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Loneliness in Older Adults Living with HIV

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Abstract

We conducted a cross-sectional study among HIV-positive adults age ≥ 50 in San Francisco to evaluate the frequency of loneliness, characteristics of those who reported loneliness, and the association of loneliness with functional impairment and health-related quality of life (HRQoL). Participants (N = 356) were predominately male (85%); 57% were white; median age was 56. 58% reported any loneliness symptoms with 24% reporting mild, 22% moderate and 12% severe loneliness. Lonely participants were more likely to report depression, alcohol and tobacco use, and have fewer relationships. In unadjusted models, loneliness was associated with functional impairment and poor HRQoL. In adjusted models, low income and depression remained associated with poor HRQoL, while low income, higher VACS index and depression were associated with functional impairment. A comprehensive care approach, incorporating mental health and psychosocial assessments with more traditional clinical assessments, will be needed to improve health outcomes for the aging HIV-positive population.

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Conflict of interest Dr. John is on the speaker's bureau and advisory boards of Gilead Sciences, Inc.; Merck & Co., Inc.; and ViiV Health-care. Dr. Greene, Dr. Hessol, Dr. Perissinotto, Dr. Zepf, Dr. Hutton Parrott, Mr. Foreman, Mr. Whirry and Dr. Gandhi declares that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

Resumen

Realizamos un estudio transversal en adultos mayores de 50 años con VIH en San Francisco para evaluar la frecuencia de la soledad, características de aquellos que reportan soledad, y la asociación de la soledad con el deterioro funcional y la calidad de vida relacionada con la salud (HRQoL). Los participantes (N = 356) fueron principalmente hombres (85%); 57% de raza blanca, la mediana de edad fue 56 años. El 58% reportó cualquier síntoma de soledad con un 24% reportando soledad leve, 22% soledad moderada, y 12% soledad severa. En los participantes que refirieron soledad era más probable que reportaran depresión, consumo de tabaco o alcohol, y menos relaciones sociales. En modelos sin ajustar, la soledad estaba asociada con deterioro funcional y baja calidad de vida relacionada con la salud. En modelos ajustados, tener bajos ingresos y depresión continuaron teniendo asociación con una baja calidad de vida relacionada con la salud, mientras que tener bajos ingresos, un índice más alto de VACS y depresión estaban asociados con deterioro funcional. Un sistema de cuidado integral, incorporando la salud mental y valoraciones psicológicas y sociales con evaluaciones médicas tradicionales, serán necesarios para poder mejorar los índices de salud de las personas VIH positivas que envejecen.

Keywords

HIV/AIDS; Aging; Loneliness; Functional status; Quality of life

Introduction

The life expectancy of people living with HIV (PLWH) has increased due to the widespread use of effective antiretroviral therapy (ART); this trend is expected to grow given recent recommendations by the World Health Organization to expand universal ART and its benefits worldwide [1–3]. As the number of older adults living with HIV increases, understanding their health-related needs is paramount. In addition to complex medical needs such as multimorbidity and polypharmacy [4–7], older adults living with HIV often also face psychosocial challenges, such as anxiety and depression, stigma, and substance use [5].

Much research examining the psychosocial challenges facing adults living with HIV has focused on depressive symptoms and social isolation, although fewer studies have examined these issues specifically among older adults [8–15]. Of the studies examining social isolation in older adults, most have focused on describing the physical support networks of older HIV-positive adults, as opposed to the perception of this support [11, 12, 16]. Importantly, one study of veterans living with and without HIV found that social isolation, defined as lack of physical supports and lack of engagement in community activities, was associated with an increased risk of hospitalization and mortality [15]. In the general population, social isolation is also often linked with these outcomes [17, 18]. However, the distinct concept of loneliness, defined as the distress that exists between actual and desired relationships -and that is separate from the concept of aloneness or living alone- is more frequently associated with adverse health outcomes than lack of physical support [19–21]. Increasingly the literature suggests that we must carefully define isolation and loneliness, be clear on what we are measuring [22], and recognize that both isolation and loneliness can affect health in

different ways [23]. As such, a need exists to understand more about loneliness-and its consequences- among older adults living with HIV.

