

Age, stress, and isolation in older adults living with HIV

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People living with HIV (PLWH) have increasingly longer life spans. This age group faces different challenges than younger PLWH, which may include increased stress and social isolation. The purpose of this study was to determine whether the age and sex of PLWH are associated with measures of physiologic stress, perceived stress, and social isolation. In this cross-sectional study, we enrolled 102 PLWH equally into four groups divided by age (younger or older than 50 years) and gender. Participants completed well-validated survey measurements of stress and isolation, and their heart rate variability over 60 minutes was measured by Holter monitor. The mean (SD) Perceived Stress Scale score was 17.4 (6.94), mean Visual Analog Stress Scale score was 3.51 (2.79), and mean Hawthorne Friendship Scale score, a measure of social isolation, was 17.03 (4.84). Mean heart rate variability expressed as the SD of successive $N-N$ intervals was 65.47 (31.16) msec. In multivariable regression models that controlled for selected demographic variables, there was no relationship between the Perceived Stress Scale and age (coefficient = -0.09 , $p = -0.23$) or female gender (coefficient = -0.12 , $p = 0.93$); however, there was a modest relationship between female gender and stress using the Visual Analog Stress Scale (coefficient = 1.24 , $p = 0.05$). Perceived Stress was negatively associated with the Hawthorne Friendship score (coefficient = -0.34 , $p = 0.05$). Hawthorne Friendship score was positively associated with younger age (coefficient = 0.11 , $p = 0.02$). Age was the only independent predictor of physiologic stress as measured by heart rate variability (coefficient = -1.3 , $p < 0.01$). Our findings suggest that younger PLWH may experience more social isolation; however, age-related changes in heart rate variability do not appear to be related to perceived stress or social isolation. Future longitudinal research is required to more thoroughly understand this relationship and its impact on the health of PLWH.

Keywords: HIV; psychological stress; aging; social isolation; social stigma

Introduction

With the development and global scale-up of potent HIV antiretroviral therapy (ART) over the past 15 years, life expectancy for people living with HIV (PLWH) has increased dramatically. In 2001, 17% of all PLWH in the USA were older than 50 years of age. This number increased to 33% in 2009 (Centers for Disease Control and Prevention, 2010), and it is estimated that by 2014, half of all PLWH in the USA will be 50 years of age or older (High et al., 2012). AIDS-related deaths have fallen dramatically from 71% in 1988–1995 to 16% in 2005–2010 (Weber et al., 2012) while mortality from non-AIDS-defining disease of aging such as cardiovascular disease and cancer is rising (Chu et al., 2011; Engels et al., 2008; Kraft-Terry, Stothert, Buch, & Gendelman, 2010; Lescure et al., 2011). For example, cancer diagnoses among PLWH now occur approximately 20 years earlier than cancer diagnoses in the general US population (Shiels, Pfeiffer, & Engels, 2010).

The prevalence of neurocognitive disorders in PLWH is also high (Vance, Woodley, & Burrage, 2007). A recent study found that 52% of PLWH had some degree of neurocognitive impairment (Heaton et al., 2010), and that this impairment impacted their ability to work, manage financial resources, and manage activities of daily living (Gorman, Foley, Ettenhofer, Hinkin, & Gorp, 2009). Emler (2006b) found that older adults living with HIV had difficulty managing these multiple health conditions which tended to complicate key self-management tasks including medication adherence (Emler, 2006b). These increasing chronic comorbidities, in addition to HIV disease, might be linked to increased stress and isolation in PLWH and be exacerbated by aging.

The daily care of HIV is stressful for PLWH (Scott-Sheldon, Kalichman, Carey, & Fielder, 2008). Over the past 10 years, there has been substantial evidence linking stress and HIV disease progression (Greenson et al., 2008; Ironson & Hayward, 2008; Scott-Sheldon et al., 2008).

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The aging process has also been found to increase chronic inflammation, leading to increased disease, organ dysfunction, and frailty (Butcher & Lord, 2004; Effros et al., 2008; Kiecolt-Glaser, McGuire, Robles, & Glaser, 2002). This chronic inflammatory state may be modulated by stress (Butcher & Lord, 2004). To better understand the impact of stress on the daily care of HIV, a number of stress reductions interventions have been tested in PLWH. Promisingly, stress management interventions for PLWH tend to improve coping skills, social support, and mental health, but almost all of these studies have been conducted in men under the age of 50 (Antoni, 2003; Scott-Sheldon et al., 2008) leaving out two important populations – older adults and women living with HIV.

