HIV Stigma, Mental Health, and Alcohol Use Disorders among People Living with HIV/AIDS in New Orleans

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Abstract Evidence suggests that HIV-related stigma is a contributing factor to mental health and substance use problems among people living with HIV (PLWH). Limited research, however, has examined the differential effects that multiple stigma constructs, specifically, anticipated, enacted, and internalized stigma may have on mental health and alcohol use disorders among PLWH. Furthermore, no studies have examined this relationship within the larger context of urban life stressors. The purpose of this study was to examine associations of an overall HIV-related stigma measure and four HIV stigma subscales on depression, anxiety, and hazardous drinking among a sample of 380 PLWH in New Orleans. Log-Poisson models with generalized estimating equations were used to estimate relative risks (RR) and 95% confidence intervals (CI). A test of interaction was used to determine presence of effect modification by urban life stressors. Overall, higher levels of HIV-stigma were associated with depressive symptoms (RR 1.67, 95% CI 1.25, 2.23), anxiety symptoms (RR 1.91, 95% CI 1.17, 3.12), and hazardous drinking (RR 1.45, 95% CI 1.02, 2.05). Internalized HIV-stigma (measured using the negative self-image subscale) was associated with all three outcomes and had the highest magnitude point estimates across the four stigma subscales. Urban life stressors, measured by the Urban Life Stressors Scale (ULSS), modified the association between HIV-related stigma and mental health and alcohol use disorders ($P < 0.2$), highlighting the importance for examining the larger urban environmental context. Findings from this study may inform interventions to reduce HIV-related stigma operating at the individual and structural level.

Keywords HIV stigma · Mental health · Alcohol use · Urban life stressors · People living with HIV

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Introduction

Mental health and substance use disorders are common co-morbidities among people living with HIV (PLWH). PLWH are twice as likely to be diagnosed with major depression and eight times more likely to have a serious mental illness (i.e., bipolar or schizophrenia) compared to those who are HIV-negative [1, 2]. In a nationally representative survey of HIV-care clinics in the USA, 36% of PLWH were diagnosed with major depression compared to 7.6% in the general population [3]. Findings from another national study found that PLWH were nearly eight times more likely to report anxiety symptoms than those without HIV [4]. Similarly, posttraumatic stress disorder (PTSD) disproportionately affects PLWH. PTSD prevalence rates for PLWH range

between 22 and 60% compared to 7% in the general public [5, 6]. Substance use disorders are also prevalent with nearly 50% of in-care PLWH reporting current or past histories of drug or alcohol disorders [7, 8]

These findings are of particular concern given that both mental illness and substance use disorders are known predictors of poor HIV disease management including suboptimal adherence to antiretroviral therapy (ART) and faster disease progression [9–11]. For example, a study by Tucker et al. showed that PLWH who also suffered from depression and generalized anxiety disorder were 1.7 and 2.2 times more likely to be nonadherent to antiretrovirals (ARVs) compared to PLWH without psychiatric disorders [12]. Chander et al. found hazardous and moderate levels of alcohol use associated with decreased ART adherence, and hazardous drinkers were 25% less likely to suppress their viral load compared to nondrinkers [13]. Understanding and addressing the risk factors that perpetuate mental health and substance use disorders among PLWH is critical for improving individual health and well-being and minimizing risks factors of poor treatment compliance.

Accumulating evidence points to HIV-related stigma as a contributing factor to the disproportionately high rates of mental health and substance use disorders among PLWH [1, 14, 15]. Broadly, HIV-related stigma can be defined as the devaluation, discrimination, and prejudice against PLWH. The HIV Stigma Framework, proposed by Earnshaw and Chaudoir [16, 17], conceptualizes HIV-related stigma as a multidimensional social process, differentiating between internalized, anticipated, and enacted stigma. Internalized HIV stigma refers to acceptance and endorsing of negative societal beliefs about HIV and applying them to oneself [16]. Anticipated stigma is the expectation that discrimination, prejudice, or stereotyping by others will occur because of one's HIV status [16]. Enacted stigma involves past or present experiences of discrimination, prejudice, or stereotyping by others due to one's HIV status [16].

According to Earnshaw and Chaudoir [16, 17], distinguishing between HIV stigma constructs may reveal associations that otherwise may be undetected by an overall HIV stigma measure. Furthermore, it is important to distinguish between different types of HIV-related stigma because the pathways by which they influence health and well-being for PLWH may differ, as well the type and level of intervention required to mitigate their effect [16]. For example, internalized stigma (self-concept in relation to illness identity) may be more

important for disease acceptance and can lead to avoidance of behaviors that remind the affected person of their illness state (e.g., daily medication, medical care visits). Anticipated stigma may have a greater influence on interpersonal interactions and outcomes (e.g., social support, trust in providers) [18]. It can lead to expectations of poor healthcare, worry of job loss, and fear of negative social interactions multiple times a day. This produces chronic worry with evidence of both physiological manifestations of chronic stress and associations with HIV disease progression evidenced by lower levels of CD4 cell counts [16]. Enacted stigma can reinforce internalized and anticipated beliefs, and similar to anticipated stigma, has been associated with increased chronic stress.

