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Discrimination as a Key Mediator of the Relationship Between Posttraumatic Stress and HIV Treatment Adherence among African American Men

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Abstract

Posttraumatic stress disorder (PTSD) is relatively common among people living with HIV/AIDS (PLHA) and may be associated with antiretroviral therapy (ART) adherence. We examined the relationship between PTSD symptom severity and adherence among 214 African American males. Because PLHA may experience discrimination, potentially in the form of traumatic stress (e.g., hate crimes), we also examined whether perceived discrimination (related to race, HIV status, sexual orientation) is an explanatory variable in the relationship between PTSD and adherence. Adherence, monitored electronically over 6 months, was negatively correlated with PTSD total and re-experiencing symptom severity; all 3 discrimination types were positively correlated with PTSD symptoms and negatively correlated with adherence. Each discrimination type separately mediated the relationship between PTSD and adherence; when both PTSD and discrimination were included in the model, discrimination was the sole predictor of adherence. Findings highlight the critical role that discrimination plays in adherence among African American men experiencing posttraumatic stress.

Keywords

HIV; adherence; posttraumatic stress; discrimination; mediation

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Mental health has been shown to play a key role in adherence to HIV antiretroviral therapy (ART). Research has predominantly focused on depression, which is highly prevalent among people living with HIV/AIDS (PLHA) (Bing et al. 2001), and widely considered to be among the strongest and most consistent predictors of adherence (Ammassari et al. 2004; DiMatteo et al. 2000; Fogarty et al. 2002). Posttraumatic stress disorder (PTSD) may also be relatively common amongst PLHA (Gore-Felton & Koopman 2002; Israelski et al. 2007; Reisner et al. 2009; Sledjeski et al. 2005; Theuninck et al. 2010), and the few data that are available suggest that PTSD poses challenges to adherence (Boarts et al. 2009; Delahanty et al. 2004; Mugavero, Sullivan et al. 2006). However, the specific mechanisms or aspects of PTSD that may drive this relationship have yet to be fully explored.

We examined the relationship between PTSD and HIV treatment adherence in a sample of African American males—a group that has disproportionately high rates of HIV (Centers for Disease Control and Prevention 2009). Some research indicates that African Americans are less likely to receive and adhere to ART regimens than Caucasians (Bogart et al. 2004; Johnson et al. 2003; Kleeberger et al. 2004; Mostashari et al. 1998; Shapiro et al. 1999; Singh et al. 1999; Singh et al. 1996), and these differences in treatment patterns could contribute to lower observed survival times among African Americans living with HIV (Centers for Disease Control and Prevention 2002). However, not all studies indicate that African Americans are less adherent than Caucasians (Ammassari et al. 2002; Bogart et al. 2004; Catz et al. 2000; Deloria-Knoll et al. 2004; Deschamps et al. 2004; French et al. 2005; Halkitis et al. 2005; Israelski et al. 2001; Johnson et al. 2003; Mehta et al. 1997). These conflicting findings may result from studies typically examining African Americans as a whole, without attention to key culturally relevant mechanisms influencing adherence that may vary across individuals, such as chronic stress from discrimination and mental health.

Discrimination may be a key culturally relevant issue in the relationship between PTSD and ART adherence among African Americans living with HIV. PLHA experience a disproportionately high number of traumatic events, often involving interpersonal violence (Gore-Felton et al. 2001; Leserman et al. 2005; Simoni & Ng 2002), in part because they are likely to be members of stigmatized social groups that are more vulnerable to discrimination, such as men who have sex with men (MSM), racial/ethnic minorities, and individuals of low socioeconomic status. In particular, HIV-infected African American MSM face a triple threat of discrimination based on their HIV status, race, and sexual orientation (Bogart et al. 2010).

To the extent that trauma results from discrimination or is experienced within a life context of long-term discrimination, repeated discrimination events may serve as reminders of prior trauma and further weaken individuals' capacity for resilience and ability to cope. For example, a considerable proportion of MSM report being the victims of hate crimes because of their sexual orientation, a form of traumatic stress stemming from discrimination (Herek & Berrill 1992). Repeated traumatic forms of discrimination may exacerbate anxiety and stress responses, leading to reduced motivation to engage in goal-directed health-promoting behaviors, including treatment adherence.