Social isolation has been described as living without companionship, social support, or social connectedness (Hawthorne, 2006). It has been linked to decreased quality of life, poor health status, increased health care utilization, functional decline, and death (Perissinotto, Cenzer, & Covinsky, 2012). HIV is a heavily stigmatized disease and older adults living with HIV tend to experience the dual threat of HIV stigma and ageism (Emlet, 2006b). Physiologically, in non-HIV-infected populations, social isolation has been linked to an increased cardiovascular risk, posited to be mediated by dysregulation of the cardiovascular, neuroendocrine, inflammatory, and metabolic systems (Grant, Hamer, & Steptoe, 2009), particularly in women (Hackett, Hamer, Endrighi, Brydon, & Steptoe, 2012). Social isolation has been linked to biomarkers predictive of cardiovascular morbidity and mortality (e.g., C-reactive protein, blood pressure, Fibrinogen) (Shankar, McMunn, Banks, & Steptoe, 2011). Similar increases in biomarkers are associated with maladaptive behaviors including smoking and physical inactivity in adults over the age of 50 (Shankar et al., 2011). These biomarkers are highly predictive of myocardial infarction and mortality in PLWH (Tien et al., 2010; Triant, Meigs, & Grinspoon, 2009). The allostatic load theory suggests that isolation results in a decreased response to cumulative stressful events by dysregulating the cardiovascular, neuroendocrine, inflammatory, and metabolic systems, in part explaining the consistent relationship between isolation and negative health outcomes in older adults (Juster, McEwen, & Lupien, 2010). Social isolation is increased in both older adults and PLWH, but no studies have described the possible impact of social isolation on psychological and physiologic stress in older adults living with HIV.

The purpose of this study was, therefore, to determine whether age and sex of PLWH are associated with their levels of stress and social isolation. Based on available literature, we hypothesized that: (1) age would be associated with stress and social isolation, such that

older adults living with HIV would have greater levels of stress and isolation than younger; and (2) women would have higher levels of stress and social isolation than men.

Methods

Sample and recruitment

In this cross-sectional study, we used purposive sampling to examine differences in stress and isolation between and younger men and women living with HIV. PLWH were recruited from HIV clinics, HIV service organizations, and a HIV research registry into four equally sized strata (women < 50 years; women > 51 years; men < 50; men > 51 years). All subjects were recruited from November 2011 to June 2012. Inclusion criteria included: (1) documented HIV diagnosis; (2) 18 years of age or older; (3) able to understand English; and (4) currently taking highly active ART for HIV. Individuals were excluded if they: (1) were unable to give informed consent; (2) had insulin-dependent diabetes; or (3) were dependent on a cardiac pacemaker. Participants with advanced diabetes and pacemakers were excluded because of the significant confounding effect on heart rate variability.

Procedures

The study was approved by the institutional review board of University Hospitals (Cleveland, OH). Written informed consent was obtained from eligible PLWH at a baseline visit. Height, weight, and vital signs were measured, and the participant was asked to rank their current level of stress on a 1–10 scale (Visual Analog Scale). Each participant then wore a Holter cardiac monitor for 1 hour at rest as described below. The participants were given a seven-day exercise and sleep diary and returned one week later to complete a survey asking about isolation, psychosocial stress, and other socio-demographic questions. Participants completed the electronic survey using iPads, to enhance the accuracy of self-report. Participants were compensated for their time with a \$50 cash gift card.

Measures

Demographic characteristics were obtained by self-report and medical data were abstracted directly from the participant's medical chart. Psychosocial stress level was assessed using two methods: the *Perceived Stress Scale* and a *single item stress Visual Analog Scale*. The Perceived Stress Scale has 10 items that are scored on a 0–4 scale. The total scale score ranges from 0 to 40 and is calculated by summing the item scores. A higher score indicates greater perceived stress. This widely used scale

has well-documented validity and a reliability coefficient of 0.78 (Cohen, Kamarck, & Mermelstein, 1983; Cohen & Williamson, 1988). The single item stress Visual Analog Scale asked participants “On a scale of 0–10, how stressed do you feel right now?” Participants were given a 10-point scale and were asked to put an “x” to mark their response. The Perceived Stress Scale was administered at the follow-up visit, as part of the survey. The Visual Analog Scale was administered at the first visit, just prior to starting the Holter cardiac monitor protocol as a method to assess the participant’s perception of stress, prior to initiating the heart rate variability protocol.

