

**ABSTRACT**

**Purpose.** Rural older people living with HIV (PLH) in the U.S. are a population of growing size and significance. A better understanding of factors associated with quality of life (QOL), depressive symptoms, and stress in this population—especially modifiable factors—could inform future interventions.

**Methods.** Online or on paper, we surveyed 446 PLH aged 50+ residing in rural counties across the U.S. ( $M_{\text{age}}=56$ , 67% male, 67% White, 23% Black). Associations between social support, HIV stigma, satisfaction with medical care, discrimination in health care settings, and structural barriers and health-related QOL, depressive symptoms, and perceived stress were assessed using multiple linear regressions.

**Findings.** Controlling for demographics, greater social support was associated with better QOL, fewer depressive symptoms, and less stress. Greater HIV stigma was associated with more depressive symptoms and stress. Satisfaction with care was associated with better QOL and less stress. Discrimination in medical settings was associated with lower QOL and more depressive symptoms and stress. Finally, experiencing more structural barriers was associated with lower QOL and more depressive symptoms and stress.

**Conclusions.** In addition to engagement in care and viral suppression, QOL and mental health are also critical considerations for rural older PLH. Increasing social support, reducing or providing skills to cope with HIV stigma, improving quality of care, reducing discrimination and stigma in medical settings, and reducing or mitigating the impact of structural barriers present potential targets for interventions aiming to improve wellbeing for older rural PLH.

**Keywords:** HIV, quality of life, mental health, rural, older adult

Factors Associated with Quality of Life, Depressive Symptoms, and Perceived Stress Among  
Rural Older Adults Living with HIV in the U.S.

## INTRODUCTION

People living with HIV (PLH) aged 50 and older account for more than half of the U.S. population living with HIV.<sup>1</sup> The population of older PLH has continued to grow with advances in biomedical science that make HIV a chronic condition,<sup>2</sup> and from 2015-2019, the largest increase in HIV prevalence for any age group, 48%, was seen among persons over 65.<sup>1</sup> Modeling estimates predict that three-quarters of PLH will be aged 50 or older by 2030.<sup>3</sup>

At the same time, the proportion of HIV diagnoses occurring in rural areas has steadily increased.<sup>4</sup> Additionally, rural PLH face higher mortality rates and are less likely to be retained in HIV care and virally suppressed than non-rural PLH.<sup>5</sup> Acknowledging these disparities, the Federal 2019 Plan to End the HIV Epidemic prioritizes states with a high burden of HIV in rural counties.<sup>6</sup> However, despite the growing importance of older and rural PLH, little research has focused on this population.

Given that HIV infection can now be considered a chronic disease, there has been increased focus on improving quality of life (QOL) and mental health among PLH. Research suggests lower QOL among PLH than among HIV-negative individuals—even for PLH who are virally suppressed<sup>7</sup>—as well as poorer QOL for older versus younger PLH.<sup>8-10</sup> Additionally, rates of depression are higher among PLH than in the general population,<sup>11</sup> with reviews suggesting between 5% and 20% of adult PLH suffer from current major depression.<sup>12,13</sup> Studies also suggest that rural PLH have higher rates of depression than those from more urban areas,<sup>14</sup> and that rates of depression are high among older PLH,<sup>15-19</sup> who are also less likely than younger PLH to seek psychological or psychiatric treatment.<sup>20,21</sup> Depression and depressive symptoms

among PLH are associated with lower levels of medication adherence, poorer engagement in care, higher viral loads, and reduced odds of HIV disclosure.<sup>22-27</sup> Stress<sup>28</sup> and lower QOL<sup>29</sup> are also associated with poorer medication adherence for PLH. Little research has focused specifically on rural older PLH in the U.S., although this population is of growing size and significance. A better understanding of factors associated with QOL, depressive symptoms, and stress in this population—especially modifiable factors—could inform future interventions.

### **Factors associated with quality of life and mental health**

This research focuses on several possible influences on QOL and mental health for rural older PLH: social support, HIV stigma, satisfaction with medical care, discrimination in health care settings, and structural barriers.

Social support may influence QOL and mental health. Older adults—particularly the younger old (ages 50-59)—are at risk of loneliness.<sup>30</sup> Older PLH receive less support and assistance than older HIV-negative individuals<sup>31,32</sup> and report being more socially isolated than younger PLH.<sup>33</sup> Additionally, rural PLH perceive lower levels of social support from family and friends than do urban PLH.<sup>34</sup> PLH with more social support and those who are less lonely report better QOL<sup>35-37</sup> and have fewer depressive symptoms.<sup>15,25,36-42</sup> A limited number of studies have suggested this is true for older adult PLH specifically.<sup>30,43</sup> Qualitative work with PLH also suggests relationships between social support, stigma, and depression that may be intensified by the rural context.<sup>44</sup> To our knowledge, little quantitative research has focused on relationships between social support and QOL or mental health among rural older PLH.

