act as both a confounder and a mediator in the relationship between IPV and HIV outcomes, addressing these dynamics would require temporality data that was beyond the scope of this analysis. As a result, future research should adopt more rigorous approaches to establish causal relationships and investigate the mediating role of mental health disorders in the observed associations. Moreover, the study did not collect other relevant variables, such as stigma and HIV status disclosure, which are known to influence both IPV and HIV prevalence [53, 54]. Including these factors in future research would provide a more comprehensive understanding of the relationships between HIV, IPV, and associated outcomes.

There remain numerous strengths to this study. This study benefitted from a large sample size in a HIV prevalent population that allows for more generalizability to the broader KwaZulu-Natal population. The prospective longitudinal

aspect of this study provides an important lens to study seroconversion over time and identify which factors create the highest risk of seroconversion for this population. Indeed, a recent scoping review of IPV and HIV among WLHIV in sub-Saharan Africa from 2009 to 2019 found minimal longitudinal studies [55]. Furthering this study's expansion and contribution to the literature, our analyses examined specific types of IPV exposure, whereas many prior longitudinal studies in the region used IPV as a dichotomous (presence/absence) variable [56, 57].

Conclusions

In summary, this paper presents both a cross sectional and a longitudinal analysis of IPV-focused factors associated with HIV status and HIV seroconversion over time among female caregivers in KwaZulu-Natal, South Africa, in a community-based study. We found high rates of IPV among both the WLHIV and HIV-negative groups. We found a high level of HIV seroconversion over time among those HIV-negative at baseline (W1) and W3 of the study, on average, 13 years later. We also found elevated prevalence of IPV among WLHIV, specifically those with other partners at W1. There were no significant differences in IPV experiences between women who remained HIV-negative and women who seroconverted at W3. We did find that women who seroconverted were younger, more likely to report hazardous drinking, more likely to report piece work as their primary income source and have less education. This study makes important contributions to the existing literature on IPV and HIV incidence among women, specifically in the Sub-Saharan, LMIC, and peri-urban context.

Author Contributions.

All authors contributed to the study conception and design. Data analysis was performed by Rachel S. Gruver. The first draft of the manuscript was written by Christopher M. Ferraris and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Declarations.

Conflict of interest The authors declare no conflicts of interest.

Ethical Approval The Asenze study received ethical approval at each wave from the Biomedical Research Ethics Committee of the University of KwaZulu-Natal and from the Institutional Review Board of Columbia University at the study inception and at all subsequent waves. Informed consent was obtained for overall participation in the study and separately for HIV testing with pre- and post- test counseling.

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Data Availability De-identified study data is available on request.

Code Availability Code available on request.

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