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Resilience And Its Mediating Effect On The Relationship Between Life Stress And Health-Related Quality Of Life In Older Adult People Living With Hiv/aids

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Resilience and its Mediating Effect
on the Relationship Between Life Stress and Health-Related Quality of Life
in Older Adult People Living with HIV/AIDS

By

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Resilience and its mediating effect on the relationship between life stress and health-related quality of life in older adult people living with HIV/AIDS

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Background: By 2015, 50% of all HIV/AIDS cases in the United States will be persons 50-plus years of age. Very little, if any, research has examined resilience in older people living with HIV/AIDS (PLWHA). This research explored the conceptual construct of resilience and investigated the mediating effect of resilience on the relationship between life stress and health-related quality of life (HRQoL) in PLWHA over fifty.

Methods: Data from a sample of 299 PLWHA over 50 was analyzed using structural equation modeling (SEM) to define a hypothesized Resilience construct (represented by Coping Self-Efficacy, Active Coping, Hope/Optimism and Social Support) and to assess meditating effects of Resilience between Life Stress and three facets of HRQoL (Physical Well-Being, Emotional Well-Being, and Functional and Global Well-Being). In addition, the mediation model was further analyzed to examine moderating effects of demographic variables on the magnitude of mediating effects.

Results: The SEM results showed satisfactory model fit for the Resilience construct, χ^2 (18, $N = 299$) = 41.2, $p = .001$, and comparative fit index (CFI) = .98, incremental fit index (IFI) = .98, Tucker-Lewis coefficient (TLI) = .96, root mean square error of approximation ($RMSEA$) =0.066 (95% CI: [.039, .092]), with all factor loading ranging from 0.61 to 0.86. The mediational model demonstrated adequate fit (χ^2 (96, $N = 299$) = 226.9, $p < .0001$, $CFI = .96$, $IFI = .96$, $TLI = .95$, $RMSEA = .068$ (95% CI: [.056, .079]) and revealed a full mediating effect of Resilience between Life Stress and Functional and Global Well-Being, as well as partial mediating effects on the relationship between Life Stress and Physical and Emotional Well-Being. What's more, the study found that race and study sites moderated the mediating effects of Resilience, suggesting that Resilience may present differently across race/ethnicity, cultures, and other factors.

Conclusion: The model indicated a well-defined Resilience construct and suggested that resilience may reduce the negative influence of life stress on physical, emotional, functional and global well-being. Findings suggest that the development of culturally-sensitive interventions that build personal capacity and environmental support may contribute to better management of HIV/AIDS and may be more efficacious in increasing HRQoL in older adult PLWHA.

Keywords: HIV; resilience; older adults; health-related quality of life; life stress; mediation; structural equation modeling

INTRODUCTION

Aging among people living with HIV/AIDS (PLWHA)

With the advent of antiretroviral medications (ARVs) in the mid-1990s, HIV/AIDS has shifted to a largely manageable chronic disease and PLWHA are living increasingly longer. As a result, the prevalence of HIV disease among adults aged 50 and older is growing rapidly over the years (CDC, 2011). According to Centers of Disease Control and Prevention (CDC), nearly 17% of the new diagnoses in 2011 were among adults aged 50 and older (CDC, 2011), an increase of 3% compared to 2010 (CDC, 2010). The proportion of PLWHA over 50 will continue grow as the 40-49 age group, which has the largest number of PLWHA, ages (CDC, 2011). It is estimated that by 2015, half of all HIV/AIDS cases in the United States will be persons over the age of 50 (Effros, Fletcher et al. 2008). This demographic change in the HIV/AIDS population represents a unique challenge in assisting older adult PLWHA to live successfully and achieve better quality of life.

HRQoL in older adult PLWHA

As life expectancy increases for PLWHA, health-related quality of life (HRQoL) becomes increasingly important. HRQoL is a multidimensional construct that describes one's well-being across multiple facets such as physical well-being, emotional well-being and functional well-being (Peterman, Cella et al. 1997). Research has found that older adult PLWHA are more likely to suffer from HIV-related stigma, co-morbid physical health problems, lack of social support, and mental illnesses compared to the general population of PLWHA (Heckman, Heckman et al. 2002; Schrimshaw and Siegel 2003; Emlet 2006; Oursler, Goulet et al. 2006; Emlet 2007; Goulet, Fultz et al. 2007; Cahill and Valadez 2013), which may result in decreased HRQoL (Slater, Moneyham et al. 2013). However, few studies have focused on HRQoL in older adult PLWHA (Slater, Moneyham et al. 2013) and more research is needed in this area.

Life stress and its relationship with HRQoL in older adult PLWHA

Life stress of PLWHA is comprised of both HIV-related stressors and other life stressors (e.g., poverty, unemployment, homelessness, stigma/discrimination, violence), which are disproportionately experienced in this population. Life stress of PLWHA has been shown to be inversely associated with both physical and mental HRQoL (Koopman, Gore-Felton et al. 2002; Gibson, Rueda et al. 2011), and it is related to greater psychological distress, psychiatric disorders (Koopman, Gore-Felton et al. 2002) and other negative health outcomes (Murphy, Moscicki et al. 2000). To date, very little research has sought to identify variables that might reduce the impact of life stress on HRQoL among older adult PLWHA. Thus, the primary aim of this study is to understand the role of a psychosocial factor (e.g. resilience) in reducing the negative effects that life stress has on quality of life outcomes in the context of HIV disease.

Resilience

Although the definition of resilience varies, the one offered by Masten, et al. is a particularly comprehensive definition: "a good outcome despite adversity, sustained competence under stress, or recovery from trauma" (Masten, Best et al. 1990). Most definitions share two core components (Garmezy 1991; Luthar 1991; Luthar and Zigler 1991; Masten, Hubbard et al. 1999; Farber, Schwartz et al. 2000; Wilcox, Richards et al. 2004; Luthar, Sawyer et al. 2006; Rutter 2006; De Santis 2008; Cicchetti 2010; Rutter 2012; Betancourt, Meyers-Ohki et al. 2013): 1) exposure to significant adversity; 2) positive adaptation despite the adversity. In addition, it is important to notice that resilience is a dynamic developmental process rather than a fixed trait of an individual, and depends on a complex interaction of protective factors including individual and environmental characteristics (Masten, Best et al. 1990; Rutter 1999; Rutter 2000).