Aside from discrimination, a number of other potential mechanisms may contribute to the relationship between traumatic stress and/or PTSD, and medication adherence. Similar to general levels of stress, traumatic stress (including PTSD symptoms of avoidant behaviors, intrusive thoughts about prior trauma, and general hyperarousal) can place demands on an individual's cognitive capability (Barrett et al. 1996), and thus affect ability to remember medication instructions and when to take doses. For PLHA, PTSD symptoms from HIV diagnosis, particularly symptoms of avoidance, may be especially detrimental for adherence as individuals may not take medications in order to avoid distressing thoughts about their illness (Abel & Painter 2003). This is supported by the finding that 89% of participants in one study reported that HIV treatment itself was a barrier to ART adherence because it reminded them of their HIV+ status (Catz et al. 2000). Preliminary work has found that individuals who had PTSD from their HIV diagnosis were more likely to endorse the symptoms related to intrusive thoughts about the event (e.g., of re-living or re-imagining the event) than were those who had PTSD from other traumas (Boarts et al. 2009).

The psychological distress (e.g., depression symptoms) and substance use associated with PTSD are other potential mechanisms by which the disorder may influence ART adherence. Depression is often a comorbid condition of PTSD (Israelski et al. 2007), and manifestations of depression can include loss of interest and motivation for daily activities, difficulty

concentrating and remembering things, and disrupted sleeping and eating patterns—all of which can pose challenges for medication adherence. Several studies have documented the strong association between depression and nonadherence to ART (Ammassari et al. 2004; DiMatteo et al. 2000; Fogarty et al. 2002). Vranceanu et al. (2008) found that while both depression and PTSD symptoms were correlated with adherence, only depression remained significant in a multivariate analysis including both constructs, suggesting that PTSD may indirectly affect adherence by increasing the likelihood of depression. However, other research has found that both PTSD and depression independently predict nonadherence (Boarts et al. 2006). Substance use is often associated with mental health issues among PLHA (Bing et al. 2001; Galvan et al. 2003), and drug and alcohol use is often used as a way to self-medicate and cope with distress (Jacobsen et al. 2001), yet often negatively impacts functioning, further elevates distress, and lowers ART adherence (Mugavero, Ostermann et al. 2006; Sullivan et al. 2008; Tucker et al. 2003). Unlike many of these studies which are cross-sectional, the reported analysis explores the role of psychosocial functioning, including depression and substance use, and PTSD on longitudinal ART adherence.

In the present study, we examined the relationship of PTSD symptoms to ART adherence, and explored the mechanisms that underlie the relationship between traumatic stress and adherence among African American MSM living with HIV. In particular, is PTSD from HIV diagnosis associated with greater nonadherence compared to PTSD caused by other types of trauma? Does discrimination serve as an explanatory variable for the relationship between PTSD symptom severity and nonadherence? Do common comorbidities of PTSD such as depression and substance abuse also help to account for the relationship between PTSD and adherence?

Methods

Recruitment

The present study was conducted with HIV-infected African American males on ART in Los Angeles. Recruitment fliers were disseminated and posted by staff at three HIV social service agencies and an HIV medical clinic. Individuals were eligible if they primarily identified as African American, were aged 18 or older, and were currently on ART. Interested individuals were screened for eligibility by telephone. Eligible participants were interviewed in confidential sound-proof rooms at the social service agencies. Study staff obtained informed consent prior to the interview. All study procedures were approved by the institutional review boards (IRBs) of Children's Hospital Boston, RAND Corporation, and Charles Drew University of Medicine and Science.

Assessments

Participants completed a 90-minute self-administered audio computer-assisted interview (ACASI) at baseline, followed by brief monthly assessments for 6 months post-baseline. All measures were included in the baseline assessment, but only measures of discrimination and adherence were assessed at each monthly assessment. In addition to adherence and discrimination, we assessed socio-demographic characteristics to describe the sample and use as covariates, and other potential explanatory mechanisms of the relationship between PTSD symptoms and adherence. We describe the primary outcome measure of adherence, followed by the leading independent variable (PTSD symptoms) and then potential mediators.