Stigma is another factor that may influence QOL and mental health among rural older PLH. In qualitative studies, rural PLH report HIV-related stigma at both the interpersonal and community levels,<sup>45,46</sup> as do older PLH.<sup>47</sup> Several studies show associations between HIV stigma

and QOL<sup>36,37,39,43,48,49</sup> and depression.<sup>15,24,26,37,41,50,51</sup> A meta-analysis found that HIV stigma was associated with higher rates of depression among PLH.<sup>52</sup> However, the authors noted that few studies controlled for important confounders and observed relatively weak associations between HIV stigma and QOL when confounders were accounted for. One study focused on older gay men living with HIV found higher HIV stigma was related to lower QOL.<sup>53</sup> Two studies found the same association among rural PLH.<sup>28,54</sup> Notably, few studies have addressed HIV stigma and associated outcomes among rural older PLH.

Health care-related factors, including patient satisfaction with providers and discrimination in health care settings, may also influence QOL and mental health for PLH. Patient satisfaction is related to retention in care and medication adherence.<sup>55</sup> Additionally, provider stigma was one of the most common barriers to care in a review of 15 studies addressing barriers for rural PLH.<sup>56</sup> However, we know little about associations between these factors and QOL or mental health, particularly among rural older PLH. Several studies have suggested that positive patient-provider interactions or better-quality relationships with providers are associated with improved QOL or reduced depression among PLH,<sup>57-59</sup> although these studies have not focused specifically on older or rural populations.

Finally, structural factors, including issues with housing, transportation, food security, and internet access, may impact QOL and mental health for PLH. In a review of studies addressing barriers to care for rural PLH, transportation needs and lack of financial resources were two of the most commonly discussed barriers.<sup>56</sup> Food insufficiency and housing concerns have also reported by many PLH.<sup>60</sup> PLH with less stable housing report more depressive symptoms and lower QOL.<sup>51,61,62</sup> Additionally, food insecurity is associated with poor mental health among PLH.<sup>63-65</sup> Transportation may be a particular concern for rural PLH, who may lack

access to affordable and reliable transportation while needing to travel long distances for specialty HIV care.<sup>66-69</sup> Few studies have considered lack of internet access as a structural barrier for PLH. However, one longitudinal study found that women living with HIV with daily internet use reported better QOL.<sup>70</sup> Little research has focused on the influence of structural barriers on QOL or mental health among rural older PLH specifically.

### **Current study**

Although studies have identified factors associated with QOL and mental health for PLH, few studies have examined these factors simultaneously, especially among rural older PLH. To address this gap, we assessed factors associated with QOL, depressive symptoms, and perceived stress in a large, national sample of rural older PLH. This study builds on the literature by focusing specifically on rural older PLH, a growing population relatively neglected by the scientific literature. We hypothesized that social support and satisfaction with medical care would be positively associated with QOL and negatively associated with depressive symptoms and stress. In contrast, we hypothesized that HIV stigma, discrimination in medical settings, and structural barriers would be negatively associated with QOL and positively associated with depressive symptoms and stress.

## **METHOD**

### **Participants and Procedures**

Participants completed a survey between June and December 2016. Participants were recruited through AIDS service organization (ASO) referrals and radio advertisements; methods are described in depth elsewhere [Blinded]. Briefly, to be eligible, individuals had to be age 50 or older; self-identify as HIV-positive; and live in a county designated as rural by the U.S. Office of Management and Budget (2010 standards).<sup>71</sup> Participants screened for eligibility online or by

phone. Eligible individuals completed the survey online or via a paper survey sent to them with a postage-paid return envelope. Participants received \$50 for their time. The [Blinded] Institutional Review Board approved all procedures.

A total of 446 participants completed our survey. By phone, 164 individuals screened and 119 (73%) were eligible and sent paper surveys. Of those, 109 (92%) returned surveys. Online, 733 individuals screened; of those, 342 (47%) were eligible. Most who were eligible (337, 99%) completed at least some of the online survey.