A "protective factor" is "something that modifies the effects of risk in a positive direction" (Luthar, Sawyer et al. 2006). Prior research on resilience has proposed three categories of protective characteristics, including personal traits, family characteristics, and external supports (Masten, Best et al. 1990). Though some resilience studies focus only on one's own competence (e.g. self-esteem, commitment, hope, self-mastery) (Farber, Schwartz et al. 2000; Martin and Marsh 2006; Howe, Smajdor et al. 2012; Betancourt, Meyers-Ohki et al. 2013), resilience can be more than just an individual trait, and may derive from interactions of individual and environmental factors (Masten, Best et al. 1990; Rutter 1999; Rutter 2000). Further, while many studies have included adaptation as a measure of resilience, adaptation may be better understood as an outcome of resilience rather than a protective factor (Rabkin, Remien et al. 1993; Farber, Schwartz et al. 2000).

The vast majority of the theoretical and empirical literature on resilience is focused on childhood resilience based on a developmental psychology framework (Cicchetti 2010). Few publications contain studies involving resilience among adults, and more specifically, in the context of HIV infection (Luthar and Cushing 2002). In addition, much of the research on mental health in adults living with HIV/AIDS has focused on risk factors and vulnerability among individuals. Thus, there is a need for a greater understanding of resilience in the context of HIV infection, which can inform future interventions aimed at building personal capacity and environmental support that will contribute to better management of HIV/AIDS and increase HRQoL in older adult PLWHA.

Overview of the study

In the present study, we will 1) develop and test a construct of Resilience; 2) examine the relationship between Life Stress and Physical, Emotional, and Functional and Global facets of HRQoL; 3) examine the relationship between Resilience and the three facets of HRQoL; 4) examine the unique mediational contributions of Resilience to the relationship between Life Stress and the three facets of HRQoL; and 5) examine the moderating effects of key

demographic variables on the mediation pathways between Life Stress and the three facets of HRQoL through Resilience.

METHODS

Participants and Procedure

PLWHA who were 50 years of age or older were recruited between November 2004 and February 2007 from New York City, Columbus, Ohio and Cincinnati, Ohio into a randomized, controlled trial (RCT) of a coping improvement group intervention (Heckman, Sikkema et al. 2011). Of 405 individuals who were screened, 349 (86.2%) were invited to complete pre-intervention assessment based on the following criteria: (a) 50 years of age or older; (b) self-reported HIV infection or AIDS; (c) a Beck Depression Inventory II (BDI-II) (Beck, Steer et al. 1996) score between 10 and 40; (d) a Modified Mini Mental State Examination (3MS) (Teng and Chui 1987) score of 75 or greater; and (e) voluntary provision of informed consent. Persons with severe depression (BDI-II > 40) and/or considerable cognitive impairment (3MS < 75) were disqualified and referred for alternative services. Eligible participants were then administered a pre-intervention assessment battery using audio computer-assisted self-interview (ACASI). Of 349 eligible individuals, 310 completed the pre-intervention assessment. Participants with missing responses for a majority (90%) of the assessment questions from any relevant scale were excluded, yielding a final sample size of 299.

Measures

The present study only used the pre-intervention assessment data ($N = 299$) to model the Resilience construct and assess the mediational model of Life Stress, Resilience and three facets of HRQoL (Physical, Emotional, and Functional and Global Well-Being). Structural equation modeling (SEM) was applied. The observed variables were measured through the following baseline scales. Each Cronbach α (scale reliability) reported is based on the data from the present study, and the calculations were performed using SPSS 16.0.

Life Stress

A 19-item Life Problems and Concerns Checklist (DeMarco, Ostrow et al. 1999) ($\alpha = .85$) was used to measure life stress across a variety of domains (e.g. health care, housing, finance, discrimination, health, family, employment, etc). Respondents indicate the extent to which they perceive each domain as a problem, based on a 5-point Likert scale ranging from 1 ('*Not a problem*') to 5 ('*Most serious problem*'). The overall score is calculated by averaging all the item ratings. In the structural model, the individual items of the checklist were randomly divided into three parcels to construct a latent variable in order to correct the biasing effects of measurement error (Coffman and MacCallum 2005) and avoid being treated as an indicator of resilience. Parceling was completed by aggregation of the items randomly assigned within each parcel and the three parcels were loaded together to create the latent variable of life stress.

Health-related Quality of life

  The revised Functional Assessment of Human Immunodeficiency Virus Infection (FAHI) quality of life instrument was used to assess participants' health-related quality of life (HRQoL) (Peterman, Cella et al. 1997). The revised FAHI is a 44-item measure with 5 subscales: 10-item *Physical Well-Being* (PWB, $\alpha = .90$), 10-item *Function and Global Well-Being* (FGWB, $\alpha = .88$), 13-item *Emotional Well-Being* (EWB, $\alpha = .88$), 8-item *Social Well-Being* (SWB, $\alpha = .88$) and 3-item *Cognitive Functioning* (CF, $\alpha = .74$). Each question is rated based on a 5-point Likert scale ranging from 0 ('*Not at all*') to 4 ('*Very much*'), indicating respondent's attitude in regard to his or her illness.

  In the present study, the subscales PWB, EWB and FGWB were used to create outcome variables in the structural model. Two subscales, SWB and CF, were excluded as SWB overlapped with the resilience construct and the 3-item CF did not have adequate stability. For analysis preparation, items from the PWB and EWB subscales reflecting a negative perspective about physical health (e.g. "*I have a lack of energy*") and emotional status (e.g. "*I worry about dying*") were inversely coded. One item ("*I am losing hope in the fight against my illness*") in FGWB was also inversely coded to maintain consistency with the other two subscales. In addition, the items of the PWB, EWB and FGWB subscales were parceled into latent variables for the same purpose and following the same procedures as for Life Stress latent variable.

