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Abuse and Resilience in Relation to HAART Medication Adherence and HIV Viral Load Among Women with HIV in the United States

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Abstract

Abuse is highly prevalent among HIV+ women, leading to behaviors, including lower adherence to highly active antiretroviral therapy (HAART) that result in poor health outcomes. Resilience (functioning competently despite adversity) may buffer the negative effects of abuse. This study investigated how resilience interacted with abuse history in relation to HAART adherence, HIV viral load (VL), and CD4+ cell count among a convenience sample of 138 HIV+ women from the Ruth M. Rothstein CORE Center/Cook County Health and Hospital Systems site of the Women's Interagency HIV Study (WIHS). Resilience was measured by the 10-item Connor-Davidson Resilience Scale (CD-RISC). HAART adherence ($\geq$95% vs. $<$95% self reported usage of prescribed medication) and current or prior sexual, physical, or emotional/domestic abuse, were reported during structured interviews. HIV viral load ($\geq$20 vs. $<$20 copies/mL) and CD4+ count (200 vs. $<$200 cells/mm) were measured with blood specimens. Multiple logistic regressions, controlling for age, race, income, enrollment wave, substance use, and depressive symptoms, indicated that each unit increase in resilience was significantly associated with an increase in the odds of having $\geq$95% HAART adherence and a decrease in the odds of having a detectable viral load. Resilience-Abuse interactions showed that only among HIV+ women with sexual abuse or multiple abuses did resilience significantly relate to an increase in the odds of $\geq$95% HAART adherence. Interventions to improve coping strategies that promote resilience among HIV+ women may be beneficial for achieving higher HAART adherence and viral suppression.

Introduction

In the United States (US), over one million individuals are living with HIV, and women account for 26% of new infections.[1] Most of the literature on women with HIV focuses on factors that place women at risk for poor health outcomes; less attention is given to identifying factors, such as resilience, which may relate to better health outcomes.[2,3] Resilience, the ability to function adaptively in the face of trauma or following adverse experiences[4–7] may buffer the negative effects of abuse.[6] In women with HIV, histories of abuse are quite prevalent,[8,9] and have been linked to risky sexual behaviors, HIV medication nonadherence, antiretroviral failure, and increased mortality.[2,3, 8,10–13]

With highly active antiretroviral therapy (HAART), the HIV infection course has changed to that of a chronic illness. Moderate to high levels of adherence are necessary to achieve viral suppression (i.e., undetectable HIV viral load), reverse immune decline (e.g., improved CD4+ cell count), and decrease risk of morbidity and mortality.[14–18] In the US, the mean adherence rate is approximately 71%[19,20] and the mean adherence rate among ethnic minority women ranges between 45% and 64%.[21] HAART nonadherence can lead to increased HIV viral loads that increase the risk of sexual transmission and the development of drug resistant HIV strains.[22–24]

Numerous barriers to HIV medication adherence and overall HIV access to care have been reported, including depression, stigma, disclosure, and drug/alcohol use.[25–28] A history of trauma or abuse among women with HIV has also been linked significantly to medication nonadherence,[3,11,29] as well as to antiretroviral failure and increased mortality.[2,3,8,11,13] Machtinger and colleagues[3] found that among HIV+ biological and transgender women, those who reported recent trauma had over four-times the odds of antiretroviral

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failure in comparison to HIV+ women who did not report recent trauma.

Cohen and colleagues found that over 67% of women in the 2000 HIV+ and 500 HIV- participants in the Women's Interagency HIV Study (WIHS) reported histories of physical, sexual, or emotional abuse.[8,11] In a meta-analysis of psychological trauma and post-traumatic stress disorder (PTSD) in HIV+ women, Machtinger and colleagues[9] reported a 55% prevalence of intimate partner violence, a rate more than double the US national average of 25%.[30] Women with HIV also face multiple stressors, including poverty, gender discrimination, stigma, violence, single parenting, and homelessness.[31–34]

Despite multiple stressors and a high prevalence of trauma/abuse, some women may be ''resilient.'' According to Connor and Davidson,[4] resilience is a combination of personality characteristics and successful coping that allows an individual to function adaptively in the face of or following adversity. Resilient personality characteristics and adaptive coping strategies include humor, optimism, self-efficacy, having a realistic sense of control, being action and goal-oriented, and viewing stress as a challenge/opportunity.[4,35–38] Resilience has also been conceptualized as the process of bouncing back from an adversity,[39,40] as an adaptive outcome (e.g., decreased substance use), and/or as a trajectory over time that consists of adaptive functioning.[41,42]

Resilience has been linked to lower PTSD and depressive symptoms, higher quality of life, positive response to pharmacology treatments among individuals with mental illnesses, and not abusing substances.[43–48] Resilience (assessed with the CD-RISC, a self-report questionnaire focused on coping strategies and personal attributes) has been found to moderate the impact of childhood maltreatment and trauma exposure on psychiatric symptoms,[6,44] to be protective among soldiers experiencing traumatic stress,[49] and to buffer against worsening metabolic indices among diabetics.[50]

No previous literature has reported a significant relationship between resilience and HAART adherence or HIV disease markers, but a limited number of studies have reported that positive coping strategies (e.g., meaning making, optimism, and acceptance) are related to better HAART adherence and disease markers.[51–53] The literature suggests that resilience has the potential to relate to better medication adherence and HIV disease markers and possibly buffer the negative influence of abuse histories on medication adherence and HIV disease markers.

