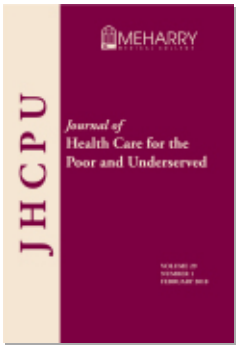
Neighborhood Crime and Sexual Transmission Risk Behavior among Black Men Living with HIV



Bisola O. Ojikutu, Laura M. Bogart, David J. Klein, Frank H. Galvan, Glenn J. Wagner

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ORIGINAL PAPER

Neighborhood Crime and Sexual Transmission Risk Behavior among Black Men Living with HIV

Bisola O. Ojikutu MD, MPH
Laura M. Bogart PhD
David J. Klein MS
Frank H. Galvan PhD
Glenn J. Wagner PhD

Abstract: Here, we examined the association of exposure to neighborhood crime with sexual risk-taking behavior among Black men living with HIV. HIV-positive Black men on antiretroviral therapy in California completed an audio computer-assisted self-interview. Crime risk per census block group was derived from the Federal Bureau of Investigation's Uniform Crime Report. Among 193 men, the mean (SD) number of sexual partners among those who were sexually active was 2.7 (3.3). 49% reported condomless sex, and 23% reported sex with an HIV-negative or unknown-serostatus partner. In multivariate analysis, illicit drug use ([IRR=1.86; 95%CI: 1.20–2.89] p=.006), depressive symptoms ([IRR=1.59; 95%CI: 1.03–2.44] p=.03), an undetectable viral load ([IRR=1.91; 95%CI: 1.22–3.00] p=.005), and neighborhood total crime risk ([IRR=1.02; 95%CI: 1.01–1.04] p=.007) remained significant. Among Black men living with HIV, exposure to neighborhood crime is associated with having multiple sexual partners whose HIV status was negative or unknown.

Key words: Black men, HIV/AIDS, HIV transmission, Neighborhood crime exposure.

While the overall crime rate in the United States has dropped precipitously over the course of the last two decades, urban cities continue to be plagued by violence and criminal activity.[1–3] From 2014 to 2015, several major metropolitan centers reported a sharp increase in the rate of violent crime, particularly homicide.[4] Neighborhood crime poses an obvious direct threat to personal safety and security. Moreover, irrespective of whether or not one is directly victimized, exposure to crime within one's surrounding community profoundly affects overall health, psychological well-being and behavior.[5–7]

Numerous studies have noted an association between neighborhood-level crime exposure and increased HIV-related risk-taking behavior. Much of this research has

BISOLA O. OJIKUTU *is affiliated with the Brigham and Women's Hospital and Harvard Medical School.* ***LAURA M. BOGART***, ***DAVID J. KLEIN***, *and* ***GLENN J. WAGNER*** *are affiliated with the RAND Corporation, Santa Monica; CA. David J. Klein is also affiliated with the Boston Children's Hospital and Harvard Medical School.* ***FRANK H. GALVAN*** *is affiliated with Bienestar Human Services Inc., Los Angeles, CA. Please address all correspondence to: Bisola Ojikutu, 75 Francis Street, Boston, MA 02114. Phone: (617) 521-3381; Email: bojikutu@partners.org.*

focused on adolescents and has highlighted the impact of witnessing community violence on early sexual debut and initiation of drug use.[8–14] Among adolescent males, exposure to violent crime has been associated with engagement in condomless sex, multiple concurrent partnerships, and the use of drugs and alcohol during sexual activity.[15] Among adults, exposure to crime may also affect vulnerability to HIV and sexually transmitted diseases. Several studies have explored exposure to neighborhood social disorder in the form of violent crime and noted a positive association with high risk partners and indirect concurrency (having a sexual partner who has other high risk sexual partners).[16,17]

Though the association between crime exposure and sexual risk-taking behavior is well documented, the mechanism through which they are linked is unclear.[9,12,14] One hypothesis is that fear of victimization is a potent psychological stressor that may lead to depressive symptoms and substance use disorders—factors often associated with increased sexual risk-taking behavior.[18–20] An alternate hypothesis suggests that residents who are chronically exposed to neighborhood crime develop a sense of disregard for their own well-being and perceive risk-taking as normative behavior.[21] These theories have also been applied more generally (beyond crime) to neighborhood disorder and disadvantage.[22,23] The relationships between crime, fear of victimization, substance use, depressive symptoms, and sexual transmission risk-taking behavior are complex. Understanding the mechanism(s) underlying these relationships will be key to intervention development.