Heart rate variability was measured as a surrogate marker of physiologic stress. At the first visit, participants were asked to wear a Holter cardiac monitor (Aria Holter, Spacelabs Healthcare, Hertford, UK) for 60 minutes. During this time, participants relaxed in a quiet room and were provided with reading materials. Participants were not permitted to smoke or consume caffeine during the data collection. The Holter data were first cleaned to remove artifact and then analyzed with Sentinel Impresario Holter, version 7.1.3 (Spacelabs Healthcare, Hertford, UK). A single time-domain measure of heart rate variability – SD of $N-N$ intervals (SDNN) – was chosen a priori for analyses because it is

valid over short periods of time and because it has been used in previous literature examining vagal tone in conditions of psychological stress (Clays et al., 2011; Lee & Theus, 2012; Patron et al., 2012).

Social Isolation was assessed using the Hawthorne Friendship Scale. This 6-item scale was developed by Hawthorne (2006) in an aging population and has been widely used to assess social isolation. Each item is scored on a 0–4 Likert scale and the items are summed to create a total scale score. Higher scores indicate greater social connectedness, and lower scores indicate greater social isolation. Example items include “it has been easy for me to relate to others” and “I felt isolated from other people.” This scale has a reported reliability coefficient of 0.83. We found a reliability coefficient of 0.72 in this study.

HIV stigma was assessed using the HIV Stigma Scale. This 13-item scale was developed by Sowell et al. (1997) and revised by Emler to measure differences in HIV stigma between older and younger adults (Emler, 2005, 2006a). Each item is scored on a 1–4 Likert scale and the scores from all 13 items are summed to create a total scale score. Higher scores indicate more perceived stigma. Example items include: “I felt blamed for my illness” and “I felt people avoided me because of my illness.” This scale has a reported

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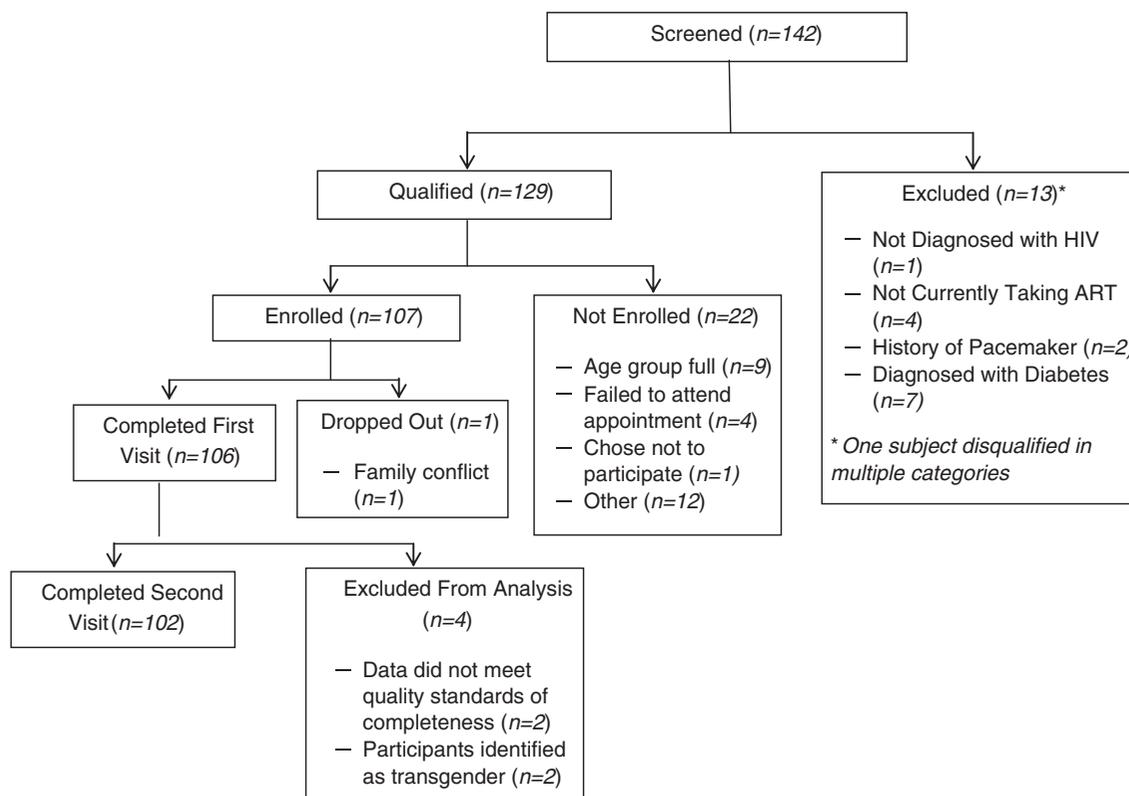