The present study hypothesized that among women with HIV (1) current abuse, any history of sexual abuse, physical abuse, or domestic violence, as well as multiple histories of abuse would significantly relate to lower HAART medication adherence, detectable viral loads, and CD4+ cell count below 200 and (2) higher resilience would significantly relate to higher medication adherence, undetectable viral loads, and CD4+ cell count above 200. We also explored whether and in what ways resilience significantly interacted with abuse histories in predicting levels of HAART medication adherence, viral load, and CD4+ cell count.

Methods

Participants and procedures

During 2011 and 2012, a convenience sample of women were recruited from the Ruth M. Rothstein CORE Center/Cook County Health and Hospital Systems site of the Women's Interagency HIV Study (WIHS), a longitudinal study of women with and at risk for HIV,[54,55] to participate in this substudy of HIV+ women. As part of the ongoing longitudinal study, women complete questionnaires at regular 6-month visits focused on sociodemographics (e.g., race, income, employment, household composition), high risk behaviors (e.g., sexual risk, substance use), and mental health (e.g., depressive symptoms, health-related quality of life). Visits also include a physical exam, and blood and gynecological specimens are collected. Women are given transportation support, childcare, and a financial honorarium of $50 for their time and effort. Data collected at one visit that occurred during 2011 through 2012 were used for the present cross-sectional resilience substudy. The protocol was approved by Institutional Review Boards of Boston University and Cook County Health and Hospital System as well as the WIHS Executive Committee. All participants provided written informed consent and received an additional $25 financial honorarium for participation in the resilience substudy.

Measures

Sexual abuse, physical abuse, and domestic violence histories. Women were asked questions to assess for each abuse type. For example, to capture physical abuse women were asked ''Since your (MONTH) study visit, have you experienced serious physical violence (physical harm by another person)? By that I mean, were you ever hurt by a person using an object or were you ever slapped, hit, punched, kicked?'' Women were asked all abuse questions at baseline to capture any prior adult or childhood (occurring prior to age 18) experience of sexual abuse, physical abuse, and domestic violence, and then again either semi-annually or annually over the course of their enrollment in WIHS (range 1–17 years). Baseline questions began with ''at any time in your life'' instead of ''since your (MONTH) study visit.'' Summary variables were created to capture any history of sexual abuse, physical abuse, or domestic violence separately (0=*no reported history*, 1=*history of abuse report*), current versus previous occurrence of any of the three types of abuses (1=*current abuse*, 0=*no current abuse*), as well as an abuse composite score summing history of all three types of abuse (0=*no reported history of abuse*, 1=*history of one type of abuse*, 2=*history of two different types of abuses*, 3=*history of all three types of abuse*).

Connor-Davidson Resilience Scale–10 item.[44] The 10-item CD-RISC is an abbreviated and more reliable version of the original 25-item CD-RISC.[4] The scale captures personality traits and adaptive coping strategies that enhance an individual's ability to strive despite adversity, including items such as ''I believe I can achieve my goals, even if there are obstacles'' and ''I try to see the humorous side of things when I am faced with problems.'' Respondents rate the 10 items on a scale from 0 (*not true at all*) to 4 (*true nearly all the time*) and total scores range from 0 to 40, with higher scores reflecting greater resilience. The CD-RISC-10 has demonstrated good internal consistency (Cronbach's α coefficient=0.85) and construct validity, with CD-RISC scores significantly moderating the relationship between childhood maltreatment, trauma exposure, and psychiatric symptoms in the general population.[44] In the current sample, the Cronbach's alpha reliability coefficient was 0.91.

HAART adherence. Women were asked how often they took their HAART medication as prescribed during the 6 months before the current study visit and chose one of five response options (1 = *100%*, 2 = *95–99%*, 3 = *75–94%*, 4 = *< 75%*, 5 = *0%*). Self-report adherence measures have been found to have reliable concurrent and predictive validity with measures of disease progression including viral load and CD4 count.[56–58] A categorical variable was created from our measure of adherence with 1 = *adherence rate ≥ 95%* and 0 = *< 95% adherence or not taking HAART* although HAART was medically indicated at the current or previous visit based on a CD4+ cell count below 500.

HIV disease progression. Immunologic disease stage was assessed by CD4+ cell counts, and virologic disease stage was assessed by HIV RNA load, given in copies per milliliter of blood. AIDS Clinical Trials Group (ACTG) certified laboratories measured CD4+ cells/mm^3 by immunofluorescence using flow cytometry; and in laboratories participating in the National Institutes of Health Viral Quality Assurance Program, HIV-1 RNA levels were assessed using a nucleic acid sequence–based amplification (COBAS/TaqMan) method, which has a detection limit of 20 copies/mL. Consistent with the CD4+ cell count below 200 being one of the criteria for the definition of AIDS,[59] we used a categorical CD4+ cell count of ≥ 200 vs. < 200 in our analyses. Viral load was dichotomized as 0 = *< 20 copies/ml* (*undetectable)* versus 1 = *≥ 20 copies/ml* (*detectable)*.