The syndemic of crime in inner cities and HIV and other sexually transmitted disease incidence may contribute to persistent racial and ethnic disparities. A *syndemic* is defined as the occurrence of two or more disorders that act synergistically to increase the burden of disease.[24] In 2015 Black individuals accounted for 45% of all new HIV infections among adults and adolescents while only comprising 12% of the United States population.[25] In order to address persistent racial and ethnic disparities, attention has shifted from individual-level predictors to the role of neighborhood-level environmental factors, such as crime, on HIV risk. The uneven distribution of crime across the country disproportionately affects Black individuals, who tend to reside in America's low income metropolitan centers.[26] Young Black men living in urban, low income communities are more at risk of exposure to community violence than any other population in the United States.[27,28] Studies linking crime exposure and sexual risk-taking behavior have noted the adverse impact that this environmental exposure has on young Black men.[8,9,11]

Among Black men, those who are living with HIV are a particularly vulnerable group who may experience high levels of exposure to neighborhood-level crime.[29] Like HIV-negative individuals, HIV-positive individuals who are exposed to neighborhood-level crime may engage in increased sexual risk-taking behavior. However, data exploring the association between crime exposure and sexual risk-taking behavior among Black men living with HIV are limited and inconsistent. In a study of young, Black men who have sex with men living with HIV, witnessing violence with a deadly weapon was associated with substance use, but not high-risk sexual behaviors.[29] In a second study of young Black men who have sex with men living with HIV, exposure to community

violence was significantly associated with condomless anal intercourse, substance use and psychological distress.[30] Additional research is needed to understand the association between crime exposure and sexual risk-taking among Black men living with HIV. This is a critical gap in the literature given the high prevalence of crime exposure and HIV among Black men and the risk of onward HIV transmission due to sexual risk-taking behavior. This study was conducted to determine the impact of exposure to neighborhood-level violent and non-violent crime in addition to individual-level factors on sexual risk-taking behavior in a cohort of Black men living with HIV in Los Angeles.

Methods

Study procedures. The present study was conducted among Black men living with HIV in Los Angeles City and County areas in California. Between 2007 and 2009, 214 Black men living with HIV were recruited using fliers posted by staff at three HIV social service agencies and an HIV medical clinic. Individuals were eligible if they self-identified as Black, were aged 18 or older, and were prescribed antiretroviral therapy at the time of the study. Individuals were screened via telephone. Participants completed a one-hour audio computer-assisted self-interview. Participants who completed the study received $30 in compensation. Clinical data were obtained via chart review. Additional details regarding study procedure are available in prior publications.[31–36] All study procedures were approved by the institutional review boards (IRBs) of Boston Children's Hospital, RAND Corporation, and Charles Drew University of Medicine and Science. Study procedures were in accordance with the Helsinki Declaration of 1975, as revised in 2000.

Measures. *Neighborhood-level variables*. Participant home addresses were obtained, geocoded, and assigned to the appropriate census block group. Crime risk indices were derived from the Federal Bureau of Investigation (FBI) Uniform Crime Report (UCR). These data are collected annually from law enforcement jurisdictions nationwide. Indices used in this analysis were derived from six years of aggregate data collected between 2005 through 2010. The total crime risk index includes violent (murder, rape, assault) and non-violent (robbery, burglary, theft, and motor vehicle theft) crimes. Indices utilized in this analysis were modeled using sociodemographic data from the 2010 Census and the American Community Survey (5 year estimates) and were calculated at the block group geographic level. Index values are weighted for population and scaled relative to a national average (United States Total Crime Index =100). Therefore, a crime risk index of 400 is interpreted as a crime risk that is 4.0 times higher than the national average.[37] Similar crime risk indices have been used in other studies.[38–40] ArcGIS version 10.3 was used to geocode, aggregate, and merge the data.[41]

Two additional neighborhood variables were included in this analysis: socioeconomic status and race and ethnicity. Both population-level socioeconomic status and race and ethnicity have been identified as structural determinants of HIV prevalence in previous studies.[42,43] Neighborhood-level socioeconomic status was estimated using the proportion of individuals below the federal poverty level by census tract from the

2010 Census. Neighborhood-level race and ethnicity distribution was estimated using the proportion of Black/African-American and Hispanic individuals by census tract from 2010 Census data.

