ORIGINAL PAPER

Intersectional Stigma, Fear of Negative Evaluation, Depression, and ART Adherence Among Women Living with HIV Who Engage in Substance Use: A Latent Class Serial Mediation Analysis

Kristi Lynn Stringer[1] · Andrea Norcini Pala[2] · Robert L. Cook[3] · Mirjam-Colette Kempf[4] · Deborah Konkle-Parker[5] · Tracey E. Wilson[6] · Phyllis C. Tien[7] · Gina Wingood[8] · Torsten B. Neilands[9] · Mallory O. Johnson[9] · Carmen H. Logie[10,11] · Sheri D. Weiser[12] · Janet M. Turan[13,14] · Bulent Turan[15,16]

Abstract
Women Living with HIV (WLHIV) who use substances face stigma related to HIV and substance use (SU). The relationship between the intersection of these stigmas and adherence to antiretroviral therapy (ART), as well as the underlying mechanisms, remains poorly understood. This study aimed to examine the association between intersectional HIV and SU stigma and ART adherence, while also exploring the potential role of depression and fear of negative evaluation (FNE) by other people in explaining this association. We analyzed data from 409 WLHIV collected between April 2016 and April 2017, Using Multidimensional Latent Class Item Response Theory analysis. We identified five subgroups (i.e., latent classes [C]) of WLHIV with different combinations of experienced SU and HIV stigma levels: (C1) low HIV and SU stigma; (C2) moderate SU stigma; (C3) higher HIV and lower SU stigma; (C4) moderate HIV and high SU stigma; and (C5) high HIV and moderate SU stigma. Medication adherence differed significantly among these classes. Women in the class with moderate HIV and high SU stigma had lower adherence than other classes. A serial mediation analysis suggested that FNE and depression symptoms are mechanisms that contribute to explaining the differences in ART adherence among WLHIV who experience different combinations of intersectional HIV and SU stigma. We suggest that FNE is a key intervention target to attenuate the effect of intersectional stigma on depression symptoms and ART adherence, and ultimately improve health outcomes among WLHIV.

Keywords Stigma · Substance use · Depression · Fear of negative evaluation

Introduction

Efforts are needed to address rising substance use (SU) and disparities in HIV treatment outcomes, ensuring health equity in HIV care for people living with HIV (PLWH) who use drugs. Adherence to anti-retroviral therapy (ART) is crucial for optimal health. PLWH who use drugs have lower ART adherence rates [1–3], leading to poorer HIV-related outcomes, including failure to achieve virologic suppression and increased mortality [4–6]. Women living with HIV (WLHIV) who use drugs face greater vulnerability and worse HIV care outcomes than men. They are less likely to consistently engage in HIV care, adhere to ART, and achieve viral suppression [7, 8]. However, PLWH who engage in substance use but adhere to HIV care and ART can achieve viral suppression, reducing mortality [9, 10] and ART resistance [10, 11].

Stigma encompasses negative attitudes towards individuals, groups, or conditions, leading to social exclusion and unfair treatment, creating barriers to full societal participation [12]. The stigma process involves labeling, negative evaluation, and subsequent loss of social status, discrimination, and prejudice [13]. Stigma takes various forms: internalized stigma, endorsing negative stereotypes towards one's own group; anticipated stigma, expecting future discrimination; and experienced stigma, actual acts of discrimination, stereotyping, or prejudice from others. This study focuses on the impact of experienced stigma related to HIV and SU.

Kristi Lynn Stringer and Andrea Norcini Pala have equally contributed to this work.

Extended author information available on the last page of the article

All forms of HIV-related stigma negatively impact the HIV continuum of care [14–18]. A meta-analysis of 63 studies suggests that HIV stigma is significantly associated with higher rates of depression, lower adherence to ART medications, reduced healthcare utilization, and decreased social support [19]. A systematic review of 23 studies found that HIV stigma affects adherence through increased vulnerability to mental health issues, decreased self-efficacy, and concerns about inadvertent disclosure of HIV status [20].

Some WLHIV also face stigma related to drug use or perceived drug use. SU related stigma refers to stigma based on one's presumed status as a person who uses drugs. SU-related stigma has been identified as a critical barrier to addressing the current SU-related epidemic [21]. SU disorders are highly stigmatized, potentially even more than HIV [22]. Moral judgments, perceiving drug users as morally weak or engaging in deviant behavior, further contribute to this stigma. Fear of judgment and discrimination prevents individuals from seeking treatment and support, exacerbating the negative health consequences and hindering rehabilitation [23–25]. Limited research has explored the relationship between SU stigma and ART adherence. studies suggest that higher levels of experienced SU-related stigma are associated with lower ART adherence [26]. Understanding the mechanisms through which SU and HIV-related stigma affect care retention and medication adherence is urgently needed for this vulnerable population.

Intersectionality and Intersectional Stigma

Intersectionality recognizes how different aspects of social identity, such as race, gender, class, sexual orientation, and disability, intersect and influence one another, leading to unique experiences of advantage or disadvantage [27]. An intersectional approach is necessary to understand the combined impact of multiple stigmatized identities, known as intersectional stigma, which results in reduced access to power and opportunities. Intersectionality acknowledges that oppression or privilege is not solely determined by a single aspect of identity but arises from the complex interplay of various social categories [27]. For instance, a black woman may face discrimination that differs from that experienced by a white woman or a black man, as her experiences are shaped by the intersection of race and gender.

The intersection of experienced HIV- and SU-related stigmas can create unique intersectional profiles of social exclusion and marginalization experiences, which may exacerbate social and health inequalities. Limited knowledge exists on the impact of intersectional experienced stigma on the treatment cascade for substance using WLHIV. Research on intersectional stigma experienced by women who use drugs have found links to sexual practices that elevate HIV and STI

exposure and lack of health care, harm reduction, and HIV treatment utilization [28–31]. While little research examines experienced SU-related stigma among PLWH, Earnshaw et al. [32] found that high internalized SU-related stigma moderated the association between internalized HIV stigma and depression symptoms [32]. In other studies, SU-related stigma has been linked to limited care access and suboptimal ART adherence, while HIV stigma was not [33, 34]. Similarly, others have found that missed appointments among MSM with HIV were associated with SU-related stigma, but not with HIV or sexual orientation stigma [35].

Stigma and Fear of Negative Evaluation

Fear of negative evaluation by other people involves a general concern about unfavorable assessments from others, avoiding evaluation situations, and an anticipation of negative evaluation from others [36]. Those with high fear of negative evaluation worry about losing social acceptance and seek favorable evaluations from others. Previous research links sensitivity to evaluation as a generalized trait with physiological responses that may affect HIV progression [37]. Cortisol responses are amplified among those more sensitive to negative appraisal and they have shorter durations to critically low CD4, AIDS diagnosis, and HIV-related death [38, 39]. Stigma may amplify generalized fear of negative evaluation and heightened awareness of societal biases towards PLWH. Studies that have elucidated the relationship between stigma, fear of negative evaluation, and ART adherence are scarce. One study found that fear of negative evaluation and attachment-related anxiety may increase vulnerability to internalizing stigma among PLWH [40].

Stigma, Depression, Fear of Negative Evaluation, and ART Adherence

HIV-related stigma leads to emotional and mental distress and depression symptoms [18, 19]. Depression may mediate the relationship between HIV-related stigma and medication adherence [16, 17, 41–43]. The few studies that have examined the impact of SU-related stigma on mental health outcomes consistently suggest an association between SU-related stigma and depression [44, 45]. Furthermore, research also links depression to fear of negative evaluation [46–49]. Thus, we propose that stigma's impact on ART non-adherence is mediated by fear of negative evaluation and depression symptoms sequentially. By understanding these complex pathways, we can gain insight into the mechanisms through which stigma affects ART non-adherence,

providing valuable knowledge for developing interventions to address this issue.

Quantitative Approaches to Investigate Intersectionality

Intersectional stigma research has emphasized the importance of understanding how marginalized identities and corresponding inequities intersect to impact the health of PLWH [50–52]. We suggest that a good method to analyze intersectional stigma is Multidimensional Latent Class Item Response Analysis (MLCIRT), a person-centered statistical approach. MLCIRT simultaneously evaluates construct measurement properties and identifies groups with similar experienced stigma levels. It considers the unique contribution of each item and accounts for measurement error, resulting in more accurate estimations of underlying constructs. To date, no study has used MLCIRT or more generally latent class analysis to examine the intersection of experienced HIV and SU stigma and association to ART adherence. We propose that fear of negative social evaluation and depression symptoms are important mediating mechanisms in the relationship between intersectional experienced stigma and lower ART adherence.

Methods

Participants and Procedures

Participants (N = 409) were WLHIV in the Women's Adherence and Visit Engagement (WAVE) sub-study of the Women's Interagency HIV Study (WIHS). Women were enrolled in the WAVE at four WIHS sites: Birmingham, Alabama; Jackson, Mississippi; Atlanta, Georgia; and San Francisco, California. Participants provided written informed consent, and study procedures were approved by the WIHS Executive Committee and the Institutional Review Boards at each participating site. All procedures were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. Data was collected between April 2016 and April 2017.

Intersectional HIV and Substance Use Stigmas

The *experienced HIV-related stigma* measure included 12 items adapted from the Earnshaw et al. HIV stigma mechanisms scale [53]. These items measure experienced HIV-related experienced stigma from 4 sources: the general community, family members, healthcare workers, and sexual partners. Cronbach's alpha for this scale was 0.92.