Substance use

Data on substance abuse were also collected because a history of substance abuse (hazardous drinking, crack, cocaine, heroin, or injecting drug use) has been found to relate to adherence, viral load, and CD4 counts data.[60] At the study visit, data were gathered for participants' self-report use of alcohol and illicit drugs (intravenous drugs, crack, cocaine, and heroin). We used the National Institute on Alcohol Abuse and Alcoholism (NIAAA) criteria for heavy alcohol drinking in women (3 or more drinks in a day or 7 or more drinks per week) and the National Institute on Drug Abuse (NIDA) recommendations for the measurement of illicit drug use. Three categories (current, former, or never) were created to capture history of alcohol, intravenous drugs, crack, cocaine, or heroin use.

Depressive symptoms

The Center for Epidemiological Studies Depression Scale (CES-D Scale),[61] a widely used self-report measure consisting of 20 items, was used to assess current depressive symptoms. Scores on the CES-D have been found to be significantly related to HAART adherence, mortality, and CD4+ cell counts among women with HIV.[62,63] The CES-D shows high internal consistency and moderate test-retest reliability in previous studies[62,63] and in the present study the Cronbach's alpha reliability coefficient was 0.98. All logistic regression analyses controlled for depression with scores ≥ 23 coded ''1'' to indicate probable depression and lower scores coded ''0''. A CES-D cut-off score of 23 to indicate clinical levels of depression has been used previously with the larger WIHS cohort.[63]

Statistical analyses

SPSS version 21.0 was used to analyze the data with Pearson correlations, independent samples *t*-tests, and hierarchical multiple logistic regressions. All analyses were two-tailed, with an alpha level of 0.05. Participants' CD-RISC resilience scores were analyzed in relation to sexual abuse, physical abuse, domestic violence, HAART adherence (≥ 95% vs. < 95%), viral load (≥ 20 vs. < 20 copies/mL), and CD4+ cell count (≥ 200 vs. < 200). A few participants were missing data on some measures: one participant was missing data on sexual abuse history and 9 participants did not have HAART adherence data because they were not medically indicated to be on HAART. Missing items were treated as missing in all data analyses.

Results

Descriptive statistics

Table 1displays descriptive statistics for the study's predictor and outcome variables as well as the sample sociodemographics. Eighty-seven percent of the sample of 138 HIV+ women self-identified as African American, 28% completed high school, and 24% attended some college. Of the 138 women, 55% percent reported a history of adult and/or childhood sexual abuse, 75% reported a history of physical abuse, 62% reported a history of domestic violence, 42% reported a history of all three types of abuse, and 9.4% reported current abuse. A history of substance use was also present in the sample, with 76.8% of women reporting a history of heavy drinking, crack/cocaine/ heroin, or intravenous drug use. The mean CD-RISC resilience score was 28.82 (SD = 7.8; Median = 30) and 27.5% of women were nonadherent to HAART (< 95%).

Preliminary analyses

Pearson correlations showed that age, income, enrollment wave, racial/ethnic identity (African American vs. other groups), depressive symptoms (CES-D score ≥ 23 vs. < 23), and substance use (i.e., heavy drinking, crack/cocaine/ heroin, or intravenous drug use), each significantly related to some predictors and/or outcomes and consequently were included as covariates in all regression analyses. Bivariate correlations also indicated that ≥ 95% HAART adherence significantly related to undetectable viral load ($r = -0.46$, $p = 0.001$) and CD4+ count ≥ 200 ($r = 0.18$, $p = 0.05$); and undetectable viral load was significantly associated with CD4+ count ≥ 200 ($r = -.018$, $p = 0.05$). A history of sexual abuse was significantly related to physical abuse ($r = 0.40$, $p = 0.001$) and domestic violence ($r = 0.42$, $p = 0.001$), and physical abuse and domestic violence were significantly associated with each other ($r = 0.42$, $p = 0.001$). In addition, no abuse variables significantly related to resilience scores.

Relationships between abuse histories, HAART adherence, and HIV disease markers

To test the hypothesis that abuse histories would relate to lower medication adherence (< 95%), detectable viral loads (≥ 20 copies/mL), and CD4+ cell count < 200, hierarchical multiple logistic regressions were run that controlled for

Table 1. Sample Characteristics and Socio-Demographic Statistics of 138 Participants