Figure 1. Recruitment and enrollment.

Table 1. Baseline characteristics of the participants.

	Male (n = 54)	Female (n = 48)	Total (n = 102)
Age (years)	47 (8.6)	48 (9.0)	48 (8.7)
Race			
African-American/Black	42 (81%)	43 (88%)	85 (84%)
Hispanic/Latina	0 (0%)	2 (4%)	2 (2%)
Native American/Indian	1 (2%)	0 (0%)	1 (1%)
White/Anglo (non-Hispanic)	7 (13%)	3 (6%)	10 (10%)
Other	2 (4%)	1(2%)	3 (3%)
Marital status			
Married	2 (4%)	7 (14%)	9 (9%)
Single	41 (79%)	29 (59%)	70 (69%)
Separated	1 (2%)	1 (2%)	2 (2%)
Divorced	3 (6%)	10 (20%)	13 (13%)
Domestic partnership	5 (10%)	0 (0%)	5 (5%)
Other	0 (0%)	2 (4%)	2 (2%)
Education level			
11th grade/less	8 (15%)	16 (33%)	26 (26%)
High school/general equivalency degree	16 (31%)	12 (25%)	28 (28%)
Some college/associates degree	17 (33%)	16 (33%)	33 (33%)
College degree (BS, BA, MS, or MA)	12 (23%)	4 (8%)	16 (16%)
Income			
No monthly income	9 (17%)	8 (16%)	17 (17%)
Less than \$200	6 (12%)	1 (2%)	7 (7%)
\$200–\$599	3 (6%)	6 (12%)	9 (9%)
\$600–\$799	17 (33%)	23 (47%)	40 (40%)
\$800–\$999	9 (17%)	2 (4%)	11 (11%)
\$1000 or more	9 (17%)	8 (16%)	17 (17%)
Have health insurance	47 (90%)	48 (98%)	95 (94%)
Type of health insurance			
Medicaid	21 (40%)	30 (61%)	51 (51%)
Medicare	15 (29%)	13 (27%)	28 (28%)
Veteran's benefits	4 (8%)	0 (0%)	4 (4%)
Private, provided by work	2 (4%)	2 (4%)	4 (4%)
Ryan white care act	16 (31%)	15 (31%)	31 (31%)
Have children (yes)	15 (29%)	41 (84%)	56 (56%)
Mean number of children	0.93 (0.88)	0.8 (0.98)	0.84 (0.95)
Paid employment	6 (12%)	8 (16%)	14 (14%)
Permanent housing	46 (88%)	45 (92%)	91 (91%)
Medical history			
Years living with HIV	14.1 (6.4)	13.21	13.57
Years since initiation of antiretroviral treatment	11 (5.0)	9 (4.9)	10 (4.9)
Recent CD4 T-cell count (cells/ μ L)	534 (322)	679 (385)	602 (358)
Undetectable HIV viral load	40 (77%)	40 (83%)	80 (78%)
One or more non-AIDS comorbidities	45 (83%)	36 (75%)	81 (80%)
Visit to the emergency department in the past 12 months	9 (16%)	12 (25%)	21 (21%)
Hospitalization in the past 12 months	3 (5.5%)	7 (15%)	10 (10%)

Notes: Data presented as mean (SD) or frequency (%). Education, having health insurance, Medicaid, veterans benefits and having children statistically differed (<0.05) between men and women at baseline. Education level, income, and Medicare statistically differed (<0.05) by age at baseline.

reliability coefficient of 0.83, and in this study, we found a reliability of 0.90.