Few studies have described loneliness in PLWH, either in the US or internationally, with only the Research on Older Adults with HIV (ROAH) study focused on this measure among older HIV-positive adults [8, 24–26]. ROAH demonstrated that loneliness was common and that older PLWH had higher degrees of loneliness than reported among older adults not living with HIV [8]. Additional research from ROAH found that loneliness and depression may be intertwined in older PLWH, suggesting that while loneliness, social support and depression are distinct concepts- they have complex interconnections (as is true in the general population) [27, 28]. While loneliness has been associated with functional decline and poor quality of life in the general population, [19, 29] less is known about the associations of loneliness with aging-related health outcomes among older PLWH.

The objectives of this exploratory cross-sectional study among older adults living with HIV were to: (a) identify the prevalence of loneliness among older adults living with HIV in an urban US-based setting; (b) examine the characteristics of older PLWH who self-report loneliness; and (c) examine the association of loneliness with functional impairment and a measure of health related quality of life (HRQoL).

Methods

Study Population and Design

Participants were from the “Silver Project”, a collaboration organized by the San Francisco Department of Public Health to better understand the needs of older PLWH [30]. The Silver Project involved two University of California, San Francisco (UCSF)-affiliated HIV clinics: (1) 360: The Positive Care Center, an outpatient HIV practice that serves privately insured and marginally insured HIV-positive individuals at the UCSF Parnassus campus; and (2) the “Ward 86” HIV Clinic at Zuckerberg San Francisco General Hospital, which is a safety net clinic serving publicly-insured and uninsured HIV-positive patients. Both programs have a long history of providing multidisciplinary HIV primary care and receive funding from the Health Services and Research Administration (HRSA)-based Ryan White HIV/AIDS Program. English-speaking PLWH ages 50 or older were eligible to participate in the Silver Project. Between December 2012 and January 2014, participants were recruited and consecutively enrolled via flyers, posters and provider referrals. Participants received Safeway gift cards for participation in the collaborative project. All protocols were approved by the UCSF Committee on Human Research.

The Silver Project collected survey data at both clinics through a one-time visit to assess participants’ physical, social, mental and cognitive health between December 2012 and January 2014 [30]. Surveys were administered by medical assistants or an RN trained in conducting the assessments [30]. The analysis for this study draws on this previously collected data.

Measures

Loneliness—Loneliness was measured using the UCLA eight item loneliness scale, which consists of eight questions with answer choices of “Never” (1 point) to “Often” (4 points) with total scores ranging from 8 to 32 [31]. This scale was adapted from the original 20 item scale [32] and scores from the eight item scale were categorized by degrees of loneliness: none (8–16), mild (17–20), moderate (21–24), or severe (> 24) based on data accumulated by the author who developed the scale (DL Russell, personal communication). Categorization of the scale was performed to provide more clinically meaningful results.

Health Related Quality of Life and Functional Impairment—Health-related quality of life (HRQoL) was assessed using a question on self-rated health (“How would you rate your current health?”). Responses are on a 5-point Likert scale including poor-fair-good-very good-excellent. This item was chosen as it has been validated to assess HRQoL among PLWH with high sensitivity and similar discriminative ability for symptom burden and HIV disease severity as a longer 21 item measure of HRQoL [33]. It has been used to estimate quality adjusted years among PLWH [34]. In the general population, this single item question has similar discriminative ability to predict mortality as the longer Short Form 36 (SF-36) [35]. This single item question was also chosen in the interests of time, given that participants were recruited from busy clinical practices and were undergoing multiple assessments to cover broad health domains. Responses were dichotomized into poor/fair versus good/very good/excellent based on the distribution of responses in our data and precedent for this dichotomization in other studies [36].

Functional impairment was defined as reporting dependence in one or more Instrumental Activities of Daily Living (IADLs), which includes tasks such as shopping, managing medications and housework. Dependence in IADLs was chosen over dependence in Activities of Daily Living (ADLs e.g., tasks such as dressing, bathing) given that our participants were more middle-aged than elderly and that a higher numbers of participants reported dependence in IADLs over ADLs [30]. The Lawton IADL scale was used which includes eight tasks that are scored 0 (dependent) or 1 (independent) for overall scores ranging from 0 (dependent in all activities) to 8 (independent in all activities) [37]. Scores were then dichotomized to 8 (fully independent) versus 7 or lower (dependent in one or more IADLs). These two categories were used to distinguish between those who were fully independent and those who needed assistance in at least one activity, similar to the categorization employed by other studies [38].