## Measures

***Demographics and other covariates.*** Participants reported their *gender*, *age*, and *ethnicity*. For *race*, variables indicated whether participants identified as (1) Black/African American or (2) multiracial or another race (i.e., Asian, Native Hawaiian/Pacific Islander, American Indian or Alaska Native); white race served as the reference category. From participant reports of state of residence, *region* (Northeast, Midwest, West, or South<sup>72</sup>) was coded. Participants reported their *sexual orientation*; a variable represented sexual minority status (0 = straight/heterosexual, 1 = gay/lesbian/homosexual, bisexual, or another orientation). *Monthly income* was on a scale from \$0-\$1000 (0) to more than \$2001 (2). Participants reported *relationship status*; a variable indicated whether participants were in a long-term relationship (0 = single or casually dating, 1 = married or in a long-term relationship). Participants reported whether they had been diagnosed with or suffered from each of 13 *comorbid conditions* (e.g., high blood pressure, diabetes); endorsed conditions were summed to yield a count. From reports of year of HIV diagnosis, *years living with HIV* was coded. **To assess engagement in HIV care, participants reported whether they had seen an HIV provider within the past 6 months, whether they were currently taking HIV antiretrovirals and—if so—how many days within the past 30**

they had missed doses, and their most recent HIV viral load. Participants were considered engaged in care if they had seen a provider in the past 6 months, were taking antiretrovirals and had missed fewer than 3 days of medication in the past 30 days, and had an undetectable (<20 copies/mL) viral load at most recent assessment. Finally, participants reported whether or not they were currently receiving case management services. Information on engagement in care and case management is provided to contextualize our sample.

### ***Predictors***

***Social support.*** Social support was assessed with the 8 items from the Modified MOS Social Support Scale<sup>73,74</sup> ( $\alpha = .95$ ). Participants indicated how often different kinds of support were available to them (e.g., “Someone who understands your problems”) on a scale from none of the time (1) to all of the time (5). Items were averaged; higher scores indicated more support.

***HIV stigma.*** Perceived HIV stigma was assessed with the 33 items from the HIV Stigma Scale<sup>75</sup> ( $\alpha = .94$ ). Items capture anticipated, internalized, and enacted stigma (e.g., “Telling someone I have HIV is risky,” “Having HIV makes me feel that I’m a bad person,” and “People seem afraid of me because I have HIV”). Responses ranged from strongly disagree (1) to strongly agree (4). Items were averaged; higher scores indicated more stigma.

***Satisfaction with medical care.*** Satisfaction with medical care was assessed with the 18 items from the Patient Satisfaction Questionnaire 3<sup>76</sup> (e.g., “My doctors treat me in a very friendly and courteous manner,”  $\alpha = .89$ ). Responses ranged from strongly disagree (1) to strongly agree (5). Items were averaged; higher scores indicated greater satisfaction.

***Discrimination in health care settings.*** Participants reported whether they had ever felt discriminated against in a medical care setting (0 = no, 1 = yes).

**Structural barriers.** To assess *housing insecurity*, participants reported whether they had been homeless, lived in a shelter, needed to move in with others because of loss of housing, or been evicted within the past 3 years, and whether they had been unable to pay rent, mortgage, or utilities within the past 12 months. Participants endorsing any item were considered to have insecure housing. To assess *food insecurity*, participants reported whether they had cut meal size or skipped meals because there wasn't enough money for food within the past 12 months (0 = no, 1 = yes). Participants were considered to have *transportation barriers* if they reported not having a car in their household. Participants who reported not having access to the internet at home were considered to lack *internet access*. Indicators were summed to create a score ranging from 0-4.

## Outcomes

**Health-related quality of life.** QOL was assessed with 30 items from the original Medical Outcomes Study-HIV Health Survey (MOS-HIV or MOS-30)<sup>77,78</sup> (e.g., "In the past 30 days, how has the quality of your life been? That is, how have things been going for you?",  $\alpha = .89$ ).

Domains assessed include general health perceptions, physical functioning, role functioning, pain, social functioning, mental health, energy, health distress, cognitive functioning, QOL, and recent changes in health. Items focus on the past 30 days. Scale scores were created as described by Wu et al.,<sup>77</sup> with the 11 different domains equally weighted. Overall scores ranged from 0 to 100; higher scores indicated better health-related QOL.

**Depressive symptoms.** Depressive symptoms during the past 2 weeks were assessed with the 9 items from the Patient Health Questionnaire-9 (PHQ-9)<sup>79</sup> ( $\alpha = .91$ ). Participants indicated how often they had experienced different depressive symptoms (e.g., "Feeling down, depressed, or hopeless"). Responses ranged from not at all (0) to nearly every day (3). Items were summed; higher scores indicated more depressive symptoms.