However, most research typically quantifies HIV stigma as a single measure or examine one type of HIV-related stigma (either anticipated, enacted, or internalized). Few studies have examined associations between multiple types of HIV-related stigma and mental health and alcohol use disorders.

Studies from multiple countries and varying contexts have documented significant associations between HIV-related stigma and mental health and substance use disorders. In India, for example, PLWH who perceived more frequent and greater HIV-related stigma were 2.1 times more likely to experience severe depression [19, 20]. Similarly, a study among HIV positive men and women in South Africa reported a higher prevalence of substance use and cognitive-affective depression scores among those with higher perceived stigma scores [20]. Stress is one mechanism through which stigma operates to produce negative effects on health [21]. According to Meyer's minority stress theory [22], exposure to stigma-related stress triggers a cascade of physiological and psychological responses, which in turn, increase the risk for depression and anxiety. Empirical evidence from several studies support this theory, linking the stress of discrimination and unequal treatment to adverse physiological response and impaired immune function [21, 23]. Stigma-related stress has also been shown to negatively influence general psychological processes (e.g., coping, emotion regulation), ultimately leading to increased anxiety, depression, and substance use disorders [23].

For many PLWH, especially the urban poor, the stress associated with HIV-related stigma may be further compounded by chronic exposure to other daily social and environmental-level stressors including unstable housing, food insecurity, and living in urban environments characterized by crime, violence, and social

disorder [24, 25]. In general, higher levels of both psychosocial and physiological stress among PLWH have been associated with poorer immune status, increased viral load over time, faster disease progression, and higher rates of mortality [26–28]. Such stressors are also likely to interfere with achieving successful care and with the development or exacerbation of clinical comorbidities. Research has shown positive associations between living in highly disordered and disadvantaged urban neighborhoods and increased risk of depression and substance use [29, 30]. For those living in stressful urban environments, programs aimed at addressing stigma may be less effective given the day-to-day environmental stressors. Yet, few studies have examined the modifying effects of urban life stressors in relation to HIV stigma and mental health and substance use disorders [30].
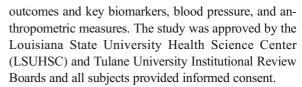
The purpose of this study was (1) to examine the relationship between different types of HIV-related stigma (i.e., internalized, anticipate, and enacted) and mental health and alcohol use disorders—specifically depressive symptoms, anxiety symptoms, and hazardous drinking among a cohort of low-income, minority PLWH; and (2) to examine the role of urban life stressors (e.g., housing, neighborhood crime, and access to public services) on these relations.

Methods

Study Population and Setting

A sample of 380 PLWH was recruited to participate in a longitudinal study, the *New Orleans Alcohol Use in HIV [NOAH]* Study. Participants were recruited through convenience sampling methods in local HIV clinics from October 2015 to October 2017. The goal of the parent study is to examine the impact of early life and adult stress on biological and clinical outcomes of PLWH over 2.5 years. Greater detail on study recruitment and data collection are provided elsewhere [31].

Study eligibility included non-pregnant PLWH age 18 and older who were without acute illness or intoxication at the baseline study visit. There were no further exclusion criteria. Consenting individuals attended a baseline visit at where data on residential address, alcohol use, physical and mental health measures, and other health-related factors were obtained. Participants also provided blood samples for analysis of HIV clinical outcomes and key biomarkers, blood pressure, and anthropometric measures. The study was approved by the Louisiana State University Health Science Center (LSUHSC) and Tulane University Institutional Review Boards and all subjects provided informed consent.

New Orleans is a metropolitan city with a population of 369,000. Approximately, 60% of the city inhabitants are African American, 34% white, and 6% other [32]. The city's urban environment can be characterized by residential racial and economic segregation, a high density of alcohol outlets per square mile, poor walkability especially in poorer neighborhoods [33], and high rates of urban crime. Although homicide and violent crime rates have decreased since Hurricane Katrina, they remain among the highest in the country. In 2011, New Orleans has a murder rate more than 10 times the national average and more than 4 times the average of cities of similar size [34], and in 2015, the city had the highest gun-related violence in the country [35].

Measures

The primary exposure was perceived *HIV stigma* measured using the HIV Stigma Scale (HSS) by Berger et al. [36]. The HSS is a 40-item inventory that measures HIV-related stigma. Each item is scored on a 4-point Likert scale (strongly disagree, disagree, agree, and strongly agree) with higher scores indicating greater stigma. Total stigma scores were derived by taking the mean of the 40-items ranging from 48 to 152. The total HIV stigma scale had high internal consistency (alpha = 0.95).

