Intersectional HIV and Chronic Pain Stigma: Implications for Mood, Sleep, and Pain Severity

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Introduction

An emerging literature attests to the fact that chronic pain is a common and debilitating comorbidity for people with HIV (PWH).[1-5] Chronic pain is associated with missed healthcare visits, poor adherence to anti-retroviral therapy (ART), lower CD4 + cell counts, and substance use disorders for PWH.[4,6,7] Another unfortunate consequence of chronic pain is stigmatization. Many chronic pain conditions are "non-specific" in nature, and non-specific chronic pain deviates from the commonly held belief that pain is the direct result of an identifiable injury or pathology.[8] As a result, people with chronic pain frequently feel invalidated and devalued by family, friends, and healthcare providers, particularly when their pain is not clearly medically understood (ie, non-specific).[9-11] PWH and chronic pain are at high risk of experiencing intersectional stigma due to the stigmatizing nature of their HIV status and chronic pain condition. Intersectional stigma is a concept that refers to the convergence of multiple stigmatized identities within a person or group and their effects on health.[12] Early on, stigmatized identities were often studied and analyzed in isolation. However, it has become clear that intersecting forms of stigma are common. Contemporary research that assumes an intersectional perspective is necessary to better understand how living with multiple stigmatized identities may come to affect physical and mental health outcomes, as well as health behaviors.[12]

Experienced stigma can become internalized when the person experiencing the stigma begins to endorse the stigmatizing beliefs and apply them to the self.[13] According to the stage model of self-stigma (ie internalized stigma), others' stigmatizing behavior will be most detrimental when the stigmatized individual is aware of, agrees with, and applies the stigmatizing attitudes to the self.[14] Therefore, this study focused specifically on internalized HIV and chronic pain stigma, as opposed to reports of anticipated or experienced stigma. The internalization of stigmatizing beliefs often has negative consequences for mental and physical health,[15] which can lead to poor chronic pain outcomes. Indeed, recent research has shown that internalized HIV stigma was associated with greater chronic pain severity in PWH.[16] This association can be better understood when considering that stigmatization represents a type of social rejection that can produce "social pain" on behalf of the individual who experiences and internalizes the stigma.[17] Social pain is now recognized to activate many of the same limbic brain centers that are activated by physical pain.[18] The shared neural network between physical pain and social pain provides a basis for enhanced understanding of how stigma (HIV, chronic pain, or otherwise) may come to affect the chronic pain severity of PWH.

Stigma is a significant social stressor and it stands to reason that stigma may adversely affect psychological and behavioral

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factors known to be relevant for the experience of chronic pain.[19] To illustrate, a recent study revealed that internalized HIV stigma was associated with greater pain severity in PWH, and this association was explained by increased depressive symptoms due to the HIV stigma.[20] Similarly, increased depressive symptoms also helped explain the effect of HIV stigma on poor sleep quality among PWH.[21] Sleep disturbances and poor sleep quality are common in PWH,[22] and poor sleep is a known risk factor for more severe chronic pain.[23] Taken together, it appears that depressive symptoms and sleep quality are likely important factors to consider when evaluating the impact of HIV and chronic pain stigma on chronic pain severity among PWH. When simultaneously considering depressive symptoms and sleep quality as intermediate factors linking stigma to chronic pain severity in PWH, the directionality of these associations must be considered. In a previous study with a non-HIV sample, we found that depressive symptoms beget poor sleep quality, and poor sleep quality was in turn related to greater pain sensitivity.[24] These findings support the directionality of associations whereby stigma gives rise to depressed mood, which in turn gives rise to poor sleep, which subsequently leads to greater chronic pain severity for PWH. However, this sequence of associations has yet to be examined empirically.

To our knowledge, the limited previous research examining stigma in relation to chronic pain severity or other pain-relevant variables (eg, sleep) among PWH has focused exclusively on HIV-related stigma independent of other sources of stigma that likely intersect with HIV stigma.[16,20] Our research group has previously shown that a high level of intersectional HIV and chronic pain stigma was associated with greater severity of depressive symptoms for PWH and chronic pain.[25] As a logical extension of our previous work, we now seek to specifically determine whether intersectional HIV and chronic pain stigma is associated with sleep quality and chronic pain severity in PWH.

The current study expands our previous work by examining the associations of intersectional HIV and chronic pain stigma with depressive symptoms, sleep quality, and chronic pain severity in PWH. We also examined HIV stigma and chronic pain stigma separately in a series of regression-based models to determine whether the association between stigma and chronic pain severity was indirectly accounted for by depressive symptoms and sleep quality. It was hypothesized that high levels of intersectional HIV and chronic pain stigma would be associated with the greatest severity of depressive symptoms, the poorest sleep quality, and the greatest severity of chronic pain in PWH. It was further hypothesized that depressive symptoms and sleep quality would sequentially mediate the association between stigma (HIV and chronic pain) and chronic pain severity in PWH.