To measure experienced *SU-related experienced stigma*, we adapted the same HIV stigma mechanisms scale [53] to ask 9 questions regarding SU-related stigma. These items mirrored those in the HIV stigma scale, minus questions regarding sexual partners. Our aim was to have parallel SU and HIV stigma measures. Cronbach's alpha for this measure was 0.91. MLCIRT was then used to identify different combinations of SU and HIV experienced stigma and create intersectional stigma profiles.

Fear of Negative Evaluation by Others

Fear of negative evaluation is assessed with a validated 12-item measure [54]. Eight items are positively keyed (straightforward wording) reflecting higher levels of fear of negative evaluation (e.g., "I worry about what other people will think of me when I know it doesn't make any difference"), while four are negatively keyed (reverse scored, e.g., "I am unconcerned even if I know people are forming an unfavorable impression of me"). Previous studies suggested that the four reverse-coded items do not load onto the same latent factor as the remaining items [55]. We performed a confirmatory factor analysis (see appendix) and found this to be true in our sample. The factor loadings of the reverse-coded items ranged from 0.14 to 0.212. The internal reliability of the scale slightly improved when the reverse-coded items were removed (from 0.93 to 0.96). Therefore, we calculated the total fear of negative evaluation score using only the straightforwardly worded items.

Depression Symptoms

Depression symptoms were assessed using the 20 item Center for Epidemiological Studies-Depression Scale (CES-D) [56]. We summed the responses to the items to create a score ranging from 0–60, with higher scores indicating greater severity of depression. Internal reliability was 0.95.

Antiretroviral Therapy (ART) Adherence

ART adherence was evaluated using a 3 item self-report measure consisting of the following three items, *(1) In the last 30 days, on how many days did you miss at least one dose of any of your HIV medicines?*; *(2) In the last 30 days, how good a job did you do at taking your HIV medicines in the way that you were supposed to?*, and *(3) In the last 30 days how often did you take your HIV medicines in the way that you were supposed to?* We created a total adherence score ranging from 0 to 100% using the algorithm suggested by Wilson et al. [57].

Sociodemographic Characteristics

Sociodemographic characteristics included age, race (white, African American/Black, other), income ($12,000 or less, $12,001–24,000, $24,001–36,000, $36,001 or more), and education (< High school/GED, High school/GED, Some college/Associate, College and above).

Substance Use (SU)

Participants were asked to self-report drug and alcohol use. SU in this paper is defined as current or past use of the following drugs: alcohol ($\geq$ 7 per week), powder cocaine, crack cocaine, heroin, methamphetamine, and/or marijuana use (current or none). Participants also reported current or past intravenous drug use. Current use is defined as use in the last 3 months; past use is defined using the drug at some point, but not in the last 3 months.

Data Analysis Plan

We used Latent Gold (Version 6.0.0.21341) and R Studio (Version 1.4.1717) to perform statistical analyses. Descriptive statistics included mean and standard deviation for continuous variables, count and percentage for categorical variables, and median and interquartile range (IQR) for ordinal variables. We used the R *psych* package to calculate Cronbach's α to estimate the internal reliability of measures [58].

We used MLCIRT to identify subgroups of participants with different combinations of SU and HIV experienced stigma. We modeled experienced stigmas as standardized latent traits, with mean = 0 and SD = 1. To determine the optimal number of subgroups (i.e., latent classes), we estimated a set of nested models (i.e., from 2- to 6-class models) and compared their fit indices, entropy, and interpretability. Fit indices included: Bayesian Information Criterion (BIC), sample adjusted BIC (SABIC), Akaike Information Criterion (AIC), and Vuong-Lo-Mendell-Rubin (VLMR) likelihood ratio test [59, 60]. Entropy is an estimate of accuracy with which a set of indicators (i.e., latent traits and items) define the latent classes, with values closer to 1.00 and greater than 0.8 indicating optimal and acceptable accuracy, respectively. Interpretability consists in comparing new information produced by N-class with N(-1)-class models. For example, when comparing 3- and 2-class models, we examined whether the additional class provides significant information. We also inspected the size of each class to determine the number of classes [59].

We tested the association between intersectional experienced stigma classes and distal outcomes using a 2-step approach [10]. The first step consisted of estimating the latent class measurement (i.e., combination of intersectional experienced stigmas based on latent traits). The second step tested the association between the log densities of the latent classes identified in step 1 and distal outcomes, whether categorical, ordinal, or continuous. Log densities express the latent class membership probability. The class with the lowest levels of experienced stigma was used as the reference group. Once we identified the number of classes (step 1), we tested the association between the latent classes (log densities) and distal outcomes, individually and within the same model to examine mediation. For example, first we tested differences in adherence levels among the latent classes. Second, we examined differences in depression symptoms among latent classes. Third, we explored differences in fear of negative evaluation among latent classes. Finally, we tested the mediating paths illustrated in the model in Fig. 1. We tested the individual mediating effect of fear of negative evaluation and depression in the relationship between intersectional experienced stigma and ART adherence. Furthermore, we tested the hypothesis of a serial mediation through which intersectional experienced stigma leads to increased fear of negative evaluation, which leads to higher depression symptoms, which ultimately affect ART adherence. In addition to testing differences between a reference group and the other groups, the 2-step approach also estimates post-hoc pairwise differences. All models were adjusted

Fig. 1 Serial Mediation Model of the Relationship between Experienced Intersectional Stigma Profiles and ART Adherence with fear of negative evaluation (M1) and Depression Symptom Severity (M2) as serial mediators
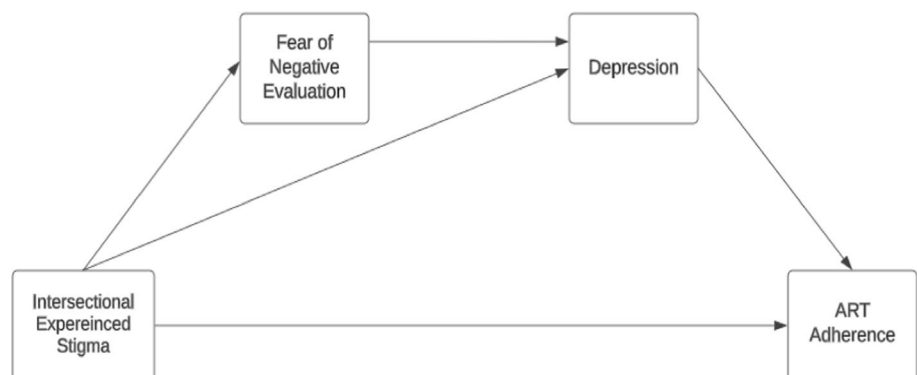
for the covariates (i.e., sociodemographic characteristics). We used non-parametric bootstrapping to estimate 95% confidence intervals for all model parameters. Missing data were accounted for using full information maximum likelihood (FIML) implemented in Latent Gold.

Table 1 Sample descriptive statistics

	N = 409
Age, mean (SD)	51.48 (9.45)
Income > 12 K n(%)	201 (51.4)
Marital status, n(%)	
Single	151 (38.4)
Married/in a relationship	105 (26.7)
Previously married	137 (34.9)
High school, n (%)	291 (71.1)
Race, n (%)	
Black/African American	323 (80.0)
White	57 (14.1)
Other	24 (5.9)
Adherence (continuous), mean (SD)	88.27(17.00)
Depression symptoms (CESD, continuous), mean (SD)	13.19 (11.76)
Fear of negative evaluation, mean (SD)	13.45 (9.30)
Drug use, n(%)	
Never	190 (48.0)
Past use	72 (18.2)
Current use	134 (33.8)
Type of drug used	
Marijuana	159 (38.9)
Heroin	7 (1.7)
Powder cocaine	34 (8.3)
Crack cocaine	48 (11.7)
Methamphetamine	8 (2.0)
Intravenous drug use	6 (1.5)
Alcohol ≥ 7 drinks per week	45 (11.0)
Other, n (%)	10 (2.4)

SD standard deviation

Results

Sample Characteristics

Sociodemographic, clinical, and substance use characteristics of the sample are shown in Table 1. Participants (N = 409) had a mean age of 51.48 years (SD = 9.45), and the majority reported an annual income exceeding $12,000 (51.4%) and a high school education (71.1%). Based on participants' marital status, 34.9% were previously married, 38.4% were single, and 26.7% were either married or in a relationship. Racial demographics indicated a predominantly Black/African American composition (80.0%). Participants self-reported mean levels of adherence equal to 88.27 (SD = 17.00), depression symptoms equal to 13.19 (SD = 11.76) and fear of negative evaluation equal to 13.45 (SD = 9.30). In terms of substance use, marijuana emerged as the most prevalent drug (38.9%), followed by crack cocaine (11.7%) and heroin (1.7%). A subset of participants reported current problematic alcohol use, with 11.0% consuming seven or more drinks per week.

Intersectional Experienced Stigma: Multidimensional Latent Class Item Response Theory

We compared the fit indices of five nested models with an increasing number of classes, from two to six (Table 2). Based on the BIC, AIC, and SABIC, the 6-class model showed optimal fit although one of the six classes consisted only of 18 participants. Furthermore, the comparison between the 6- and 5-class model based on the VLMR test was non-significant (p = 0.057), thus we selected the 5-class model.