Individual-level variables. Sociodemographic characteristics, variables related to sexual behavior in previous studies, and clinical data were selected for analysis.[44,45] Sociodemographic characteristics included age, education (less than high school, high school diploma or GED, and college degree or higher), employment status (unemployed versus part time or full time employment), health insurance status, annual income, housing status [*stably housed* defined as renting a home or apartment, living in a home or apartment owned by the participant or someone else in the household, or living in subsidized housing; *unstably housed* defined as living in temporary/transitional housing (e.g., hotel, AIDS-specific housing, sober living facility), sleeping in a shelter, or sleeping on the street, beach, car], sexual orientation (gay/same gender loving, bisexual, heterosexual or straight, or other), and illicit drug use (including heroin, cocaine [crack or powder and amphetamines], tranquilizers, or other drugs without a prescription in the last 30 days]. Personal incarceration history was determined by asking the respondent to indicate whether or not they had been in prison in their lifetime (yes/no).

Depressive symptoms were assessed using the Medical Outcome Study (MOS) Depression Screener, a validated eight-item scale used to identify depressive disorders.[46] Participants were asked if they had experienced cognitive ("I felt depressed," "I enjoyed life," "I had crying spells," "I felt sad," and "I felt that people disliked me") and vegetative ("My sleep was restless") symptoms within the prior week. Respondents rated the frequency of symptoms from 1, rarely or none of the time, to 4, most or all of the time. Two additional Yes/No questions assessed depressive symptoms within the last year ("Have you had 2 weeks or more during which you felt sad, blue, or depressed; or when you lost all interest or pleasure in things that you usually cared about or enjoyed?" and "Have you felt depressed or sad much of the time in the past year?"). Using a predetermined algorithm, responses were recoded into a continuous score to vary from 0 to 1; scores greater than .06 are considered to be indicative of a high likelihood of depression.

Clinical data included most recent viral load (copies/ml) and CD4 count (cells/mm^3). For participants whose medical record was not available, viral load and CD4 count were obtained via self-report. For this sample, 52% of data were derived from medical records. Forty-eight percent was obtained via self-report.) Self-reported CD4 count and viral load data (detectable versus undetectable) have been validated in prior studies.[47,48]

Sexual behavior. The primary outcome of this study was the number of HIV-negative and unknown-serostatus sexual partners in the last 3 months, analyzed as a continuous variable. The number of sexual partners in the last 3 months was assessed by asking, "In the past 3 months, how many males have you had oral or anal sex with?" and "In past 3 months, how many females have you had sex with? By sex, we mean oral, anal, or vaginal sex." If the participant reported any sexual partners, then they were asked, "Of the [x] number of males/females that you had sex with in the last 3 months how many were HIV-negative?" and "Of the [x] number of males/females that you had sex

with in the last 3 months how many did you not know their HIV status when you had sex with them?" Participants were also asked how many times they had engaged in condomless sex and how many partners they had anal sex with.

Data analysis. Means and standard deviations for continuous variables and percentages for categorical variables were calculated. Bivariate and multivariate Poisson regression was used to generate adjusted estimates of associations with having multiple partners within the last three months prior to the study interview. The effect of each factor was summarized using incidence rate ratios (IRRs) with associated confidence intervals (CIs) and p values. Multivariate models included any socio-demographic or clinical covariate that was significantly related to the outcome at $p<0.10$ in the univariate models. Variables yielding $p<0.05$ in multivariate regression models were considered significant.