Characteristics	*Mean (SD)*
Age	45.74 (8.38)
Resilience (CD-RISC)	28.82 (7.8)
	n (%)
Current abuse	13 (9.4)
History of domestic violence	86 (62.3)
History of physical abuse	104 (75.4)
History of sexual abuse	76 (55.1)
Abuse composite	
History of 3 abuses	58 (42)
History of 2 abuses	32 (23.2)
History of 1 abuse	26 (18.8)
ART adherence (<95%)	38 (27.5)
Detectable viral load (≥20 copies/mL)	50 (36.2)
Below CD4 cutoff of 200	21 (15.2)
Substance use	
Current use	50 (36.2)
Previous use	64 (46.4)
Race	
White/non-Hispanic	6 (4.3)
White/Hispanic	6 (4.3)
African-American/non-Hispanic	120 (87)
African-American/Hispanic	1 (.7)
Other/Hispanic	2 (1.4)
Asian/Pacific Islander	1 (.7)
Native American/Alaskan	1 (.7)
Other	1 (.7)
Education	
Grade 11 or less	60 (43.4)
Completed high school	38 (27.5)
Some college	33 (23.9)
Completed college	5 (3.6)
Attended/completed graduate school	2 (1.4)
Income	
$6,000 or less	30 (21.7)
$6,001–$12,000	64 (46.4)
$12,001 or more	42 (30.4)
Employed	25 (18.1)
Marital Status	
Legally/common-law marriage	20 (14.5)
Not married but living with partner	9 (6.5)
Widowed	12 (8.7)
Divorced/annulled	21 (15.2)
Separated	15 (10.9)
Never married	60 (43.5)

age, race, income, wave, substance use, and depressive symptoms (CES-D score ≥23 vs. <23). Covariates were entered in block 1; sexual abuse, physical abuse domestic violence, abuse composite score, or current abuse were entered separately, each in an independent regression, as a main effect in block 2, and outcomes were HAART adherence (≥95% vs. <95%), viral load (≥20 vs. <20 copies/mL), and CD4+ cell count (≥200 vs. <200) with each outcome also tested in independent regressions. Results indicated that there were no significant main effects of current abuse, any of the three types of abuse histories, or multiple abuses on HAART adherence or HIV disease markers.

Relationships between resilience, HAART adherence, and HIV disease markers

Hierarchical multiple logistic regressions were run to test the hypothesis that women scoring higher on resilience would have higher medication adherence (≥95%), undetectable viral loads (<20 copies/mL), and CD4+ cell count ≥200 while controlling for age, race, income, wave, substance use, and depressive symptoms (CES-D score ≥23 *vs.* <23). Covariates were entered in block 1, resilience was entered as a main effect in block 2, and outcomes were HAART adherence (≥95% vs. <95%), viral load (≥20 vs. <20 copies/mL), and CD4+ cell count (≥200 vs. <200). Findings (shown in Table 2) indicated that each unit increase in resilience score was associated with a 1.08 increase in the odds of having ≥95% HAART adherence (95% CI 1.00–1.15) and a decrease of 0.94 in the odds of having a detectable viral load (95% CI 0.89–0.99).

Resilience interacting with abuse histories in relation to HAART adherence and HIV disease markers

Analyses were conducted to explore if resilience significantly interacted with sexual abuse, physical abuse, and domestic violence histories in relation to HAART adherence (≥95% vs. <95%), viral load (≥20 vs. <20 copies/mL), and CD4+ cell count (≥200 vs. <200). Two-way dummy interaction terms were created by multiplying standardized scores of abuse histories (sexual abuse, physical abuse, domestic violence, abuse composite score, or current abuse) and standardized resilience scores. Hierarchical multiple logistic regressions included the covariates: age, income, race, wave, substance use, and depressive symptoms (CES-D score ≥23 vs. <23) entered in block 1; abuse histories (each type in independent regressions) and resilience entered as main effects in block 2; and the dummy variables representing the interaction of resilience with abuse histories entered in block 3. The outcome variables of HAART adherence (≥95% vs. <95%), viral load (≥20 vs. <20 copies/mL), and CD4+ cell count (≥200 vs. <200) were tested in independent regressions. Results showed significant interactions between resilience and sexual abuse (OR = 1.85, 95% CI 1.11–3.09, $p = 0.02$) and resilience and the abuse composite score (OR = 1.85, 95% CI 1.08–3.16, $p = 0.03$) in relation to HAART adherence (≥95% vs. <95%). As displayed in Table 3, follow-up analyses showed that among women with a history of sexual abuse, each unit increase in resilience was associated with 1.15 increase in the odds of

Table 2. Logistic Regression Findings of Resilience Increasing Odds of ≥95% HAART Adherence and Decreasing Odds of Having Detectable Viral Load

Resilience score	*Wald*	*df*	p	*OR*	*95% CI*
HAART adherence (≥95% vs. <95%)	4.30	1	0.04	1.08	1.00–1.15
Viral load (≥20 vs. <20 copies/mL)	4.89	1	0.03	0.94	0.89–0.99
CD4+ cell count (≥ 200 vs. < 200)	1.05	1	0.31	0.97	0.91–1.03

Table 3. Logistic Regression Results of Resilience Relating to HAART Adherence as Moderated by Sexual and Multiple Abuse Histories