Medication adherence—Medication adherence was measured electronically for 6 months post-baseline using the Medication Event Monitoring System (MEMS), which

consists of bottle caps [electronic Drug Exposure Monitor (eDEM) caps, AARDEX Ltd., Zug, Switzerland] that record the times when medication bottles are opened and pills are presumed to have been ingested. Software developed by the manufacturer of the caps was used to generate detailed reports of daily medication-taking patterns and to calculate the percentage of total prescribed doses actually taken. We only monitored adherence to the ART medication with the most complex regimen, because research indicates that rates of adherence do not differ significantly across medications (Arnsten et al. 2002). Participants were instructed to replenish the bottle when needed by refilling it after they removed the last pill.

At each monthly follow-up, data were downloaded from the participant's electronic monitoring cap and participants completed a short questionnaire assessing whether (and how often) they (1) opened the bottle without removing a dose, (2) took a dose from a source other than the MEMS bottle, and (3) removed multiple doses from the bottle at a time (i.e., pocketed doses) over the past month. We used these data to adjust electronic adherence scores to more accurately reflect actual pill taking behavior – a strategy that has been previously validated (Bangsberg et al. 2000). We adjusted the data for 13% of participants who reported using such strategies. The main study outcome of ART adherence is a continuous measure representing the percentage of prescribed doses that were taken during the study period, and was calculated by averaging the up to six available monthly intervals of adherence, thus representing adherence over the 6-month study period.

Posttraumatic stress disorder (PTSD)—Participants were asked whether they experienced any of the following traumatic events in their lifetime: accident, fire, or explosion; natural disaster; physical assault; sexual assault; sexual contact at a young age; war or military combat; imprisonment; torture; and other. Participants then selected the worst trauma they experienced, using a list that included all traumas endorsed, as well as "HIV or AIDS diagnosis."

Presence and severity of PTSD symptoms in the last month were assessed using an adapted version of the Posttraumatic Stress Diagnostic Scale (PDS) (Foa et al. 1997), completed in reference to the "worst" trauma experienced if more than one trauma was endorsed, or in reference to HIV or AIDS diagnosis if none of the other traumatic events was endorsed. Since all participants experienced at least one trauma (i.e., HIV or AIDS diagnosis), all participants completed this scale. Symptoms were grouped into three subscales, for re-experiencing (5 items: e.g., nightmares, emotionally upset when reminded of the trauma; $\alpha = .91$); avoidance (7 items: e.g., trying not to think, talk, or have feelings about the trauma; $\alpha = .90$); and arousal (5 items: e.g., easily startled, overly alert; $\alpha = .87$). Symptom severity was rated on a scale from 1 'never' to 6 'almost all of the time' in the past month. Subscale scores represent the sum of all items. Respondents were considered to have PTSD if they scored above 1 on at least one re-experiencing symptom, three avoidance symptoms, and two arousal symptoms over the past month, which is consistent with the DSM-IV-TR criteria for the disorder (APA, 2000).

Socio-demographic characteristics—We assessed age, education level, income, employment, sexual orientation, housing accommodations, and date of HIV test status. Education was dichotomized into low (less than high school diploma) versus high school diploma or greater; annual income into low (<$5,000 annually) versus ≥$5,000 annually; employment into employed full/part-time versus unemployed, on disability, retired, or in school; sexual orientation into heterosexual versus other categories (i.e., gay/same-gender loving, bisexual, not sure or in transition, something else, or don't know); and housing into stable (rent or own home or apartment, subsidized housing) versus unstable (homeless,

living rent-free with friend/relative, residential treatment facility, temporary/transitional housing). We calculated the length of time since diagnosis from the baseline interview date.

Depression—Depression was measured with the 8-item depression scale (α = .81) from the Medical Outcomes Study (Wells et al. 1996). The first two items assess whether or not the respondent experienced feeling 'sad, blue or depressed' or 'lost all interest or pleasure in thing' for at least a 2-week period during the prior year, and whether or not the respondent felt 'depressed or sad much of the time' in the past year. The remaining 6 items ask about mostly cognitive symptoms (e.g., 'felt depressed', 'had crying spells', 'I enjoyed life'), and respondents were asked to rate the frequency of symptoms from 1 'rarely or none of the time' to 4 'most or all of the time' in the past week. A continuous variable was created using a weighted algorithm as instructed by the authors of the scale.