Results

A total of 193 men whose addresses were available and could be geocoded were included in this analysis. All participants self-identified as Black/African-American. The mean age was 44.3 (± 8.2). Most had a high school diploma/GED or less (94.8%), and 85% were unemployed. More than one-third (37%) had an annual income <$5,000, 57% were stably housed, and 97% had some form of health insurance. Fifty-eight percent of participants identified as gay/same gender loving. Recent illicit drug use was reported by more than 25% of participants, and 29% reported a personal history of incarceration. Forty-four percent reported symptoms indicating a high likelihood of depression. Among participants who provided medical records data, approximately 42% had an undetectable viral load; of those who self-reported viral load data, approximately 58% had an undetectable viral load. Among all participants, an undetectable viral load was noted in 49% of participants. (See Table 1.)

Among all participants, 74% reported having sex with men or women during the three months prior to data collection. Of those who reported having sex, the mean number of male sexual partners was 2.6 (±3.1), and the mean number of female sexual partners was 1.6 (±3.1). Sixty percent of participants who reported sexual activity engaged in sex with a partner(s) whose HIV status was negative or unknown. Twenty-six percent reported having multiple HIV-negative or unknown-serostatus partners. Almost half (49%) engaged in condomless sex. Of those who reported sexual activity, 23% engaged in anal sex with an HIV-negative or unknown-status partner. (See Table 1.)

In bivariate regression analysis, full or part-time employment ([IRR=1.91; 95%CI: 1.14–3.22] p=.01), any illicit drug use [IRR=2.17; 95%CI: 1.38– 3.40] p<.001), depressive symptoms ([IRR=2.17; 95%CI: 1.38–3.40] p=.01), and undetectable viral load ([IRR=2.01; 95%CI: 1.26–3.22] p=.004) were significantly associated with engagement in sex with multiple HIV-negative or status unknown sexual partners. Among neighborhood-level variables, total crime risk (violent and non-violent crime combined) was significantly associated with engagement in sex with multiple HIV-negative or status unknown partners ([IRR=1.03; 95%CI: 1.01–1.05] p<.001). No association was noted between violent or non-violent crime and engagement in sex with multiple HIV-negative or status unknown partners when analyzed separately. In multivariate

Table 1.

SOCIODEMOGRAPHIC, CLINICAL STATUS AND SEXUAL BEHAVIOR OF STUDY PARTICIPANTS

	N=193
Demographics	**Mean (SD) or %**
Mean age (SD)	44.3 (8.2)
Education	
Less than high school	20.8
High school diploma or GED	74.0
College degree or higher	5.2
Employment Status	
Unemployed	85.0
Income	
<$5,000	37.0
Stably Housed[a]	57.0
Health Insurance[b]	97.0
Sexual Orientation	
Gay/same gender loving	57.9
Bisexual	16.3
Heterosexual or straight	21.6
Other	4.2
Illicit Drug Use[c]	25.9
Incarceration History	29.2
Depressive Symptoms	43.8
Clinical Status	
Undetectable Viral Load	49.2
Mean CD4 count cells/mm[c] (SD)	471 (270)
Sexual Behavior (All participants)	
Any sex with men, women, or both in past 3 months	74.1
Sexual Behavior (Participants who reported sexual activity)	
Mean number of sexual partners	
Male	2.6 (3.1)
Female	1.6 (3.1)
Both	2.7 (3.3)
Sexual partner HIV status	
Negative or Unknown-Serostatus	60.1
Positive	66.7
Sex with multiple HIV negative or unknown-serostatus partners	26.1
Subject had detectable viral load and had sex with a HIV negative or unknown partner	25.4
Subject had detectable viral load and had sex with multiple HIV negative or unknown partners	9.2

(*continued on p. 389*)

Table 1. (*continued*)

	N=193
Demographics	**Mean (SD) or %**
Engagement in any condomless sex[d]	49.0
Engagement in anal sex	
With HIV negative or unknown-status partner	23.1
With HIV positive partner	38.5

Notes
[a]Stably housed is defined as renting a home or apartment, living in a home or apartment owned by the participant or someone else in the household or living in subsidized housing). Unstably housed is defined as living in temporary/transitional housing (e.g., hotel, AIDS specific housing, sober living, etc), sleeping in a shelter, or sleeping on the street, beach, car, etc).
[b]Includes all types of health insurance
[c]Use in the last 30 days. Includes heroin, cocaine (crack and/or powder), amphetamines, tranquilizers, or other drugs without prescription.
[d]Sex includes vaginal or anal intercourse.

analysis, illicit drug use ([IRR=1.95; 95%CI: 1.27–3.00] p=.002), depressive symptoms ([IRR=1.64; 95%CI: 1.07–2.51] p=.02), an undetectable viral load ([IRR=1.86; 95%CI: 1.19–2.90] p=.007), and neighborhood total crime risk ([IRR=1.02; 95%CI: 1.01–1.04] p=.003) remained significant. No significant associations emerged between total crime risk and engagement in condomless sex or engagement in anal sex with an HIV-negative or unknown-serostatus partner. (See Table 2.)