Statistical analysis

All data were directly imported from the web-based data collection system, REDCAP, into a data management

program (Harris et al., 2009). All variables were summarized using appropriate descriptive statistics. Univariate comparisons between males and females were made using two-sample *t*-tests. Our primary hypotheses were tested using multivariable regression models. Separate models were fit for each of the three stress outcomes (Perceived Stress Scale, visual analog scale,

Table 2. Descriptive statistics of stress, isolation, and stigma by gender.

Scale	Possible range	Male (<i>n</i> = 54)		Female (<i>n</i> = 48)		Total (<i>n</i> = 102)		<i>p</i> -value
		Mean	SD	Mean	SD	Mean	SD	
Perceived Stress Scale	0–40	17.0	6.8	17.8	7.2	17.4	7.0	0.58
Heart rate variability (SDNN, msec)	N/A	64.9	31.0	66.1	31.7	65.5	31.2	0.85
Visual Analog Stress Scale	1–10	3.1	2.8	4.0	2.7	3.5	2.8	0.14
Hawthorne Friendship Scale (Isolation)	0–24	16.8	5.0	17.3	4.6	17.0	4.8	0.66
HIV Stigma Scale	13–52	22.6	9.9	22.6	7.7	22.6	8.9	0.99

Note: SDNN, Standard deviation of *N*–*N* intervals.

and heart rate variability) and for isolation (Hawthorne Friendship Scale). Potential covariates were chosen a priori and were consistent with previous literature.

Results

A total of 107 participants enrolled in the study. Two participants were later found to be transgender and were removed from the primary analyses because the study aimed to compare differences between gender and age groups. Two transgender participants did not provide a large enough sample to make statistically valid claims for this group. Three participants were excluded because they were enrolled twice or dropped out before completion of the study procedures. Participant flow is described in Figure 1. Among the final sample of 102 participants, 54 were male, and 52 were over 50 years old. The mean age of all participants was 48 years, and most were African-American (83%). On average, participants had been living with HIV for 13.5 years. Mean duration of ART was 11 years (range: 1–27 years), and 78% of participants had undetectable viral load. Eighty percent had a co-occurring health condition, and 21% had been admitted to the emergency department in the past 12 months. Additional baseline characteristics are compared in Table 1.

The mean (SD) Perceived Stress Scale score was 17.4 (6.9), mean heart rate variability (SDNN) was 65.5 (31.2) msec, and mean Visual Analog Stress Scale score was 3.5 (2.8). The correlation between the Perceived Stress Scale and single-item Visual Analog Scale was

0.19 ($p = 0.05$); between the Perceived Stress Scale and heart rate variability was 0.03 ($p = 0.77$); and between the Visual Analog Scale and heart rate variability was 0.16 ($p = 0.13$). Overall, the mean Hawthorne Friendship Scale score was 17.0 (4.8) and was similar in women compared to men [17.3 (4.6) vs. 16.8 (5.0), respectively, $p = 0.66$]. Mean HIV stigma score was 22.6 (8.9) and was also similar in women compared to men [22.6 (7.7) vs. 22.6 (9.9) respectively, $p = 0.99$]. Perceived stress varied ($p = 0.06$) between older participants and younger participants. Older participants had a mean score of 23.6 (6.8) and younger participants had a mean score of 21.0 (6.9). Heart rate variability significantly ($p = 0.02$) differed by the age of the participants, with older participants having less heart rate variability than younger participants. Additional descriptive information on the outcomes can be found in Tables 2 and 3.

In a multivariable regression model that controlled for additional covariates of interest (Table 4) there was no relationship between the Perceived Stress Scale and either age ($p = 0.23$) or gender ($p = 0.93$). Female gender was associated with a 1.2 point increase in stress as measured by the Visual Analog Scale, relative to males ($p = 0.05$). However, age was not associated with stress, as measured by the Visual Analog Scale ($p = 0.11$). Age was associated with a 1.3 msec decrease in heart rate variability ($p < 0.01$), although gender was not ($p = 0.50$). Similarly, a one-year increase in age predicted a 0.1 point decrease in friendship, ($p = 0.02$); but gender did not ($p = 0.7$). There were no observed interactions

Table 3. Descriptive statistics of stress, isolation, and stigma by age.