Discrimination—Perceived discrimination was measured with the Multiple Discrimination Scale (MDS), which has strong construct validity and reliability (Bogart et al. 2010). Participants were asked whether they experienced 10 different discrimination events in the past year, with response options 'yes' and 'no.' MDS items cover violence (verbal, physical, property; e.g., "In the past year, were you physically assaulted or beaten up because someone knew or suspected that you are HIV-positive?"); institutional discrimination (employment, housing, health care; e.g., "In the past year, were you denied a job or did you lose a job because someone thought that you were gay?"), and interpersonal discrimination (from close others, partners, strangers, in general; e.g., "In the past year, were you ignored, excluded, or avoided by people close to you because you are Black/African American?"). The MDS uses parallel items (10 items each) to capture discrimination due to Black/African-American race/ethnicity (MDS-Black; α = .83), HIV-serostatus (MDS-HIV; α = .85), and gay sexual orientation (MDS-Gay; α = .86). The MDS was administered at baseline to assess discrimination events in the past year and at all six monthly follow-up assessments to assess discrimination in the past month (approximately since the last assessment). For this analysis we calculated the mean of each of the three subscales across all follow-up assessments up to and including the assessment of the final adherence measurement for each participant.

Substance use—Problematic drinking was measured with the RAPS4-QF (Cherpitel 2002), which contains four items to screen for alcohol problems over the past year (feeling guilt or remorse about drinking, blackouts, failure to complete responsibilities due to drinking, drinking when first waking up), and two quantity-frequency (QF) questions (drinking five or more drinks on at least one occasion during the last year, and drinking as often as once a month during the last year). If the respondent answers 'yes' to any of the initial four items, or 'yes' to both of the QF items, then the participant is considered to be engaging in problematic drinking behavior (binary variable). In addition, we assessed the frequency of use of cocaine (powder and crack), heroin, and amphetamine/methamphetamine in the past 30 days; a dichotomous variable was created to represent whether or not any such illicit drug use was reported.

Statistical Analysis

SAS Version 9.2 was used for all analyses. Descriptive statistics were computed on all study variables. Means and standard deviations were examined for continuous variables, and frequencies were examined for categorical variables. Bivariate tests (linear regressions, Pearson correlations, two-tailed independent t-tests) were conducted to examine the relationships between the continuous measure of adherence and continuous and categorical measures of PTSD, trauma, and other variables that were potential mediators of the relationship between PTSD and adherence.

Variables that were significantly correlated (at $p < .05$) with both PTSD (PDS total or subscale score) and adherence in bivariate analysis were considered to be potential mediators of the relationship between PTSD and adherence. To test for mediation, we conducted a series of regression models predicting the following: adherence with PTSD and the potential mediator; adherence with PTSD but not the potential mediator; and the potential mediator with PTSD; all models controlled for baseline covariates. We used a bootstrapping approach with 5,000 iterations (Preacher and Hayes, 2004; 2008) to assess whether any effect of PTSD on adherence was accounted for by the mediator. This method does not produce a single statistic with a p-value, but does produce a 95% confidence interval; significance at p<.05 can be inferred when the confidence interval does not include zero.

Due to participant drop-out, some participants did not complete all six assessments. Response rates at the monthly follow-up assessments from Month 1 to Month 6 were 80%, 66%, 60%, 58%, 56% and 59%, respectively. The measure of 6-month average adherence was calculated using any non-missing assessments; however, since adherence data is collected continuously throughout the study period by the electronic cap (which is confirmed by self-report of the participant), data can be collected from all prior months in the study once the cap is returned, even if prior monthly assessment visits were missed.

In some cases ($n = 17$), participants had discrimination assessments after the last assessment of adherence data. In such cases, we truncated the discrimination data to match the time-frame for the adherence data. Specifically, the three types of discrimination subscales were calculated by averaging the discrimination scores for all follow-up assessments on or before the last available observation of adherence. This strategy was used since discrimination was conceptualized as a mediator of adherence and thus the discrimination data could not follow the last available adherence data.