Resilience

  Based on the reviewed literature on factors contributing to resilience and the available baseline measures, the hypothesized measurement model of resilience was constructed using four indicator variables--Coping Self-Efficacy, Active Coping, Hope/Optimism and Social Support. Among these variables, Coping Self-Efficacy and Hope/Optimism are observed variables, while Active Coping and Social Support were treated as latent variables constructed by observed variables from the baseline measures below.

Coping Self-Efficacy

  Coping Self-efficacy was assessed using the Coping Self-Efficacy Scale (CSS) (Chesney, Folkman et al. 1996). The CSS is a 26-item scale that measures participants' beliefs about their ability to cope with challenges and threats. Each question uses an 11-point Likert scale ranging from 0 ('*Cannot do at all*') to 10 ('*Certain can do*'). The overall CSS score is calculated by averaging all the item ratings. The scale has excellent internal consistency in the current sample ($\alpha = .97$).

Active Coping

  The 61 coping items used in the study assessed coping strategies that HIV-infected older adults may employ to deal with life stressors. Of 61 items, 32 were from the Ways of Coping Questionnaire (WCQ) (Chesney, Folkman et al. 1996) and 11 items were from the Coping with

Illness Inventory (CWI) (Murphy, Rotheram‑Borus et al. 2003). Eight additional items were created solely for the intervention study. The WCQ is a 66-item questionnaire that assesses thoughts and actions individuals utilize to cope with stressful encounters, and the CWI is a 31-item questionnaire that assesses coping responses related to HIV illness. Respondents indicate the extent to which they have used each coping strategy, based on a 4-point Likert scale ranging from 1 ('*Not used*') to 4 ('*Used a great deal*'). The coping factors used in the current study were based on the results of a previous study which explored the coping structure using the same data set (Hansen, Harrison et al. 2013). The study found five specific first order coping factors (*Distancing Avoidance, Social Support Seeking, Self-Destructive Avoidance, Spiritual Coping, and Solution-Focused Coping*), which can be categorized into two general second order factors (*Active Coping and Avoidant Coping*). In the measurement model of resilience, only active coping factors (*Social Support Seeking* ($\alpha = .85$)*, Spiritual Coping* ($\alpha = .91$), *and Solution-Focused Coping* ($\alpha = .88$) were included to form a latent variable of Active Coping. In the structural model, coping was treated as an observed variable through aggregation of the three Active Coping factors ($\alpha = .92$).

Hope/Optimism

An 8-item Future Orientation Scale (FOS) was developed to assess the participants' attitudes towards the future. Three items were taken from the Future Time Perspective Inventory (Heimber, 1963). Five items were taken from the Beck Hopelessness scale (Beck, Kovacs et al. 1975). Questions (e.g. "*The future seems very vague and uncertain to me*") are negatively worded and the items with positive wording were inversely coded. A 4-point Likert scale was used to rate the disagreement of negative perspective about the future, ranging from 1 ('*Completely true*') to 4 ('*Completely false*'). The overall score of FOS is created by averaging all the item ratings ($\alpha = .87$).

Social Support

Social Support was measured using the Provision of Social Relation Scale (PSR) (Turner, Frankel et al. 1983). The PSR ($\alpha = .89$) consists of two subscales: support from *Friends* (nine items, $\alpha = .88$) and *Family* (six items, $\alpha = .86$). Each question uses a 6-point Likert scale ranging from 0 ('*Very much like me*') to 5 ('*Not at all like me*'). Some items were inversely coded so that factor loadings were positive. In the measurement model of resilience, items from the PSR-Friends subscale were randomly divided into two parcels so that the latent variable of social support could be formed with three indicators. Overall scores for each of the PSR-Friends parcels and the PSR-Family subscale were calculated by averaging all the item ratings. In the structural model, social support was treated as an observed variable through aggregation of PSR-Friends and PSR-Family.

Statistical Analyses

The study hypothesized that: 1) the construct of Resilience in older adult PLWHA is comprised of Coping Self-Efficacy, Active Coping, Hope/Optimism, and Social Support; 2) greater Life Stress is related to lower levels of Physical Well-Being, Emotional Well-Being, and Functional and Global Well-Being; 3) greater Resilience is related to higher levels of Physical Well-Being, Emotional Well-Being, and Functional and Global Well-Being; 4) Resilience mediates the negative effect of Life Stress on Physical Well-Being, Emotional Well-Being and Functional and Global Well-Being; and 5) race and study sites moderate the mediating effects of Resilience on the relationship between Life Stress and Physical Well-Being, Emotional Well-Being and Functional and Global Well-Being.

Structural equation modeling (SEM) was applied to perform confirmatory factor analysis for the measurement model of Resilience and analysis of mediation for the structural model. SEM is a more efficient method for this type of analysis because it allows both observed variables and latent variables, accounts for measurement error (Hoyle 1995), simultaneously accounts for multiple regression equations and variances, and provides a more effective and direct way of modeling mediation, indirect effects, and other complex relationship among variables (Kline 2010). The analyses were completed using AMOS 21.0.

The model was evaluated for goodness of fit using the following fit indices: comparative fit index (*CFI*), incremental fit index (*IFI*), Tucker-Lewis coefficient (*TLI*), and root mean square error of approximation (*RMSEA*). Multiple fit indices have been shown to be an effective way to evaluate the fit of a model. A model is considered acceptable if *CFI* > .93 (Bryne 1994), *IFI* > .9, *TLI* > .9, and *RMSEA* < .08 (Browne, Cudeck et al. 1993). An ideal model is indicated when *CFI* > .95, *IFI* > .95, *TLI* > .95, and *RMSEA* < .05 (Steiger 1990) or alternatively, the upper bound of RMSEA should not exceed 0.08 (Hu and Bentler 1995). Modification indices (*MIs*) were examined to isolate sources of ill fit and correlate error terms with reasonable high covariance.

