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Incident Stressful & Traumatic Life Events and HIV Sexual Transmission Risk Behaviors in a Longitudinal, Multi-Site Cohort Study

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Abstract

Objective—To assess the association between incident stressful life events (e.g., sexual and physical assault; housing instability; and major financial, employment, and legal difficulties) and unprotected anal or vaginal sexual intercourse (unprotected sex) among people living with HIV/AIDS (PLWHA).

Methods—We assessed incident stressful events and unprotected sex over 27 months in 611 participants in an 8-site, 5-state study in the Southeast US. Using mixed-effects logistic models and separately estimating between-person and within-person associations, we assessed the association of incident stressful events with unprotected sex with all partners, HIV+ partners, and HIV–/serostatus-unknown partners.

Results—Incident stressful events reported at one-third or more of interviews included major illness, injury or accident (non-HIV related); major illness of a family member/close friend; death of a family member/close friend; financial stresses; and relationship stresses. In multivariable models, each additional moderately stressful event an individual experienced at a given time point above his or her norm (within-person association) was associated with a 24–27% increased odds of unprotected sex for each partner type.

Conclusions—Risk reduction among PLWHA remains a major focus of efforts to combat the HIV epidemic. Incident stressful events are exceedingly common in the lives of PLWHA and are associated with increased unprotected sex. Efforts to either prevent the occurrence of such events (e.g., financial or relationship counseling) or address their sequelae (e.g., coping skills or other behavioral counseling) may help reduce secondary HIV transmission.

Keywords

HIV; AIDS; Stress; Transmission; Risk behaviors

Introduction

Secondary prevention, or risk reduction among people living with HIV/AIDS (PLWHA), remains a major focus of efforts to combat the HIV pandemic.(1) Of the approximately 56,000 people newly infected with HIV each year in the United States (U.S.), virtually all acquire HIV through sexual contact or sharing of drug equipment with an HIV-positive individual.(2) Accordingly, much research has focused on identifying barriers to and facilitators of safer sex and drug use practices among PLWHA in order to reduce transmission.

Psychosocial factors have emerged as important predictors of HIV transmission risk behaviors among PLWHA.(3) Depression, anxiety, and substance use disorders are highly prevalent in this population(4, 5) and are associated with increased sexual and drug use risk behaviors.(3, 6) A growing literature also underscores both the high prevalence of past traumatic experiences, such as childhood sexual and physical abuse,(7–9) as well as the influence of trauma history on sexual and drug use risk behaviors in PLWHA.(10–12)

Stressful and traumatic events occurring or continuing after HIV infection may be particularly relevant to continued risk behaviors. Recent or incident stressful events are common in this population: a study of HIV-infected women in the U.S. Southeast found that 14% had experienced physical abuse and 6% had experienced sexual abuse in the previous 6 months,(13) and in the HIV/AIDS Cost and Service Utilization Study, a national study of PLWHA receiving medical care (1996–1998), 20.5% of women, 11.5% of men who reported having sex with men (MSM), and 7.5% of heterosexual men reported physical abuse by a partner since HIV diagnosis.(14) No studies were identified that related recent or incident stressful events to risk behaviors in PLWHA.

The purpose of this study was to describe the association between incident (past 9 months) stressful and traumatic events and sexual risk behaviors over 27 months of longitudinal follow-up in the Coping with HIV/AIDS in the Southeast (CHASE) sample of 611 PLWHA receiving medical care at eight sites in five southeastern states. We hypothesized that higher levels of stressful and traumatic events during follow-up would be associated with increased sexual risk behaviors. The CHASE sample is uniquely well situated to address this research question because of its large and diverse sample as well as the detailed, prospective data collected on a wide range of stressful and traumatic events and other important psychosocial constructs.

Methods

Sample and Procedure

The CHASE study has been described in detail previously.(15, 16) Briefly, from December 2001 through April 2002 611 consecutively sampled HIV-infected patients (79% of those invited and meeting eligibility criteria) receiving care at one of eight infectious diseases clinics in five Southeastern U.S. states (AL, GA, LA, NC, SC) enrolled in the study. Patients completed detailed interviews with trained, field-certified interviewers at baseline and at approximately 9, 18, and 27 months post-baseline. The resulting sample closely matched the epidemiologic profile of PLWHA in the Southeastern US in demographic and risk group characteristics.(16) The study was approved by the Institutional Review Boards at Duke University and all study sites.