Resilience score		*Wald*	*df*	p	*OR*	*95% CI*
Sexual abuse history	HAART adherence (≥95% vs. <95%)	5.45	1	0.02	1.15	1.02–1.29
No sexual abuse history	HAART adherence (≥95% vs. <95%)	0.01	1	0.92	1.01	0.90–1.12
Multiple abuse history	HAART adherence (≥95% vs. <95%)	6.18	1	0.01	1.12	1.02–1.22
No multiple abuse history	HAART adherence (≥95% vs. <95%)	0.11	1	0.74	1.02	0.90–1.17

≥95% HAART adherence (95% CI 1.02–1.29) and for women with multiple abuse histories, each unit increase in resilience was associated with 1.12 increase in the odds of ≥95% HAART adherence (95% CI 1.02–1.22). However, among women with no history of sexual abuse or multiple abuse histories, resilience did not have a significant effect on HAART adherence (≥95% vs. <95%). The interactions between resilience and sexual abuse did not significantly relate to viral load (≥20 vs. <20 copies/mL) and CD4+ cell count (≥200 vs. <200) and the interactions between resilience and current abuse, physical abuse, or domestic violence did not significantly relate to CD4+ cell count (≥200 vs. <200), viral load (≥20 vs. <20 copies/mL), and HAART adherence (≥95% vs. <95%).

Discussion

The results of the present study indicated that resilience is an important factor that relates to better HIV health outcomes for women with HIV. The median CD-RISC score in this sample was high and similar to that found in samples of majority African American and women with trauma exposure,[6] which is noteworthy given other risk factors (e.g., poverty, substance use, and HIV stigma) experienced by women with HIV.[31] HIV-infected women who scored higher on resilience had increased odds of having undetectable viral loads and higher level of adherence to HAART. Our findings are consistent with previous studies reporting that positive psychological factors including finding meaning in challenging circumstances and being optimistic were related to slower rates of decline in CD4+ cell count and lower HIV mortality.[51] Resilience may have bidirectional relationships with levels of stress hormones as well as immune functioning, as suggested by the field of psychoneuroimmunology, which posits reciprocal relationships between psychological factors and neural and immune functioning.[64,65]

Resilience was measured using the CD-RISC-10, a self-report scale which captures personal qualities and adaptive coping strategies including humor, persistence, being able to adapt to change, and believing in one's ability to surpass obstacles.[4,44] Women scoring high on resilience may engage in more health promoting behaviors such as eating healthy foods, exercising, attending doctors' appointments, and adhering to prescribed medications. In addition, women who scored high on resilience may be able to conceptualize long-term goals of successfully managing their HIV and of having undetectable viral loads and may work toward achieving those goals by adhering to their medications consistently.

We also found that sexual abuse and multiple abuse history moderated relationships between resilience and HAART adherence. For women with HIV, having a history of sexual abuse or multiple abuses in combination with high resilience predicted high HAART medication adherence (≥95%), but for women without abuse histories resilience did not significantly relate to HAART adherence. This speaks to the potential power of resilience in promoting HAART adherence, especially for women with HIV who have histories of sexual abuse or multiple abuses. Women who have a history of abuse and score high on resilience may view HIV as yet another hardship that they can bounce back from, given that they survived and bounced back following abuse (i.e., their previous experiences have given them the courage and mindset to feel that they can overcome adversity). Having this view may buffer against the negative influence of abuse and translate into more consistent adherence to medications.

Inconsistent with previous literature noting that abuse/trauma is associated with HIV medication nonadherence and viral failure,[2,3,8,11,13] we did not find significant associations between current abuse or any histories of abuse (sexual abuse, physical abuse, or domestic violence) with HAART adherence, viral load, and CD4 count, even though we used the same measures of abuse. This may perhaps be due to our somewhat small sample size. Similarly, we did not detect any direct associations between abuse histories and resilience, as consistent with previous literature in which significant associations between resilience and abuse histories are not often found.[6,44,66] Experiencing abuse does not guarantee that one will develop adaptive coping strategies and personal qualities that are measured by CD-RISC; in fact many survivors have negative outcomes.

Our overall findings support the argument that among women with HIV, the association between abuse histories and poor HAART adherence and HIV disease markers that is often found in the literature can be mitigated by the presence of high resilience. Findings were limited by a cross-sectional study design, but suggest that intervention efforts aimed at promoting better health outcomes for women with HIV should assess for previous abuse and incorporate aspects that target resilience (e.g., encouraging women to view stressors and challenges as experiences they can overcome). Interventions that have targeted resilience have provided some evidence for feasibility and effectiveness.[67,68] A resilience intervention for women with HIV or at risk HIV- women may consist of culturally relevant sessions on resilient coping strategies (e.g., believing that you can take control and manage stressors in your life such as motherhood or HIV).[44] Future studies are needed among women with HIV to investigate changes in resilience over time in relation to their health outcomes and develop interventions to improve women's resilience.