Discussion

Exposure to crime and violence is a major public health issue affecting physical health, mental health and general well-being, particularly among Black individuals living in urban communities in the US. This study found that among Black men living with HIV, neighborhood crime is associated with having multiple HIV-negative or unknown-serostatus sexual partners, independent of several other individual-level factors (illicit drug use, depressive symptoms, and having an undetectable viral load) that were also found to be significantly associated with having multiple sexual partners at risk for contracting HIV. On an individual level, we did not find a significant association between personal history of incarceration and number of sexual partners. On the neighborhood-level, we also did not find a significant association between poverty and number of sexual partners. These findings suggest that future interventions should address other individual and neighborhood-level structural factors, such as crime exposure, to reduce HIV transmission risk.

The impact of crime exposure on HIV risk transmission behavior is of concern among sexually active Black individuals living with HIV, some of whom reside in areas characterized by urban blight. Among participants in this study, the risk of HIV trans-

Table 2.

BIVARIATE AND MULTIVARIATE ASSOCIATIONS BETWEEN INDIVIDUAL LEVEL, NEIGHBORHOOD LEVEL CHARACTERISTICS AND NUMBER OF HIV NEGATIVE AND UNKNOWN PARTNERS

	Bivariate			Multivariate		
	IRR	**CI**	**p value**	**IRR**	**CI**	**p value**
Individual Level Factors						
Age	1.00	0.97–1.03	.90			
Education (ref ≥High School)						
<High School	0.95	0.54–1.68	.86			
Employment (ref Unemployed)						
Full or Part Time	1.91	1.14–3.22	.01	1.57	0.96–2.57	.07
Income (ref ≥$5,000)						
<$5,000	0.92	0.57–1.49	.73			
Housing Status (ref Stably Housed)						
Homeless/Marginal/Temporary	0.77	0.49–1.21	.25			
Sexual Orientation (ref Heterosexual)						
Other	1.07	0.62–1.84	.81			
Illicit drug use (ref None)						
Any drug use	2.17	1.38–3.40	<.001	1.95	1.27–3.00	.002
Incarceration (ref No)						
Yes	1.10	0.67–1.80	.70			
Depressive Symptoms (ref No)						
Yes	1.80	1.14–2.84	.01	1.64	1.07–2.51	.02
Undetectable Viral Load (ref No)						
Yes	2.01	1.26–3.22	.004	1.86	1.19–2.90	.007
Neighborhood Level Factors						
Total Crime (per 10 units)	1.03	1.01–1.05	<.001	1.02	1.01–1.04	.003
Poverty[a]	1.45	0.40–5.29	.57			
Race and Ethnicity[b]						
Black/African-American	1.03	0.38–2.78	0.96			
Hispanic	1.32	0.47–3.68	0.60			

Notes
[a]The proportion of individuals below the federal poverty level by census tract, 2010 Census.
[b]The proportion of Black/African-American or Hispanic individuals by census tract, 2010 Census.

mission was high because only 49% of participants reported having an undetectable viral load. In addition, one-half of the cohort engaged in condomless sex, and one-quarter engaged in anal sex with an HIV-negative or unknown-serostatus partner. Few other studies have explored the association between exposure to community violence and sexual transmission risk behavior among people living with HIV. Quinn et al. noted significantly higher rates of condomless anal intercourse among Black men who have

sex with men living with HIV who reported exposure to crime (both direct victimization and witnessing community violence).[30] Our study did not specifically explore the association between crime exposure and condomless anal sex because the format of our survey did not allow for assessment of these factors for each partner. Instead, we focused on HIV transmission risk to HIV-negative and unknown-serostatus partners. Additional research should be undertaken to further corroborate findings from both studies among diverse groups of people living with HIV.