Measures

Sexual risk behaviors—Our outcome measure was any self-reported anal or vaginal penetrative sexual intercourse without a condom (unprotected sex) in the 9 months

preceding each interview. We separately considered unprotected sex with HIV-negative and serostatus-unknown partners, unprotected sex with HIV-positive partners, and any unprotected sex with any partner. These endpoints were assessed at baseline and at 9 and 18 months.

Incident stressful events, severe stressful events, and traumatic events—We used a modified version of the Life Events Survey(17, 18) to measure the occurrence of stressful events in the 9 months preceding the baseline interview and in the intervals between consecutive interviews. We included only those events considered to be moderately to severely stressful based on previous studies with interviewer-based objectively rated stresses; these measures have consistently predicted HIV disease progression.(19, 20) Moderate stressors included experiences such as relationship difficulties; death or serious illness of a close friend or family member; employment difficulties (e.g. loss of job); and non-HIV-related serious illnesses, injuries, and accidents. Severe stressors included divorce/separation, death or illness of an immediate family member, major financial problems (e.g., foreclosure), more than a week in prison, and sexual and physical assault. We further considered as traumatic events those severe stressors that would satisfy criterion A(1) of the definition of post-traumatic stress disorder:(21) sexual and physical assault and death of a spouse/partner or child. Based on these items, we calculated three continuous measures of stressful events at each interview: the number of moderately stressful events in the past 9 months, the number of severe stressful events in the past 9 months, and the number of traumatic events in the past 9 months.

Finally, we defined a baseline measure of the number of types of lifetime traumatic experiences based on a detailed trauma assessment completed by each participant at baseline, as described in detail previously.(15, 16)

Other psychosocial covariates—Psychiatric symptoms at each interview were measured using the Brief Symptom Inventory (BSI),(22) a shortened version of the well-validated Symptoms Checklist-90. At baseline the full BSI was completed whereas at follow-up interviews participants completed only 5 of the 9 subscales (depression, anxiety, hostility, paranoid ideation, and somatization). Each scale is standardized to gender-specific general population norms with a mean of 50, a theoretical range of 0–100 (higher scores indicate greater psychopathology), and with 10 units representing one standard deviation in the general population. For comparability across data-collection waves, we calculated for each wave the mean of the 5 subscales listed above as a measure of psychiatric symptoms. Results did not change appreciably when we replaced this global measure with the normed depression subscale in sensitivity analyses.

Alcohol and drug use in the nine months prior to the baseline interview were assessed with the Addiction Severity Index (ASI),(23) whose reliability and validity are well established. (23, 24) Although the ASI alcohol and drug severity scores have been widely used for research purposes, their clinical interpretation remains challenging. For alcohol consumption, we therefore focused on an individual item reflecting the reported frequency of drinking alcohol to intoxication in the prior nine months (ordinal response categories: never; once; 2–3 times; once a month; once every two weeks; once a week; 2–3 times a week; 4–5 times a week; daily or almost daily). For drug use, we created a summary measure indicating whether the respondent reported using any nonprescription substance, apart from marijuana and alcohol, at least weekly in the past nine months.

Self-reported general health was measured at each interview with the widely used Medical Outcomes Study Short Form-36 (SF-36) (version 2.0).(24) We used standard procedures to

calculate the SF-36 Physical Composite Score (PCS), which has a theoretical range of 0–100.(25)

Socio-demographic covariates—Patient age, race/ethnicity, gender, and sexual orientation were recorded at the baseline interview. Nearly all participants were either Caucasian/Non-Hispanic (31%) or African American/Non-Hispanic (63%) so we classified participants as either Caucasian/Non-Hispanic or of minority race/ethnicity. Given the small number of female participants self-identifying as gay or bisexual (n=8, 1.3% of sample), we classified participants as males who have sex with men (MSM), male heterosexuals, and females. Men who self-identified as heterosexual but who reported having male sexual partners were classified as MSM.

Statistical analyses

We describe the baseline characteristics of the study participants using means and standard deviations for continuous variables and percentages for categorical variables. For time-varying measures (sexual risk behaviors, stressful events, SF-36 physical health score, and BSI psychiatric symptoms score), we report percentages or means and standard deviations for measurements pooled across all time points. We also describe the proportion of total variance in these measures attributable to between-person variation (rather than within-subject variation) using the intraclass correlation coefficient.