Methods

Study Overview

This study was part of a larger investigation that examined psychosocial risk and resilience factors in PWH and chronic pain (Comprehensive HIV and Pain Study; CHIPS). The participants described below were recruited between March 2017 and October 2019. A portion of the data generated from CHIPS has previously been published by our group.[26,27] While some of the data (eg, mood, sleep) published by Cody and colleagues does overlap with the data presented here, this study is unique in that the primary focus is on HIV and chronic pain stigma. The participants and measures described below are limited to those involved in the current study. PWH and chronic pain were recruited via posted flyers from a large, urban HIV clinic in Alabama, USA that provides comprehensive medical, social, and behavioral services to approximately 3500 adults (≥18 years) living with HIV. Participants were assessed for eligibility via an initial telephone screening and review of medical records. Eligible participants subsequently presented to the laboratory to complete a single study session. We determined CD4 + count and viral load for each participant via blood draw. Participants completed standardized self-report questionnaires that assessed their experiences of HIV and chronic pain stigma, as well as depressive symptoms, experiences of insomnia, and pain severity. Sociodemographic information was collected from all participants including age, sex/gender, and ethnicity/race. Additional information gathered from medical records included prescribed medications (eg, ART, opioids), duration of HIV infection, duration of chronic pain, and other documented health comorbidities.

Ethical Approval and Informed Consent

This study and all procedures were reviewed and approved by the University of Alabama at Birmingham (UAB) Institutional Review Board (approval # IRB-160720003), and carried out in a manner consistent with ethical research guidelines as outlined in the Declaration of Helsinki. All participants provided written informed consent prior to enrollment in the study.

Participants

A total of 91 PWH and chronic pain were enrolled into this cross-sectional study. Six participants were disqualified from further participation due to the presence of one or more exclusion criteria. Three participants did not provide complete data and were omitted from further analysis; leaving a final sample size of 82 PWH and chronic pain. All PWH with chronic pain reported that the pain had been present for at least three consecutive months, and was an ongoing problem for at least half of the days in the past six months.[28] Additional inclusion criteria were age ≥18 years; no evidence of uncontrolled hypertension (ie, resting blood pressure > 150/95); no circulatory disorders (eg, Raynaud's disease); no history of cardiac events, no history of stroke, seizures, or other neurological disorders, no history of metabolic disease, no history of cancer and related treatment, and not currently pregnant. Furthermore, participants were excluded from study participation if they demonstrated signs of acute infection (ie, core body temperature >37.8 °C), reported any pain-alleviating surgery within the past year, or receipt of any pain intervention treatment within the past month (eg,

steroid injection). Written informed consent was obtained from each participant prior to commencing the study, and the participants were compensated for their participation.

Measures

Internalized HIV Stigma. The HIV Stigma Mechanisms Scale is a 24-item measure that assesses internalized stigma, enacted stigma, and anticipated stigma in PWH.[13] Items are measured on a 5-point Likert scale (1 = strongly disagree and 5 = strongly agree) and total scores are calculated by summing the responses from each of the three stigma subscales.[29] For this study, we specifically focused on the internalized stigma subscale and only included it in data analysis. Example items in the internalized stigma subscale include: "Having HIV makes me feel like a bad person", I think less of myself because I have HIV", "Having HIV makes me feel unclean". Scores on this subscale range from 6 to 30 with higher scores representing greater experiences of internalized HIV stigma. The internalized stigma subscale of this measure demonstrated excellent internal consistency in the current study (Cronbach's α = .924).

Internalized Chronic Pain Stigma. The Internalized Stigma of Chronic Pain scale is a 28-item measure that assesses alienation, discrimination experience, social withdrawal, and stigma resistance (reverse coded prior to inclusion in the total score) in individuals with chronic pain.[9] Example items on this measure include: "I feel embarrassed or ashamed that I have chronic pain", "I feel inferior to others who don't have chronic pain", I am disappointed in myself for having chronic pain". Items are measured on a 4-point Likert scale (1 = strongly disagree and 4 = strongly agree) and total scores are calculated by taking the average of the four subscales. Scores range from 1 to 4 and higher scores on this measure indicate greater internalized chronic pain stigma. The Internalized Stigma of Chronic Pain scale used in this study had excellent internal consistency (Cronbach's α = .911).

Depressive Symptoms. The Center for Epidemiological Studies Depression (CES-D) Scale is a 20-item measure that assesses the frequency of depressive symptoms in the past week. Scores on the CES-D range from 0–60, with responses ranging from 0 (never or rarely) to 3 (most of the time) and higher scores representing greater severity of depression. Depressive symptoms that are assessed by the CES-D include negative mood, guilt/worthlessness, helplessness/hopelessness, psychomotor retardation, loss of appetite, and sleep disturbances.[30] Proof of validity and reliability has been shown in the general population, as well as chronic pain and HIV populations.[31,32] The CES-D demonstrated good internal consistency (Cronbach's α = .893) for this study.