We also calculated four HIV stigma subscales given that stigma type has been shown to differentially impact behavioral and physical health indicators [16, 17]. The first subscale, *personalized stigma* (18 items) measures actual experiences with HIV stigma and represents enacted stigma. The *disclosure concerns* subscale (9 items) measures the distress that people feel about others knowing their HIV status (i.e., anticipated stigma). The *concern with public attitudes* subscale (20 items) assesses how PLWH believe others view them (i.e., anticipated stigma). The *negative self-image* subscale (13 items) measures how HIV-related stigma affects self-worth (i.e., internalized stigma). The four subscales were derived by calculating the mean included response items. Details on construct validity and reliability for each subscale can be found in Berger et al. [36]. Cronbach's alphas for the subscales ranged from 0.84 to 0.94. Due to non-normal distributions, the total

stigma scale and four subscales were dichotomized to define high (> 75th percentile) vs. low stigma.

Primary outcomes included *alcohol use severity, anxiety symptoms,* and *depressive symptoms.* Alcohol use severity was assessed by the Alcohol Use Disorders Test (AUDIT) questionnaire, a 10-item tool developed by the World Health Organization (WHO) [37]. The AUDIT contains items assessing alcohol consumption and associated harms. It has been widely used in both primary care and epidemiologic research, and its reliability and validity have been established in a variety of populations and settings [38–41]. Item responses are coded numerically and summed for an overall score ranging from 0 to 40. Scores of 8 or higher reflect harmful or hazardous drinking [37].

Anxiety and depressive symptoms were measured using the Hospital Anxiety and Depression Scale (HADS), a validated and reliable screening tool consisting of 14 items (including 7-item subscales for anxiety and depression) [42–44]. Scored responses were categorized into normal or borderline/abnormal.

Socio-demographic variables in the analysis included age, sex, sexual orientation (self-identified as gay, lesbian or bisexual versus heterosexual) [45], and socio-economic status which was measured using an indicator of educational attainment. History of incarceration, homelessness, and current smoking status were also included due to known associations with HIV and mental health and alcohol use disorders. The primary drug use covariate included polydrug use given the variety of drugs used by study participants. Polydrug use was defined as the use of at least two of the following substances in the last month: heroin, methadone, other opiates, barbiturates, sedative, cocaine, amphetamines, marijuana, hallucinogens, and inhalants.

The effect modifier of interest, *urban life stressors*, was assessed using the Urban Life Stressors Scale (ULSS) [46], a 21-item instrument used to measure subjective contextual community-level stressors (i.e., poverty, employment, housing, education) in urban environments. Items are scored on a scale of 1 'no stress at all' to 5 'extremely stressful—more than I can handle.' ULSS had high internal consistency (alpha = 0.89). The measure was dichotomized at > 75th percentile to identify high and low ULSS.

Data Analysis

Descriptive statistics were utilized to describe the population's sociodemographic characteristics, prevalence of mental health and substance use disorders, and mean stigma and mean urban life stressor scores. We conducted unadjusted bivariate analysis to identify crude associations between each of the HIV-related stigma scales and depressive symptoms, anxiety symptoms, and hazardous drinking. Then, we fit a series of log-Poisson models with generalized estimating equations clustering by geographic area, and a compound symmetry working correlation structure to estimate the relative risk of depressive symptoms, anxiety symptoms, and hazardous drinking associated with HIV-related stigma and the four stigma subscales controlling for sex, gender identity, sexual orientation, age, education, incarceration history, homelessness, smoking status, urban life stressors, and polydrug use [47, 48]. Subsequently, we fit the same series of models including a test for interaction between urban life stressors and HIV stigma. Models with significant interaction terms ($P < 0.2$) were stratified to examine within-group differences. Analysis was conducted using SAS version 9.4 (SAS Institute, Cary, NC).
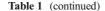
Results

Table 1 presents sample characteristics. The study population was 66% male and 34% female, and 37% of the sample self-identified as lesbian, gay, or bisexual. The study population was 82% African American, 17% White, and 1% other. Over 59% were age 50 or older and almost 39% had less than high school education. Approximately, 60% had ever been incarcerated and 50% reported a history of homelessness. Twenty-eight percent reported polydrug use in the past 30 days and 57% were current smokers. Moderate/high depressive symptoms were prevalent in 26% of the sample, while 43% screened positive for anxiety symptoms and approximately 35% for high alcohol use severity. The mean score for the overall HIV-stigma scale was 2.5 (SD = 0.45, range 1 to 4). Mean levels of the four sub-stigma scales were 2.4 (SD = 0.54) personalized stigma, 2.8 (SD = 0.53) disclosure stigma, 2.3 (SD = 0.56) negative self-stigma, and 2.6 (SD = 0.48) concerns with public attitudes. The average urban life stressor score was 2.3 (SD = 0.88, range 1 to 5).