The characteristics of the five latent classes are presented in Fig. 2, with 0 representing the sample mean. The five classes exhibited two distinct patterns: classes 1, 4, and 5 had either lower or higher levels of experienced stigma compared to the average, while the other pattern showed only one stigma level higher than average. We assigned the following labels to the

Table 2 Fit indices of 2- through 6-class models: multidimensional latent class item response theory (N = 409)

Model	BIC	AIC	SABIC	Entropy	Min size	VLMR
2-Class	8925.28	8584.11	8655.56	0.90	168	
3-Class	8362.24	8009.03	8083.00	0.88	83	< 0.001
4-Class	8109.59	7744.34	7820.83	0.87	39	< 0.001
5-Class	7945.27	7567.98	7646.99	0.86	30	0.024
6-Class	7858.03	7468.70	7550.24	0.85	18	0.057

BIC Bayesian information criterion, *SABIC* sample adjusted BIC, *AIC* Akaike information criterion, *VLMR* Vuong-Lo-Mendell-Rubin likelihood ratio test (df) and p-value
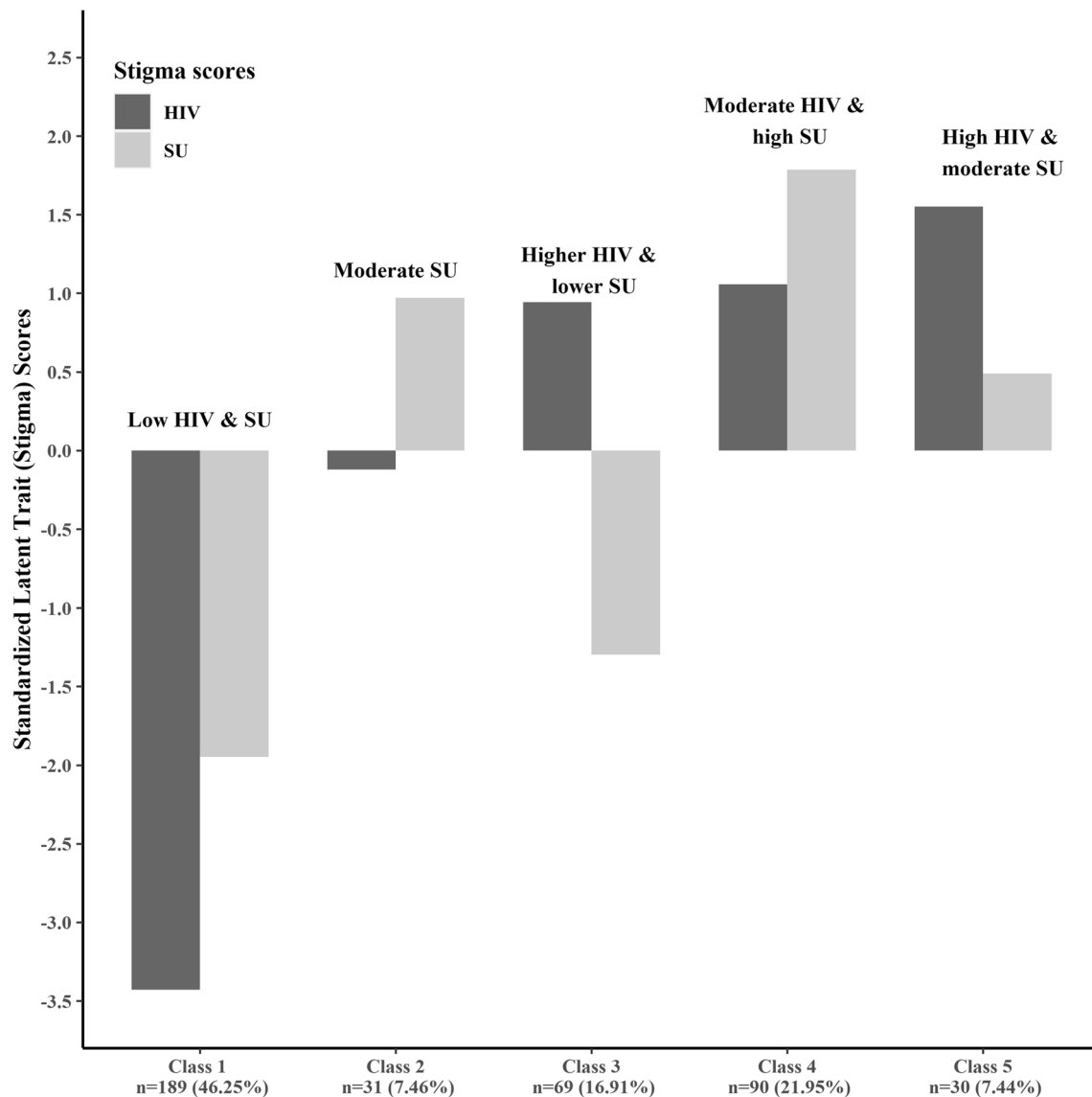
Fig. 2 Substance Use and HIV Experienced Stigma Latent Classes (N = 409)

latent classes: class 1—Low HIV and low SU stigma, class 2—Moderate SU stigma (with low levels of HIV stigma), class 3—High HIV stigma (with low levels of SU stigma), class 4—Moderate HIV and high SU stigma, and class 5—High HIV and moderate SU stigma. Class distribution among women in the sample was as follows: class 1—46.25%, class 2—7.46%, class 3—16.91%, class 4—21.95%, and class 5—7.44%.

Intersectional Stigma and Adherence

In Fig. 3, we presented the average adherence levels across the latent classes. Participants in class 3, characterized by higher HIV experienced stigma, and class 4, characterized by high SU and moderate HIV experienced stigma, exhibited significantly lower levels of ART adherence compared to those in class 1. Adherence levels were lower in classes 2 and 5 compared to class 1, but the difference was not statistically significant with p-values 0.097 and 0.51, respectively (Table 3). Participants in class 4 demonstrated the lowest adherence levels compared to all the other classes, though this difference was statistically significant only compared to class 1 (Wald test = 10.26, p = 0.001) and class 5 (Wald test = 4.70, p = 0.03) (Fig. 3).
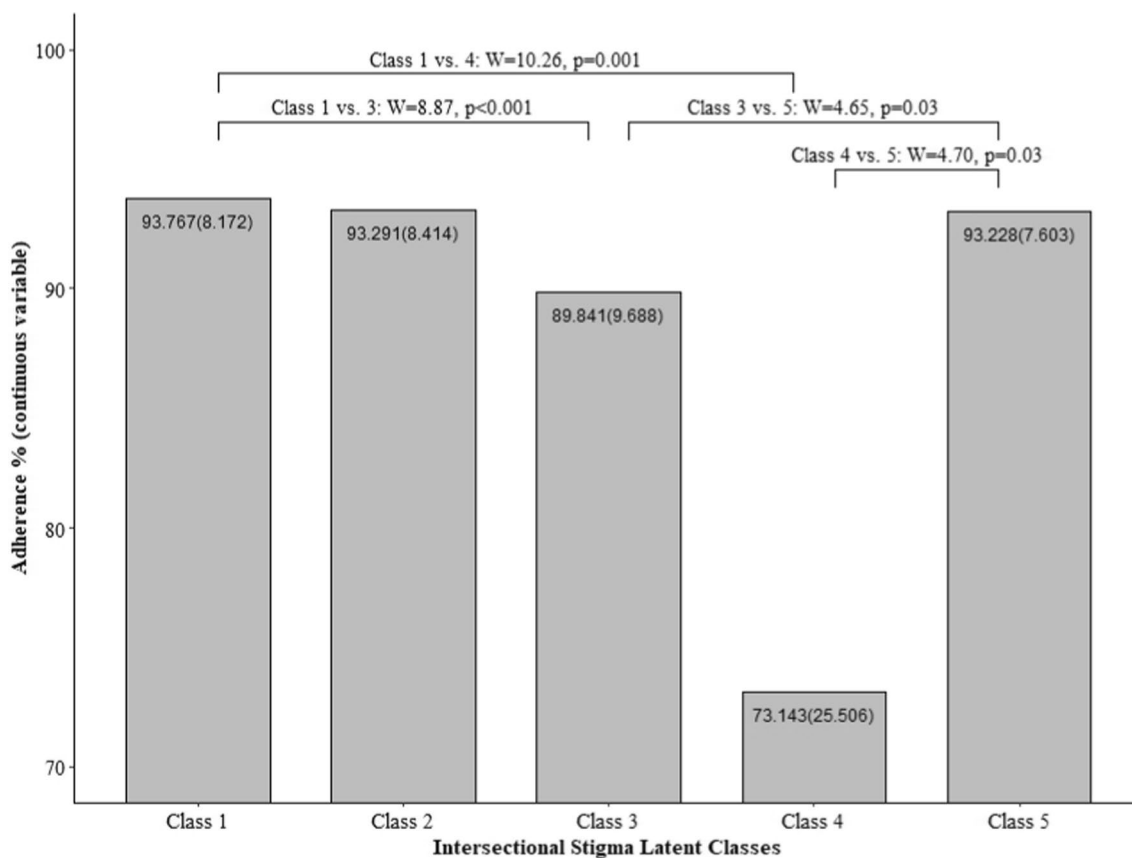
Fig. 3 Adherence Level by Latent Classes (N=409). W: Wald Test to compare classes' differences; p: p-value; Classes' mean and (standard deviation) are shown inside each Class bar. Class 1: Low HIV and SU stigma; Class 2: Moderate SU stigma; Class 3: Higher HIV stigma and lower SU stigma; Class 4: Moderate HIV stigma and High SU stigma; Class 5: High HIV stigma and moderate SU stigma