Insomnia Severity. The Insomnia Severity Index (ISI) is a 7-item questionnaire that assesses clinically significant symptoms of insomnia.[33] Scores on the ISI range from 0 to 28, with higher scores indicating greater symptoms of insomnia. Interpretation of scores for this measure is broken up into 3 subdivisions:

0–7 = no clinically significant Insomnia; 8–14 = subthreshold insomnia; 15–21 = moderate insomnia; 22–28 = severe insomnia. For the purpose of this study, however, the ISI was analyzed as a continuous variable. The ISI index has been deemed reliable and valid, detecting cases of insomnia in the general population and clinical populations.[33,34] The ISI in this study demonstrated excellent internal consistency (Cronbach's α = .946).

Pain Severity. The Brief Pain Inventory Short-Form (BPI-SF) is an 11-item pain scale that measures pain severity and interference with daily functioning. The BPI-SF includes a 4-item severity scale and a 7-item interference scale that are each averaged to form two composite scores. In this study we focused exclusively on the pain severity subscale of the BPI-SF. Pain severity is assessed by averaging the 4 items assessing current, worst, least and average pain in the last week, with each item having a score that ranges from 0 (no pain) to 10 (worst imaginable pain). Higher scores on the BPI-SF indicate greater pain severity. Previous research has demonstrated the reliability and validity of the BPI-SF in patients with chronic neuropathic pain and musculoskeletal pain.[35,36] Internal consistency of the BPI-SF pain severity subscale used in this study was good (Cronbach's α = .899).

Opioid use. Participants answered the following question regarding opioid use for pain management, *have you used opioid "painkillers" as a treatment for your chronic pain?* For the sake of clarity, this question described opioid painkillers as prescription medications including morphine, codeine, hydrocodone, oxycodone, hydromorphone, oxymorphone, methadone, and tramadol. Only generic names of prescription opioids are listed here; however, participants were provided with generic names as well as their corresponding brand names for reference. Response options to this opioid use question included, *no*, *yes*, or *not sure*. Medical records were reviewed for each participant to determine whether there was an active prescription for any opioid painkiller. Opioid use is to be included as a control variable in our data analytic models described below given previous work by our group showing that opioid use is associated with depressive symptoms, insomnia severity, and chronic pain in PWH.[26]

Statistical Analyses

Descriptive data are reported as either means and standard deviations or medians and interquartile ranges for continuous variables, while categorical variables are presented as numbers and percentages. A correlation matrix was generated to illustrate zero-order associations among continuously measured variables. Differences across categorical variables were examined using one-way Analysis of Variance (ANOVA). Consistent with our previously published work,[25] an intersectional HIV and chronic pain composite variable was created by completing a median split for the internalized HIV stigma subscale (median = 12.0) and the internalized chronic pain stigma scale (median = 1.95). Individuals who scored above the median for both scales were categorized as "high" intersectional HIV and chronic pain stigma, and individuals who scored below the median for both

scales were categorized as "low". Additionally, those who scored above the median for one scale and below the median for another were categorized as "moderate" intersectional HIV and chronic pain stigma. Analysis of covariance (ANCOVA) was utilized to examine the independent associations of the intersectional HIV and chronic pain stigma composite variable to depressive symptoms, insomnia severity, and pain severity while controlling for appropriate covariates. Post-hoc contrasts to examine differences across the high, moderate, and low intersectional HIV and chronic pain stigma groups were completed as necessary. Adjustment for multiple comparisons (ie, 3 pairwise contrasts per ANCOVA) was completed using a Bonferroni correction, such that the adjusted alpha level for the pairwise contrasts was $p < .017$ (.05 / 3 = .017). Lastly, sequential mediation analyses were conducted via PROCESS[37] to determine the indirect effect of both HIV stigma and chronic pain stigma on pain severity through depressive symptoms and insomnia severity while controlling for covariates. Data analysis was completed using IBM SPSS Statistical Software version 25.

Results

Participant Characteristics

Full descriptive data for this sample are presented in **Table 1**. Based on the composite variable created for intersectional HIV and chronic pain stigma, 38% of participants were categorized as "high", 28% were categorized as "moderate", and 34% were categorized as "low". The median CD4 + lymphocyte count was 620, 13% had a detectable viral load (>200 copies/mL), and 99% were prescribed antiretroviral therapy. The most frequently reported locations of chronic pain were low back/hips (45%), followed by legs/feet (26%), widespread (3 + sites) (20%), arms/hands (6%), head (2%), and neck/shoulders (1%). Forty-two percent of the PWH reported using opioids for pain management. The median number of reported health comorbidities beyond HIV (corroborated by medical record) was 4 (IQR = 3-5). The sample was comprised of 67% men and 33% women, while 74% were African American/Black, 20% were Caucasian/White, and the remaining 6% were Multiracial. The vast majority of the sample reported living in poverty. Severity of insomnia symptoms was significantly greater for the multiracial group compared to the African American/Black group (p = .012) and the Caucasian/White group (p = .010). Those who used opioids reported significantly greater severity of depressive symptoms (p = .043) and insomnia symptoms (p = .001) compared to those who did not use opioids. There were no significant differences in depressive symptoms, insomnia symptoms, or pain severity between men and women.