Table 2 presents the results of unadjusted bivariate analysis and 95% confidence intervals between the overall HIV stigma scale and the four stigma subscales with anxiety symptoms, depressive symptoms, and hazardous drinking. Results show that overall HIV stigma

Table 1 Characteristics of the New Orleans alcohol use in HIV study (*n* = 380)

	N (%)
Sex	
Female	131 (34.47)
Male	249 (65.53)
Sexual orientation	
Gay/lesbian/bisexual	140 (36.84)
Heterosexual or straight	240 (63.16)
Race/ethnicity	
African America	312 (82.11)
White	64 (16.84)
Other	4 (1.05)
Age	
< 20	60 (15.79)
40 < = 50	94 (24.74)
50 < = 60	172 (45.26)
60 < = 70	54 (14.21)
Education	
Less than high school	147 (38.68)
High school graduate/GED	124 (32.63)
At least some college	109 (28.68)
Ever incarcerated	
Yes	227 (59.74)
No	153 (40.26)
Ever homeless	
Yes	192 (50.53)
No	188 (49.47)
Current smoker	
Yes	218 (57.37)
No	162 (42.63)
Current polydrug use	
Yes	108 (28.42)
No	272 (71.58)
Hazardous drinking (AUDIT score > 8)	
Yes	131 (34.47)
No	249 (65.53)
Depressive symptoms	
Borderline or abnormal	100 (26.32)
Normal	280 (73.68)
Anxiety symptoms	
Borderline or abnormal	163 (42.89)
Normal	217 (57.11)
	Mean (SD)
Overall HIV-related stigma score (range 1–4)	2.5 (0.45)
HIV-related stigma subscales	
Personalized stigma sub-scale	2.4 (0.54)

Table 1 (continued)

	N (%)
Disclosure stigma sub-scale	2.8 (0.53)
Negative self-image stigma sub-scale	2.3 (0.56)
Concerns with public attitudes stigma sub-scale	2.6 (0.48)
Urban Life Stressor Scale (ULSS) (range 1–5)	2.3 (0.88)

was associated with anxiety and depressive symptoms, but not hazardous drinking. Symptoms of anxiety were also associated with all four stigma subscales. Depressive symptoms were associated with two stigma subscales, concerns about public attitudes and negative self-image. Hazardous drinking was significantly associated with one stigma subscale, negative self-image.

Table 3 presents results from fully adjusted multivariable models. After controlling for demographic and behavioral characteristics and urban life stressors, participants reporting a high level overall HIV-related stigma were 1.67 (95% CI 1.25, 2.23), 1.91 (95% CI 1.17, 3.12), and 1.45 (95% CI 1.02, 2.05) times more likely to report anxiety symptoms, depressive symptoms, and hazardous drinking, respectively, compared to those reporting a low level of overall HIV-related stigma. All four HIV stigma subscales were correlated with anxiety symptoms. Individuals reporting a high level of personalized stigma, disclosure stigma, concern with public attitudes, and negative self-image were 1.48 (95% CI 1.13, 1.93), 1.55 (95% CI 1.17, 2.04), 1.53 (95% CI 1.18, 1.98), and 1.84 (95% CI 1.41, 2.40) times more likely to report anxiety symptoms compared to those with a low level of the respective stigma subscales. Two of the subscales were significantly associated with increased risk of depressive symptoms in the fully adjusted models. Participants reporting a concern with public attitudes and negative self-image were 1.49 (95% CI 1.02, 2.18) and 1.88 (95% CI 1.29, 2.74) times more likely to report depressive symptoms compared to those with little or no perceived experience of HIV-related stigma. Lastly, risk of hazardous drinking was 1.68 (95% CI 1.23, 2.30) times higher among participants with high negative self-image.

A significant test for interaction in the fully adjusted models (*P* < 0.2) suggested that the association between HIV-related stigma and anxiety symptoms, depressive symptoms, and hazardous drinking, varied by exposure to urban life stressors. To further examine differences, we fit adjusted models stratified by high and low urban

Table 2 Crude relative risks and 95% confidence intervals between HIV stigma scales and mental health outcomes and hazardous drinking

	Anxiety			Depression			Hazardous drinking		
	RR	95% CI		RR	95% CI		RR	95% CI	
Overall HIV stigma									
Low	Ref			Ref			Ref		
High	1.90	1.42, 2.54	***	2.05	1.25, 3.35	**	1.33	0.97, 1.83	
Personalized stigma									
Low	Ref			Ref			Ref		
High	1.90	1.45, 2.49	***	1.72	0.99, 2.90		1.19	0.85,1.68	
Disclosure concerns									
Low	Ref			Ref			Ref		
High	1.70	1.25, 2.32	***	1.44	0.91, 2.27		1.23	0.83, 1.84	
Concerns about public attitudes									
Low	Ref			Ref			Ref		
High	1.79	1.36, 2.34	***	1.70	1.09, 2.66	*	1.17	0.81, 1.67	
Negative self-image									
Low	Ref			Ref			Ref		
High	1.99	1.51, 2.63	***	1.93	1.29, 2.90	***	1.60	1.17, 2.19	**

$*P < 0.05, **P < 0.01, ***P < 0.001$

Table 3 Adjusted relative risks and 95% confidence intervals between HIV stigma scales and mental health outcomes and hazardous drinking