We used mixed-effects logistic regression models to estimate the associations between sexual transmission risk behaviors and predictor variables while accounting for correlations between repeated observations on the same individual. All models included random intercepts for clinic site and for each participant.

In each model, we included predictors that were of interest *a priori*, with a particular focus on the association between incident stressful events and sexual transmission risk behaviors. Each time-varying predictor (stressful events, SF-36 PCS, and BSI) is represented in the models by two terms.(26) The first term (constant across all time points) was calculated as the individual's mean score on that item across all time points, and the second (varying across time points) was calculated as the deviation (difference) between an individual's overall mean and his score at each particular time point. Coefficients on the first set of terms represent between-person associations (e.g., are people with a higher average number of stressful events more likely to engage in unprotected sex than people with a lower average number?) while coefficients on the second set of terms represent within-person associations, in effect allowing each person to serve as his own control (e.g., if at a given interview an individual reports more stressful events than his norm, is he also more likely to report unprotected sex?). This decomposition is important since between-person and within-person effects are not always of the same magnitude or even in the same direction.(26)

We rescaled age, SF-36 physical health score, and BSI psychiatric symptoms score so that odds ratios (ORs) corresponded to the change per 10 years of age, per 10 SF-36 PCS units, and per 10 BSI units (one normed standard deviation). We included the ordinal variable representing reported frequency of drinking alcohol to intoxication as a simple continuous variable; the ORs for this variable correspond to the change in outcome associated with an approximate doubling in frequency of drinking to intoxication, since each successive response option represents approximately twice the frequency of the previous option.

Results

Sample characteristics

Of the 611 study participants, the mean (SD) age was 40.1 (8.7), 31% were female, 44% were MSM, and 64% were African American with the remainder primarily Caucasian/Non-Hispanic (Table 1). (16) The mean (SD) number of years of education was 12.4 (2.0), mean baseline CD4 cell count was 417 (265) cells/mm³, and mean baseline log₁₀ HIV RNA viral load was 3.1 (1.3). One quarter of the sample drank to intoxication in the 9 months prior to baseline and 11% had used non-marijuana drugs at least weekly in the prior 9 months. At baseline, half the sample had experienced 3 or more traumatic experiences in their lifetimes (mean 3.1, SD 2.3).

Across the 4 waves, the mean (SD) number of moderately stressful events in the past 9 months was 2.7 (2.1) (range: 0–12), while the mean number of severely stressful events was 0.9 (0.9) (range: 0–5) and the mean number of traumatic events was 0.1 (0.3) (range: 0–3) (Table 2). Unprotected sex in the past 9 months with HIV-negative or serostatus-unknown partners, HIV-positive partners, and any partner was reported at 10.5%, 13.3%, and 20.7% of interviews, respectively. The ICCs for all risk behavior and stressful event measures were <50%, indicating that the majority of the variance in these measures was attributable to within-person changes over time rather than between-person differences and underlining the value of measuring such behaviors and events longitudinally. In contrast, there was relatively greater between-person variability (and less within-person variability) in physical and mental health over time.

Follow-up at 9, 18, and 27 months was 81%, 73%, and 73%, respectively; 88% of the sample completed at least one follow-up interview. Those with no follow-up interviews were more likely to be of minority race/ethnicity (79% vs. 67%, $p=0.05$) and on average had fewer years of education (mean 11.9 vs. 12.5, $p=0.02$), lower baseline CD4 counts (mean 284 vs. 427, $p<0.01$), and higher baseline viral loads (log₁₀ mean 3.7 vs. 3.0, $p<0.01$) but were comparable on other characteristics, including measures of sexual risk and incident stressful and traumatic events.