Table 3 Intersectional (SU and HIV) experienced stigmas, ART adherence, depression symptoms, and fear of negative evaluation (N=409)

	ADH		CESD		FNE	
	B	p-value	B	p-value	B	p-value
Class 1: Low Stigmas (Ref. group)						
Class 2: Moderate SU stigma	− 8.903	0.097	**9.987**	**< 0.001**	**4.928**	**0.03**
Class 3: Higher HIV and lower SU stigma	**− 11.06**	**0.003**	3.354	0.065	**2.511**	**0.01**
Class 4: High SU and moderate HIV stigma	**− 9.808**	**0.001**	**8.045**	**< 0.001**	**3.293**	**0.001**
Class 5: High HIV and moderate SU stigma	− 8.903	0.51	**10.012**	**< 0.001**	**8.063**	**< 0.001**

Bold values indicate statistically significant coefficients

B: Unstandardized linear regression coefficient; ADH: ART Adherence; CESD: Depression Symptoms; FNE: Fear of Negative Evaluation; Model adjusted for covariates, including Age, Income, Marital status, Education, Race, Ethnicity, Drug use; 100% adherence was used as reference group in multinomial regression

Intersectional Experienced Stigma and Depression Symptoms

Figure 4 and Table 3 show that participants in class 1 (low HIV and low SU experienced stigma) had the lowest depression symptom levels compared to all the other classes. These differences, however, were statistically significant to class 2 (Wald test = 11.98, p < 0.001), class 4 (Wald test = 21.14, p < 0.001), and 5 (Wald test = 12.18, p < 0.001), while the comparison between class 1 and class 3 was not statistically significant. Compared to women with low HIV and SU stigmas (class 1), those
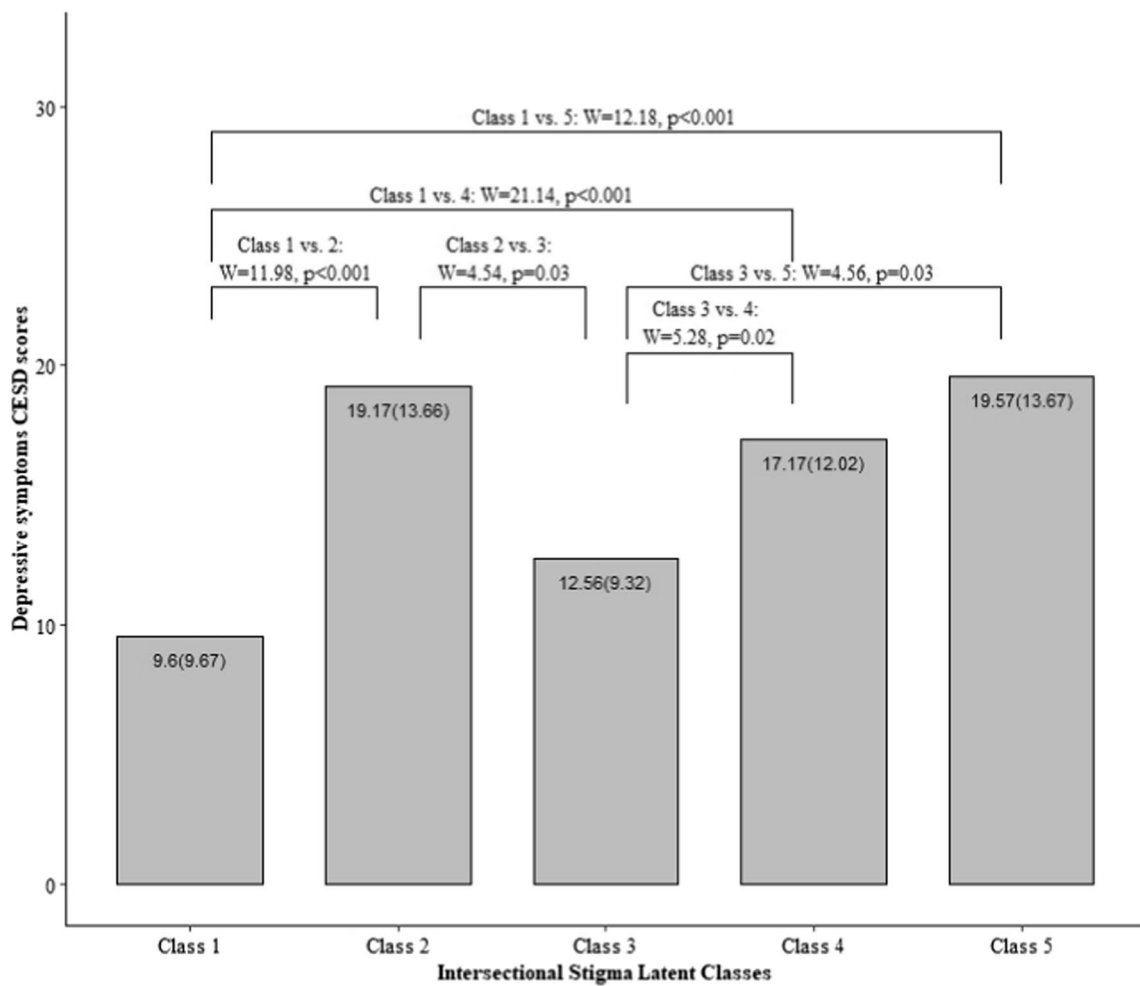
Fig. 4 Depression Symptom Levels by Latent Classes (N = 409). W: Wald Test to compare classes' differences; p: p-value; Classes' mean and (standard deviation) are shown inside each Class bar. Class 1: Low HIV and SU stigma; Class 2: Moderate SU stigma; Class 3: Higher HIV stigma and lower SU stigma; Class 4: Moderate HIV stigma and High SU stigma; Class 5: High HIV stigma and moderate SU stigma

who experienced moderate or high SU experienced stigma exhibited nearly double the levels of depression symptoms (classes 1 CESD mean = 9.6 vs. classes 2 CESD mean = 19.17, class 4 CESD mean = 17.17, and class 5 CESD mean = 19.57). Participants in classes 2, 4, and 5 had significantly higher levels of depression symptoms also compared to those in class 3 (high HIV experienced stigma and lower SU experienced stigma; class 3 CESD mean = 12.56) (Fig. 5).

Intersectional Experienced Stigma and Fear of Negative Evaluation

Women in class 1 had the lowest fear of negative evaluation (FNE mean = 3.48) in comparison to classes 2 (FNE mean = 7.67; p = 0.05), 3 (FNE mean = 5.77; p = 0.02), 4 (FNE mean = 7.23; p < 0.001), and 5 (FNE mean = 12.53; p < 0.001). The differences between class 1 and the other classes were statistically significant. Women in classes 2, 3, and 4 had approximately twofold higher fear of negative evaluation compared to class 1. Class 5, characterized by high HIV and moderate SU stigma, had nearly fourfold higher levels of fear of negative evaluation compared to class 1. Class 5 also exhibited significantly higher fear of negative evaluation compared to classes 3 and 4.

Intersectional Experienced Stigma, Fear of Negative Evaluation, Depression Symptoms, and Adherence

In our path-analysis, we examined the mechanisms in the relationships between intersectionality experienced stigma classes, ART adherence, fear of negative evaluation, and

Fig. 5 Fear of negative evaluation Levels by Latent Classes (N = 409). W: Wald Test to compare classes' differences; p: p-value; Classes' mean and (standard deviation) are shown inside each Class bar. Class 1: Low HIV and SU stigma; Class 2: Moderate SU stigma; Class 3: Higher HIV stigma and lower SU stigma; Class 4: Moderate HIV stigma and High SU stigma; Class 5: High HIV stigma and moderate SU stigma
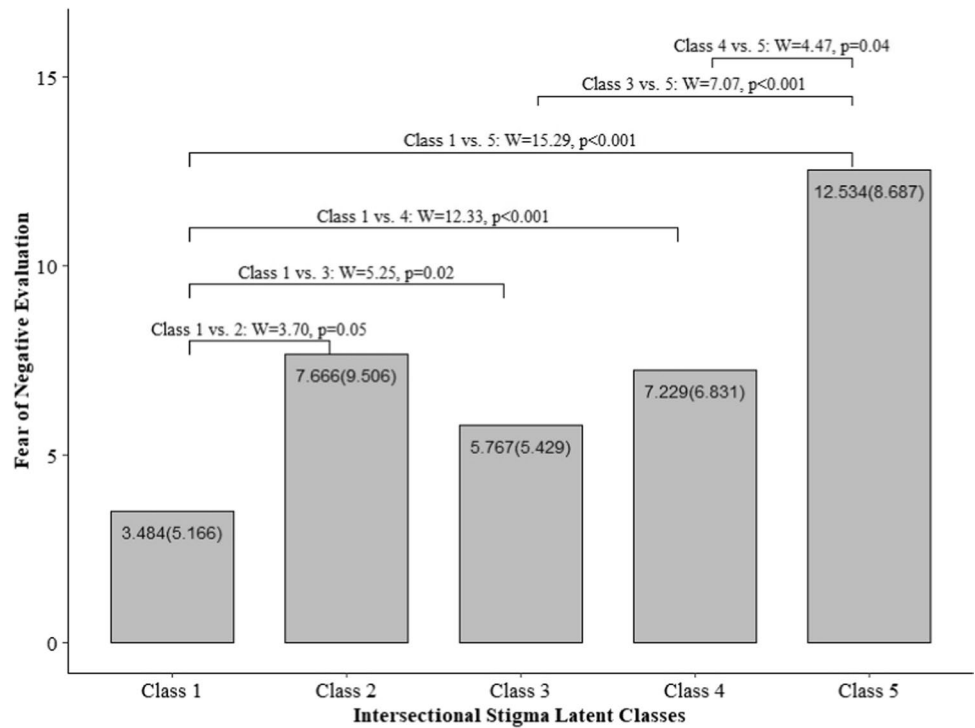
Table 4 Path-analysis results: direct associations (N = 409)