Prior to analysis, some scale items were inversely coded so that the correlations between items and factors were positive. In the original data set, invalid responses were re-coded as missing values. Because the percent of missing was very small (0.2%), simple imputation was used and missing values for ordinal and continuous variables were replaced with marginal means. Scores for the observed variables were created by averaging the corresponding item ratings. Distributions of the observed variables were examined, and severe non-normality was corrected using log-transformation. Scale reliability was assessed for all scales and subscales. The above procedures were completed using SAS 9.2 and SPSS 17.0.

After the mediational model was fitted, scores for the latent variables were calculated by summing the weighted factor scores based on the factor loadings. Bivariate associations between latent variables (Life Stress, Resilience, Physical Well-Being, Emotional Well-Being, Functional

and Global Well-Being) and demographic variables (Age, Number of years since diagnosis with HIV, Race, Sex, Education, Income, Relationship status, Sexual relationship status, AIDS status, Living status, and Study site) were examined to determine any potential moderator. Multi-group comparison was performed for possible moderators using AMOS 21.0.

RESULTS

Descriptive results

Table 1 provides detailed information regarding the study participants. The participants had an average age of 55 and had been living with HIV for an average of 12 years. More than half (60%) had been diagnosed with AIDS. The majority of the participants were male (67.6%),

Table 1. Demographic data for older adult PLWHA (*N* = 299)

Variable	*N* (%)	*M ± SD*	*Median*	*Range*
Age (in years)		55.2 ± 4.8	54	48-76
Number of years since diagnosis with HIV		12.4 ± 5.3	13	0-25
Sites				
New York City	236 (78.9)			
Ohio	63 (21.1)			
Sex				
Male	202 (67.6)			
Female	97 (32.4)			
Race				
African American	173 (57.9)			
Non-African American	126 (42.1)			
Education				
>=high school	228 (76.3)			
< high school	71 (23.7)			
Income				
<=$20,000	259 (87.2)			
>$20,000	38 (12.8)			
Relationship status				
In a relationship	154 (51.5)			
Not in a relationship	145 (48.5)			
Sexual relationship status				
Partnered	164 (54.8)			
Unpartnered	135 (45.2)			
Living status				
Living alone	196 (65.6)			
Living with others	103 (34.4)			
AIDS status				
Have been diagnosed with AIDS	180 (60.2)			
Not have been diagnosed with AIDS	119 (39.8)			

a. Percentages do not sum to 100 due to rounding error.

b. Frequencies do not sum to 299 due to missing data.

(African American (57.9%), had received at least a high school education (76.3%), and had an annual income less than $20,000 (87.2%). Further, about half of the study participants reported being in a relationship (51.5%) and slightly more than half reported being in a sexual relationship (54.8%), though more than half of the respondents reported living alone (65.6%).

Bivariate analysis of demographic information of the study participants was performed, and significant associations among Sex, Race, Education and Study sites were found (**Table 2**). Among 299 study participants, women were significantly more likely to be African Americans (79.4%), less educated (39.2%) and live in New York City (96.9%) compared to men (*p's* < .001), African Americans were more likely to live in New York City (89.6%) and to be less educated (30.6%) compared to non-African Americans (*p's* < .01), and New York City had more participants who were less educated (27.1%) compared to Ohio (*p* < .01).

Table 2. Associations among demographic variables for older adult PLWHA (N=299)

Variable	Male (n = 202) Freq (%)	Female (n = 97) Freq (%)	χ^2
Race			27.3***
African American	96 (47.5)	77 (79.4)	
Non-African American	106 (52.5)	20 (20.6)	
Study sites			27.9***
New York City	142 (70.3)	94 (96.9)	
Ohio	60 (29.7)	3 (3.1)	
Education			18.9***
<high school	33 (16.3)	38 (39.2)	
>=high school	169 (83.7)	59 (60.8)	
	African American (n = 173) Freq (%)	Non-African American (n = 126) Freq (%)	χ^2
Study sites			28.1***
New York City	155 (89.6)	81 (64.3)	
Ohio	18 (10.4)	45 (35.7)	
Education			10.8**
<high school	53 (30.6)	18 (14.3)	
>=high school	120 (69.4)	108 (85.7)	
	New York City (n = 238) Freq (%)	Ohio (n = 63) Freq (%)	χ^2
Education			7.0**
<high school	64 (27.1)	7 (11.1)	
>=high school	172 (72.9)	56 (88.9)	

a. Percentages do not sum to 100 due to rounding error.
b. Frequencies do not sum to 299 due to missing data.
c. ** p < .01 *** p < .001