**Perceived stress.** Stress during the past month was assessed with the 10 items from the Perceived Stress Scale (PSS)<sup>80</sup> (e.g., “In the last month, how often have you felt nervous and stressed?”,  $\alpha = .89$ ). Responses ranged from never (1) to very often (5). Items were averaged; higher scores indicated more stress.

### Data Analysis

Missing data was relatively rare (7% of all data was missing). Missing data was handled using multiple imputation,<sup>81</sup> with 100 datasets imputed and analyzed in Mplus 8.<sup>82</sup>

Linear regressions explored associations between social support, stigma, satisfaction with care, discrimination in medical settings, and structural barriers (predictors) and QOL, depressive symptoms, and perceived stress (outcomes), controlling for covariates. Simple regressions explored bivariate associations; multiple regression models then considered predictors simultaneously. We fit regression models in Mplus<sup>82</sup> using a full information maximum likelihood estimator robust to non-normality (the MLR estimator). We report standardized coefficients ( $\beta$ s). For binary predictors,  $\beta$ s are STDY estimates from Mplus, which can be interpreted as the change in the outcome variable in standard deviation units when the categorical covariate changes from zero to one.<sup>82</sup>

## RESULTS

### Descriptive Information

Our sample included 446 participants aged 50 to 74 ( $M_{\text{age}} = 55.60$ ,  $SD_{\text{age}} = 4.60$ ). Most were male (67% male, 33% female, <1% another gender) and white (67% white, 23% Black, 10% multiracial or another race, 9% Latinx). Participants came from 41 states across all 4 U.S. regions (16% Northeast, 24% Midwest, 33% South, 28% West). **Most participants (75%) were engaged in care, and 44% were currently receiving HIV case management services.** Further

demographic characteristics and descriptive information for predictors and outcomes appear in Table 1.

Participants reported moderate social support ( $M = 3.49$ ) and moderate-to-high satisfaction with medical care ( $M = 3.90$ ). While most participants (83%) had not experienced discrimination in medical settings, they reported moderate HIV stigma ( $M = 2.63$ ). Approximately half of participants did not face any structural barriers, although 21% faced 1 barrier, 30% faced 2-3 barriers, and 10% faced all 4 barriers. All barriers assessed were experienced by some participants: 31% had experienced housing insecurity, 25% had experienced food insecurity, 21% did not have a car in their household, and 19% lacked internet access.

The average QOL was 63.74 on the 100-point scale. Nearly half (47%) of participants met or exceeded the PHQ-9 cutoff score for mild depression, 21% for moderate depression, and 5% for severe depression.<sup>83</sup> Finally, perceived stress was moderate ( $M = 2.48$ ).

### **Factors Associated with Quality of Life, Depressive Symptoms, and Perceived Stress**

Multiple regression models (Table 2) showed that, after controlling for demographics and other covariates, those with more social support reported a better QOL,  $\beta = 0.29$  (0.05),  $p < .001$ , fewer depressive symptoms,  $\beta = -0.31$  (0.05),  $p < .001$ , and less stress,  $\beta = -0.36$  (0.05),  $p < .001$ . Those who perceived higher HIV stigma had more depressive symptoms,  $\beta = 0.12$  (0.05),  $p = .003$ , and higher stress,  $\beta = 0.10$  (0.04),  $p = .03$ . Those who were more satisfied with their medical care reported a better QOL,  $\beta = 0.10$  (0.04),  $p = .02$ , and less stress,  $\beta = -0.08$  (0.04),  $p = .045$ . Experiencing discrimination in medical settings was associated with lower QOL,  $\beta = -0.29$  (0.12),  $p = .01$ , and more depressive symptoms,  $\beta = 0.35$  (0.12),  $p = .004$ . Those experiencing

more structural barriers reported lower QOL,  $\beta = -0.17 (0.05)$ ,  $p < .001$ , more depressive symptoms,  $\beta = 0.20 (0.05)$ ,  $p < .001$ , and more stress,  $\beta = 0.22 (0.05)$ ,  $p < .001$ .

Considering covariates, those who were sexual minorities reported lower QOL,  $\beta = -0.24 (0.10)$ ,  $p = .01$ , more depressive symptoms,  $\beta = 0.22 (0.10)$ ,  $p = .03$ , and more stress,  $\beta = 0.37 (0.11)$ ,  $p = .001$ . Those who were married or in long-term relationships also had lower QOL,  $\beta = -0.29 (0.09)$ ,  $p = .002$ , more depressive symptoms,  $\beta = 0.24 (0.10)$ ,  $p = .02$ , and higher stress,  $\beta = 0.65 (0.10)$ ,  $p < .001$ . Individuals with more comorbid conditions reported lower QOL,  $\beta = -0.34 (0.04)$ ,  $p < .001$ , and more depressive symptoms,  $\beta = 0.19 (0.05)$ ,  $p < .001$ . Women reported lower QOL than men,  $\beta = -0.24 (0.07)$ ,  $p = .001$ . Finally, those with higher monthly income had a better QOL,  $\beta = 0.08 (0.05)$ ,  $p = .03$ .