These findings provide additional evidence for the existence of a syndemic of neighborhood-level crime and HIV risk among Black men. Studies have been undertaken to develop appropriate behavioral and psychosocial interventions to mitigate HIV risk among the most vulnerable population, Black men who have sex with men.[49–52] However, addressing this syndemic requires a multidisciplinary approach including structural interventions. Structural interventions promote health by altering the environment within which health is produced and reproduced and can include programs as well as policy initiatives. Interventions such as community development to build social cohesion, education initiatives, access to housing, increased economic opportunities, and enhanced policing policies have been implemented to address crime rates in inner cities.[53] Future research should determine the combination of structural interventions to address crime that might be included in a comprehensive package of HIV prevention initiatives.

Our study also noted a significant positive association between recent illicit drug use (heroin, cocaine and amphetamine) and having multiple HIV-negative or unknown partners. Substance use is a well-established risk factor for engagement in sexual HIV transmission risk behavior.[54,55] Among men who have sex with men, drug use with sexual activity is especially concerning because of the higher prevalence and risk of transmitting HIV and other sexually transmitted diseases.[56,57] Our study did not specifically ask about drug use immediately prior to or during sexual acts. In addition to the increase in sexual risk behavior, illicit drug use compromises adherence to treatment and retention in care among people living with HIV. One-quarter of participants reported recent illicit drug use and only one-half reported an undetectable viral load, suggesting that ongoing drug use is significant concern in this population.

In this study, having multiple HIV-negative and unknown-serostatus partners was also associated with the presence of depressive symptoms. High rates of depression have been noted among men who have sex with men and among people living with HIV.[58–60] Previous studies have noted an association between depression and engagement in high risk behaviors, such as condomless anal sex.[61–63] Therefore, addressing depression may be important to mitigating onward HIV transmission risk. However, several studies exploring this relationship have also noted either a decrease or no difference in sexual risk-taking among individuals with depression.[64,65] Further exploration has suggested that the relationship between depression and sexual risk-taking is curvilinear—increased risk-taking at moderate levels of depression and decreased at lower and higher levels.[66] These findings suggest that the relationship between depression and sexual risk-taking is complex and deserves additional study.

In this study we also found that having an undetectable viral load is associated with multiple HIV-negative and unknown-serostatus partners. This finding is consistent

with previous research. Several studies have noted an increase in condomless anal sex among men who have sex with men when they believed their HIV-positive partner had an undetectable viral load.[67,68] Having an undetectable viral load significantly decreases (but does not eliminate entirely) the risk of HIV transmission. The risk of transmission of other sexually transmitted infections is also an ongoing concern. Therefore, condom use and decreasing partner number continue to be recommended strategies for risk reduction.

Several limitations of this study warrant mention. The primary outcome—number of HIV-negative and unknown-serostatus partners—relies upon self-report, which induces response bias. Furthermore, participants were asked to posit whether their partner was HIV-negative, HIV-positive or of unknown serostatus. We did not obtain this information directly from participants' sexual partners. The primary outcome includes both oral and anal sex. Though oral sex is associated with little risk of HIV transmission, it is difficult to determine accurately the level of risk because people often engage in oral sex and intercourse during the same sexual interaction.[69] When medical records were not available we relied on self-reported clinical data (viral load and CD4 count). Self-reported viral load suppression may have been overestimated due to social desirability concerns, as evidenced by the higher percentage of participants reporting viral suppression than found in the medical records data. Thus, it is possible that the perception of being virally suppressed may have led participants to feel that they could engage in sex with negative or unknown-serostatus partners with minimal transmission risk. Lastly, and importantly given the focus of this study, exposure to crime was assumed based upon crime indices associated with participants' home address census block group. No standard measure of crime or violence exposure exists. Other studies have used self-reported measures.[9,11,29] For this study we chose to use an objective, geographic measure. Future studies should consider combining measures and exploring crime exposure in other environments in which participants spend their time (social, work, and school environments).

Despite these limitations, this study's findings underscore the need to look beyond individual-level variables and explore the impact of structural factors, such as neighborhood crime and community violence, on sexual risk behavior in people living with HIV. Ultimately, novel, multidisciplinary interventions will be required to address the complex role of environment on HIV transmission risk in diverse populations.

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