Measurement model of Resilience

Prior to analyzing the structural model, a measurement model of Resilience was formed using the two latent variables (Active Coping and Social Support) and two observed variables (Coping Self-Efficacy and Hope/Optimism) described above (**Figure 1**). An initial test of the measurement model suggested satisfactory model fit, χ^2 (18, $N = 299) = 41.2$, $p = .001$, $CFI = .98$, $IFI = .98$, $TLI = .96$, $RMSEA = .066$ (95% CI: [.039, .092]). All factor loadings were significant ($p's < .0001$), and Resilience had reasonable loadings on its four indicators, with a range from 0.61 to 0.86. The results indicated the Resilience construct was relatively well-defined.
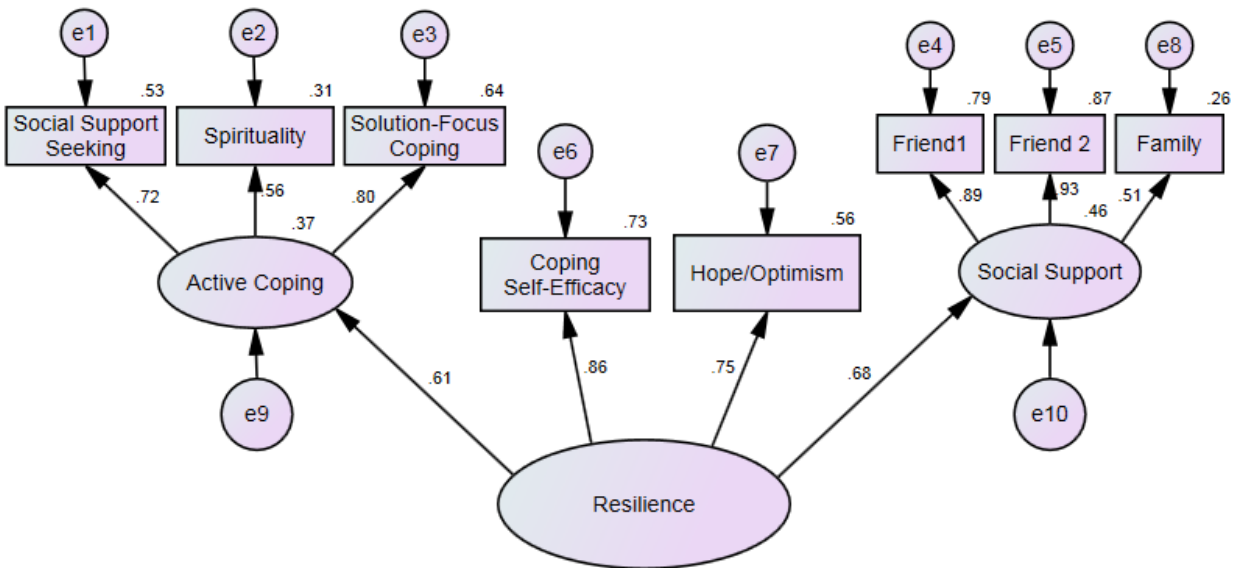

Figure 1. Measurement model of Resilience ($N = 229$). Standardized parameter estimates are shown beside the single-directional arrows. Squared multiple correlations are shown beside latent and observed variables, representing the portions of variable variance explained in the endogenous variables. e1 - e10 are residual terms.

Resilience mediational model

A structural model was fit to determine whether Resilience mediated the relationships between Life Stress and three facets of HRQoL (Physical Well-Being, Emotional Well-Being, and Functional and Global Well-Being) (**Figure 2**). The modification indices for the structural model suggested a disturbance error covariance between the dependent variables *Physical Well-Being* and *Emotional Well-Being*, which, when allowed to correlate, resulted in a significant improvement in the model fit. The final model had an adequate fit, χ^2 (96, $N = 299) = 226.9$, $p < .0001$, $CFI = .96$, $IFI = .96$, $TLI = .95$, $RMSEA = .068$ (95% CI: [.056, .079]). The path from Life Stress to Functional and Global Well-Being was non-significant ($\beta = -.10$, $p = .134$). The other parameter estimates were all significant ($p's < .0001$). The model accounted for 73% of the variance in Functional and Global Well-Being, 61% in Emotional Well-Being, and 40% in Physical Well-Being. **Table 3** displays means, standard deviations, and scale ranges of the variables in both measurement model and structural model.
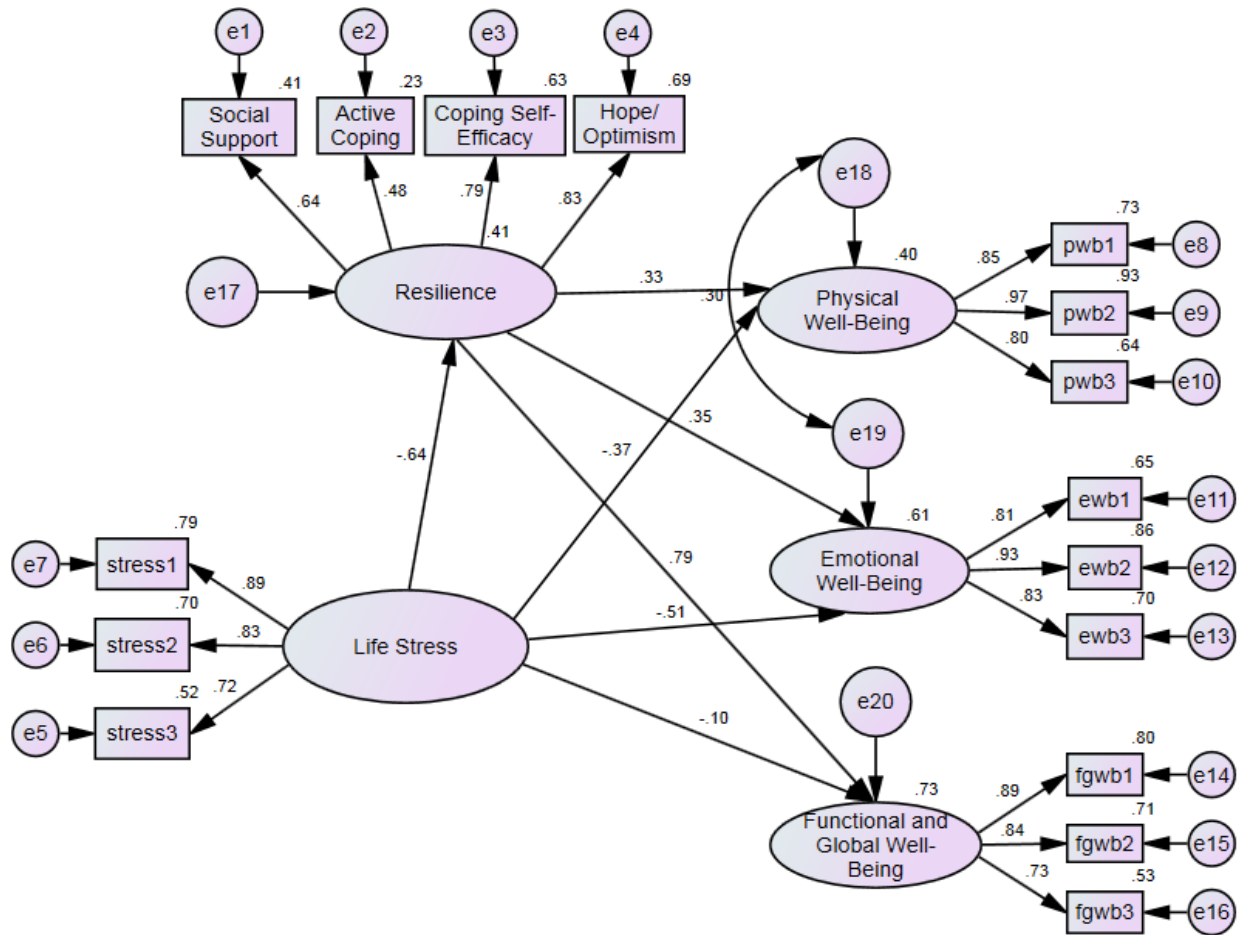
Figure 2. Final model of relationships among Resilience, Life Stress and three dimensions of HRQoL. Standardized parameter estimates are shown beside the single-directional arrows. Squared multiple correlations are shown beside latent and observed variables, representing the portions of variable variance explained by the endogenous variables.