Zero-Order Correlations

Greater HIV stigma was found to be significantly correlated with greater depressive symptoms (r = .398, p < .001) and greater insomnia symptoms (r = .290, p = .008), but not pain

Table 1. Participant Characteristics (N = 82).

Variable	
Demographics	
Age in Years, Mean (SD)	49 (8.35)
Gender, N (%)	
Men	55 (67%)
Women	27 (33)%
Race, N (%)	
African American/Black	61 (74%)
Caucasian/White	16 (20%)
Multiracial	5 (6%)
Poverty, N (%)	
Below Poverty Line	74 (90%)
Above Poverty Line	8 (10%)
Clinical Characteristics	
ART Use, N (%)	81 (99%)
CD4 +, Median (IQR)	620 (430-794)
Detectable Viral Load (>200), N (%)	11 (13%)
HIV Duration, Median (IQR)	16.5 (10-23)
Chronic Pain Duration, N (%)	
>3 months but <6 months	10 (12%)
>6 months but <1 year	9 (11%)
>1 year but <3 years	8 (10%)
>3 years but <5 years	14 (17%)
>5 years but <10 years	18 (22%)
>10 years but <20 years	13 (16%)
>20 years	10 (12%)
Opioid Use, N (%)	34 (42%)
Number of Comorbidities, Median (IQR)	4 (3-5)
HIV Stigma, Mean (SD)	12.97 (7.34)
Chronic Pain Stigma, Mean (SD)	1.92 (0.51)
CES-D – Depressive Symptoms, Mean (SD)	21.57 (11.41)
ISI – Insomnia Symptoms, Mean (SD)	12.46 (8.37)
BPI-SF – Pain Severity, Mean (SD)	5.84 (2.31)

Note: BPI = Brief Pain Inventory; CES-D = Center for Epidemiological Studies Depression Scale.

severity (r = .159, p = .154). Greater chronic pain stigma was significantly correlated with greater depressive symptoms (r = .576, p < .001), greater insomnia symptoms (r = .268, p = .015), and greater pain severity (r = .300, p = .006). Greater pain severity was significantly correlated with greater insomnia symptoms (r = .258, p = .019) but not depressive symptoms (r = .035, p = .754), while greater depressive symptoms were significantly correlated with greater insomnia symptoms (r = .610, p < .001). Greater pain severity was also significantly associated with duration of chronic pain (r = .398, p < .001). Neither pain severity, depressive symptoms, nor insomnia symptoms were significantly correlated with age, CD4 count, viral load, comorbidities, or duration of HIV infection. Additional correlations are presented in **Table 2**.

Intersectional HIV and Chronic Pain Stigma

The use of median splits (**Table 3**) to categorize intersectional HIV and chronic pain stigma into high, moderate, and low groups was successful for producing three distinct groups that significantly differed according to their self-reported HIV stigma ($F_{2,79} = 32.32$,

Table 2. Zero-Order Correlations.

Variable	1	2	3	4	5	6	7	8	9
1. HIV Stigma	___								
2. Chronic Pain Stigma	.498**	___							
3. CES-D	.398**	.576**	___						
4. ISI	.290**	.268*	.610**	___					
5. BPI-SF Pain Severity	.159	.300**	.035	.258*	___				
6. CD4 +	-.049	-.138	-.062	.037	.069	___			
7. Viral Load	-.099	-.050	.045	-.060	-.180	.167	___		
8. Comorbidities	.032	.028	.119	.130	.065	-.086	.280*	___	
9. HIV Duration	-.129	-.023	-.074	-.057	-.033	-.102	.099	.167	___
10. Chronic Pain Duration	-.043	.076	-.037	-.028	.398**	.252*	.008	.168	.062

$* = p < .05$, $** = p < .01$.
Note: CES-D = Center for Epidemiological Studies Depression Scale; ISI = Insomnia Severity Index; BPI-SF = Brief Pain Inventory – Short Form; viral load coded 1 = Detectable >200 copies/1 mL blood, 2 Non-detectable <200 copies/1 mL blood.

Table 3. Means (Standard Deviations) for High, Moderate, and low Intersectional HIV and Chronic Pain Stigma.

	Intersectional HIV and Chronic Pain Stigma			
Variable	High	Moderate	Low	P value
HIV Stigma, Mean (SD)	18.55 (6.28)	12.74 (7.19)	7.00 (1.72)	<.001
Chronic Pain Stigma, Mean (SD)	2.39 (.31)	1.88 (.40)	1.43 (.26)	<.001

Table 4. ANCOVA Predicting Depressive Symptom Severity on the CES-D.