Of the 214 study participants, 182 (85%) had PTSD data at baseline and adherence and discrimination data for at least one follow-up assessment; their data were included in the mediational analysis. This subgroup of participants did not differ from the other 32 participants on demographics or PTSD measures (all p values > .05).

Results

Sample Description

A total of 214 African American males with HIV enrolled in the study and completed the baseline interview. Mean age was 44 ($SD = 8$), 14% were employed, and 21% had not graduated from high school; 23% identified as heterosexual, and 11% were male-to-female transgender. The sample had multiple life stressors and psychosocial challenges including annual income less than $5,000 (39%), unstable temporary housing (55%), and active illicit drug use (27%).

ART Adherence

On average, participants took 60% ($SD = 29\%$) of prescribed doses of ART during the 6-month study period; 22% took at least 90% of prescribed doses. Showing the validity of the adherence measure for disease outcomes, greater adherence was significantly associated with undetectable viral load as measured by self-report ($t = 2.81$, $df = 178$, $p < .01$), as well as medical records ($t = 2.97$, $df = 104$, $p < .01$) for the subgroup for whom we were able to obtain laboratory reports from medical providers ($N = 102$).

Prevalence and Types of Experienced Trauma and PTSD

Not counting the HIV or AIDS diagnosis, 75% (158/212; data missing for two participants) reported experiencing trauma in their lifetime. The most common types of trauma (among those who had a trauma other than HIV or AIDS diagnosis) were fire and explosions (56%), child sex abuse (51%), physical assault (48%), prison (39%), and sexual assault (27%). Among the 158 who had experienced trauma, most (76%) had experienced more than one type of trauma, with a range of 1–8 types of trauma.

When asked to identify the most bothersome type of trauma experienced, including HIV or AIDS diagnosis, 58% (111/193; data missing for 21 participants) reported that HIV or AIDS diagnosis was the most bothersome trauma, followed by child sex abuse (11%), prison (10%), and an accident or fire (7%). Based on self-reported PTSD symptoms associated with this most bothersome trauma, 38% (80/209; data missing for three participants) met criteria for PTSD. Of the 80 with PTSD, 46 (58%) said their HIV or AIDS diagnosis was their most bothersome trauma.

Relationship Between ART Adherence, Experienced Trauma, and PTSD

ART adherence did not differ between those who met criteria for a PTSD diagnosis (M = 58%, SD = 31%) and those who did not (M = 61%, SD = 28%), nor was adherence associated with the number of traumatic events experienced or the number of types of trauma experienced (p values > .05). Among those with PTSD, those whose most bothersome trauma was their HIV or AIDS diagnosis (M = 59%) did not differ from others with PTSD (M = 56%) with regard to adherence. Severity of PTSD symptoms, as measured by the PDS total score, was negatively correlated with adherence ($r = -0.15$; $p < .05$), as was the PDS re-experiencing subscale ($r = -0.18$; $p < .05$); the avoidance and arousal subscales were not significantly associated with adherence (see Table 1).

We also assessed whether the socio-demographics were associated with adherence and PTSD symptoms (PDS-total and PDS-re-experiencing) (see Table 1). Older age and more formal education were associated with better adherence, while younger age and unstable housing were associated with greater PTSD total symptom severity and re-experiencing symptoms.

Mechanisms by Which PTSD Symptom Severity May Influence Adherence

To explore how PTSD symptoms may influence adherence, we examined whether depression, problematic drinking, drug use, and discrimination were associated with the PDS total score and PDS re-experiencing subscale (as these were both correlated with adherence), as well as adherence, and thus may serve as potential explanatory variables for the relationship between PTSD and adherence. PTSD symptom severity (PDS total) and greater PTSD re-experiencing symptoms were each associated with greater depression, problem drinking and discrimination related to being African American, gay, and HIV-positive (see Table 1). Greater ART adherence was only associated with less discrimination from being African American, gay, and HIV-positive (see Table 1).

Discrimination as a Mediator of the Relationship Between PTSD and Adherence: Mediational Analyses

The above results indicate that the three forms of discrimination were associated with both the adherence and the PTSD measures. Thus, we performed separate analyses testing each of the three discrimination measures as potential mediators of the relationship between PTSD and adherence. In each analysis, age, education, housing, depression, and problematic drinking were included as covariates, as these variables were significantly correlated with either adherence or PTSD symptoms.