Limitations

Our findings were limited by several factors. A cross-sectional study design prevents conclusions about causality and possible relationships among our variables over time. Our use of self-report measures to capture resilience, abuse, and HAART adherence may have been impacted by social desirability motivations and by participant's retrospective reports of past abuse. Moreover, due to our somewhat small sample size, we may have been inadequately powered to detect significant relationships been some variables (e.g., abuse histories and HAART adherence). Although resilience was significantly associated with increased odds of HAART adherence, and based on a clinically significant level ($\geq 95\%$) of HAART adherence,[14–16] the magnitude was small, but nonetheless consistent with some existing literature.[69,70] Finally, beyond controlling for depressive symptoms, we did not assess or take other psychiatric diagnoses into consideration, which may have been related to resilience and adherence. Future studies with larger samples and longitudinal designs controlling for psychiatric diagnoses are needed to increase our understanding of changes in resilience over time in relation to health outcomes in women with HIV. However, the novel findings from the present study extend our understanding of resilience and health outcomes among women with HIV and suggest additional areas for research and intervention efforts.

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Author Disclosure Statement

All authors declare that they have no conflicts of interest to disclose.

References

1. Centers for Disease Control Prevention. HIV Prevalence Estimates—United States, 2006. MMWR 2008:57:1073–1076.
2. Leserman J, Pence BW, Whetten K, et al. Relation of lifetime trauma and depressive symptoms to mortality in HIV. Am J Psychiatr 2007;164:1707–1713.
3. Machtinger EL, Haberer JE, Wilson TC, Weiss DS. Recent trauma is associated with antiretroviral failure and HIV transmission risk behavior among HIV-positive women and female-identified transgenders. AIDS Behav 2012;16: 2160–2170.
4. Connor KM, Davidson JRT. Development of a new resilience scale: The Connor-Davidson Resilience Scale (CD-RISC). Depress Anxiety 2003;18:76–82.
5. Farber EW, Schwartz JA, Schaper PE, Moonen DJ, McDaniel JS. Resilience factors associated with adaptation to HIV disease. Psychosomatics 2000;41:140–146.
6. Wingo AP, Wrenn G, Pelletier T, Gutman AR, Bradley B, Ressler KJ. Moderating effects of resilience on depression in individuals with a history of childhood abuse or trauma exposure. J Affect Disord 2010;126:411–414.
7. Yu XN, Lau JT, Mak WW, Cheng YM, Lv YH, Zhang JX. Risk and protective factors in association with mental health problems among people living with HIV who were former plasma/blood donors in rural China. AIDS Care 2009;21:645–654.
8. Cohen M, Deamant C, Barkan S, et al. Domestic violence and childhood sexual abuse in HIV-infected women and women at risk for HIV. Am J Public Health 2000;90:560–565.
9. Machtinger EL, Wilson TC, Haberer JE, Weiss DS. Psychological trauma and PTSD in HIV-positive women: A meta-analysis. AIDS Behav 2012;16:2091–2100.
10. Arriola KR, Louden T, Doldren MA, Fortenberry RM. A meta-analysis of the relationship of child sexual abuse to HIV risk behavior among women. Child Abuse Negl 2005; 29:725–746.
11. Cohen MH, Cook JA, Grey D, et al. Medically eligible women who do not use HAART: The importance of abuse, drug use, and race. Am J Public Health 2004;94:1147–1151.
12. Keuroghlian AS, Kamen CS, Neri E, Lee S, Liu R, Gore-Felton C. Trauma, dissociation, and antiretroviral adherence among persons living with HIV/AIDS. J Psychiatr Res 2011;45:942–948.
13. Meade CS, Hansen NB, Kochman A, Sikkema KJ. Utilization of medical treatments and adherence to antiretroviral therapy among HIV-positive adults with histories of childhood sexual abuse. AIDS Patient Care STDS 2009;23:259–266.
14. Paterson DL, Swindells S, Mohr J, et al. Adherence to protease inhibitor therapy and outcomes in patients with HIV infection. Ann Intern Med 2000;133:21–30.
15. Wood E, Hogg RS, Yip B, Harrigan PR, O'Shaughnessy MV, Montaner JS. The impact of adherence on CD4 cell count responses among HIV-infected patients. J Acquir Immune Defic Syndr 2004;35:261–268.
16. Garcia de Olalla P, Knobel H, Carmona A, Guelar A, Lopez-Colomes JL, Cayla JA. Impact of adherence and highly active antiretroviral therapy on survival in HIV-infected patients. J Acquir Immune Defic Syndr 2002;30: 105–110.
17. Bangsberg DR. Less than 95% adherence to nonnucleoside reverse-transcriptase inhibitor therapy can lead to viral suppression. Clin Infect Dis 2006;43:939–941.
18. Shuter J, Sarlo JA, Kanmaz TJ, Rode RA, Zingman BS. HIV-infected patients receiving lopinavir/ritonavir-based antiretroviral therapy achieve high rates of virologic suppression despite adherence rates less than 95%. J Acquir Immune Defic Syndr 2007;45:4–8.
19. Golin CE, Liu H, Hays RD, et al. A prospective study of predictors of adherence to combination antiretroviral medication. J Gen Intern Med 2002;17:756–765.
20. Mannheimer S, Friedland G, Matts J, Child C, Chesney M. The consistency of adherence to antiretroviral therapy