Variable	SS	df	MS	F	P value
Race[1]	242.91	1	242.91	2.43	.124
Race[2]	243.97	1	234.97	2.44	.123
Gender	14.89	1	14.89	0.15	.701
Opioid Use	83.95	1	83.95	0.84	.363
Chronic Pain Duration	6.65	1	6.65	0.07	.797
Intersectional HIV and Chronic Pain Stigma	1969.79	2	984.89	9.84	<.001

$R^2 = .298$, $p < .001$.
[1] = First dummy-coded race variable (1 = non-Hispanic Black, 2 = non-Hispanic White), [2] = Second dummy-coded race variable (1 = Multiracial, 2 = non-Hispanic White); Gender coded 1 = men, 2 = women; Opioid Use coded 1 = No, 2 = Yes; CES-D = Center for Epidemiological Studies Depression Scale.

p < .001) and chronic pain stigma ($F_{2,79} = 62.15$, p < .001). Specifically, post-hoc tests with Bonferroni adjusted alpha levels showed that the high intersectional HIV and chronic pain stigma group reported significantly greater HIV stigma than did the moderate (p < .001) and low (p < .001) groups. The moderate intersectional HIV and chronic pain stigma group reported significantly greater HIV stigma than the low group (p < .001). The same pattern of results were observed for chronic pain stigma, such that the high intersectional HIV and chronic pain stigma group reported significantly greater chronic pain stigma than did the moderate (p < .001) and low (p < .001) groups. The moderate intersectional HIV and chronic pain stigma group reported significantly greater chronic pain stigma than the low group (p = .001).

Race, gender, opioid use, and duration of chronic pain were included as covariates in all analyses presented below. After controlling for covariates, results of the series of ANCOVAs revealed that intersectional HIV and chronic pain stigma was significantly associated with severity of depressive symptoms ($F_{2,74} = 9.84$, p < .001; see **Table 4**), insomnia symptom severity ($F_{2,74} = 3.53$, p = .034; see **Table 5**), and pain severity ($F_{2,74} = 3.40$, p = .039; see **Table 6**). Pairwise contrasts revealed that individuals in the high intersectional HIV and chronic pain stigma group reported significantly greater depressive symptoms than those in the low (p < .001) and moderate (p = .005) groups (**Figure 1**). Similarly, individuals in the high intersectional HIV and chronic pain stigma group also reported significantly greater insomnia symptoms (p = .016; **Figure 2**) and greater pain severity (p = .013); **Figure 3**)

Table 5. ANCOVA Predicting Insomnia Severity on the ISI.

Variable	SS	df	MS	F	P value
Race[1]	465.99	1	465.99	8.32	.005
Race[2]	36.62	1	36.62	0.65	.421
Gender	0.54	1	0.54	0.01	.975
Opioid Use	409.51	1	409.51	7.32	.008
Chronic Pain Duration	3.16	1	3.16	0.06	.813
Intersectional HIV and Chronic Pain Stigma	394.65	2	197.33	3.53	.034

$R^2 = .269$, $p = .001$.
[1] = First dummy-coded race variable (1 = non-Hispanic Black, 2 = non-Hispanic White), [2] = Second dummy-coded race variable (1 = Multiracial, 2 = non-Hispanic White); Gender coded 1 = men, 2 = women; Opioid Use coded 1 = No, 2 = Yes; ISI = Insomnia Severity Index.

compared to the low group. Insomnia symptoms (p = .046) and pain severity (p = .093) did not significantly differ between the high and moderate intersectional HIV and chronic pain stigma groups according to the Bonferroni adjusted alpha level.

Table 6. ANCOVA Predicting Pain Severity on the BPI-SF.

Variable	SS	df	MS	F	P value
Race[1]	7.45	1	7.45	1.81	.183
Race[2]	15.50	1	15.50	3.76	.053
Gender	0.09	1	0.09	0.02	.885
Opioid Use	7.06	1	7.06	1.71	.195
Chronic Pain Duration	62.09	1	62.09	15.07	<.001
Intersectional HIV and Chronic Pain Stigma	27.98	2	13.99	3.40	.039

R^2 = .297, p < .001.
[1] = First dummy-coded race variable (1 = non-Hispanic Black, 2 = non-Hispanic White), [2] = Second dummy-coded race variable (1 = Multiracial, 2 = non-Hispanic White); Gender coded 1 = men, 2 = women; Opioid Use coded 1 = No, 2 = Yes; BPI-SF = Brief Pain Inventory-Short Form.
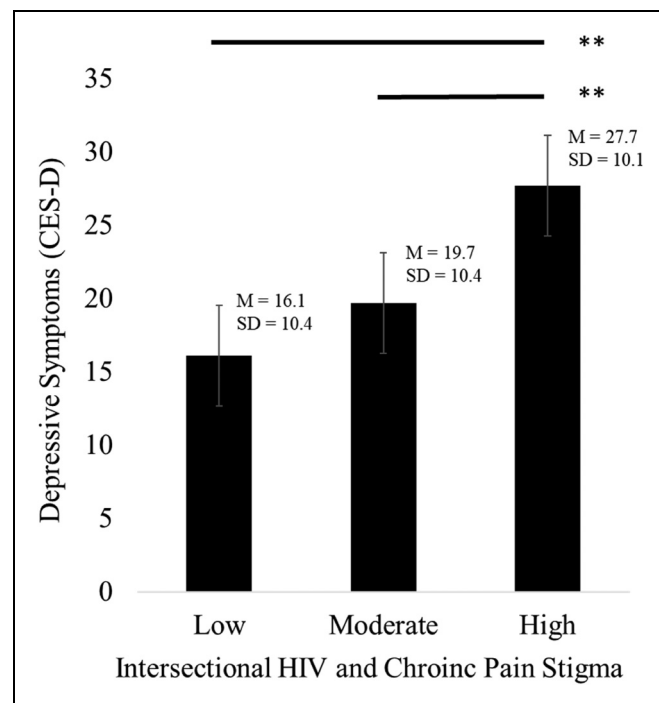
Figure 1. Differences in depressive symptom severity according to category of intersectional HIV and chronic pain stigma. ** = p < .01; M = mean; SD = standard deviation. M and SD adjusted for covariates.