Other Measures—Basic sociodemographic data (e.g., sex, race/ethnicity, education, income) were collected and assessed in bivariate and multivariate models in relationship to our key outcomes. Sexual orientation, duration of HIV infection, and behavioural factors such as tobacco and alcohol use were also collected. For alcohol and drug use, the CAGE-AID screening tool was used to identify problem drinking and/or drug use behaviours and was dichotomized as low risk (0–1) or at risk (≥ 2) using the standard clinical cut points [39, 40]. The Veterans Aging Cohort Study (VACS) index score was used to capture disease severity, both for HIV disease as well as other comorbid conditions, and has been shown to predict mortality among HIV-infected populations [41]. To calculate the VACS index, the

following variables are included in the assessment: age, CD4 count, HIV viral load, hemoglobin, liver fibrosis, renal function, and Hepatitis C infection. Depressive symptoms were measured with the Patient Health Questionnaire (PHQ)-9 scale and scores categorized as none (0–4), mild (5–9), moderate (10–14), or severe (> 14), [42, 43], which are the validated clinical cut points. Cognitive impairment was measured using the Montreal Cognitive Assessment (MOCA) score, which is typically dichotomized as no impairment (score ≥ 26) or impaired (score < 26). In addition to detecting mild cognitive impairment in the setting of Alzheimer's disease, the MOCA has also been validated for the diagnosis of HIV-associated neurocognitive disorders in a study using the same cut point of 26 [44]. Physical social support was measured using the Lubben Social Network Scale (LSNS) [45] to assess the numbers of relationships with family and friends and was dichotomized as little support (≤ 12) or normal support (> 12) to help understand the role of support as a contributing factor to our outcomes [45].

Statistical Analysis

Contingency table analyses were conducted to compare the distribution of participant characteristics and assessment results by loneliness (none vs. mild, moderate, or severe); the Chi square test measured two-sided statistical significance. For age, CD4 + cell count, HIV viral load, and VACS score, non-parametric tests of medians measured two-sided statistical significance. Unadjusted and adjusted modified Poisson logistic regression analyses calculated prevalence ratios (PRs) and 95% confidence intervals (95% CIs) for each covariate and their association with either poor/fair HRQoL or needing assistance on IADL. For the regression analyses, the loneliness score was included as a continuous variable (per 5-point increase) and the VACS index scores were included as continuous scores per 10-point increase. Other variables were included as described using clinically meaningful categorizations when possible. No appreciable differences were observed when variables were assessed as continuous or categorical. Multivariable models were constructed by manual stepwise regression using backward elimination. At each step, each remaining predictor was examined as a possible deletion from the model, and the one with the largest p-value was removed, until all predictors had a p-value of < 0.10. Each candidate model was run separately to avoid excessive case-wise deletion of observations that had missing values on other unselected candidate predictors. Regression models, stratified by depressive symptoms (none vs. all others) assessed the effect of depressive symptoms as modifiers of the effect of loneliness on IADL and HRQoL. All statistical analyses were performed using SAS® software, version 9.3 (SAS Institute Inc., Cary NC).

Results

A total of 356 patients from the two clinical sites contributed data for this study: 159 from 360: The Positive Care Center and 197 from the Ward 86 Clinic. Among the 356 participants who completed the loneliness assessment, 58% reported symptoms of loneliness with a quarter (24%) of the participants reporting mild loneliness, 22% reporting moderate and 12% reporting severe loneliness. The mean loneliness score was 18 ± 5, consistent with mild symptoms.

Compared to non-lonely participants, lonely participants were more likely to be a current smoker or at-risk problem drinker and/or drug user, have lower physical social supports in place, have depressive symptoms, and poor or fair HRQoL ($p < 0.05$, Table 1). Although not statistically significant, lonely participants were also more likely to have low annual incomes ($p = 0.08$) and cognitive impairment ($p = 0.08$) than non-lonely participants.

In unadjusted analyses, loneliness was associated with poor or fair HRQoL. Other variables associated with poor/fair HRQoL were low income, depressive symptoms, fewer years of education, and low physical social support (Table 2). In adjusted analyses, only low income and depressive symptoms remained significantly associated with this outcome.

Loneliness was also significantly associated with functional impairment (dependent in ≥ 1 IADL) in unadjusted analyses. Other variables associated with this outcome were gender at birth, non-White race, low income, higher VACS index, depressive symptoms, lower education, and low physical social support (Table 3). After adjustment, low income, higher VACS index, and depressive symptoms remained significantly associated with functional impairment. In regression models that were stratified on depressive symptoms, there was no evidence of depression modifying the effect of loneliness on functional impairment or HRQoL (data not shown). When duration of HIV infection was included in the adjusted models, the results did not change appreciably, and due to missing data for this variable, the estimates were less precise with wider confidence intervals (data not shown).