	OUTCOME					
	FNE[a]		CESD[b]		ADH[c]	
	B	p-value	B	p-value	B	p-value
Class 1: Low Stigmas (Ref. group)						
Class 2: Moderate SU stigma	4.927	0.03	7.619	0.007	− 5.086	0.30
Class 3: Higher HIV and lower SU stigma	2.511	0.01	2.175	0.24	− 6.755	0.19
Class 4: High SU and moderate HIV stigma	3.293	0.001	6.354	<0.001	− 9.141	0.02
Class 5: High HIV and moderate SU stigma	8.063	<0.001	6.203	0.03	2.474	0.27
FNE			0.583	<0.001	− 0.248	0.03
CESD					− 0.228	0.002

B: Unstandardized linear regression coefficient; The model included intersectionality stigma classes, fear of negative evaluation (FNE), depression symptoms (CESD) as predictors of ART adherence (ADH). Model adjusted for covariates, including Age, Income, Marital status, Education, Race, Ethnicity, Drug use. a) Fear of Negative Evaluation: Fig. 1, path a; b) CESD, Depression symptoms: Fig. 1, path b; c) Adherence: Fig. 1, path c

depression symptoms. We analyzed direct and indirect associations using two serial mediators: fear of negative evaluation (mediator 1) and depression symptoms (mediator 2). The direct associations are presented in Table 4, while the mediated (indirect) associations can be found in Table 5.

Depression symptoms. The associations between stigma classes and depression symptoms were attenuated with fear of negative evaluation in the model (Table 4 and 5). In the model without fear of negative evaluation, class 2 (B = 9.99, p < 0.001), 4 (B = 8.05, p < 0.001), and 5 (B = 10.01, p < 0.001). The differences between class 1 and 2 were approaching statistical significance (B = 3.35, p = 0.065). With fear of negative evaluation in the model, these differences remained statistically significant, but their magnitude decreased class 2 (B = 7.62, p = 0.007), 4 (B = 6.35, p < 0.001), and 5 (B = 6.20, p = 0.03). These findings suggest that fear of negative evaluation significantly mediated the association between stigma classes and depression symptoms (Table 5).

Table 5 Path-analysis results: indirect associations, simple and serial mediation paths (N = 409)

	IS→FNE→CESD		IS→CESD→ADH		IS→FNE→CESD→ADH	
	B	p-value	B	p-value	B	p-value
Class 1: Low Stigmas (Ref. group)						
Class 2: Moderate SU stigma	**2.870**	**0.04**	**− 1.734**	**0.04**	− 0.653	0.09
Class 3: Higher HIV & lower SU stigma	**1.463**	**0.02**	− 0.495	0.27	− 0.333	0.07
Class 4: High SU & moderate HIV stigma	**1.918**	**0.004**	**− 1.446**	**0.02**	**− 0.437**	**0.04**
Class 5: High HIV & moderate SU stigma	**4.696**	**< 0.001**	− 1.412	0.07	**− 1.069**	**0.02**

Bold values indicate statistically significant coefficients

B: linear regression path coefficient; IS: Intersectional Stigma Classes; CESD: Depression symptoms; FNE: Fear of Negative Evaluation; ADH: ART Adherence; The model included intersectionality stigma classes as the main predictor of ART adherence, and FNE, and depression symptoms as mediators. Model adjusted for covariates, including Age, Income, Marital status, Education, Race, Ethnicity, Drug use

Adherence. The inclusion of fear of negative evaluation and depression symptoms in the model attenuated associations between stigma classes and adherence levels. In the unadjusted model (without fear of negative evaluation and depression symptoms), women in classes 3 (B = -11.06, p = 0.003) and 4 (B = -9.81, p = 0.001) had significantly lower adherence levels compared to those with low stigmas (class 1; Table 3). Path-analysis results indicate that fear of negative evaluation and depression symptoms mediate the association between stigma and adherence in a serial fashion. Fear of negative evaluation was associated with higher levels of depression symptoms (B = 0.58, p < 0.001). Fear of negative evaluation and depression symptoms were both associated with lower ART adherence levels (B = -0.25, p = 0.03 and B = -0.23, p = 0.002, respectively).

Because women in class 4 experience higher levels of depression symptoms (B = 6.35, p < 0.001; Table 4) compared to women with low stigmas (class 1), they also show lower adherence levels (B = -1.45, p = 0.02; Table 5). In addition, adherence is further reduced due to fear of negative evaluation and depression symptoms as a result of facing high SU stigma and moderate HIV stigma (class 4) or high HIV stigma and moderate SU stigma (class 5). Specifically, compared to class 1, women in class 4 and 5 reported higher fear of negative evaluation levels (B = 3.29, p = 0.001 and B = 8.06, p < 0.001; Table 4), which may result in higher levels of depression symptoms (B = 1.92, p = 0.004 and B = 4.70, p < 0.001; Table 5). This, in turn, may lead to lower ART adherence levels (B = -0.44, p = 0.04, and B = -1.07, p = 0.02; Table 5). Considering the approaching statistical significance of indirect associations (p < 0.1), we conclude that depression symptoms and fear of negative evaluation may be mechanisms through which intersectional stigma affects adherence levels.

Discussion

This study examined ART adherence differences among participants with unique combinations of experienced HIV and SU stigma, identifying five distinct classes. Class 1 represented low experienced intersectional stigmas, while class 2 had moderate SU stigma and class 3 had higher HIV stigma. Classes 4 and 5 had higher overall stigma experiences, but with differing intensities between HIV and SU stigma. The MLCIRT approach revealed nuanced experiences of intersectional stigmas that traditional quantitative methods may miss (e.g., linear regression models with interaction terms [52]).

In examining the relationship between intersectional experienced stigma and depression, we found that women with low HIV and SU stigma (class 1) had the lowest levels of depression. Significant differences in depression symptoms were observed between class 1 and classes 2, 4, and 5, as well as between class 3 and these same classes. Women with higher SU stigma experienced nearly double the severity of depression symptoms compared to those with low HIV and SU stigmas. These results highlight the elevated risk of depression symptoms among participants with higher SU stigma. Additionally, depression symptoms stemming from intersectional experienced stigmas have implications for ART adherence and health outcomes [61, 62]. Thus, interventions focused on treating depression may not only directly reduce depression symptoms, but they may also indirectly impact ART adherence. Psychological interventions that incorporate a cognitive-behavioral component and that also address stigma may be particularly effective in treating depression among PLWH [63].

Additionally, fear of negative evaluation by others may be a key modifiable mechanism through which intersectional experienced stigmas affect WLHIV's mental health and HIV treatment outcomes. Women who experienced any

type and level of stigma had higher levels of fear of negative evaluation. Specifically, women with higher HIV stigma and moderate SU stigma (class 5) had three times higher levels of fear of negative evaluation compared to those with lower levels of both stigmas (class 1). These findings align with previous research on the negative effects of HIV- and SU-related stigma separately [19, 64], but extends this work by elucidating the impact of different intersectional stigma profiles on mental health outcomes. Consistent with our findings on depression, women in class 1 had the lowest levels of fear of negative evaluation, and significant differences were observed between class 1 and all other classes. Additionally, women in classes 2, 3, and 5 had twice the levels of fear of negative evaluation compared to class 1, while class 5 showed fear of negative evaluation levels four times higher than class 1.

Stigma, and ensuing fear of negative evaluation, may also impact suboptimal treatment adherence partly because it may increase concerns about being seen taking HIV medication [65]. It is important to note that the relationship between experienced stigma and fear of negative evaluation may be bidirectional. Individuals who fear being poorly evaluated by others may be especially attuned to social status concerns and regularly scan their surroundings for signs of negative evaluation. People who have higher levels of fear of negative evaluation have a greater propensity to read social ambiguity in a way that is detrimental [66] and a higher propensity to attune their attentional bias to negative social threats [67]. Thus, the fear of being evaluated and judged negatively by others may enhance the amount of experienced stigma a person perceives. While stigma related to specific identities or conditions and a general fear of negative evaluation are similar constructs, studies have shown that these two constructs represent two distinct pathways through which aspects of the social environment impact mental and physical health [40, 68].