Controlling for the covariates, PDS-total was significantly associated with racial discrimination [*b (SE)* = .02 (.005); $p < .01$], but not associated with adherence [*b (SE)* = −.17 (.11); p=.12]. When both racial discrimination and PDS-total were entered into the model, discrimination [*b (SE)* = −4.33 (1.68); $p < .05$] remained a significant predictor, and the bootstrap test indicated that the reduction of the effect of PDS-total on adherence, whose coefficient was reduced to *b (SE)* = −.10(.11), was significant [confidence interval (−0.17, −0.02) does not include zero] (see Table 2).

This mediational analysis was repeated with the PDS re-experiencing subscale as the predictor of adherence and racial discrimination as the mediator: without racial discrimination, re-experiencing symptoms were marginally associated with worse adherence [*b (SE)* = −.67 (.34); $p < .10$], and in a model without adherence, re-experiencing was significantly associated with racial discrimination [*b (SE)* = .05 (.02), p<.001). When racial discrimination and PDS re-experiencing were in the model together, racial discrimination was still a significant predictor [*b (SE)* = −4.16 (1.70); $p < .05$], while PDS re-experiencing was not. The bootstrap test indicated that the reduction of the effect of PDS re-experiencing symptoms on adherence was significant [confidence interval (−.65, −.04)] (see Table 3).

Parallel mediational analyses were used for HIV and gay discrimination separately; results were similar to those for racial discrimination. Neither PDS total nor PDS re-experiencing symptom severity were significant predictors of worse adherence when discrimination was included in the model. When PDS total symptom severity score was in the model, HIV discrimination [*b (SE)* = −3.98 (1.68); $p < .05$] and gay discrimination [*b (SE)* = −3.71 (1.52); $p < .05$] were significant predictors of adherence in separate models (see Table 2). Similarly, when PDS re-experiencing was in the model, HIV discrimination [*b (SE)* = 3.89 (1.69); $p < .05$] was a significant predictor of adherence, as was gay discrimination [*b (SE)* = −3.58 (1.54); $p < .05$] (see Table 3). In each case, the bootstrap test was significant. For all six models that include a PTSD measure, discrimination, and covariates, discrimination and low education were the sole significant predictors of adherence (see Tables 2 and 3).

Discussion

With increasing evidence of the role of mental health in HIV clinical outcomes and ART adherence, more studies are examining traumatic stress and PTSD in PLHA. Among African American males on ART, we found high rates of lifetime history of trauma and current PTSD, similar to other published studies (Gore-Felton et al. 2001; Kelly et al. 1998; Kimerling, Armistead et al. 1999; Kimerling, Calhoun et al. 1999; Martinez et al. 2002; Theuninck et al. 2010); three quarters of all participants reported any history of trauma other than their HIV diagnosis, and 38% currently met criteria for PTSD. Aside from HIV diagnosis, the most common types of trauma were childhood sexual abuse, physical assault, and a fire or explosion, all of which had been experienced by roughly half of the sample. Most had experienced multiple types of trauma.

With HIV diagnosis recognized as a traumatic event that can cause PTSD (Kelly et al. 1998), we included one's HIV diagnosis when asking participants to indicate the most bothersome trauma. HIV diagnosis was rated by the majority of the sample as being the traumatic event that currently causes the most problems in their lives. The trauma of HIV diagnosis was driving traumatic stress symptoms for 46 (58%) of the 80 participants with current PTSD, which represents just over 20% of the sample; this rate is similar to other studies that have indicated around 30% of PLHA meet criteria for PTSD as a result of their HIV diagnosis (Kelly et al. 1998; Theuninck et al. 2010).