Stressful events and sexual risk

The likelihood of engaging in unprotected sex increased monotonically with the number of stressful events experienced in the prior 9 months (Figure 1). Of those experiencing 0–2 events, 6.4% (95% confidence interval [CI]: 4.2–8.7%) reported any unprotected sex with HIV-negative or serostatus-unknown partners compared to 10.7% (8.0–13.3%) of those experiencing 3–5 events, 15.4% (10.7–20.1%) of those experiencing 6–8 events, 18.4% (8.0–28.8%) of those experiencing 9–11 events, and 31.2% (11.8–50.6%) of those experiencing 12–14 events. Similar relationships held for unprotected sex with HIV-positive partners and all partners. In multivariable models (Table 3), each additional moderately stressful event experienced by an individual above his norm (within-person association) was associated with a 27% increase in the odds of unprotected sex with HIV-negative or serostatus-unknown partners (adjusted odds ratio = 1.27, 95% confidence interval 1.05–1.53), a 24% increase in the odds of unprotected sex with HIV-positive partners (aOR 1.24, 1.04–1.49), and a 25% increase in the odds of unprotected sex with any partner (aOR 1.25, 1.07–1.46). Note that these odds ratios are expressed per additional event for this continuous variable. Thus, an individual who experienced two events more than his norm would be predicted to have a 57% increased odds of engaging in unprotected sex with any partner ($1.25^2 = 1.57$), whereas an individual with two fewer events than his norm would be predicted to have 36% reduced odds of unprotected sex ($1.25^{-2} = 0.64$) (Figure 2).

Within-person associations of severely stressful events with unprotected sex were generally close to the null. Associations with traumatic events were larger than for moderately stressful events but with wide confidence intervals due to the small number of events. Associations of between-person differences in stressful events and unprotected sex were generally not statistically significant. The exception – the association of incident traumatic events and unprotected sex with HIV-negative and serostatus-unknown partners (aOR 6.24, 1.28–30.48) – was largely attenuated by removing experiences of incident sexual assault (n=14, 9% of all incident traumatic events) from the analysis.

Drug use was associated with higher odds of unprotected sex, while older age was associated with lower odds. Age was removed from the model of unprotected sex with HIV-positive partners due model convergence difficulties; however, parallel models using generalized estimating equations confirmed that its removal did not substantively affect other model coefficients. MSM and women had higher odds of unprotected sex than heterosexual men. The higher odds of unprotected sex with HIV-negative and serostatus-unknown partners among women was attenuated when experiences of sexual assault were removed from the analysis (of the 14 experiencing incident sexual assault, 9 were women and the remaining 5 were MSM).

Discussion

In this large cohort of consecutively recruited patients engaged in HIV medical care, incident stressful experiences during longitudinal follow-up were associated with increased sexual transmission risk behaviors. In particular, participants who experienced a short-term increase in stressful life events above their norm were more likely to report unprotected sex with HIV-negative and serostatus-unknown partners, HIV-positive partners, and all partners during the same time interval (within-person associations, i.e. each participant serving as his own control).

Traumatic and stressful life experiences have been linked to a wide range of negative HIV-related behaviors and health outcomes. Sexual risk behaviors, including inconsistent condom use and sex with partners of unknown or HIV-negative serostatus, are more common in PLWHA with a history of traumatic events, particularly childhood sexual abuse. (10–12) Trauma history and recent stressful events are also associated with worse reported antiretroviral medication adherence (15, 18, 27) and more rapid HIV clinical progression. Kimerling and colleagues reported that previous traumatic events were associated with greater declines in CD4+/CD8+ ratios and increased frequency of AIDS-defining conditions in cohorts of African American women. (28, 29) The Coping in Health and Illness Project has shown that stressful life events were associated with immune dysfunction and HIV disease progression in a cohort of MSM. (19, 30) In the CHASE cohort, a history of traumatic events was associated with increased incidence of opportunistic infections and higher AIDS-related and all-cause mortality (35, 36) while incident stressful events were associated with worse antiretroviral medication adherence. (27)

However, we did not identify any published studies evaluating the impact of incident stressful and traumatic events on HIV sexual risk behaviors among patients in care, as done in the current study, nor papers focusing on the relative impact of within-person versus between-person differences in stressful events as modeled here. The results of the present analysis suggest that an individual with a low “background” level of stressors who experiences an unusual number of acute life events may be at risk of subsequent higher risk behaviors. Accordingly, added attention to sexual risk reduction counseling should focus not only on individuals with high background levels of stressors but also on individuals with low background levels but experiencing acute difficulties.