We found significant differences in ART adherence levels based on the combinations of intersectional experienced stigmas (i.e., latent classes). ART levels for women who experienced moderate HIV and high SU stigma (class 4; 73.14%) or higher HIV stigma (class 3; 89.84%) were significantly lower compared with the remaining classes (approximately 93%). These differences have important clinical implications. Currently available ART regimens lead to viral suppression when ART adherence are reported to be more than 80% [57]. ART adherence is also independently associated with lower chronic immune activation [69, 70], which has been associated with greater risk of comorbidities (e.g., cardiovascular disease) and premature death [71, 72]. Because of the significantly lower levels of ART adherence associated with intersectional experienced stigmas, women who experience HIV and SU stigma might be at a higher risk for poor HIV treatment outcomes and comorbidities.

Our mediation analysis sheds light on the mechanisms through which HIV and SU stigma may jointly impact ART adherence. Results are consistent with prior research suggesting that fear of negative evaluation is associated with increased symptoms of depression [46, 47]. Our results suggest that depression symptom level is a mechanism through which women who experience higher levels of HIV stigma and moderate SU stigma (class 5) or higher SU stigma and some HIV stigma (class 4) have significantly lower levels of ART adherence. These results go beyond previous reports, showing that, by exacerbating depression symptoms, fear of negative evaluation might indirectly reduce ART adherence. These findings have practical utility in the selection and development of interventions designed to increase uptake and adherence to ART medications. In addition to addressing structural factors affecting health outcomes for PLWH [73], such as efforts to reduce stigmatizing behaviors and attitudes toward PLWH and people who use substances among community and families, psychosocial interventions are also needed. Interventions that address the fear of criticism, such as cognitive-behavioral therapies for anxiety, may be a successful strategy to mitigate the detrimental effects of experienced stigma on ART adherence, especially if they increase their focus on reducing fear of negative evaluation by others. Cognitive-behavioral, acceptance and commitment, mindfulness, problem-solving, self-affirmation interventions, and stress inoculation interventions have shown promise to promote resilience and mitigate the effects of experienced stigma [74, 75].

In Fig. 3, we presented the average adherence levels across the latent classes. Participants in class 3, characterized by higher HIV experienced stigma, and class 4, characterized by high SU and moderate HIV experienced stigma, exhibited significantly lower levels of ART adherence compared to those in class 1. Adherence levels were lower in classes 2 and 5 compared to class 1, but the difference was not statistically significant (Table 3). Notably, participants in class 4 demonstrated significantly lower adherence levels than participants in all other classes (Fig. 3).

Limitations and Strengths

Potential limitations of our study include the use of cross-sectional data, impeding the inference of causal relationships, and the self-reported nature of the data. With self-reported data, there is always a chance that social desirability bias may affect participant responses; for example, by causing underreporting of drug use and stigmatizing experiences. Another limitation of our study is that detailed SU data were

not collected. However, the purpose of this investigation was to examine associations between participants' experiences of SU stigma and HIV-related outcomes rather than quantifying details of their actual substance use. Further, it is interesting to consider marijuana in the context of other substances because the landscape of marijuana use stigmatization is changing so rapidly with legalization of marijuana gaining traction in multiple states. Similarly, there is some evidence that stigma may vary by geography and political landscapes, however, this was beyond the scope of this investigation and will be an important question for future research to address. Notwithstanding these limitations, our study has several strengths, such as the use of MLCIRT, that has allowed us to highlight a significant relationship between intersectional experienced stigma profiles, ART adherence, depression, and fear of negative evaluation.

Conclusion

As the overdose epidemic grows globally, the impact of SU-related stigma has drawn much attention, but research on the intersections of HIV related and SU-related stigma is limited [52]. This study strengthens the existing evidence on HIV and SU experienced stigmas by elucidating a more nuanced understanding of these stigmas and linking them to adherence and mental health outcomes. Current stigma reduction strategies based on traditional variable-centered analytical findings may miss important stigma-health behavior connections. Multi-level stigma reduction interventions must address these stigmas simultaneously to improve outcomes. Recently, a set of program recommendations for addressing intersectional stigma among people living with HIV has been developed [76]. These recommendations underscore the importance of prioritizing community ownership, engagement, and connectedness in successful stigma reduction interventions. Emphasis is placed on establishing equal partnerships between communities and researchers, acknowledging diverse skill sets, and ensuring equitable sharing of resources. The use of non-traditional, community-driven methodologies, collaboration with mental health researchers, and incorporation of frontline service providers' perspectives are highlighted for comprehensive intervention approaches. The recommendations also advocate for expansive intersectional stigma interventions, validated impact measures, and flexible, dynamic approaches in creating evidence-based compendiums for addressing intersectional stigmas. Finally, the recommendations note the importance of addressing funding priorities. With a call to broaden support beyond behavioral and biomedical outcomes to encompass stigma reduction and community empowerment through funding multilevel interventions.

Our research highlights factors that may mediate effects of intersectional experienced stigma on ART adherence.

After identifying a potentially modifiable intervention target, next steps may include identifying change strategies to reduce stigma and assessing their impact on ART adherence. Greater understanding of the causal mechanisms underlying the links between stigma and HIV outcomes will help refine the types of skills and behaviors to include in interventions to reduce stigma's harmful effects. Interventions targeting depression and fear of negative evaluation may mitigate the impact of intersectional stigma on HIV treatment outcomes. These interventions may improve WLHIV well-being and reduce depression, promoting ART adherence and HIV treatment behaviors and outcomes.

Author Contributions KLS: Conceptualization, Visualization Writing—Original Draft Preparation, Writing—Review and Editing; ANP: Conceptualization, Formal Analysis, Methodology, Writing—Original Draft Preparation, Visualization; RLC: Funding Acquisition, Investigation, Writing—Review and Editing; M-CK: Funding Acquisition, Investigation, Writing—Review and Editing; DK-P: Funding Acquisition, Investigation, Writing—Review and Editing; TEW: Funding Acquisition, Investigation, Writing—Review and Editing; PCT: Funding Acquisition, Investigation, Writing—Review and Editing; GW: Funding Acquisition, Investigation, Writing—Review and Editing, TBN: Funding Acquisition, Investigation, Writing—Review and Editing, MOJ: Funding Acquisition, Investigation, Writing—Review and

Declarations

Conflict of interest Kristi Lynn Stringer, Andrea Norcini Pala, Robert L Cook, Mirjam-Colette Kempf, Deborah Konkle-Parker, Tracey E. Wilson, Phyllis C. Tien, Gina Wingood, Torsten B. Neilands, Mallory O. Johnson, Carmen H. Logie, Sheri D. Weiser, Janet M. Turan, and Bulent Turan declare that they have no conflict of interest.

References

1. Parsons JT, Starks TJ, Millar BM, Boonrai K, Marcotte D. Patterns of substance use among HIV-positive adults over 50: implications for treatment and medication adherence. Drug Alcohol Depend. 2014;139:33–40. https://doi.org/10.1016/j.drugalcdep.2014.02.704.

2. Gonzalez A, Mimiaga MJ, Israel J, Bedoya CA, Safren SA. Substance use predictors of poor medication adherence: the role of substance use coping among HIV-infected patients in opioid dependence treatment. AIDS Behav. 2013;17(1):168–73. https://doi.org/10.1007/s10461-012-0319-6.

3. Zhang Y, Wilson TE, Adedimeji A, et al. The impact of substance use on adherence to antiretroviral therapy among HIV-infected women in the United States. AIDS Behav. 2018;22(3):896–908. https://doi.org/10.1007/s10461-017-1808-4.

4. Ghiam MK, Rebeiro PF, Turner M, et al. Trends in HIV continuum of care outcomes over ten years of follow-up at a large HIV primary medical home in the Southeastern United States. AIDS Res Hum Retroviruses. 2017;33(10):1027–34. https://doi.org/10.1089/aid.2017.0016.

5. Hall HI, Frazier EL, Rhodes P, et al. Differences in human immunodeficiency virus care and treatment among subpopulations in the United States. JAMA Intern Med. 2013;173(14):1337–44. https://doi.org/10.1001/jamainternmed.2013.6841.

6. Petoumenos K, Law MG. Smoking, alcohol and illicit drug use effects on survival in HIV-positive persons. Curr Opin HIV AIDS. 2016;11(5):514–20. https://doi.org/10.1097/COH.0000000000000306.

7. Meyer JP, Zelenev A, Wickersham JA, Williams CT, Teixeira PA, Altice FL. Gender disparities in HIV treatment outcomes following release from jail: results from a multicenter study. Am J Public Health. 2014;104(3):434–41. https://doi.org/10.2105/AJPH.2013.301553.

8. Crepaz N, Tang T, Marks G, Hall HI. Viral suppression patterns among persons in the United States with diagnosed HIV infection in 2014. Ann Intern Med. 2017;167(6):446–7. https://doi.org/10.7326/L17-0278.

9. Donoghoe MC, Bollerup AR, Lazarus JV, Nielsen S, Matic S. Access to highly active antiretroviral therapy (HAART) for injecting drug users in the WHO European Region 2002–2004. Int J Drug Policy. 2007;18(4):271–80. https://doi.org/10.1016/j.drugpo.2007.02.010.

10. Wood E, Hogg RS, Lima VD, et al. Highly active antiretroviral therapy and survival in HIV-infected injection drug users. JAMA. 2008;300(5):550–4. https://doi.org/10.1001/jama.300.5.550.

11. Werb D, Mills EJ, Montaner JSG, Wood E. Risk of resistance to highly active antiretroviral therapy among HIV-positive injecting drug users: a meta-analysis. Lancet Infect Dis. 2010;10(7):464–9. https://doi.org/10.1016/S1473-3099(10)70097-9.