Table 3. Means and standard deviations of variables in models (*N* = 299)

Variable	Scale Range	*M*	*SD*
Life Stress	1-5	1.80	0.57
Resilience			
Active Coping	1-4	2.30	.61
Social Support Seeking	1-4	2.24	.73
Spirituality	1-4	2.30	.87
Solution-Focused Coping	1-4	2.35	.70
Social Support	0-5	3.74	.76
Friends	0-5	3.90	.76
Family	0-5	3.60	.99
Coping Self-Efficacy	0-10	6.69	1.97
Hope/Optimism	1-4	2.77	.61
Physical Well-Being	0-4	2.71	.80
Emotional Well-Being	0-4	2.54	.88
Functional and Global Well-Being	0-4	2.17	.74

Direct effects

All direct effects are shown in **figure 2**. The model indicated that Life Stress negatively predicted Resilience ($\beta = -.64$, $p < .0001$). The direct effects of Resilience on Physical Well-Being ($\beta = .33$, $p < .0001$), Emotional Well-Being ($\beta = .35$, $p < .0001$), and Functional and Global Well-Being ($\beta = .79$, $p < .0001$) revealed that HIV-positive older adults with greater resilience were significantly more likely to have better physical, emotional, and functional and global well-being. The positive effect was greater on Functional and Global Well-Being than on the other two latent outcome variables. When the direct effect of Life Stress on Functional and Global Well-Being was adjusted for Resilience, it became non-significant, indicating a full mediation.

Total effects and indirect effects

Total effects and indirect effects of Life Stress on dependent variables are detailed in **table 4**. The results indicated that Life Stress was negatively associated with Physical Well-Being, Emotional Well-Being and Functional and Global Well-Being. The indirect paths were all significant (*p's* $< .0001$), indicating that Resilience significantly reduced the negative effects of Life Stress on HRQoL outcomes. The results evidenced that: 1) Resilience fully mediated the negative effect of Life Stress on Functional and Global Well-Being (percent mediated = 83.7%), with the adjusted direct effect being non-significant; and 2) Resilience partially mediated 36.5% of the total effect of stress on Physical Well-Being and 30.2% on Emotional Well-Being (the adjusted direct effects were still significant).

Table 4: Standardized total and indirect effects for structural model ($N = 299$)

Independent variable	Dependent variable		
	Physical Well-Being	Emotional Well-Being	Functional and Global Well-Being
	Total effects		
Life Stress	-.578***	-.735***	-.606***
	Indirect effects		
	-.211***	-.222***	-.507***
	Percent medicated through stress (Indirect effect/Total effect)		
	36.5%	30.2%	83.7%

*** $p < .001$

Moderated mediation

The bivariate analysis only showed significant associations between a few demographic variables (Study site, Race, Sex and Education) and the latent variables (Life Stress, Resilience, Physical Well-Being, Emotional Well-Being and Functional and Global Well-Being) (**Table 5**). The results indicated that older adult PLWHA living in NYC were associated with greater resilience ($p < .001$), and better physical, emotional and functional HRQoL (*p's* $< .01$) compared to those living in Ohio. Life stress did not differentiate across study sites ($p > .05$). Older black

PLWHA were associated with greater resilience ($p < .001$), less life stress ($p < .05$), and better physical, emotional and functional HRQoL ($p's < .01$) compared to other older adult PLWHA. In addition, the results showed that those who had education less than high school were associated with greater resilience compared to those with a higher education level ($p < .05$). As described above, there were more female study participants who were African American, less educated and living in New York City compared to the male participants; thus, life stress, resilience and HRQoL would also be likely to differ across sex. However, the results indicated that older female PLWHA only had significantly greater resilience compared to their male counterparts ($p < .001$). No significant correlations were detected between continuous demographic variables (Age, Number of years since diagnosis with HIV) and the latent variables.

Table 5. Associations between demographic variables and latent variables

Study site

Latent Variable	NYC ($n = 236$) $M \pm SD$	Ohio ($n = 63$) $M \pm SD$	t
Resilience	3.8 ± .8	3.2 ± .8	-5.47***
Life Stress	1.4 ± .5	1.5 ± .4	1.43
Physical Well-Being	2.4 ± .7	2.1 ± .7	-2.85**
Emotional Well-Being	2.2 ± .8	1.9 ± .6	-3.17**
Functional and Global Well-Being	1.8 ± .6	1.6 ± .5	-3.23**

* p < .05 ** p < .01 *** p < .001

Race

Latent Variable	Blacks ($n = 173$) $M \pm SD$	Non-Blacks ($n = 126$) $M \pm SD$	t
Resilience	3.9 ± .7	3.4 ± .8	-5.03***
Life Stress	1.4 ± .5	1.5 ± .5	2.00*
Physical Well-Being	2.5 ± .7	2.2 ± .7	-4.33***
Emotional Well-Being	2.3 ± .8	2.1 ± .7	-2.38*
Functional and Global Well-Being	1.8 ± .6	1.7 ± .6	-1.86