Multiple regression models accounted for 53% of the variance in QOL, 46% of the variance in depressive symptoms, and 45% of the variance in perceived stress.

## DISCUSSION

Aging rural PLH may have fewer resources than their urban counterparts, impacting their QOL and mental health. This study of rural older PLH adds to a limited body of literature. Our analysis showed that, controlling for important covariates, social support, HIV stigma, satisfaction with medical care, experiences of discrimination in medical settings, and structural barriers were associated with QOL and mental health outcomes. Findings suggest targets for future interventions aimed at improving well-being within this population.

Perceived social support had robust associations with outcomes; participants with more support reported better QOL, fewer depressive symptoms, and less stress. This aligns with previous research focused on more general samples of PLH identifying associations between social support and QOL and mental health.<sup>15,25,30,35,36,38,40-43</sup> Increasing social support may improve

QOL and mental health for PLH. For example, one peer support intervention for PLH in Vietnam resulted in significant improvements in QOL.<sup>84</sup> Additionally, group support interventions have decreased depressive symptoms and stress among older PLH.<sup>85-87</sup> However, no interventions that we are aware of have targeted social support among rural older PLH specifically, although research suggests that rural and older PLH may suffer from lower levels of social support than other PLH.<sup>30-33</sup> Improving social support in rural settings may require technology use, given long travel distances to ASOs and other community-based organizations. Telephone support interventions may be one solution. Heckman et al. have had success delivering support interventions—including interpersonal support, coping, and supportive-expressive group therapy interventions—to older PLH by telephone.<sup>85-87</sup> Alternatively, some research finds that internet use helps older people maintain social engagement and reduce loneliness.<sup>88</sup> A review of 25 studies suggested that information and communication technology interventions had potential to increase social support and decrease isolation among older adults, although this review did not focus specifically on rural populations or PLH.<sup>89</sup> Reviewed interventions often included internet or web-based apps, such as online chat rooms, videoconferencing, and social networking apps. Virtual support groups could offer new sources of support to rural older PLH.

Higher levels of HIV stigma were positively related to depressive symptoms and stress in our sample. HIV stigma may be a particular problem in the rural context.<sup>90,91</sup> These associations are in line with previous literature identifying similar relationships in other PLH populations.<sup>15,24,36,39,41,43,48-51</sup> Notably, in our analysis, stigma was a unique contributor to depressive symptoms and stress even after accounting for social support, contrasting with some prior research with PLH finding social support fully mediates associations between stigma and depression.<sup>36</sup> Multiple stigma reduction interventions exist,<sup>92</sup> including for PLH.<sup>93</sup> However,

recent reviews conclude there are few well-designed intervention studies documenting reductions in stigma among PLH.<sup>94</sup> One exception is an empowerment intervention in Nepal that decreased stigma, increased social support, and improved QOL among PLH.<sup>95</sup> Additionally, in the U.S., a video intervention sharing personal stories decreased internalized stigma among women living with HIV in the South,<sup>96</sup> and an intervention focused on providing information about HIV, improving coping skills, and providing social support reduced multiple types of stigma among young men newly diagnosed with HIV.<sup>97</sup> However, we are not aware of any interventions focused on rural or older PLH. Rather than targeting internalized or anticipated stigma among PLH, interventions instead might aim to reduce enacted stigma at the community level. Along these lines, a group intervention delivered in Black churches in Alabama focused on increasing HIV knowledge, highlighting negative effects of stigma, and encouraging action to combat stigma and advocate for PLH significantly decreased HIV stigma among those participating.<sup>98</sup> It will be important for interventions addressing stigma to account for multiple types of stigma experienced by different subpopulations of rural older PLH, including HIV stigma, homophobia, racism, sexism, and agism.<sup>99</sup>