predicts biologic outcomes for human immunodeficiency virus-infected persons in clinical trials. Clin Infect Dis 2002;34:1115–1121.
21. Howard AA, Arnsten JH, Lo Y, et al. A prospective study of adherence and viral load in a large multi-center cohort of HIV-infected women. AIDS 2002;16:2175–2182.
22. Richman DD, Morton SC, Wrin T, et al. The prevalence of antiretroviral drug resistance in the United States. AIDS 2004;18:1393–1401.
23. Lucas GM. Antiretroviral adherence, drug resistance, viral fitness and HIV disease progression: A tangled web is woven. J Antimicrob Chemother 2005;55:413–416.
24. Wainberg MA, Friedland G. Public health implications of antiretroviral therapy and HIV drug resistance. JAMA 1998;279:1977–1983.
25. Vyavaharkar M, Moneyham L, Tavakoli A, et al. Social support, coping, and medication adherence among HIV-positive women with depression living in rural areas of the southeastern United States. AIDS Patient Care STDs 2007; 21:667–680.
26. Kalokhe AS, Paranjape A, Bell CE, et al. Intimate partner violence among HIV-infected crack cocaine users. AIDS Patient Care STDS 2012;26:234–240.
27. Tedaldi EM, van den Berg-Wolf M, Richardson J, et al. Sadness in the SUN: Using computerized screening to analyze correlates of depression and adherence in HIV-infected adults in the United States. AIDS Patient Care STDS 2012;26:718–729.
28. Toth M, Messer LC, Quinlivan EB. Barriers to HIV care for women of color living in the Southeastern US are associated with physical symptoms, social environment, and self-determination. AIDS Patient Care STDS 2013;27:613–620.
29. Schafer KR, Brant J, Gupta S, et al. Intimate partner violence: A predictor of worse HIV outcomes and engagement in care. AIDS Patient Care STDS 2012;26:356–365.
30. Tjaden P, Thoennes N. Extent, nature, and consequences of intimate partner violence: Findings from the National Violence Against Women Survey. Washington, DC: National Institute of Justice and the Centers for Disease Control and Prevention, July 2000.
31. Centers for Disease Control and Prevention. HIV infection among heterosexuals at increased risk–United States, 2010. Morbidity Mortality Weekly Rep 2013;62:183–188.
32. Demarco R, Lynch MM, Board R. Mothers who silence themselves: A concept with clinical implications for women living with HIV/AIDS and their children. J Pediatr Nurs 2002;17:89–95.
33. Whetten K, Reif S, Whetten R, Murphy-McMillan LK. Trauma, mental health, distrust, and stigma among HIV-positive persons: Implications for effective care. Psychosom Med 2008;70:531–538.
34. Kelso GA, Cohen MH, Weber KM, Dale SK, Cruise RC, Brody LR. Critical consciousness, racial and gender discrimination, and HIV disease markers in African American women with HIV. AIDS Behav 2013 Sept 28 [Epub ahead of print] DOI: 10.1007/s10461-013-0621-y.
35. Kobasa SC. Stressful life events, personality, and health: An inquiry into hardiness. J Pers Soc Psychol 1979;37:1–11.
36. Rutter M. Resilience in the face of adversity: Protective factors and resistance to psychiatric disorder. Br J Psychiatr 1985;147:598–611.
37. Lyons J. Strategies for assessing the potential for positive adjustment following trauma. J Trauma Stress 1991/01/01 1991;4:93–111.
38. Werner EE. Risk, resilience, and recovery: Perspectives from the Kauai Longitudinal Study. Dev Psychopathol 1993;5:503–515.
39. Olsson CA, Bond L, Burns JM, Vella-Brodrick DA, Sawyer SM. Adolescent resilience: A concept analysis. J Adolesc 2003;26:1–11.
40. Jacelon CS. The trait and process of resilience. J Adv Nurs 1997;25:123–129.
41. Bonanno GA. Uses and abuses of the resilience construct: Loss, trauma, and health-related adversities. Soc Sci Med 2012;74:753–756.
42. Bonanno GA, Galea S, Bucciarelli A, Vlahov D. Psychological resilience after disaster: New York City in the aftermath of the September 11th terrorist attack. Psychol Sci 2006;17:181–186.
43. Davidson J, Stein DJ, Rothbaum BO, Pedersen R, Szumski A, Baldwin DS. Resilience as a predictor of treatment response in patients with posttraumatic stress disorder treated with venlafaxine extended release or placebo. J Psychopharmacol 2012;26:778–783.
44. Campbell-Sills L, Stein MB. Psychometric analysis and refinement of the connor–davidson resilience scale (CD-RISC): Validation of a 10-item measure of resilience. J Trauma Stress 2007;20:1019–1028.
45. Min JA, Lee NB, Lee CU, Lee C, Chae JH. Low trait anxiety, high resilience, and their interaction as possible predictors for treatment response in patients with depression. J Affect Disord 2012;137:61–69.
46. Sexton MB, Byrd MR, von Kluge S. Measuring resilience in women experiencing infertility using the CD-RISC: Examining infertility-related stress, general distress, and coping styles. J Psychiatr Res 2010;44:236–241.
47. Wang L, Shi Z, Zhang Y, Zhang Z. Psychometric properties of the 10-item Connor–Davidson Resilience Scale in Chinese earthquake victims. Psychiatry Clin Neurosci 2010;64:499–504.
48. Fadardi JS, Azad H, Nemati A. The relationship between resilience, motivational structure, and substance use. Procedia Soc Behav Sci 2010;5:1956–1960.
49. Pietrzak RH, Johnson DC, Goldstein MB, Malley JC, Southwick SM. Psychological resilience and postdeployment social support protect against traumatic stress and depressive symptoms in soldiers returning from Operations Enduring Freedom and Iraqi Freedom. Depress Anxiety 2009;26:745–751.
50. Yi JP, Vitaliano PP, Smith RE, Yi JC, Weinger K. The role of resilience on psychological adjustment and physical health in patients with diabetes. Br J Health Psychol 2008;13:311–325.
51. Ickovics JR, Milan S, Boland R, et al. Psychological resources protect health: 5-year survival and immune function among HIV-infected women from four US cities. AIDS 2006;20:1851–1860.
52. Ironson G, Hayward H. Do positive psychosocial factors predict disease progression in HIV-1? A review of the evidence. Psychosom Med 2008;70:546–554.
53. Psychd ST, Troop M, Burgess AP, et al. The relationship of psychological variables and disease progression among long-term HIV-infected men. Int J STD AIDS 2000;11:734–742.
54. Barkan SE, Melnick SL, Preston-Martin S, et al. The Women's Interagency HIV Study. WIHS Collaborative Study Group. Epidemiology 1998;9:117–125.
55. Bacon MC, von Wyl V, Alden C, et al. The Women's Interagency HIV Study: An observational cohort brings