Overall adherence was very low in this sample, with a mean adherence rate of 60% and just over one-fifth demonstrating good adherence (defined as taking at least 90% of prescribed doses). While electronic monitoring typically results in lower measures of adherence, this adherence rate is still at the low end of the 60–90% range of adherence generally found in studies conducted in the United States with the same methodology (Bangsberg et al. 2001; Liu et al. 2001). Unlike other studies (Boarts et al. 2009; Mugavero, Sullivan et al. 2006), those who met criteria for PTSD did not differ from those without PTSD with regard to ART adherence; nor were the number or types of lifetime trauma associated with adherence. Furthermore, HIV-related trauma was not related to greater nonadherence than other traumatic experiences. However, the severity of traumatic symptoms in general (PDS total score) was significantly correlated with lower adherence, as was the re-experiencing of trauma symptoms (PDS re-experiencing subscale). These findings suggest that the level of symptoms needed to meet criteria for PTSD may not represent a level of distress that has a strong influence on adherence; however, as symptoms become more severe, adherence significantly declines. Further research is needed to determine the threshold at which traumatic stress symptoms become severe enough to demonstrate a significant effect on adherence. With regard to re-experiencing PTSD symptoms, distressing memories and thoughts of prior traumas may challenge an individual's motivation, coping ability and concentration and thus impede health behaviors such as medication adherence; clinicians treating clients with PTSD symptoms should monitor the presence of re-experiencing symptoms and their potential impact on adherence.

Discrimination was one of the few variables significantly correlated with adherence. A greater number of discrimination experiences from being gay, African American, or HIV-positive were negatively correlated with adherence. When exploring possible mechanisms by which traumatic stress symptoms influence adherence, perceptions of each of the three types of discrimination were the only potential mediators correlated with both traumatic stress symptom severity and adherence. Specifically, all three types of discrimination mediated the relationship between PTSD and adherence; when both PTSD and discrimination were entered into the model, discrimination was the sole independent predictor and PTSD no longer was associated with adherence. This was true for overall PTSD symptom severity, as well as re-experiencing symptom severity. These findings highlight the critical role that discrimination may play in the ability to adhere well to ART among patients experiencing traumatic stress and PTSD, particularly among populations at high risk for discrimination. In the context of posttraumatic stress, discrimination may serve as an additional stressor beyond the effects of trauma exposure and can thus weaken coping mechanisms and impede health behaviors including adherence.

Although adherence was associated with discrimination and posttraumatic stress, both of which have been found to coincide with depression and elevated distress among PLHA (Simbayi et al 2007; Israelski et al. 2007), depression was surprisingly not correlated with adherence in this study, as has been found in prior research (Ammassari et al. 2004; DiMatteo et al. 2000; Fogarty et al. 2002; Vranceanu et al. 2008). Our null finding may be related to the more global measure of depression that we used as opposed to a measure with more specificity in terms of diagnostic cutoffs for depressive severity or types of depression symptoms (e.g., cognitive versus vegetative symptoms).

There are a number of limitations to this study. The sample cannot be considered representative of all African American HIV-positive males who are gay or bisexual, as recruitment was not random, not all were gay or bisexual, and participants were largely recruited in lower socioeconomic strata in inner-city neighborhoods. In addition, we relied on self-reported surveys rather than clinical interviews for PTSD and depression symptoms, as well as substance use, and we assessed perceived rather than actual discrimination.

Research is needed to confirm our results in more diverse samples, as well as with more valid clinical assessments.

In conclusion, this study not only contributes to a growing body of evidence revealing high levels of traumatic stress and PTSD among PLHA and the association to ART nonadherence, but also highlights the particular vulnerability of HIV-positive African American males, especially MSM, to the effects of discrimination. The participants in this study demonstrated very low adherence in general, and had multiple psychosocial challenges, including unstable housing, low income, and substance abuse; however, it was discrimination, whether it be associated with one's race, sexual orientation, or HIV status that was highly associated with severity of post traumatic stress symptoms, and the strongest predictor of nonadherence. These findings draw attention to the need to improve efforts to screen and treat mental health problems among PLHA; more specifically, such efforts must go beyond the usual emphasis on depression and substance use, and must address traumatic stress, PTSD, and discrimination in order to assist clients to achieve optimal adherence and clinical outcomes.