Our research considered two factors related to health care. Individuals who were more satisfied with their medical care reported better QOL and lower stress, while those who had experienced discrimination in medical settings reported worse QOL and more depressive symptoms. Rural PLH may face issues accessing quality HIV care, given the lack of specialty providers in rural areas.<sup>69,100,101</sup> PLH who live far from infectious disease specialty clinics are less likely to use specialty care and instead use primary care.<sup>102</sup> Discrimination in health care settings may also be a greater concern in rural areas.<sup>56,66,68,100,103</sup> One approach to improving care satisfaction for older rural PLH may be telemedicine, which has expanded during the COVID-19

pandemic.<sup>104,105</sup> Telemedicine could allow for greater access to specialty providers located farther away from rural PLH. However, there are disparities in telemedicine use, including lower use by older individuals and those with Medicare or Medicaid.<sup>104</sup> A small pilot study suggested that telemedicine for HIV care—HIV specialty care by video combined with primary care in person—was feasible and acceptable to rural veterans living with HIV.<sup>106</sup> Further research is needed to investigate the impact of telemedicine for HIV care on patient satisfaction, care outcomes, and QOL. Consultation and support for primary care providers may also help improve access to HIV care in rural areas. For example, the Extension for Community Health Outcomes (ECHO) program combines didactic sessions and case-based learning to increase the capacity of rural primary care providers to deliver specialized care.<sup>107</sup> Related to discrimination in health care settings, interventions with providers show promise in reducing stigma,<sup>108,109</sup> which could lessen discrimination. A review suggested that popular opinion leader approaches are effective in reducing avoidance intent and prejudicial attitudes toward PLH in health care settings.<sup>110</sup> This review suggested other approaches to reducing HIV-related stigma and discrimination may be effective, but noted poor evidence quality thus far, with future RCTs called for.<sup>111</sup>

Finally, our study found that rural older PLH facing more structural barriers reported lower QOL, more depressive symptoms, and greater stress. Structural barriers such as housing instability, transportation difficulties, food insecurity, and poor technology access have been cited as barriers to care engagement for PLH in prior studies.<sup>56</sup> Additionally, factors such as transportation and lack of broadband internet have been noted as difficulties for rural populations.<sup>112,113</sup> However, little previous research has explored how these factors relate to QOL or mental health for rural and/or older PLH. Interventions for PLH may not be able to eliminate structural barriers; however, they may be able to reduce the impact of these barriers on QOL and

mental health. For example, case management interventions that assist with linkages to supportive services and address structural barriers may help reduce barriers. These types of interventions have improved medication adherence, retention in care, and viral suppression among PLH,<sup>114-116</sup> although QOL and mental health have been less commonly considered as outcomes. Importantly, older rural PLH may face additional challenges accessing both case management services and supportive services due to long distances to care and support organizations and limited transportation options. Remotely-delivered case management could improve access to services for rural older PLH, **although HIV service providers will likely require additional resources to implement new services, especially given the existing strain on rural service providers identified in previous research.**<sup>117,118</sup> **Additional research may be useful to elucidate whether briefer case management services, delivered remotely, could be effective while requiring less time per client than do current case management standards.** Additionally, policy solutions are needed to improve access to both home-based care and services such as food banks for rural older populations.

In addition to the primary predictors, our research identified associations between covariates and QOL and mental health. Sexual minority participants reported lower QOL, more depressive symptoms, and more stress than heterosexual participants. This aligns with some prior research.<sup>119</sup> Rural gay and bisexual men may face particular difficulties given high levels of stigma, which may lead individuals not to disclose their sexual orientation.<sup>120-122</sup> Additionally, individuals with more comorbid health conditions reported lower QOL, more depressive symptoms, and more stress. This aligns with studies showing associations between comorbid conditions or physical health problems and QOL for PLH in general<sup>19,49,123,124</sup> and for older PLH specifically.<sup>35,43,125</sup> Comorbid conditions have been noted as a challenge for those aging with

HIV.<sup>17,19,31,126,127</sup> After accounting for other factors, women in our sample reported lower QOL, in line with other studies.<sup>40,123,128</sup> Finally, after accounting for other factors, we found those who were married or had long-term partners reported lower QOL, more depressive symptoms, and higher stress. This conflicts with prior research with PLH that suggested being married or partnered benefitted QOL.<sup>123,129</sup> Rural PLH aging with partners may face additional difficulties if partners also have health challenges, especially given rural isolation and low socioeconomic status.

### **Limitations**

This research has several limitations. First, we recruited a convenience sample of rural older PLH primarily through ASOs. Those in our sample may have been better engaged with care than rural older PLH in general. Second, this cross-sectional study identifies associations between variables but cannot determine cause and effect. However, we did control for covariates addressed in the literature. Future longitudinal and intervention research with rural older PLH is called for. Finally, many interrelated factors may influence QOL and mental health for rural older PLH. We chose to focus on several factors that present targets for interventions with this population. Future research should consider more complex relationships between these factors and QOL and mental health, including potential mediation and moderation.