Figure 2. Differences in insomnia symptoms according to category of intersectional HIV and chronic pain stigma. ** = p < .017; M = mean; SD = standard deviation. M and SD adjusted for covariates.

Figure 3. Differences in pain severity according to category of intersectional HIV and chronic pain stigma. ** = p < .017; M = mean; SD = standard deviation. M and SD adjusted for covariates.

Sequential Mediation Analyses

Sequential mediation analyses controlling for covariates were conducted to determine the indirect effects of chronic pain stigma and HIV stigma, respectively, on pain severity through depressive symptoms and insomnia symptoms. In these analyses, the HIV stigma and chronic pain stigma variables had to be examined separately, not as an intersectional composite. All paths for the full model including chronic pain stigma are presented in **Figure 4**. There was a significant indirect effect of chronic pain stigma on pain severity through depressive symptoms and insomnia symptoms with a point estimate of .583
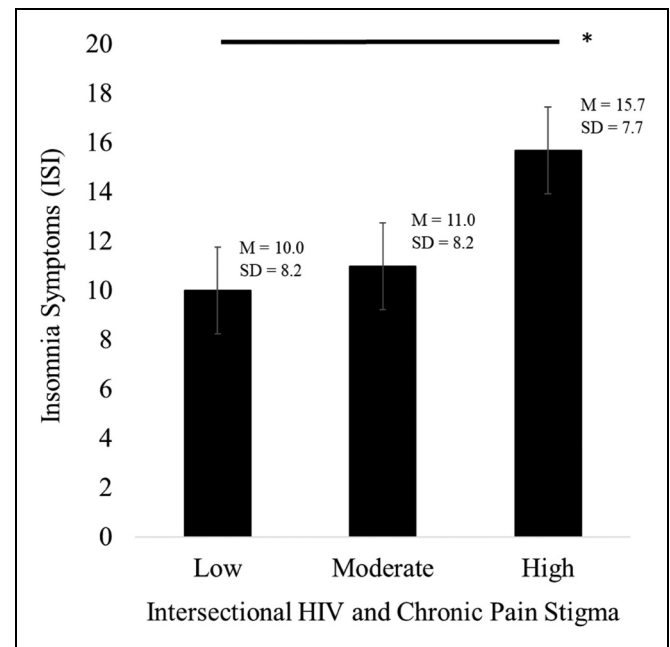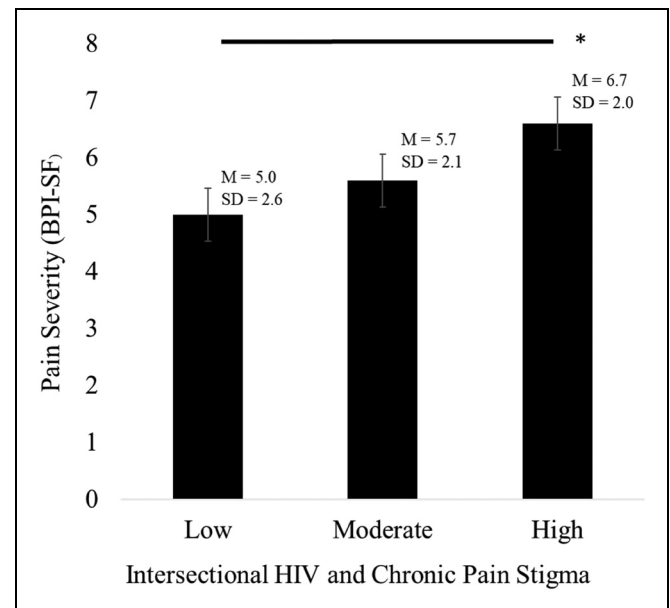
and a 95% confidence interval of .138 to 1.227. These results support our hypothesized sequential mediation model with chronic pain stigma. Specifically, greater chronic pain stigma was significantly associated with greater depressive symptoms (t = 6.21, p < .001). Greater depressive symptoms were significantly associated with greater severity of insomnia symptoms (t = 5.72, p < .001), which in turn was associated with greater
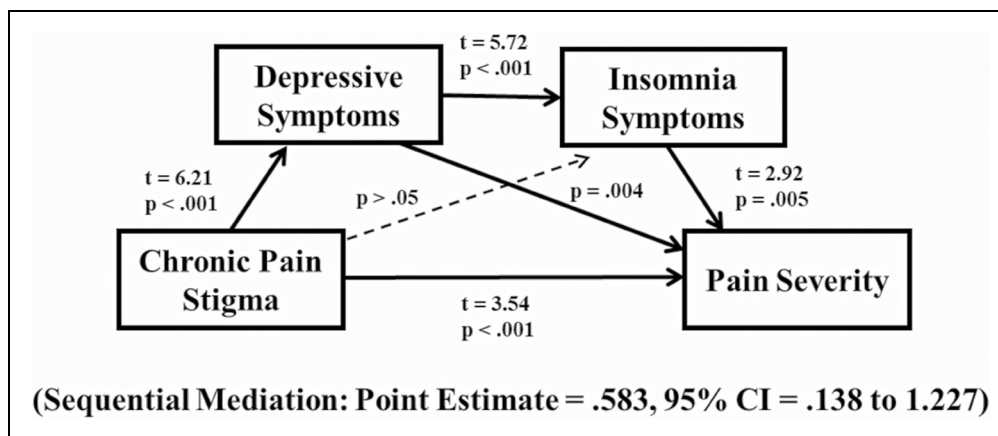
Figure 4. Sequential mediation model depicting the indirect effect of chronic pain stigma on pain severity through depressive symptoms and insomnia symptoms.
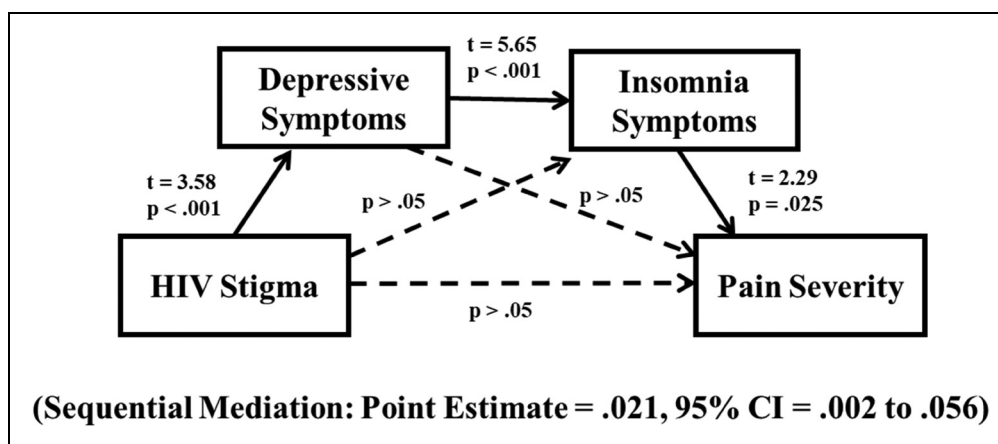