The CHASE sample was well suited to address our research question of the association between stressful events and sexual risk behaviors because of its large size, prospective design, and detailed information on past and incident stressful and traumatic experiences. The CHASE cohort is largely representative of HIV-infected individuals engaged in care in the Southeast U.S., but may not be generalizable to patients in other regions of the country, large cities, or internationally. There were some differences between participants who completed at least one follow-up interview and those who did not ($n=72$, 12%); specifically, those with no follow-up data on average were more likely to be a member of a minority racial/ethnic group, had less education, had lower CD4 counts and higher viral loads, and were more likely to have used non-marijuana drugs at least weekly in the 9 months before baseline. However, those retained and those lost were comparable on the sexual risk outcome measures as well as on the measures of baseline and incident stressful and traumatic events, making it unlikely that selection introduced bias into these analyses.

Even in a prospective design such as the present study, the untangling of causal relationships can be challenging. This analysis compared the frequency of stressful events from a given 9-month interval and sexual risk behaviors from the same interval; it was unknown whether the specific stressful events preceded or followed the risky behaviors. While some stressful events could be the result of risky sex or its surrounding environment (e.g., sexual or physical assault, relationship difficulties), the majority of the stressful events considered here are likely to be independent of sexual risk behaviors (e.g., death or illness in the family; major financial and employment difficulties), strengthening the argument in favor of a causal effect of stressful events on risky sex. While a cause/effect relationship is difficult to establish, the longitudinal nature of the data and analyses as well as most events being unlikely to be caused by risky behavior lend some credence to the importance of stress management in aiding risk reduction.

We observed associations of moderate stressful events with unprotected sex but not severely stressful or traumatic events. It is possible that the types of events classified as severe or traumatic have different relationships with sexual transmission risk behaviors. Alternatively, the low frequency of severely stressful and traumatic events may have hampered our ability to estimate their association with risk behaviors with the necessary precision. Confidence intervals around the estimates for traumatic events in particular were quite wide.

In summary, the present study adds to the growing literature suggesting that both historical and recent stressful and traumatic life experiences have profound implications for HIV transmission. While many studies document elevated sexual risk behaviors in individuals with significant trauma history, especially childhood sexual abuse, little research has focused on the implications of incident events and the less severe but more frequent stressful life events that are so common in the lives of many PLWHA. While only 2% of participants in this sample experienced incident sexual assault during 27 months of prospective follow-up, the average participant experienced 9.9 stressful life events during the same time period – and these stressful events were associated with increased sexual risk behaviors. The present study underscores the importance of within-person changes in exposure to stressful events: individuals with relatively low background levels of stressful events may be more likely to engage in sexual risk behaviors if they experience a short-term increase in stressors, highlighting the importance of individualized, patient-centered care and risk reduction counseling. Efforts to address the sequelae of stressful life events, for example by improving coping skills and enhancing resiliency(31, 32), and to prevent stressful events when possible, may prove an important component of secondary HIV prevention.

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Abbreviations

aOR	Adjusted odds ratio
ASI	Addiction Severity Index
BSI	Brief Symptoms Inventory
CHASE	Coping with HIV/AIDS in the Southeast
CI	Confidence interval
MSM	Men who have sex with men
OR	Odds ratio
PCS	Physical composite score
PLWHA	People living with HIV/AIDS
SD	Standard deviation
SE	Standard error
SF-36	Medical Outcomes Study Short Form-36

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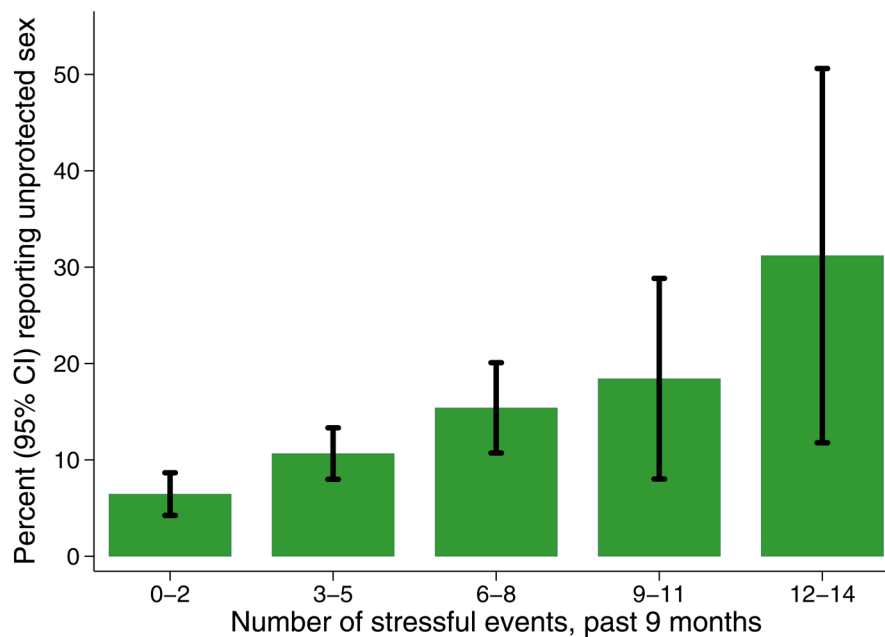