### **Conclusions**

This study identified factors associated with QOL, depressive symptoms, and perceived stress for rural older PLH. Although engagement in care and viral suppression are important foci for research with this population, QOL and mental health are also critical considerations. Our work suggests that increasing social support, reducing or providing skills to cope with HIV stigma, improving quality of medical care, reducing discrimination and stigma in medical



settings, and reducing or mitigating the impact of structural barriers present potential targets for interventions aiming to improve wellbeing for older rural PLH. Future longitudinal research addressing changes in QOL and mental health over time among rural older PLH is needed. Additionally, research should pilot interventions aiming to improve QOL and mental health for this population.

Table 1.

Descriptive Characteristics of a Sample of Rural Older Adults Living with HIV ( $N = 446$ )

<b>Covariates</b>	<b>%</b>	<b><i>M (SD)</i></b>
Female	33 %	--
Age (range: 50-74)	--	55.60 (4.60)
<i>Race</i>		
White	67 %	--
Black/African American	23 %	--
Multiracial or another race	10 %	--
Latino ethnicity	9%	--
<i>Region</i>		
Northeast	16 %	--
Midwest	24 %	--
South	33 %	--
West	28 %	--
Sexual minority	37 %	--
<i>Monthly income</i>		
\$0-\$1000	39 %	--
\$1001-\$2000	53 %	--
\$2001 or more	8%	--
Married or long-term partner	26 %	--
Number of comorbid conditions (range: 0-10)	--	2.82 (1.84)
Years since HIV diagnosis (range: 1-35)	--	19.62 (7.20)
Engaged in HIV care <sup>a</sup>	75 %	--

Currently receiving HIV case management	44 %	--
<b>Predictors</b>	<b>%</b>	<b><i>M (SD)</i></b>
Social support (range: 1-5)	--	3.49 (1.11)
HIV stigma (range: 1-4)	--	2.63 (0.51)
Satisfaction with medical care (range: 1-5)	--	3.90 (0.57)
Discrimination in medical settings	17 %	--
Structural barriers (range: 0-4)	--	0.95 (1.17)
<b>Outcomes</b>	<b>%</b>	<b><i>M (SD)</i></b>
Health-related quality of life (range: 0-100)	--	63.74 (19.14)
Depressive symptoms (range: 0-27)	--	6.10 (5.99)
Perceived stress (range: 1-5)	--	2.48 (0.74)

*Note.* <sup>a</sup>Participants were considered engaged in care if they had seen an HIV provider in the past 6 months, were currently taking and adherent to HIV antiretrovirals (<10% of doses missed), and reported an undetectable (<20 copies/mL) viral load at most recent assessment.

Table 2.  
 Factors Associated with Quality of Life, Depressive Symptoms, and Perceived Stress Among Rural Older Adults Living with HIV ( $N = 446$ )