	Anxiety				Depression				Hazardous drinking			
	RR	95% CI			RR	95% CI			RR	95% CI		
Overall HIV stigma												
Low	Ref				Ref				Ref			
High	1.67	1.25	2.23	***	1.91	1.17	3.12	**	1.45	1.02	2.05	*
Personalized stigma												
Low	Ref				Ref				Ref			
High	1.48	1.13	1.93	**	1.45	0.89	2.34		1.28	0.85	1.92	
Disclosure concerns												
Low	Ref				Ref				Ref			
High	1.55	1.17	2.04	**	1.37	0.89	2.13		1.30	0.85	1.98	
Concerns about public attitudes												
Low	Ref				Ref				Ref			
High	1.53	1.18	1.98	***	1.49	1.02	2.18	*	1.16	0.77	1.74	
Negative self-image												
Low	Ref				Ref				Ref			
High	1.84	1.41	2.40	***	1.88	1.29	2.74	***	1.68	1.23	2.30	**

[1] All models adjusted for age, sex, sexual orientation, education, incarceration history, homelessness, polydrug use, smoking, urban life stressors

$^{*}P < 0.05, **P < 0.01, ***P < 0.001$

life stressors (Table 4). Among PLWH in the high urban life stressors category, significant associations were only detected between one HIV-related stigma measure, negative self-image, and anxiety symptoms (RR 1.56, 95% CI 1.15, 2.11). Among PLWH in the low urban life stressors category, significant variations were also detected such that participants with high HIV-related stigma concerns or experiences were at an increased risk for anxiety symptoms (RR 2.94, 95% CI 1.65, 5.23) and hazardous drinking (RR 2.13, 95% CI 1.29, 3.51) compared to those with low HIV-stigma concerns or experiences. Risk of depressive symptoms was also significantly higher (RR 1.68, 95% CI 1.13, 2.50) for those with high vs low concerns of public attitudes. Urban life stressors did not modify the association between the subscale disclosure concerns and mental health symptoms nor hazardous drinking.

Discussion

This study examined the role of HIV-related stigma on mental health and alcohol use problems among a cohort of primarily low-income and non-white PLWH in New Orleans. Statistically significant point estimates from adjusted models ranged from 1.45 to 1.91 with the strongest association detected between the overall HIV stigma measure and depressive symptoms. These results corroborate previous studies that have demonstrated positive associations between HIV-related stigma and depression and anxiety symptoms and hazardous drinking [1, 9, 19, 49].

In addition to the overall HIV stigma measure, the subscale, negative self-image, was significantly associated with all three outcomes and had the highest magnitude point estimates across the four stigma subscales. This suggests that participants are less able to achieve self-acceptance as an HIV-positive person may be more likely to suffer from depressive and anxiety symptoms and hazardous drinking. As such, future interventions may consider incorporating activities that focus on self-efficacy, self-acceptance, and self-esteem building.

Findings also revealed that associations between HIV-related stigma and mental health and alcohol use disorders varied significantly by exposure to urban life stressors. In stratified models, a diminished or insignificant effect of HIV-related stigma on mental health and alcohol use was detected among participants with high urban life stressors. On the contrary, significant

associations between HIV-related stigma and mental health and alcohol use remained for participants with low urban life stressors. One explanation for this finding could be that the stress of HIV-related stigma in the context of an urban city like New Orleans becomes less relevant in the face of other daily environmental stressors (including high violent crime rates, residential racial segregation, poor public transport, etc.) that are often uncontrollable at the individual-level. As such, HIV-related stigma may be a stronger predictor of adverse mental health outcomes in situations where environmental stressors are low.

Despite strengths, this study is not without its limitations. The cross-sectional nature of this study makes it difficult to delineate the relationship between HIV and co-occurring mental health disorders as depression and/or anxiety may be present prior to or after HIV diagnosis. Further, the extent to which cognitive biases, especially among individuals with increased depressive and anxiety symptoms, may influence the study findings is difficult to ascertain. According to cognitive research, depressed, and anxious individuals are more likely to exhibit negative cognitive biases in memory re-call interpretation, and perceptions and attitudes and this, in turn, may influence outcome-exposure relationships. It is plausible that the detected associations between HIV-related stigma and increased depressive and anxiety symptoms are skewed due to unmeasured cognitive biases. Additionally, outcome and exposure measures were based on self-report, which can be implicated in recall bias and same-source bias. To minimize self-report bias, validated and standardized instruments were used. Due to many missing cases ($n = 129$), we were not able to account for potential variability in the exposure-outcome relationship based on length of time living with HIV given missing information on year diagnosed. In addition, stigma-related data was limited to HIV stigma, restricting our ability to test and compare other types of stigma as potential predictors. Finally, generalizability is a concern as the sample included low-income PLWH in-care in New Orleans, which may be different from PLWH in other geographic areas and PLWH who are not in-care.