Discussion

With the aging of the HIV population, it is critical to understand the health needs of older PLWH. Consistent with a holistic geriatrics approach, as well as building upon the HRSA Ryan White model of providing “wrap around services”, medical issues cannot be treated alone without considering mental health needs and psychosocial issues in the overall care plans of PLWH. This study is among the first to explore the prevalence of loneliness in older PLWH, the characteristics of those who report loneliness, and the relationship between loneliness and age-related health outcomes.

A report of loneliness symptoms was common among our study population; 58% of participants reported at least some symptoms of loneliness (mild 24%, moderate 22%, severe 12%). While fewer participants reported severe loneliness symptoms, a report of any symptoms in the general population, including mild symptoms, has been associated with functional decline and increased mortality risk (with increasing severity of symptoms associated with a higher risk of mortality) [19, 20]. Additionally, both chronic and episodic loneliness are associated with increased mortality in the general population [46]. Currently, no data comparing the presence of any loneliness symptoms to severe symptoms in PLWH exists, which highlights the need for areas of future study.

The rates of loneliness were higher in this study of older adults than in previously reported studies of HIV-positive adults of all ages (60% vs. 30–46%) [24, 25]. One possible explanation for the higher prevalence in our study could be, in part, the inclusion of only older adults in our study. Prior work has suggested that older PLWH may have poorer

emotional health than younger PLWH, in part related to loneliness [47]. However, data on emotional health among older PLWH are mixed, with other studies showing resilience among older adults [48]. Another challenge that arises when comparing our results to the published literature is that the measurements of loneliness differs across these studies, which affects our ability to compare results directly. This is a common problem in this area of research. For example, the New York City-based ROAH study, the only other study examining loneliness specifically in older adults with HIV, utilized the 20-item UCLA loneliness scale. However, in unpublished results using the 8-item scale and similar cut points to our study, the results were similar, with 60% reporting at least mild symptoms of loneliness (Brennan-Ing, M, personal communication).

Other possible explanations for the high prevalence of loneliness in our study may relate to the characteristics of study participants. Over 70% of our sample identified as homosexual, bisexual or other. Some studies have suggested that older adults who identify as lesbian, gay or bisexual often experience higher degrees of loneliness than their heterosexual peers [49]. 60% of participants had an annual income of < $20,000 and lower socioeconomic status has been associated with loneliness [50]. Additionally, participants had a median length of HIV infection of 23 years.

Many people who have lived with HIV for a long time, also known as “long term survivors”, lost significant portions of their social networks, which could contribute to feelings of loneliness [51]. The psychosocial needs of long term survivors is another area of needed research as time since HIV diagnosis has also been associated with positive traits such as mastery, resiliency, or self-efficacy [52]. As additional context for our results, rates of loneliness in a nationally representative sample of the general population of community dwelling older adults age 65 and older were reported to be closer to 40% [19]. Therefore, our work adds support to the existing literature that PLWH have higher rates of loneliness than HIV-negative adults [47].

Regarding characteristics of those who reported loneliness, lonely participants in our study were more likely to be smokers, at risk for alcohol and/or drug use problems, have smaller social support networks, and report more depressive symptoms than participants without loneliness. This is consistent with findings published in a recent study of HIV-positive smokers in New York City, where higher nicotine dependence, alcohol use and depression were all associated with loneliness [24]. Our findings lend further support to the concept that loneliness is a complex phenomenon intertwined with substance use, social networks and other mental health issues such as depression among PLWH [24, 27, 53].

The models that examined the association of loneliness with both HRQoL and functional impairment may also support the concept that loneliness is intertwined with other psychosocial issues. In unadjusted models, loneliness was associated with both HRQoL and functional impairment, but in models that adjusted for depressive symptoms, the association between loneliness and these outcomes was no longer statistically significant. While one possible interpretation is that depression is a more important contributor to functional status and HRQoL than loneliness among older PLWH, research examining loneliness and depression in both HIV-positive and HIV-negative adults suggests that the relationship is

more complex. Specifically, studies in PLWH have shown that loneliness contributes to depressive symptoms [27, 54]. Thus another possible explanation of our findings is that depression is on the pathway between loneliness and age-related health outcomes (e.g., depression mediates the relationship between loneliness and both HRQoL and functional impairment). While loneliness in the general population has been reported to have an effect independent of depression on functional decline in older adults in some studies [19], other studies have reported that loneliness both affects and is affected by depression and functional limitations over time, suggesting a more complicated mechanistic relationship between these variables [29]. The complexity of these relationships cannot be examined in our cross-sectional data, however overall these prior studies suggest that when examining the psychosocial health of older adults, one cannot focus solely on depression, loneliness, or even stigma. Instead one must consider all of these factors as their interventions will differ and our ability to preserve health will depend on recognizing all of the risk factors.