Figure 5. Sequential mediation model depicting the indirect effect of HIV stigma on pain severity through depressive symptoms and insomnia symptoms.

pain severity (t = 2.92, p = .005) for PWH. This sequential mediation model was then tested again but with HIV stigma included; all paths for the full model are presented in **Figure 5**. Results again revealed a significant indirect effect of HIV stigma on pain severity through depressive symptoms and insomnia symptoms with a point estimate of .021 and a 95% confidence interval of .002 to .056. These results further support our hypothesized sequential mediation model with HIV stigma, such that greater HIV stigma was significantly associated with greater depressive symptoms (t = 3.58, p<001). Greater depressive symptoms were significantly associated with greater insomnia symptoms (t = 5.65, p<.001) and greater insomnia symptoms were significantly associated with greater pain severity (t = 2.29, p = .025) in this sample of PWH.

Discussion

In the most comprehensive systemic review with meta-analysis on the topic to date, Scott and colleagues reported "moderate" evidence for an association between pain in PWH and psychosocial factors including depression, substance abuse, sleep disturbances, health care use, and reduced ART adherence, among others.[38] Importantly, this systematic review indicated that few studies had previously examined pain in relation to social processes such as stigma among PWH. Along this line, several very recent studies have reported significant associations between the experience and internalization of HIV stigma and greater pain severity.[16,20] The influence of stigma on the experience of pain in PWH is likely to be driven by complex interactions among biological, psychosocial, and behavioral factors. To explore this possibility, the current study examined two psychological and behavioral factors: depressive symptoms and sleep, respectively. We chose to focus on these factors given that both depression and sleep disturbances have been shown to be particularly relevant for pain outcomes in PWH according to the systemic review and meta-analysis conducted by Scott and colleagues.[38]

Focusing exclusively on HIV stigma will likely provide an incomplete picture of the stigmatization experiences of PWH, as well as how stigma affects pain outcomes in this population.

This is because PWH and chronic pain are at increased risk for experiencing stigma due to HIV as well as their chronic pain.[2] The internalization of both HIV and chronic pain stigmas (ie, intersectional stigma) among PWH and chronic pain may synergistically perpetuate pain severity in a more profound manner than either one stigma alone. Indeed, previous work by our group has shown that high levels of intersectional HIV and chronic pain stigma was associated with significant depressive symptoms.[25] Results from the current study replicate this finding and expand upon it in important ways. We found significant differences in depressive symptoms, insomnia symptoms, and pain severity according to self-reported high, moderate, and low levels of intersectional HIV and chronic pain stigma. Specifically, individuals who reported the highest levels of intersectional HIV and chronic pain stigma reported the greatest symptom severity for depression, insomnia, and pain compared to those who reported moderate and low intersectional HIV and chronic pain stigma.