* p < .05 ** p < .01 *** p < .001

Associations of sex, education level and resilience

Variable	Male ($n = 202$) $M \pm SD$	Female ($n = 97$) $M \pm SD$	t	<=high school ($n = 71$) $M \pm SD$	> high school ($n = 228$) $M \pm SD$	t
Resilience	3.6 ± .8	4.0 ± .7	4.20***	3.9 ± .8	3.6 ± .8	-2.44*

* p < .05 ** p < .01 *** p < .001

Multi-group comparisons by race (Blacks vs. Non-Blacks) and study site (NYC vs. Ohio) were then performed to determine whether or not these two variables were moderators for the structural model. The results were shown in **figure 3** and **figure 4**. Race and study site significantly moderated the indirect effect of Life Stress on Functional and Global Well-Being

through Resilience. Among older adult PLWHA who were Black, Resilience mediated the negative effect of Life Stress on Functional and Global Well-Being (β = -.554, p < .0001) to a greater extent than among older adult PLWHA who were not Black (β = -.469, p < .0001). Among older adult PLWHA who lived in NYC when the study was conducted, Resilience mediated the negative effect of Life Stress on Functional and Global Well-Being (β = -.543, p < .0001) to a greater extent than among older adult PLWHA who lived in Ohio (β = -.384, p < .0001).
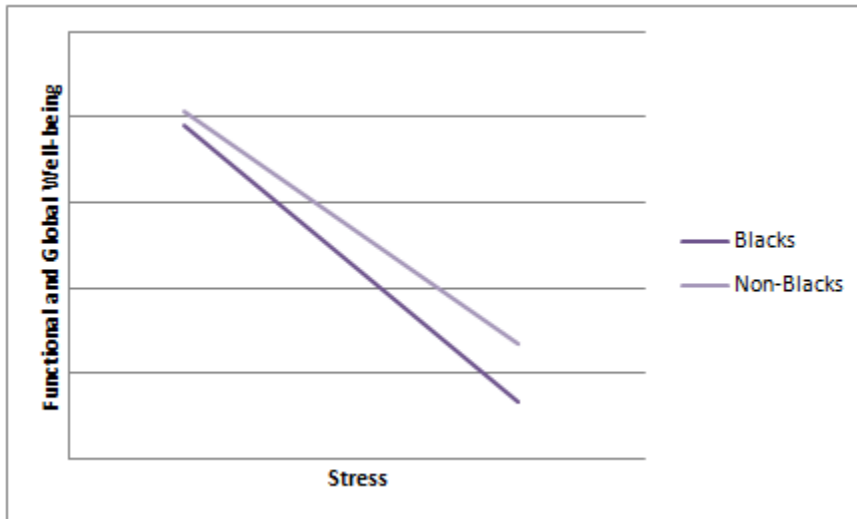

Figure 3. Life Stress and race group interact to predict Functional and Global Well-Being through the effect of Resilience.
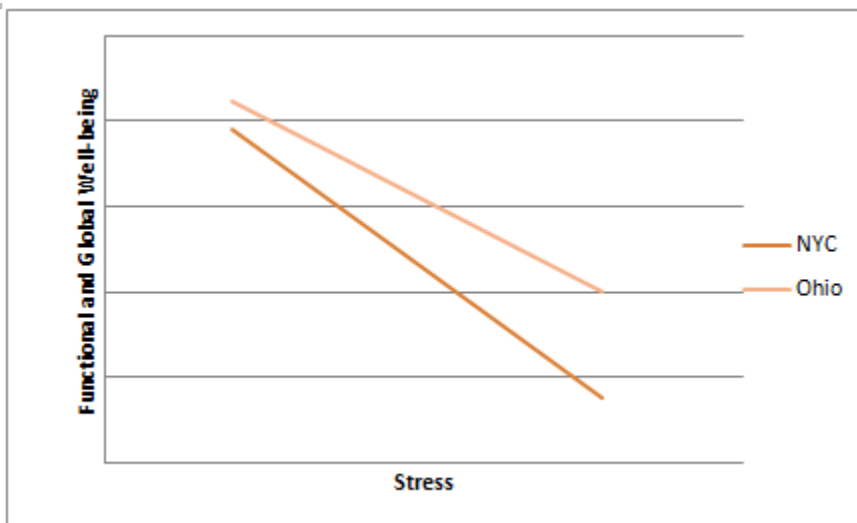

Figure 4. Life Stress and study site interact to predict Functional and Global Well-Being through the effect of Resilience.

CONCLUSIONS AND IMPLICATIONS

This study explored the construct of Resilience and examined how Resilience, in the context of HIV infection, influences the relationship between Life Stress and Physical, Emotional, and Functional and Global facets of HRQoL in older adult PLWHA, a group that is growing rapidly in size. The use of SEM allowed us to assess the total, direct and indirect effect

of Life Stress on three HRQoL dimensions in the mediation model, as well as simultaneously examine the moderating effects of demographic variables.