Figure 1. Percent (95% CI) of respondents reporting unprotected anal or vaginal sexual intercourse with HIV-negative or serostatus-unknown partners in the past 9 months, by number of stressful events experienced in the past 9 months

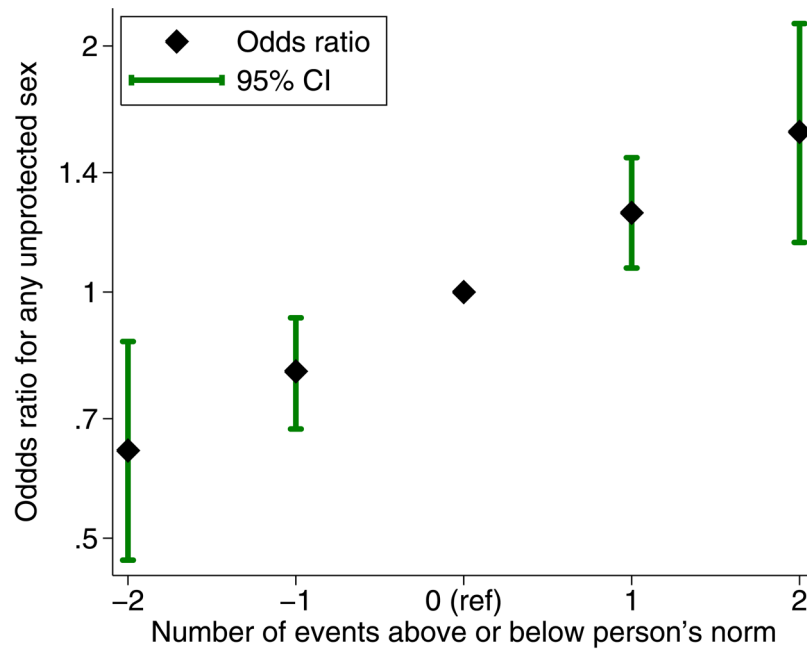


Figure 2. Association of within-person changes in incident stressful events and odds of reporting any unprotected sex, predicted from multivariable mixed effects model.

Table 1

Description of sample (n=611)

Characteristic	Mean (SD) or n (%)
Age, years (range 20–71)	40.1 (8.7)
Female gender	191 (31.3%)
MSM	268 (43.9%)
Race/ethnicity:	
Caucasian non-Hispanic	189 (31.6%)
African American non-Hispanic	383 (64.1%)
Hispanic	16 (2.7%)
Other	10 (1.7%)
Education, years (range: 3–18)	12.4 (2.0)
CD4 count, cells/mm ³ (range: 0–1,580)	417 (265)
HIV RNA viral load, log ₁₀ (range: 0–>6.4)	3.1 (1.3)
Drank to intoxication, past 9 months	146 (25.3%)
Used non-marijuana drugs at least weekly, past 9 months	65 (10.6%)
Lifetime traumatic experiences (range: 0–12)	3.1 (2.3)

MSM: Man who has sex with men.

Table 2
Time-varying measures of sexual risk behaviors, stressful events, and physical and mental health

	Number of observations	Mean (SD) or n (%)	Range	Intraclass correlation coefficient
Any unprotected anal/vaginal intercourse in past 9 months...				
with HIV- or serostatus-unknown partners	1453	152 (10.5)	0-1	0.39
with HIV+ partners	1455	193 (13.3)	0-1	0.48
with any partner	1453	301 (20.7)	0-1	0.48
Stressful events experienced, past 9 months				
Incident moderately stressful events	1453	2.7 (2.1)	0-12	0.38
Incident severely stressful events	1453	0.9 (0.9)	0-5	0.31
Incident traumatic events	1453	0.1 (0.3)	0-3	0.20
SF-36 physical composite score	1452	45.5 (11.2)	9-69	0.58
BSI global mental health score	1453	55.7 (9.8)	41-80	0.60

SF-36: Short Form-36. BSI: Brief Symptoms Inventory.