Future research should explore how other stigmas related to sexual orientation, race and ethnicity, occupation (e.g., sex work), language, and risk behaviors (e.g., drug use) interact with experiences of HIV-related stigma to shape mental and physical health outcomes. Understanding the intersectionality of HIV-related stigma with other stigmatized identities and behaviors will only

Table 4 Adjusted relative risk of and 95% confidence intervals between HIV stigma scales and mental health outcomes and hazardous drinking by level of Urban Life Stressors Scale (ULSS)[1]

	Anxiety ULSS				Depression ULSS				Hazardous drinking ULSS			
	High		Low		High		Low		High		Low	
	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI
Total HIV stigma												
Low	Ref											
High	1.28	0.92, 1.78	2.94	1.65, 5.23 ***					1.00	0.65, 1.54	2.13	1.29, 3.51 **
Personalized stigma												
Low	Ref											
High									1.04	0.65, 1.67	1.92	1.02, 3.64 *
Disclosure concerns												
Low	Ref											
High												
Concerns about public attitudes												
Low	Ref											
High												
Negative self-image												
Low	Ref											
High	1.56	1.15, 2.11 **	2.72	1.51, 4.93 ***	1.06	0.44, 2.54	1.68	1.13, 2.50 *	0.86	0.53, 1.39	2.18	1.41, 3.36 ***

[1] All models adjusted for age, sex, sexual orientation, education, incarceration history, homelessness, polydrug use, smoking

$* P < 0.05$, $** P < 0.01$, $*** P < 0.001$

strengthen interventions aimed at addressing stigma [50]. Given that urban life stressors moderated associations and appear to play a very strong role in depressive and anxiety symptoms and hazardous drinking in this sample, greater attention must be paid to the social context. Among patients experiencing great levels of urban life stress, interventions aimed at stressors—both perceived and objective—may be more beneficial than those addressing stigma. It is also important for future research to characterize which chronic environmental stressors (e.g., concentrated poverty, neighborhood crime, access to resources) matter most and the mechanisms through which these stressors impact mental health and substance use. Finally, there is a great need to utilize study designs and methodologies that permit causal inference such as prospective cohort designs as well as the use of marginal structural models.

Notwithstanding these limitations, this study provides further evidence that HIV-related stigma is associated with an increased risk of mental health and alcohol use problems among a sample of PLWH. The differential effects of the stigma subscales may improve our understanding of how stigma impacts health and well-being. While further evidence documenting differential effects of internalized, anticipated, and enacted stigma on specific health outcomes is needed, our findings suggest that internalized stigma may have a slightly stronger role on mental health and well-being compared to anticipated and enacted stigma in this population. As an internal cognitive process, internalized stigma may be more closely related to psychological outcomes like depression. At the same time, however, our findings also demonstrate that while HIV-related stigma may be an important factor driving poor mental health outcomes among PLWH, it should be considered within the broader social and environmental context in which PLWH live. From an intervention or policy perspective, examining the role of HIV-related stigma on health outcomes within the larger context of other distal urban life stressors may need a different approach and adaptation to context.

Findings from this study may inform interventions to reduce HIV-related stigma. Effective interventions should operate at multiple-levels and target a variety of populations including health care practitioners, communities, family members, PLWH, and policy-makers. At the individual-level, interventions could focus on building self-esteem and acceptance and developing adaptive coping strategies. In addition to working to decrease internal stigma at the individual-level, interventions to promote social acceptance of HIV are also critical as these wider social norms shape the perception of people with HIV that serve as the precursor to internal HIV stigma. Structural interventions could focus on community sensibilization, housing security, employment protection including legal protection from HIV-related stigma, and health facility and school-based interventions as well as addressing chronic urban life stressors. Examples of successful structural level interventions include an integrated socioeconomic, educational, and community participation program in Thailand which showed a significant decrease in external HIV-related stigma post-intervention [51], and the Housing Opportunities for People with AIDS (HOPWA) program [52] implemented in three USA cities. HOPWA provided rental assistance to PLWH, leading to improvements in self-perceived mental and physical health and perceived stress levels. While the intention of this intervention was not focused on HIV-related stigma reduction, reducing the chronic stress associated with homelessness indirectly improved self-esteem and reduced internalized stigma.

References

1. Logie C, Gadalla TM. Meta-analysis of health and demographic correlates of stigma towards people living with HIV. *AIDS Care*. 2009;21(6):742–53.

2. Ciesla JA, Roberts JE. Meta-analysis of the relationship between HIV infection and risk for depressive disorders. *Am J Psychiatry*. 2001;158(5):725–30.

3. Bogart LM, Wagner GJ, Galvan FH, Landrine H, Klein DJ, Sticklor LA. Perceived discrimination and mental health symptoms among black men with HIV. *Cult Divers Ethn Minor Psychol*. 2011;17(3):295–302.

4. Bing EF, Burnam MA, Longshore D, et al. Psychiatric disorders and drug use among human immunodeficiency virus-infected adults in the United States. *Arch Gen Psychiatry*. 2001;58(8):721–8.

5. Gore-Felton C, Koopman C. Traumatic experiences: harbinger of risk behavior among HIV-positive adults. *J Trauma Dissociation*. 2002;3(4):125–35.