Although this study is one of the first and largest to explore the association of loneliness with aging-related health outcomes, there are limitations. Generalizability may be limited as our population was predominately male, urban, 57% white, and had a long self-reported duration of HIV infection (median 23 years); however the study sample is representative of older adults living with HIV in San Francisco [55]. As our study was cross-sectional, we were unable to examine temporal relationships between loneliness and depression with HRQoL and functional impairment, which would be important to better unravel the relationship between these variables. Specifically, with the cross-sectional nature of our study, we cannot perform tests of mediation and prior research indicates that the directionality of the relationships may be complex and multidirectional [29]. Although we did not have a measure of living situation (living alone), we did look at the number of relationships with family and friends as measured by the Lubben Social Support Scale. We did not include marital status in our analysis as the majority of participants identified as men-who-have-sex-with-men (MSM) who were unmarried. We also did not have a measure of HIV-related stigma, and prior research has shown stigma, loneliness and depression are often inter-related among PLWH. [27] Finally, our measure of HRQoL, which was chosen in part for ease of administration, did not include a measure of mental health related quality of life; part of the CDC recommended definition. Despite these limitations, this study contributes valuable information about the prevalence of loneliness among older PLWH, characteristics associated with loneliness, and the relationship between loneliness and age-related health outcomes.

We sought to gain a better understanding about loneliness in older adults living with HIV in this study. In summary, symptoms of loneliness (ranging from mild to severe) were common among older PLWH in an urban US-based setting—especially in those reporting depression, limited support networks and substance use. Loneliness was associated with functional impairment and HRQoL in univariate analysis, but was not significantly associated with either outcome in multivariate models including depressive symptoms. Given (a) the high prevalence of loneliness in our study; (b) findings in the general population that even mild loneliness has been associated with increased risk of mortality; and (c) that loneliness among PLWH is associated with substance use and risky sexual behaviors [56, 57], more research is indicated to better understand loneliness in older adults living with HIV. Future studies

should include longitudinal data to be able to test for mediation and better examine the complex relationships between loneliness, depression, isolation and stigma. Additionally, future studies should include a broader range of participants including those from diverse geographic regions (both urban and rural areas), women, and those who acquired HIV through non-MSM contact to understand more about loneliness across the heterogeneous group of older adults living with HIV. A comprehensive approach to the care of aging adults living with HIV, incorporating mental health and psychosocial assessments with more traditional clinical assessments, is necessary to improve health outcomes in this growing population.

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Table 1

Participant characteristics by loneliness status, silver project, San Francisco

Characteristic	Lonely[a] N = 206 (58%) N (%) or median (IQR)	Not lonely N = 150 (42%) N (%) or median (IQR)	p-Value[b]
Age	56 (53–60)	56 (53–62)	0.90
Male sex at birth	179 (87)	129 (86)	0.81
Latino ethnicity	24 (12)	14 (9)	0.46
Non-White race	90 (44)	62 (41)	0.60
Education			
< High school	26 (13)	18(12)	0.97
High school	32 (16)	26(17)	
Some college/college degree	106 (51)	76(51)	
Some graduate/graduate degree	42 (20)	30 (20)	
Sexual orientation			
Homosexual	125 (61)	106 (71)	0.10
Heterosexual	50 (24)	30 (20)	
Bisexual/other	30 (15)	13 (9)	
Annual income			
< $10,000	64 (33)	33 (24)	0.08
$10,000–20,000	71 (37)	48 (35)	
≥ $20,001	59 (30)	57 (41)	
Current cigarette smoker	71 (35)	37 (25)	**0.04**
At risk alcohol and/or drug use[c]	78 (39)	33 (22)	**0.0009**
CD4 T cell count (cells/mm^3)	520 (323–687)	503 (299–654)	0.54
HIV viral load < 40 copies/mL	164 (80)	126 (85)	0.31
Years living with HIV			
1–5	8	10	0.92
6–10	14	14	
11–20	34	46	
20 +	78	101	
VACS index[d]	28 (19–43)	28 (18–44)	0.89