¹ Any of the following: unprotected sexual intercourse with an HIV-negative or serostatus-unknown partner; sexual intercourse while high or intoxicated; exchange of sex for drugs or money

² Measured only at waves 1-3

Table 3

Multivariable mixed-effects models of sexual risk behaviors.

	Any unprotected anal / vaginal intercourse with:		
	HIV – or serostatus-unknown partner OR (95% CI)	HIV+ partner OR (95% CI)	Any partner OR (95% CI)
<i>Stressful events: Within-person associations</i>			
Incident moderately stressful events	1.27 (1.05, 1.53)	1.24 (1.04, 1.49)	1.25 (1.07, 1.46)
Incident severely stressful events	0.98 (0.68, 1.42)	0.72 (0.49, 1.06)	0.97 (0.71, 1.31)
Incident traumatic events	1.74 (0.79, 3.84)	1.70 (0.72, 4.00)	1.50 (0.75, 3.00)
<i>Stressful events: Between-person associations</i>			
Incident moderately stressful events	1.02 (0.75, 1.37)	1.23 (0.90, 1.69)	0.97 (0.75, 1.27)
Incident severely stressful events	1.33 (0.69, 2.57)	1.11 (0.54, 2.26)	1.39 (0.77, 2.51)
Incident traumatic events	6.24 (1.28, 30.48)	0.69 (0.11, 4.22)	3.24 (0.74, 14.16)
<i>Physical and mental health: Within-person associations</i>			
SF-36 physical health score, per 10 units	1.30 (0.85, 1.98)	1.29 (0.86, 1.92)	1.24 (0.89, 1.75)
BSI global mental health score, per 10 units	1.15 (0.71, 1.87)	1.24 (0.79, 1.95)	1.18 (0.80, 1.74)
<i>Physical and mental health: Between-person associations</i>			
SF-36 physical health score, per 10 units	1.19 (0.74, 1.89)	0.95 (0.59, 1.54)	0.91 (0.60, 1.37)
BSI global mental health score, per 10 units	0.76 (0.42, 1.39)	0.75 (0.40, 1.43)	0.78 (0.46, 1.32)
<i>Fixed characteristics</i>			
Age, per 10 years	0.51 (0.31, 0.83)	—	0.38 (0.24, 0.59)
Gender / Sexual orientation			
Male heterosexual	1.00 (ref)	1.00 (ref)	1.00 (ref)
Male who has sex with men	2.22 (0.73, 6.72)	4.42 (1.37, 14.25)	2.31 (0.88, 6.02)
Female	3.67 (1.21, 11.15)	2.11 (0.65, 6.90)	2.83 (1.07, 7.46)
Caucasian non-Hispanic	1.90 (0.84, 4.32)	2.10 (0.85, 5.21)	2.82 (1.32, 6.02)
Lifetime traumatic experiences	1.11 (0.93, 1.32)	1.25 (1.04, 1.51)	1.20 (1.03, 1.41)
Frequency of getting drunk	0.91 (0.70, 1.18)	0.87 (0.66, 1.15)	0.82 (0.65, 1.04)
Drug use at least weekly	2.90 (0.76, 10.97)	4.81 (1.09, 21.16)	4.25 (1.24, 14.57)
<i>Random effects: SD (SE)</i>			
Site random intercepts	0.00 (0.31)	0.00 (0.37)	0.00 (1.23)
Participant random intercepts	2.54 (0.33)	3.06 (0.32)	2.69 (0.27)

Any unprotected anal / vaginal intercourse with:			
HIV- or serostatus-unknown partner OR (95% CI)	HIV+ partner OR (95% CI)	Any partner OR (95% CI)	
90.74 (2); $P < 0.001$	150.75 (2); $P < 0.001$	165.82 (2); $P < 0.001$	

-2LL Wald chi-square (df); P value

OR: Odds ratio (estimated from mixed-effects logistic regression).

SF-36: Short Form-36. BSI: Brief Symptom Inventory.