6. Kessler RC, Chiu WT, Demler O, Walters EE. Prevalence, severity, and comorbidity of twelve-month DSM-IV disorders in the National Comorbidity Survey Replication (NCS-R). *Arch Gen Psychiatry*. 2005;62(6):617–27.

7. Durvasula R, Miller T. Substance abuse treatment in persons with HIV/AIDS: challenges in managing triple diagnosis. *Behav Med*. 2014;40(2):43–52.

8. UNAIDS. *On the fast-track to end AIDS by 2030: focus on location and population*. Geneva: UNAIDS; 2015.

9. Rueda S, Mitra S, Chen S, Gogolishvili D, Globerman J, et al. Examining the associations between HIV-related stigma and health outcomes in people living with HIV/AIDS: a series of meta-analyses. *BMJ Open*. 2016;6(7):e011453.

10. Rintamaki LS, Davis TC, Skripkauskas S, Bennett CL, Wolf MS. Social stigma concerns and HIV medication adherence. *AIDS Patient Care STDs*. 2005;20:359–68.

11. Vanable P, Carey M, Blair D, Littlewood R. Impact of HIV-related stigma on health behaviors and psychological adjustment among HIV-positive men and women. *AIDS Behav*. 2006;10(5):473–82.

12. Tucker JS, Burnam MA, Sherbourne CD, Kung FY, Gifford AL. Substance use and mental health correlates of nonadherence to antiretroviral medications in a sample of patients with human immunodeficiency virus infection. *Am J Med*. 2003;114(7):573–80.

13. Chander G, Lau B, Moore RD. Hazardous alcohol use: a risk factor for non-adherence and lack of suppression in HIV infection. *J Acquir Immune Defic Syndr*. 2006;43(4):411–7.

14. Wardell J, Shuper P, Rourke S, Hendershot C. Stigma, coping, and alcohol use severity among people living with HIV: a prospective analysis of bidirectional and mediated associations. *Ann Behav Med*. 2018;52:762–72.

15. Blashill AJ, Perry N, Safren SA. Mental health: a focus on stress, coping, and mental illness as it relates to treatment retention, adherence and other health outcomes. *Curr HIV/AIDS Rep*. 2011;8(4):215–22.

16. Earnshaw V, Chaudoir S. From conceptualizing to measuring HIV stigma: a review of HIV stigma mechanism measures. *AIDS Behav*. 2009;13(6):1160–77.

17. Earnshaw V, Smith L, Chaudoir S, Amico KR, Copenhaver M. HIV stigma mechanisms and well-being among PLWH: a test of the HIV stigma framework. *AIDS Behav*. 2013;17(5):1785–95.

18. Turan B, Budhwani H, Pariya FL, et al. How does stigma affect people living with HIV? The mediating roles of internalizzed and anticipated HIV stigma in the effects of perceived community stigma on health and psychosocial. *AIDS Behav*. 2017;21:283–91.

19. Charles B, Jayaseelan L, Pandian AK, Sam AE, Thenmozhi M, et al. Association between stigma, depression and quality of life of people living with HIV/AIDS (PLHA) in South India - a community based cross sectional study. *BMC Public Health*. 2012;12:463.

20. Simbayi L, Strebel A, Cloete A, Henda N, Mqeketo A. Internalized stigma, discrimination, and depression among men and women living with HIV/AIDS in Cape Town, South Africa. *Soc Sci Med*. 2007;64(9):1823–31.

21. Hatzenbuehler M, Phelan J, Link B. Stigma as a fundamental cause of population health inequalities. *Am J Public Health*. 2013;103(5):813–21.

22. Meyer IH. Minority stress and mental health in gay men. *J Health Soc Behav*. 1995;36(1):38–56.

23. Hatzenbuehler M. How does sexual minority stigma "get under the skin"? A Psychological Mediation Framework. *Psychol Bull*. 2009;135(5):707–30.

24. Pellowski JA, Kalichman SC, Matthews KA, Adler N. A pandemic of the poor: social disadvantage and the US HIV epidemic. *Am Psychol*. 2013;68(4):197–209.

25. Gant Z, Lomotey M, Hall H, Hu X, Guo X, et al. A county-level examination of the relationship between HIV and social determinants of health: 40 states, 2006–2008. *Open AIDS J*. 2012;6(1):1–7.

26. Ironson G, Stuetzle R, Fletcher M. An increase in religiousness/spirituality occurs after HIV diagnosis and predicts slower disease progression over 4 years in people with HIV. *J Gen Intern Med*. 2006;21(supplement 5):S62–8.

27. Lesesrman J. HIV disease progression: depression, stress, and possible mechanisms. *Biol Psychiatry*. 2003;54(3):295–306.

28. Lesesrman J, Petitto JM, Golden RN, et al. Impact of stressful life events, depression, social support, coping, and cortisol on progression to AIDS. *Am J Psychiatriy*. 2000;157(8):1221–8.

29. Latikn CA, Curry AD. Stressful neighborhoods and depression: a prospective study of the impact of neighborhood disorder. *J Health Soc Behav*. 2003;44(1):34–44.