Given the above findings, a series of sequential mediation models were tested to determine whether the impact of depressive symptoms on sleep quality (ie, insomnia symptoms) might help explain the observed association of pain severity with chronic pain stigma as well as HIV stigma. We found significant indirect effects for both HIV and chronic pain stigma on pain severity through depressive symptoms and symptoms of insomnia. Specifically, results revealed that greater chronic pain stigma predicted greater severity of depressive symptoms, which in turn predicted greater insomnia severity, which subsequently predicted greater chronic pain severity for PWH. This pattern of findings remained significant in an additional sequential mediation model that included HIV stigma instead of chronic pain stigma. These findings emphasize the clinical relevance of HIV and chronic pain stigma. Previous research in PWH has shown that HIV and chronic pain stigma is associated with a more depressed mood[20,25] and greater sleep disturbances.[21,39] Furthermore, depression and sleep are known to predict pain outcomes[24,40,41]. It may be that depressive symptoms and poor sleep (eg, insomnia) play a contributory role in the effects of internalized HIV and chronic pain stigma on pain outcomes in PWH. This possibility remains speculative at present and additional longitudinal research on this topic is needed to properly address this hypothesis.

Appreciation for the intersectionality of multiple stigmas is becoming well described in the literature; however, significant gaps in our understanding remain. For example, further development of valid measures for assessing and understanding intersectional stigma, as well as acceptable means of analyzing the data generated from these measures, is needed. There is currently no consensus on the best methods for quantifying intersectional stigma. This gap in the literature relates to a limitation of the current study that must be considered when interpreting the findings. While consistent with our previously published work,[25] the method for creating the intersectional HIV and chronic pain stigma composite variable in this study is fallible. This is because median splits were used to categorize participants as either low, moderate, or high in intersectional

HIV and chronic pain stigma, and it is possible that some participants may have been inaccurately grouped. Another clinically important gap in current understanding of intersectional stigma pertains to a lack of empirically-supported interventions for internalized stigma – HIV stigma, chronic pain stigma, or otherwise. While interventions designed to build resilience and mental well-being hold promise,[42,43] they do not directly address the societal and structural determinants of stigma. The burden of coping with stigma should not fall exclusively upon the individual being stigmatized, but rather macro-level policy and educational interventions are needed to help stop the perpetuation of stigma.[44] Another limitation of the current study is that although our findings identify intersectional HIV and chronic pain stigma as a likely risk factor for poor pain outcomes in PWH, it does not offer much insight into best practices for intervening on these stigmas. However, it should be noted that empirically-supported interventions for depression and sleep are available and may help improve the chronic pain experienced by PWH.[45,46]

Additional limitations of this study should be considered when interpreting our results. The study design was cross-sectional, which precluded a temporal precedence among the variables included in our sequential mediation models. The ability to make reliable causal inferences is limited by the lack of a true longitudinal study design with repeat measurements. Therefore, the directionality of reported effects in this study should be considered tentative and interpreted with caution. Future research should use a longitudinal approach to elucidate whether internalized HIV and chronic pain stigma at baseline predicts subsequent development or worsening of depression, insomnia, and pain severity. While certain inclusion criteria for participation in this study are directly relevant (eg, presence of chronic pain, lack of acute infection), we appreciate that other inclusion criteria may not appear relevant or necessary (eg, no evidence of uncontrolled hypertension, no circulatory disorders, etc). These inclusion criteria were necessary to ensure the safety of participants who completed the larger investigation (Comprehensive HIV and Pain Study; CHIPS) from which the data for the current study were derived. These additional study inclusion criteria may limit the generalizability of the current findings to PWH and chronic pain without other significant medical comorbidity. Lastly, we focused specifically on HIV and chronic pain stigma in this study. We realize that other forms of stigma related to race, sex/gender, sexual orientation, and other health conditions may have also contributed to the mood, sleep, and pain in this sample of PWH.[47] Future research should address how additional stigmas beyond health-related stigma converge to affect the health outcomes of marginalized individuals including PWH. Despite these limitations, the results of this study contribute to a better understanding of the impact of intersectional stigma on health outcomes among PWH and provides implications for future longitudinal research addressing the directionality of our findings.

In conclusion, the experience of both HIV and chronic pain stigma is likely to be detrimental to the mental and physical health of individuals living with these conditions. Our findings

support the notion that intersectional HIV and chronic pain stigma is indeed associated with poor health outcomes, particularly chronic pain severity. Future interventions should aim to reduce the amount of stigma perpetrated against PWH in society, as well as increase resilience in these individuals in order to prevent the internalization of experienced stigma.

Declaration of Conflicting Interests

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