Our results supported the pre-defined Resilience model and found that Resilience in HIV-positive older adults could be predicted by Coping Self-Efficacy, Active Coping, Hope/Optimism and Social Support. In addition, individuals who reported more life stressors were less resilient and had decreased physical, emotional and functional well-being, while participants with greater resilience had better physical, emotional and functional well-being. A primary finding from the model was that Resilience could reduce some of the negative effects of Life Stress on Physical and Emotional Well-Being and all negative effects on Functional and Global Well-Being. Our results are in accord with some previous findings. According to Vance et al, spirituality and religiousness may help people age successfully with HIV and improve quality of life (QOL) (Vance, Brennan et al. 2011). In this study, spiritual coping approaches were a component of active coping and may contribute to resilience and serve as a buffer against life stress. It was also found among older Whites and African Americans that more spiritual and emotional support were associated with increased optimism and hence, leaded to better health outcome (Krause 2002). Social support has also been found to be significantly and positively correlated with QOL (Emlet, Fredriksen-Goldsen et al. 2013; Slater, Moneyham et al. 2013). Problem- and perception-focused coping were also positively related to QOL (Friedland, Renwick et al. 1996; Slater, Moneyham et al. 2013). Similarly, in the present study, Active Coping, including Social Support Seeking and Solution-Focused Coping, was positively associated with QOL. Research has also found self-efficacy to be a protective factor for mental health-related quality of life (Emlet, Fredriksen-Goldsen et al. 2013). Moreover, it has been shown that mastery (related to self-efficacy) can moderate negative effects of stressors, such as economic hardship, on HRQoL (Pudrovska, Schieman et al. 2005). However, these prior studies did not focus specifically on older adult PLWHA, as the current study has done.

Another interesting finding of this study was that being Black, female, living in NYC, and having less education were associated with greater resilience, part of which did not follow the expected directions and will need further speculations. It is understandable that participants living in NYC were more resilient than those living in Ohio given no significant difference in life stress, since NYC tends to have wider community network, more liberal attitude towards HIV/AIDS and homosexuals, and better structured living environment with more services and resources. After examining the associations among gender, education, race/ethnicity and four indicator variables of Resilience (Coping Self-Efficacy, Active Coping, Hope/Optimism and Social Support), the results indicated female participants and African Americans had significantly higher scores across all the four indicator variables ($p's < .01$), while less education was only associated with greater Coping Self-Efficacy ($p < .05$). As the majority of non-African Americans in this study were Whites (69%), previous studies that compared difference between African Americans and Whites could be referred to. An interesting finding from one study indicated that older Black people were more likely to benefit from religious belief and

spirituality which may increase coping capacity and optimism towards the future and hence lead to greater health outcome, compared to older Whites (Krause 2002). However, in terms of social support, older African Americans were reported to have significantly less frequent interactions with family and friends than older Whites (Peek and O'Neill 2001). Given the fact that Life Stress was negatively correlated with Resilience, lower level of life stress experienced by African American in this study may serve as a major reason for greater resilience. Regarding the gender variations on resilience, one study examining the role of gender in coping with HIV/AIDS among newly diagnosed patients indicated that women were more likely to engage in religious activities to cope with HIV/AIDS (Olley, Seedat et al. 2004), thus would have greater resilience. Additionally, female tended to seek and receive more emotional support than male, suggesting female had better social well-being than male (Vingerhoets and Van Heck 1990; Reevy and Maslach 2001; Day and Livingstone 2003). The reasons why less education was correlated with greater Coping Self-Efficacy remained unclear. It may be due to the fact that our study population generally perceived relatively higher social support and less life stress than expected, which has attenuated the positive effects of education. Regardless of previous study findings, as mentioned earlier, more women, African Americans and less-educated participants lived in NYC than Ohio, thus it is also likely that the geographic reason has contributed significantly to the variations of resilience across gender, race/ethnicity, and education level. What's more, this study also found that the mediating effects of resilience differed by study site and race. In all, our result suggested that resilience may present differently across geographic areas, cultures, genders and other factors.

The results from this study have several implications for experimental research and clinical practice. Specifically, interventions that aim at improving HRQoL among older adult PLWHA may consider building resilience through enhancing coping self-efficacy, active coping strategies, and social support, while encouraging hope for the future. More specifically, three components (social support seeking, spirituality, and solution-focused coping) of active coping may be incorporated into interventions that focus on strengthening active coping strategies among older adult PLWHA. The results also suggest that levels of resilience and the mediating effect of resilience may differ by gender, race, and geographic areas. While the underlying reasons have not been fully understood, future research that focuses on resilience may be designed to better understand factors that affect gender, race/ethnicity, and educational differences in manifesting resilience among older adult PLWHA. The results also inform future interventions that aim at improving resilience while taking race/ethnicity, gender, and geographic differences into consideration.

This study has several strengths that should be noted. First, this is one of the only studies we are aware of that has examined resilience, and the relationships among resilience, life stress and HRQoL, in older adult PLWHA, an increasingly growing population. Second, the focus of the study was on participant strengths or protective factors, as opposed to risk factors or vulnerability. Third, our study provided a way of measuring resilience that is empirically based.

The predictors of Resilience, as measured in this study (including Coping Self-Efficacy, Active Coping, Hope/Optimism, and Social Support), provide support for future interventions aiming to strengthen resilience among older adult PLWHA, as well as a measurement model to guide the assessment of resilience. Fourth, data were collected via ACASI interviews that maximized reliability. Finally, the study also examined resilience, life stress and quality of life across different demographic groups, which increases generalizability and provides further information to guide intervention designs that incorporate geographic, racial, gender and cultural differences.

However, the study has several limitations. First, the study is cross-sectional and did not account for confounding or alternative hypotheses, thus limiting the ability to make causal inferences from existing data. Reverse causality could exist. Longitudinal data would be needed to determine if improved HRQoL is temporally related to resilience. Second, the choice and measures of protective factors were limited to existing data from a larger study. It is possible that a more comprehensive model of protective factors and resilience could be achieved if survey questionnaires were specifically designed for this purpose. Third, the structural model did not consider alternative possibilities. There could be other variables that contribute to the structural paths. Finally, generalization may be an issue as study participants were all recruited from urban settings in the eastern United States (NYC, and Columbus and Cincinnati, Ohio), and participants on average had relatively low life stress and high social support. Future studies could address these limitations by using a longitudinal design, sampling a large and more geographically-diverse population, and considering more complex models with additional relevant variables such as medical co-morbidities and depression.

Taken as a whole, this study underscores the importance of resilience among older adult PLWHA and suggests that interventions designed to increase resilience through enhancing coping self-efficacy, active coping, social support and hope/optimism may be effective at improving the physical, emotional and functional well-being in this growing population.

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