30. Latkin C, Curry A, Hua W, Davey M. Direct and indirect associations of neighborhood disorder with drug-use and high-risk sexual partners. *Am J Prev Med*. 2007;32(6 Suppl):S234–41.

31. Welsh D, Ferguson T, Theall K, et al. The New Orleans alcohol use in HIV [NOAH] study: a translational investigation of alcohol use, biological and socioenvironmental mechanisms, and geriatric multimorbidity in people living with HIV. *Alcohol Clin Exp Res*. 2019;43(4):704–9.

32. United States Census Bureau. QuickFacts: New Orleans City, Louisiana. 2018; https://www.census.gov/quickfacts/neworleanscitylouisiana#qf-headnote-a. Accessed 1 July 2018.

33. Lowe K. Environmental justice and pedestrianism: sidewalk continuity, race, and poverty in New Orleans, Louisiama. *Transp Res Rec*. 2016;2598(1):119–23.

34. Wellford C, Bond BJ, Goodison S. *Crime in New Orleans: analyzing crime trends and New Orleans' responses to crime*. In: Justice USDo, editor. . Baltimore: University of Maryland; 2011.

35. Kegler S, Dahlberg L, Mercy J. Firearm homicides and suicides in major metropolitan areas, 2012–2013 and 2015–2016. *MMWR Morb Mortal Wkly Rep*. 2018; 67(44): 1233–1237.

36. Berger B, Ferrans C, Lashley R. Measuring stigma in people with HIV: psychometric assessment of the HIV stigma scale. *Res Nurs Health*. 2001;24:518–29.

37. Saunders JB, Aasland OG, Babor TF, de la Fuente JR, Grant M. Development of the alcohol use disorders identification test (AUDIT): WHO collaborative project on early detection of person with harmful consumption—II. *Addiction*. 1993;88(6):791–804.

38. Bohn MJ, Babor TF, Kranzler HR. The alcohol-use disorders identification test (Audit) - validation of a screening instrument for use in medical settings. *J Stud Alcohol*. 1995;56(4):423–32.

39. Valladolid GR, Vicedo JB, Sanchez-Serrano MCC, Carrasco JSD. Validation of the alcohol use disorders identification test (AUDIT) in primary care. *Rev Clin Esp*. 1998;198(1): 11–4.

40. Tang YL, Jovanovic T, Wingo A, Michopoulos V, Schwartz A, Ressler KJ. Validation of the alcohol use disorders identification test (AUDIT) in an inner city primary care Sample. *Biol Psychiatry*. 2015;77(9): 374s–374s.

41. Lundin A, Hallgren M, Balliu N, Forsell Y. The use of alcohol use disorders identification test (AUDIT) in detecting alcohol use disorder and risk drinking in the general population: validation of AUDIT using schedules for clinical assessment in neuropsychiatry. *Alcohol Clin Exp Res*. 2015;39(1):158–65.

42. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand*. 1983;67(6):361–70.

43. Snaith RP. The hospital anxiety and depression scale. *Health Qual Life Outcomes*. 2003;1:29.

44. Bjelland I, Dahl AA, Haug TT, Neckelmann D. The validity of the hospital anxiety and depression scale. An updated literature review. *J Psychosom Res*. 2002;52(2):69–77.

45. Patterson J, Jabson J, Bowen D. Measuring sexual and gender minority populations in health surveillance. *LGBT Health*. 2017;4(2):82–105.

46. Jaffee KD, Liu GC, Canty-Mitchell J, Qi RA, Austin J, Swigonski N. Race, Urban community stressors, and behavioral and emotional problems of children with special health care needs. *Psychiatr Serv*. 2005;56:63–39.

47. McNutt LA, Wu C, Xuer X, Hafner JP. Estimating relative risk in cohort studies and clinical trials of common outcomes. *Am J Epidemiol*. 2003;157(10):940–3

48. Yelland LN, Salter AB, Ryan P. Performance of the modified Poisson regression approach for estimating relative risks from clustered prospective data. *Am J Epidemiol*. 2011;174(8):984–92.

49. Katz I, Ryu A, Onuegbu, Psaros C, Weiser SD, et al. Impact of HIV-related stigma on treatment adherence: systematic and meta-synthesis. *J Int AIDS Soc*. 2013;16;(3 Suppl 2): 18640.

50. Bowleg L. The problem with the phrase women and minorities: intersectionality—an important theoretical framework for public health. *Am J Public Health*. 2012;102(7):1267–73.

51. Apinundecha C, Laohasiriwong W, Cameron MP, Lim S. A community participation intervention to reduce HIV/AIDS stigma, Nakhon Ratchasima province, Northeast Thailand. *AIDS Care*. 2007;19(9):1157–65.

52. Wolitski R, Kidder D, Pals S, Royal S, Aidala A, et al. Randomized trial of the effects of housing assistance on the health and risk behaviors of homeless and unstably housed people living with HIV. *AIDS Behav*. 2010;14(3):493–503.