clinical sciences to the bench. Clin Diagn Lab Immunol 2005;12:1013–1019.
56. Lazo M, Gange SJ, Wilson TE, et al. Patterns and predictors of changes in adherence to highly active antiretroviral therapy: Longitudinal study of men and women. Clin Infect Dis 2007;45:1377–1385.
57. Nieuwkerk PT, Oort FJ. Self-reported adherence to antiretroviral therapy for HIV-1 infection and virologic treatment response: A meta-analysis. J Acquir Immune Defic Syndr 2005;38:445–448.
58. Wilson TE, Barron Y, Cohen M, et al. Adherence to antiretroviral therapy and its association with sexual behavior in a national sample of women with human immunodeficiency virus. Clin Infect Dis 2002;34:529–534.
59. Centers for Disease Control and Prevention. 1993 Revised classification system for HIV infection and an expanded surveillance case definition for AIDS among adolescents and adults. MMWR Recommend Rep 1992; 41:1–19.
60. Arnsten JH, Demas PA, Grant RW, et al. Impact of active drug use on antiretroviral therapy adherence and viral suppression in HIV-infected drug users. J Gen Intern Med 2002;17:377–381.
61. Radloff LS. The CES-D Scale: A self-report depression scale for research in the general population. Appl Psychol Meas 1977;1:385–401.
62. Ickovics JR, Hamburger ME, Vlahov D, et al. Mortality, CD4 cell count decline, and depressive symptoms among HIV-seropositive women: Longitudinal analysis from the HIV Epidemiology Research Study. JAMA 2001;285: 1466–1474.
63. Cook JA, Cohen MH, Burke J, et al. Effects of depressive symptoms and mental health quality of life on use of highly active antiretroviral therapy among HIV-seropositive women. J Acquir Immune Defic Syndr 2002;30:401–409.
64. Gidron Y, Gilutz H, Berger R, Huleihel M. Molecular and cellular interface between behavior and acute coronary syndromes. Cardiovasc Res 2002;56:15–21.
65. Maier SF, Watkins LR, Fleshner M. Psychoneuroimmunology. The interface between behavior, brain, and immunity. Am Psychol 1994;49:1004–1017.
66. Scali J, Gandubert C, Ritchie K, Soulier M, Ancelin ML, Chaudieu I. Measuring resilience in adult women using the 10-items Connor-Davidson Resilience Scale (CD-RISC). Role of trauma exposure and anxiety disorders. PLoS One 2012;7:e39879.
67. Steinhardt M, Dolbier C. Evaluation of a resilience intervention to enhance coping strategies and protective factors and decrease symptomatology. J Am Coll Health 2008;56:445–453.
68. Steinhardt MA, Mamerow MM, Brown SA, Jolly CA. A resilience intervention in African American adults with type 2 diabetes: A pilot study of efficacy. Diabetes Educ 2009;35:274–284.
69. Barclay TR, Hinkin CH, Castellon SA, et al. Age-associated predictors of medication adherence in HIV-positive adults: Health beliefs, self-efficacy, and neurocognitive status. Health Psychol 2007;26:40–49.
70. Brown JL, Littlewood RA, Vanable PA. Social-cognitive correlates of antiretroviral therapy adherence among HIV-infected individuals receiving infectious disease care in a medium-sized northeastern US city. AIDS Care 2013;25: 1149–1158.

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