12. Goffman E. Stigma: notes on the management of spoiled identity. New York: Simon and Schuster; 1968.

13. Link BG, Phelan JC. Conceptualizing stigma. Annu Rev Sociol. 2001;27(1):363–85. https://doi.org/10.1146/annurev.soc.27.1.363.

14. Sullivan MC, Rosen AO, Allen A, et al. Falling short of the first 90: HIV stigma and HIV testing research in the 90–90–90 era. AIDS Behav. 2020;24(2):357–62. https://doi.org/10.1007/s10461-019-02771-7.

15. Nyblade L, Mingkwan P, Stockton MA. Stigma reduction: an essential ingredient to ending AIDS by 2030. The Lancet HIV. 2021;8(2):e106–13. https://doi.org/10.1016/S2352-3018(20)30309-X.

16. Yigit I, Bayramoglu Y, Weiser SD, et al. Changes in internalized stigma and HIV health outcomes in individuals new to HIV care: the mediating roles of depression and treatment self-efficacy. AIDS Patient Care STDS. 2020;34(11):491–7. https://doi.org/10.1089/apc.2020.0114.

17. Turan B, Rice WS, Crockett KB, et al. Longitudinal association between internalized HIV stigma and antiretroviral therapy adherence for women living with HIV: the mediating role of depression. AIDS. 2019;33(3):571–6. https://doi.org/10.1097/QAD.0000000000002071.

18. Rice WS, Burnham K, Mugavero MJ, Raper JL, Atkins GC, Turan B. Association between internalized HIV-related stigma and HIV care visit adherence. J Acquir Immune Defic Syndr. 2017;76(5):482–7. https://doi.org/10.1097/QAI.0000000000001543.

19. Rueda S, Mitra S, Chen S, 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. https://doi.org/10.1136/bmjopen-2016-011453.

20. Sweeney SM, Vanable PA. The association of HIV-related stigma to HIV medication adherence: a systematic review and synthesis of the literature. AIDS Behav. 2016;20(1):29–50. https://doi.org/10.1007/s10461-015-1164-1.

21. Tsai AC, Kiang MV, Barnett ML, et al. Stigma as a fundamental hindrance to the United States opioid overdose crisis response. PLoS Med. 2019;16(11):e1002969. https://doi.org/10.1371/journal.pmed.1002969.

22. Pachankis JE, Hatzenbuehler ML, Wang K, et al. The burden of stigma on health and wellbeing: a taxonomy of concealment, course, disruptiveness, aesthetics, origin, and peril across 93 stigmas. Pers Soc Psychol Bull. 2018;44(4):451–74. https://doi.org/10.1177/0146167217741313.

23. Ventura CAA, Carrara BS, Fernandes RHH, et al. General beliefs about illicit drug use and stigma: perspective of people who use illicit drugs. Commun Ment Health J. 2022;58(7):1346–53. https://doi.org/10.1007/s10597-022-00944-8.

24. Lloyd C. The stigmatization of problem drug users: a narrative literature review. Drugs: Educ Prev Policy. 2013;20(2):85–95. https://doi.org/10.3109/09687637.2012.743506.

25. Stringer KL, Baker EH. Stigma as a barrier to substance abuse treatment among those with unmet need: an analysis of parenthood and marital status. J Fam Issues. 2018;39(1):3–27. https://doi.org/10.1177/0192513X15581659.

26. Patel P, Borkowf CB, Brooks JT, Lasry A, Lansky A, Mermin J. Estimating per-act HIV transmission risk: a systematic review. AIDS. 2014;28(10):1509–19. https://doi.org/10.1097/QAD.0000000000000298.

27. Crenshaw K. Mapping the margins: intersectionality, identity politics, and violence against women of color. Stanf Law Rev. 1991;43(6):1241. https://doi.org/10.2307/1229039.

28. Stringer KL, Mukherjee T, McCrimmon T, et al. Attitudes towards people living with HIV people who inject drugs: a mixed method study of stigmas within harm reduction programs in Kazakhstan. Int J Drug Policy. 2019;68:27–36. https://doi.org/10.1016/j.drugpo.2019.02.007.

29. Mburu G, Ayon S, Tsai AC, et al. "Who has ever loved a drug addict? It's a lie. They think a 'teja' is as bad person": multiple stigmas faced by women who inject drugs in coastal Kenya. Harm Reduct J. 2018;15:29. https://doi.org/10.1186/s12954-018-0235-9.

30. Kumar S, Gupte HA, Isaakidis P, Mishra JK, Munjattu JF. "They don't like us….": Barriers to antiretroviral and opioid substitution therapy among homeless HIV positive people who inject drugs in Delhi: a mixed method study. PLoS ONE. 2018;13(8):e0203262. https://doi.org/10.1371/journal.pone.0203262.

31. Medina-Perucha L, Scott J, Chapman S, Barnett J, Dack C, Family H. A qualitative study on intersectional stigma and sexual health among women on opioid substitution treatment in England: implications for research, policy and practice. Soc Sci Med. 2019;222:315–22. https://doi.org/10.1016/j.socscimed.2019.01.022.

32. Earnshaw VA, Smith LR, Cunningham CO, Copenhaver MM. Intersectionality of internalized HIV stigma and internalized substance use stigma: implications for depressive symptoms. J Health Psychol. 2015;20(8):1083–9. https://doi.org/10.1177/1359105313507964.

33. Stringer KL, Marotta P, Baker E, et al. Substance use stigma and antiretroviral therapy adherence among a drug-using population living with HIV. AIDS Patient Care STDS. 2019;33(6):282–93. https://doi.org/10.1089/apc.2018.0311.

34. Vetrova MV, Cheng DM, Bendiks S, et al. HIV and substance use stigma, intersectional stigma and healthcare among HIV-positive PWID in Russia. AIDS Behav. 2021;25(9):2815–26. https://doi.org/10.1007/s10461-021-03172-5.

35. Batchelder AW, Foley JD, Wirtz MR, Mayer K, O'Cleirigh C. Substance use stigma, avoidance coping, and missed HIV appointments among MSM who use substances. AIDS Behav. 2021;25(5):1454–63. https://doi.org/10.1007/s10461-020-02982-3.

36. Watson D, Friend R. Measurement of social-evaluative anxiety. J Consult Clin Psychol. 1969;33(4):448–57. https://doi.org/10.1037/h0027806.

37. Kemeny ME. Psychobiological responses to social threat: evolution of a psychological model in psychoneuroimmunology. Brain Behav Immun. 2009;23(1):1–9. https://doi.org/10.1016/j.bbi.2008.08.008.

38. Cole SW, Kemeny ME, Taylor SE. Social identity and physical health: accelerated HIV progression in rejection-sensitive gay men. J Pers Soc Psychol. 1997;72(2):320–35. https://doi.org/10.1037/0022-3514.72.2.320.

39. Dickerson SS, Kemeny ME. Acute stressors and cortisol responses: a theoretical integration and synthesis of laboratory research. Psychol Bull. 2004;130(3):355–91. https://doi.org/10.1037/0033-2909.130.3.355.

40. Turan B, Crockett KB, Buyukcan-Tetik A, et al. Buffering internalization of HIV stigma: implications for treatment adherence and depression. J Acquir Immune Defic Syndr. 2019;80(3):284–91. https://doi.org/10.1097/qai.0000000000001915.

41. Turan B, Smith W, Cohen MH, et al. Mechanisms for the negative effects of internalized HIV-related stigma on antiretroviral therapy adherence in women: the mediating roles of social isolation and depression. J Acquir Immune Defic Syndr. 2016;72(2):198–205. https://doi.org/10.1097/QAI.0000000000000948.

42. Rao D, Feldman BJ, Fredericksen RJ, et al. A structural equation model of HIV-related stigma, depressive symptoms, and medication adherence. AIDS Behav. 2012;16(3):711–6. https://doi.org/10.1007/s10461-011-9915-0.

43. Glynn TR, Llabre MM, Lee JS, et al. Pathways to health: an examination of HIV-related stigma, life stressors, depression, and substance use. Int J Behav Med. 2019;26(3):286–96. https://doi.org/10.1007/s12529-019-09786-3.

44. Wang K, Schick MR, Quinn DL, Weiss NH. The role of emotion dysregulation in the association between substance use stigma and depressive symptoms among trauma-exposed, substance-using individuals. Stigma and Health. Published online 2021:No Pagination Specified-No Pagination Specified. https://doi.org/10.1037/sah0000313

45. Luoma JB, O'Hair AK, Kohlenberg BS, Hayes SC, Fletcher L. The development and psychometric properties of a new measure of perceived stigma toward substance users. Subst Use Misuse. 2010;45(1–2):47–57. https://doi.org/10.3109/10826080902864712.

46. Button KS, Kounali D, Stapinski L, Rapee RM, Lewis G, Munafò MR. Fear of negative evaluation biases social evaluation inference: evidence from a probabilistic learning task. PLoS ONE. 2015;10(4):e0119456. https://doi.org/10.1371/journal.pone.0119456.

47. Kornienko O, Santos CE. The effects of friendship network popularity on depressive symptoms during early adolescence: moderation by fear of negative evaluation and gender. J Youth Adolesc. 2014;43(4):541–53. https://doi.org/10.1007/s10964-013-9979-4.

48. Williams KC, Falkum E, Martinsen EW. Fear of negative evaluation, avoidance and mental distress among hearing-impaired employees. Rehabil Psychol. 2015;60(1):51–8. https://doi.org/10.1037/rep0000028.