Scale	Possible range	≤50 (<i>n</i> = 49)		>49 (<i>n</i> = 52)		<i>p</i> -value
		Mean	SD	Mean	SD	
Perceived Stress Scale	0–40	21.0	6.9	23.6	6.8	0.06
Heart rate variability (SDNN, msec)	N/A	72.9	32.9	58.5	28.0	0.02
Visual Analog Stress scale	1–10	3.3	3.05	3.72	2.53	0.46
Hawthorne Friendship Scale (Isolation)	0–24	16.5	5.2	17.5	4.5	0.33
HIV Stigma Scale	13–52	24.0	9.0	21.3	8.6	0.14

Table 4. Multivariable models of the predictors of stress and social isolation.

	Model 1: Perceived Stress Scale		Model 2: Stress Visual Analog Scale		Model 3: Heart rate variability		Model 4: Hawthorne Friendship Scale	
	Estimate (CI)	p-value	Estimate (CI)	p-value	Estimate (CI)	p-value	Estimate (CI)	p-value
Age (years)	-0.09 (-0.24, 0.06)	0.23	-0.05 (-0.12, 0.01)	0.11	-1.3 (-2.1, -0.6)	<0.01	0.11 (0.02, 0.20)	0.02
Gender: Female	-0.12 (-2.39, 2.69)	0.93	1.24 (-0.01, 2.48)	0.05	4.6 (-8.8, 18.0)	0.50	0.32 (-1.41, 2.05)	0.71
BMI	0.05 (-0.12, 0.22)	0.55	0.01 (-0.07, 0.09)	0.76	-0.9 (-1.7, -0.1)	0.03	0.00 (-0.10, 0.11)	0.97
Income > \$800/month	-0.04 (-2.93, 3.01)	0.98	0.41 (-0.92, 1.73)	0.54	11.0 (-3.1, 25.2)	0.14	-0.09 (-1.92, 1.75)	0.35
Education ≥ high school	-2.14 (-5.21, 0.93)	0.17	0.06 (-1.30, 1.42)	0.93	-14.4 (-28.9, 0.2)	0.05	0.89 (-0.98, 2.77)	0.35
Years since HIV diagnosis	0.05 (-0.17, 0.26)	0.65	0.05 (-0.04, 0.15)	0.29	-0.30 (-0.7, 1.1)	0.53	-0.09 (-0.22, 0.04)	0.19
Friendship (Isolation)	-0.34 (-0.68, 0.00)	0.05	-0.05 (-0.20, 0.10)	0.55	0.50 (-1.1, 2.1)	0.57	-	-
Stigma	0.19 (0.00, 0.39)	0.05	0.03 (-0.04, 0.15)	0.29	0.20 (-0.7, -1.1)	0.67	-0.34 (-0.43, -0.25)	<0.01

between age and gender for all four outcomes modeled (all $p > 0.49$).

Additional statistically significant or borderline predictors of heart rate variability were body mass index (BMI) and education level (Table 4, model 3); however, psychosocial factors such as HIV stigma and social isolation were not related to heart rate variability as measured in this study (both $p > 0.5$). In contrast, HIV stigma was associated with both perceived stress and social isolation (Table 4, models 1 and 4). Social isolation also was associated with perceived stress independent of HIV stigma and other covariates (Table 4, model 1).

Conclusion

To the best of our knowledge, this is the first study designed to quantitatively assess the relationship between age, stress, and social isolation in adults living with HIV – a priority area defined by the NIH Office of AIDS Research HIV and Aging Working Group (High et al., 2012). Although Perceived Stress Scale scores did not differ by age or gender, our study suggests that PLWH have an overall higher level of stress compared to national normative data. In a large, national study ($N = 2387$), the average (SD) perceived stress for men was 12.1 (5.9) and for women it was 13.7 (6.6) (Cohen & Williamson, 1988). In our study, the mean perceived stress score was about 4–5 points (30–40%) higher on average. Similar to the trend described by Cohen et al., older participants in our study tended to report less perceived stress. Several recent studies using the same 10-item Perceived Stress Scale have also described high levels of stress among adults living with HIV. A recent analysis of 148 PLWH found a mean score of 20.40 (6.96) (Johnson, Sevelius, Dilworth, Saberi, & Neilands, 2012). The mean age of this sample was 45 years and over 80% were male. A study of 60 adult women living with HIV found a mean score of 30.5 (6.1), indicating very high perceived stress (Brown, Vanable, Carey, & Elin, 2011). The average age of this female sample was also 45 years. This increased stress may be related to the women’s unique social roles, increased poverty, decreased power in relationships, and increased mental health difficulties (Brown et al., 2011). Our study supports this existing evidence that PLWH experience higher levels of stress than those not infected with HIV and that women living with HIV may experience more stress than men. Additionally, younger adults living with HIV may experience more stress than those who are older, which suggests that interventions targeting this younger group should include strategies to help minimize stress.