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Table 1

Bivariate Correlations of ART Adherence, PTSD Total Symptom Severity (PDS-total), and PTSD Re-Experiencing Symptom Severity (PDS-re-exp)

	ART adherence[1]	PDS-total	PDS-re-exp
PDS-total	−0.15*	---	---
PDS-re-experiencing	−0.18*	0.91***	---
PDS-avoidance	−0.12	0.95***	0.83***
PDS-arousal	−0.11	0.89***	0.71***
Age	0.15*	−0.16*	−0.17*
Low education	0.17*	−0.12	−0.10
Low income	−0.07	0.13	0.14
Employed	0.03	−0.07	−0.06
Heterosexual orientation	−0.06	0.03	0.05
Stable housing	0.02	−0.29***	−0.23**
Time since HIV diagnosis	−0.04	−0.05	−0.07
Depression	−0.06	0.41***	0.33***
MDS-Black	−0.21**	0.33***	0.34***
MDS-gay	−0.22**	0.34***	0.34***
MDS-HIV	−0.21**	0.31***	0.32***
Problematic drinking	−0.05	0.22**	0.17*
Any drug use	−0.09	0.11	0.05

[1] Average adherence over the 6-month study period

* p < .05,

** p < .01,

*** p < .001

Table 2

Multivariate Analyses of Discrimination as a Mediator of the Relationship Between PTSD Total Symptom Severity and ART Adherence (N = 182)

	Discrimination		
Predictor	**Racial/Ethnic Adjusted b (SE)[a]**	**Sexual Orientation Adjusted b (SE)[a]**	**HIV-Serostatus Adjusted b (SE)[a]**
PTSD Total Symptom Severity	−0.10 (0.11)	−0.11 (0.11)	−0.11 (0.11)
Discrimination			
Racial/Ethnic	−4.33 (1.68)*[b]	—	—
Sexual Orientation	—	−3.71 (1.52)*[c]	—
HIV-Serostatus	—	—	−3.98 (1.68)*[d]
Socio-demographic Factors			
Low Education	12.44 (5.18)*	11.91 (5.19)*	11.90 (5.19)*
Age	0.50 (0.26)	0.45 (0.26)	0.47 (0.26)
Stable Housing	−2.65 (4.42)	−2.79 (4.43)	−2.58 (4.43)
Depression	8.52 (9.48)	7.74 (9.45)	8.11 (9.50)
Problem drinking	−1.21 (4.57)	−0.77 (4.56)	−1.48 (4.61)
R-square	.1020	.0985	.0972

[a] Adjusted unstandardized beta and standard error shown.

[b] CI for indirect effect of racial/ethnic discrimination on adherence (−0.17, −0.02)

[c] CI for indirect effect of sexual orientation discrimination on adherence (−0.17, −0.01)

[d] CI for indirect effect of HIV-serostatus discrimination on adherence (−0.17, −0.01)

* $p < .05$.

Table 3

Multivariate Analyses of Discrimination as a Mediator of the Relationship Between PTSD Re-experiencing Symptom Severity and ART Adherence (N = 180)

	Discrimination		
Predictor	**Racial/Ethnic Adjusted b (SE)[a]**	**Sexual Orientation Adjusted b (SE)[a]**	**HIV-Serostatus Adjusted b (SE)[a]**
PTSD Re-experiencing Symptom Severity	−0.44 (0.35)	−0.46 (0.35)	−0.47 (0.35)
Discrimination			
Racial/Ethnic	−4.16 (1.70)*[b]	—	—
Sexual Orientation	—	−3.58 (1.54)*[c]	—
HIV-Serostatus	—	—	−3.89 (1.69)*[d]
Socio-demographic Factors			
Low Education	12.62 (5.18)*	12.16 (5.19)*	12.14 (5.19)*
Age	0.49 (0.26)	0.45 (0.27)	0.46 (0.27)
Stable Housing	−3.09 (4.37)	−3.08 (4.38)	−2.97 (4.38)
Depression	9.12 (9.26)	8.16 (9.21)	8.67 (9.27)
Problem drinking	−1.80 (4.56)	−1.49 (4.56)	−2.20 (4.60)
R-square	.1084	.1053	.1048

[a] Unstandardized beta and standard error shown.

[b] CI for indirect effect of racial/ethnic discrimination on adherence (−0.62, −0.06)

[c] CI for indirect effect of sexual orientation discrimination on adherence (−0.65, −0.04)

[d] CI for indirect effect of HIV-serostatus discrimination on adherence (−0.59, −0.04)

* $p < .05$.