49. Talhat K, Aslam N. Fear of negative evaluation and psychological distress among patients of drug addiction. J Indian Acad Appl Psychol. 2012;39:44–54.

50. Logie CH, Wang Y, Lacombe-Duncan A, et al. HIV-related stigma, racial discrimination, and gender discrimination: pathways to physical and mental health-related quality of life among a national cohort of women living with HIV. Prev Med. 2018;107:36–44. https://doi.org/10.1016/j.ypmed.2017.12.018.

51. Rice WS, Logie CH, Napoles TM, et al. Perceptions of intersectional stigma among diverse women living with HIV in the United States. Soc Sci Med. 2018;208:9–17. https://doi.org/10.1016/j.socscimed.2018.05.001.

52. Turan JM, Elafros MA, Logie CH, et al. Challenges and opportunities in examining and addressing intersectional stigma and health. BMC Med. 2019;17:7. https://doi.org/10.1186/s12916-018-1246-9.

53. Earnshaw VA, Smith LR, Chaudoir SR, Amico KR, Copenhaver MM. HIV stigma mechanisms and well-being among PLWH: a test of the HIV stigma framework. AIDS Behav. 2013;17(5):1785–95. https://doi.org/10.1007/s10461-013-0437-9.

54. Leary MR. A brief version of the fear of negative evaluation scale. Pers Soc Psychol Bull. 1983;9(3):371–5. https://doi.org/10.1177/0146167283093007.

55. Rodebaugh TL, Woods CM, Thissen DM, Heimberg RG, Chambless DL, Rapee RM. More information from fewer questions: the factor structure and item properties of the original and brief fear of negative evaluation scale. Psychol Assess. 2004;16(2):169–81. https://doi.org/10.1037/1040-3590.16.2.169.

56. Radloff LS. The CES-D scale: a self-report depression scale for research in the general population. Appl Psychol Meas. 1977;1(3):385–401. https://doi.org/10.1177/014662167700100306.

57. Wilson IB, Lee Y, Michaud J, Fowler FJ, Rogers WH. Validation of a new three-item self-report measure for medication adherence. AIDS Behav. 2016;20(11):2700–8. https://doi.org/10.1007/s10461-016-1406-x.

58. Revelle W. psych: procedures for psychological, psychometric, and personality research. 2022.

59. Jung T, Wickrama KAS. An introduction to latent class growth analysis and growth mixture modeling: latent trajectory classes. Soc Pers Psychol Compass. 2008;2(1):302–17. https://doi.org/10.1111/j.1751-9004.2007.00054.x.

60. Nylund KL, Asparouhov T, Muthén BO. Deciding on the number of classes in latent class analysis and growth mixture modeling: a monte carlo simulation study. Struct Equ Model. 2007;14(4):535–69. https://doi.org/10.1080/10705510701575396.

61. Remien RH, Stirratt MJ, Nguyen N, Robbins RN, Pala AN, Mellins CA. Mental health and HIV/AIDS: the need for an integrated response. AIDS. 2019;33(9):1411–20. https://doi.org/10.1097/QAD.0000000000002227.

62. Koenig LJ, O'Leary A. Improving health outcomes for women with HIV: the potential impact of addressing internalized stigma and depression. AIDS. 2019;33(3):577–9. https://doi.org/10.1097/QAD.0000000000002072.

63. Sherr L, Clucas C, Harding R, Sibley E, Catalan J. HIV and depression—a systematic review of interventions. Psychol Health Med. 2011;16(5):493–527. https://doi.org/10.1080/13548506.2011.579990.

64. Kulesza M, Larimer ME, Rao D. Substance use related stigma: what we know and the way forward. J Addict Behav Ther Rehabil. 2013;2(2):782. https://doi.org/10.4172/2324-9005.1000106.

65. Seghatol-Eslami VC, Dark HE, Raper JL, Mugavero MJ, Turan JM, Turan B. Brief report: interpersonal and intrapersonal factors as parallel independent mediators in the association between internalized HIV stigma and ART adherence. J Acquir Immune Defic Syndr. 2017;74(1):e18–22. https://doi.org/10.1097/QAI.0000000000001177.

66. Dryman MT, Heimberg RG. Emotion regulation in social anxiety and depression: a systematic review of expressive suppression and cognitive reappraisal. Clin Psychol Rev. 2018;65:17–42. https://doi.org/10.1016/j.cpr.2018.07.004.

67. Tanaka H, Ikegami T. Fear of negative evaluation moderates effects of social exclusion on selective attention to social signs. Cogn Emot. 2015;29(7):1306–13. https://doi.org/10.1080/02699931.2014.977848.

68. Willemse H, Geenen R, Egberts MR, Engelhard IM, Van Loey NE. Perceived stigmatization and fear of negative evaluation: two distinct pathways to body image dissatisfaction and self-esteem in burn survivors. Psychol Health. 2021. https://doi.org/10.1080/08870446.2021.1970160.

69. Castillo-Mancilla JR, Musinguzi N, Asiimwe S, et al. High residual inflammation despite HIV viral suppression: lessons learned from real-time adherence monitoring among people with HIV in Africa. HIV Med. 2022;23(5):465–73. https://doi.org/10.1111/hiv.13200.

70. Castillo-Mancilla JR, Phillips AN, Neaton JD, et al. Incomplete ART adherence is associated with higher inflammation in individuals who achieved virologic suppression in the START study. J Intern AIDS Soc. 2019. https://doi.org/10.1002/jia2.25297.

71. Peterson TE, Baker JV. Assessing inflammation and its role in comorbidities among persons living with HIV. Curr Opin Infect Dis. 2019;32(1):8–15. https://doi.org/10.1097/QCO.0000000000000510.

72. Duffau P, Ozanne A, Bonnet F, et al. Multimorbidity, age-related comorbidities and mortality: association of activation, senescence and inflammation markers in HIV adults. AIDS. 2018;32(12):1651–60. https://doi.org/10.1097/QAD.0000000000001875.

73. Whittle HJ, Leddy AM, Shieh J, et al. Precarity and health: theorizing the intersection of multiple material-need insecurities, stigma, and illness among women in the United States. Soc Sci Med. 2020;245:112683. https://doi.org/10.1016/j.socscimed.2019.112683.

74. Leppin AL, Bora PR, Tilburt JC, et al. The efficacy of resiliency training programs: a systematic review and meta-analysis of randomized trials. PLoS ONE. 2014;9(10):e111420. https://doi.org/10.1371/journal.pone.0111420.

75. Kim GM, Lim JY, Kim EJ, Park S. Resilience of patients with chronic diseases: a systematic review. Health Soc Care Commun. 2019;27(4):797–807. https://doi.org/10.1111/hsc.12620.

76. Kerr J, Lelutiu-Weinberger C, Nelson LE, et al. Addressing intersectional stigma in programs focused on ending the HIV epidemic. Am J Public Health. 2022;112(S4):S362–6. https://doi.org/10.2105/AJPH.2021.306657.

Authors and Affiliations

Kristi Lynn Stringer[1] · **Andrea Norcini Pala**[2] · **Robert L. Cook**[3] · **Mirjam-Colette Kempf**[4] · **Deborah Konkle-Parker**[5] · **Tracey E. Wilson**[6] · **Phyllis C. Tien**[7] · **Gina Wingood**[8] · **Torsten B. Neilands**[9] · **Mallory O. Johnson**[9] · **Carmen H. Logie**[10,11] · **Sheri D. Weiser**[12] · **Janet M. Turan**[13,14] · **Bulent Turan**[15,16]

✉ Kristi Lynn Stringer
  Kristi.stringer@Mtsu.edu

1 Department of Health and Human Performance, Community and Public Health, Middle Tennessee State University, Murfreesboro, TN 37132, USA

2 Columbia School of Social Work, Columbia University, New York, NY, USA

3 Department of Epidemiology, Colleges of Public Health and Health Professions and Medicine, University of Florida, Gainesville, FL, USA

4 Schools of Nursing, Public Health, and Medicine, University of Alabama at Birmingham, Birmingham, AL, USA

5 Schools of Nursing, Medicine and Population Health, University of Mississippi Medical Center, Oxford, MS, USA

[6] Department of Community Health Sciences, School of Public Health, State University of New York Downstate Health Sciences University, Brooklyn, NY, USA

[7] Department of Medicine, Department of Veteran Affairs Medical Center, University of California, San Francisco and Medical Service, San Francisco, CA, USA

[8] Department of Sociomedical Sciences, Columbia University Mailman School of Public Health, New York City, NY, USA

[9] Division of Prevention Science, Department of Medicine, University of California, San Francisco, San Francisco, CA, USA

[10] Factor-Inwentash Faculty of Social Work, University of Toronto, Toronto, ON, USA

[11] Women's College Research Institute, Women's College Hospital, Toronto, ON, USA

[12] Division of HIV, ID and Global Medicine, Department of Medicine, University of California, San Francisco, San Francisco, CA, USA

[13] Department of Health Policy and Organization, School of Public Health, University of Alabama at Birmingham, Birmingham, AL, USA

[14] Department of Public Health, School of Medicine, Koc University, Istanbul, Turkey

[15] College of Social Sciences and Humanities, Psychology, Koc University, Istanbul, Turkey

[16] Department of Psychology, University of Alabama at Birmingham, Birmingham, AL, USA