We also found that our participants experienced more social isolation, on average, compared to national norms and that younger PLWH were significantly more isolated

than older PLWH. On average, our participants experienced significant amounts of isolation with a total mean score of 17.0 (4.8) that differed minimally by gender. These absolute scores are lower than national norms. For example, during the development of the Hawthorne Friendship Scale in over 3000 participants, 59% were very or highly socially connected with total scores ranging from 22 to 24 (Hawthorne, 2006), whereas only 20% of the subjects in our study had scores in that range. Interestingly, we found that younger PLWH were significantly more isolated than older PLWH, a phenomenon that was also seen in HIV-uninfected populations using this scale (Hawthorne, 2006). These findings are inconsistent with conflicting data which suggests that older PLWH have “limited and fragile friend-centered social networks” (High et al., 2012). Rather than focusing exclusively on older PLWH, our data provide compelling evidence of the need to examine the different causes and consequences of an increased isolation among younger PLWH. There are several possibilities for this conflicting data. First, older PLWH in this study were more experienced with HIV and over the years may have developed social networks more adapted to their health needs. Younger adults may still be struggling to accept HIV as a chronic condition and have social networks less suitable to their health needs. Second, while PLWH are living longer, it remains uncommon to see elder PLWH. The oldest participant in this study was 64 years old. Supportive social networks may disappear at more extreme ages than were represented in this study. As PLWH continue to age, further studies must continue observing support networks. Until then, this study suggests interventions to decrease isolation may be best targeted at younger adults.

Stigma associated with HIV was a significant predictor of perceived stress and social isolation in our study. HIV stigma continues to be a challenge for PLWH across their lifespan (Mahajan et al., 2008), but little work has focused on the effects of HIV as PLWH age. In one study, Grov, Golub, Parsons, Brennan, & Karpiak, (2010) found that HIV-associated stigma, increased loneliness, decreased cognitive functioning, and reduced levels of energy were significantly associated with depression in older adults living with HIV. These authors suggest that the interventions focused on reducing stigma and isolation could have lasting effects on perceived mental and physical health in this population.

Unfortunately, the existing literature provides little guidance on how to tailor individual, social, and structural stigma-reduction interventions to PLWH across the lifespan. Our study highlights the interconnectedness between HIV stigma, stress, isolation, and age in PLWH. We therefore suggest that a comprehensive, tailored, and multilevel approach may be best in

dealing with these complex issues (Latkin, Weeks, Glasman, Galletly, & Albarracin, 2010; Mahajan et al., 2008; Sengupta, Banks, Jonas, Miles, & Smith, 2011).

There are several limitations to this study. First, this was a single-site, cross-sectional study. PLWH in different geographic areas may have different experiences with stress, isolation, and stigma than those who participated in our study. We attempted to overcome this limitation with widely used and validated measurements, thus facilitating comparison with studies using other populations of PLWH. Second, while our study provides a baseline understanding of the relationship age, and stress, and social isolation, further longitudinal studies are needed to understand the complex causes of stress and social isolation in PLWH of all ages. Third, we did not ask about age-related discrimination which may add to the effects of HIV-related stigma in this population. Fourth, the sample population in this study was predominantly African-American which may limit the generalizability of study findings to more diverse populations or other ethnic minorities.

There is much to learn about the relationship between age, stress, and isolation in adults living with HIV. However, this study provides important contributions to this knowledge base. Given the increase in the prevalence of older adults living with HIV, it is important to better understand this relationship in order adults to develop interventions that will help PLWH to overcome the barriers of stress and social isolation to truly live well with the disease.

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