Predictor	Health-Related Quality of Life				Depressive Symptoms				Perceived Stress			
	Simple		Multiple		Simple		Multiple		Simple		Multiple	
	$\beta$ (SE)	$p$	$\beta$ (SE)	$p$	$\beta$ (SE)	$p$	$\beta$ (SE)	$p$	$\beta$ (SE)	$p$	$\beta$ (SE)	$p$
Female	0.01 (0.10)	.920	<b>-0.24</b> (0.07)	<b>.001</b>	-0.09 (0.10)	.358	0.14 (0.08)	.074	-0.18 (0.10)	.080	0.13 (0.09)	.127
Age	<b>-0.13</b> (0.05)	<b>.008</b>	0.01 (0.04)	.888	0.10 (0.05)	.057	-0.03 (0.04)	.449	<b>0.15 (0.05)</b>	<b>.002</b>	0.02 (0.04)	.546
Race (ref: White)												
Black/African American	0.12 (0.11)	.273	0.12 (0.09)	.181	-0.21 (0.11)	.062	<b>-0.18</b> (0.09)	<b>.039</b>	-0.04 (0.11)	.697	0.08 (0.10)	.429
Multiracial or another race	0.16 (0.17)	.344	0.09 (0.11)	.415	-0.12 (0.15)	.448	-0.07 (0.12)	.580	-0.10 (0.18)	.576	0.01 (0.13)	.966
Latino ethnicity	0.20 (0.17)	.240	0.00 (0.14)	.989	-0.15 (0.18)	.416	0.16 (0.16)	.306	0.13 (0.15)	.414	0.21 (0.15)	.155
Region (ref: South)												
Northeast	0.19 (0.16)	.232	0.22 (0.12)	.065	0.09 (0.15)	.573	-0.01 (0.12)	.960	0.28 (0.15)	.063	0.23 (0.13)	.076
Midwest	-0.12 (0.13)	.359	0.15 (0.10)	.133	0.23 (0.14)	.099	-0.07 (0.10)	.482	0.23 (0.13)	.089	-0.01 (0.11)	.944
West	0.18 (0.12)	.122	0.03 (0.09)	.736	-0.19 (0.11)	.090	-0.09 (0.09)	.327	0.00 (0.12)	.978	0.10 (0.11)	.354
Sexual minority	<b>-0.43</b> (0.10)	<b>&lt;.001</b>	<b>-0.24</b> (0.10)	<b>.014</b>	<b>0.43 (0.10)</b>	<b>&lt;.001</b>	<b>0.22 (0.10)</b>	<b>.031</b>	<b>0.52 (0.10)</b>	<b>&lt;.001</b>	<b>0.37 (0.11)</b>	<b>.001</b>
Monthly income	<b>0.19 (0.05)</b>	<b>&lt;.001</b>	<b>0.08 (0.04)</b>	<b>.027</b>	<b>-0.15</b> (0.05)	<b>.003</b>	-0.03 (0.04)	.441	<b>-0.12</b> (0.05)	<b>.010</b>	-0.02 (0.04)	.534
Married or long-term partner	-0.16 (0.11)	.132	<b>-0.29</b> (0.09)	<b>.002</b>	0.06 (0.11)	.584	<b>0.24 (0.10)</b>	<b>.022</b>	<b>0.51 (0.10)</b>	<b>&lt;.001</b>	<b>0.65 (0.10)</b>	<b>&lt;.001</b>

Number of comorbid conditions	<b>-0.55</b> (0.04)	<.001	<b>-0.34</b> (0.04)	<.001	<b>0.43 (0.05)</b>	<.001	<b>0.19 (0.05)</b>	<.001	<b>0.29 (0.05)</b>	<.001	0.05 (0.04)	.293
Years since HIV diagnosis	0.01 (0.05)	.929	0.06 (0.04)	.147	0.01 (0.06)	.931	-0.04 (0.04)	.375	-0.09 (0.05)	.051	<b>-0.08</b> (0.04)	<b>.037</b>
Social support	<b>0.49 (0.04)</b>	<.001	<b>0.29 (0.05)</b>	<.001	<b>-0.51</b> (0.04)	<.001	<b>-0.31</b> (0.05)	<.001	<b>-0.47</b> (0.04)	<.001	<b>-0.36</b> (0.05)	<.001
HIV stigma	<b>-0.20</b> (0.05)	<.001	-0.03 (0.04)	.459	<b>0.29 (0.05)</b>	<.001	<b>0.12 (0.05)</b>	.003	<b>0.19 (0.05)</b>	<.001	<b>0.10 (0.04)</b>	<b>.029</b>
Satisfaction with medical care	<b>0.20 (0.05)</b>	<.001	<b>0.10 (0.04)</b>	.015	<b>-0.20</b> (0.05)	<.001	-0.08 (0.05)	.079	<b>-0.16</b> (0.05)	.001	<b>-0.08</b> (0.04)	<b>.045</b>
Discrimination in medical settings	<b>-0.98</b> (0.13)	<.001	<b>-0.29</b> (0.12)	.014	<b>0.99 (0.13)</b>	<.001	<b>0.35 (0.12)</b>	.004	<b>0.70 (0.13)</b>	<.001	0.10 (0.13)	.445
Structural barriers	<b>-0.48</b> (0.04)	<.001	<b>-0.17</b> (0.05)	<.001	<b>0.47 (0.04)</b>	<.001	<b>0.20 (0.05)</b>	<.001	<b>0.44 (0.04)</b>	<.001	<b>0.22 (0.05)</b>	<.001
<b>R<sup>2</sup></b>			<b>0.53 (0.04)</b>	<.001			<b>0.46 (0.05)</b>	<.001			<b>0.45 (0.04)</b>	<.001

*Notes.* Simple = Simple Linear Regressions, Multiple = Multiple Linear Regression. Standardized regression coefficients are reported. For binary predictors, we report STDY estimates from Mplus, which can be interpreted as the change in the outcome variable in standard deviation units when the categorical covariate changes from zero to one (Muthén & Muthén, 1998-2015). Coefficients significant at the  $p < .05$  level are bolded.

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