Characteristic	Lonely[a] N = 206 (58%) N (%) or median (IQR)	Not lonely N = 150 (42%) N (%) or median (IQR)	p-Value[b]
Cognitive impairment (MOCA < 26)[e]	76 (37)	42 (28)	0.08
Low physical social support (0–12)[f]	128 (62)	50 (33)	**< 0.0001**
Depressive symptoms (PHQ-9 scores ≥ 5)[g]	134 (66)	58 (39)	**< 0.0001**
Poor/fair health related quality of life[h]	73 (36)	32 (21)	**0.003**
Dependent in ≥ 1 ADL	29 (14)	13 (9)	0.10
Dependent in ≥ 1 IADL	88 (43)	48 (33)	0.05

[a] At least mild symptoms of loneliness, defined as UCLA 8 item loneliness score ≥ 17

[b] p-values < 0.05 are shown in bold

For categorical characteristics result is based on Chi square or fisher exact test, for comparison of medians result is based on Wilcoxon Rank Sum test

[c] Defined as having 2 or more questions positive on CAGE-AID screen

[d] Veteran Aging Cohort Study index scores

[e] Montreal Cognitive Assessment scores, scores < 26 can be suggestive of mild cognitive impairment

[f] Lubben Social Network Scale scores of ≤ 12

[g] At least mild depressive symptoms (defined as PHQ-9 scores of 5 or higher)

[h] Report of poor or fair self-rated health

ADL activities of daily living, *IADL* instrumental activities of daily living

Table 2

Association of loneliness symptoms and poor or fair Health Related Quality of Life (HRQoL)

	N with poor/fair health	Unadjusted PR (95% CI)	Adjusted[a] PR (95% CI)
Loneliness[b] (per 5 point increase)		**1.36 (1.13–1.63)**	1.06 (0.85–1.33)
Age[c]		0.98 (0.94–1.01)	
Male sex at birth[c]	91	0.95 (0.55–1.63)	
Non-white race[c]	52	1.34 (0.92–1.97)	
Latino ethnicity	17	1.67 (0.99–2.81)	
Annual income			
< $10,000	41	**2.58 (1.50–4.45)**	**1.85 (1.05–3.28)**
$10,000–20,000	39	**1.98 (1.15–3.43)**	1.60 (0.90–2.84)
≥ $20,001 (reference)	19	1.0	1.0
VACS index[d]		1.07 (0.96–1.19)	1.03 (0.92–1.16)
Length of time with HIV (years)[e]		1.07 (0.94–1.23)	
Depressive symptoms by PHQ-9[f]			
None (reference)	19	1.0	1.0
Mild	30	**2.57 (1.45–4.56)**	**2.19 (1.17–1.12)**
Mod	31	**5.15 (2.91–9.12)**	**4.18 (2.14–8.16)**
Severe	24	**4.84 (2.65–8.84)**	**4.34 (2.13–8.85)**
Education			
< High school	15	2.06 (0.97–4.41)	
High school	21	**2.14 (1.05–4.35)**	
Some college/college degree	58	1.87 (1.0–3.47)	
Some graduate/graduate degree (reference)	12	1.0	
Cognitive impairment[g]	41	1.23 (0.83–1.81)	
At risk alcohol and/or drug use[h]	38	1.30 (0.87–1.94)	
Low physical social support[i] (0–12)	64	**1.54 (1.04–2.27)**	

Confidence intervals that do not include 1.0 are shown in bold

[a] Adjusted for income, VACS index (age, race, sex CD4, viral load, hemoglobin, liver and renal function, Hepatitis C status), depressive symptoms

[b] Per five point increase in UCLA-loneliness score

[c] Age, sex, race are included in VACS index and so were not included separately in final model

[d] Per 10 point increase in VACS index score

[e] Per 5 years of HIV infection

[f] PHQ-9 scores categorized as mild (5–9), moderate (10–14), severe (≥ 15)

[g] Defined as MOCA score < 26, indicating possible mild cognitive impairment

[h] Defined as 2 or more positive answers on CAGE-AID screen

[i] Lubben social network scale score of ≤ 12

Table 3

Association of loneliness symptoms and functional impairment (dependent with ≥ 1 Instrumental Activities of Daily Living) Confidence intervals that do not include 1.0 are shown in bold

	N dependent with ≥ 1 IADL	Unadjusted PR (95% CI)	Adjusted[a] PR (95% CI)
Loneliness[b] (per 5 point increase)		**1.19 (1.01–1.40)**	1.02 (0.84–1.24)
Age[c]		0.99 (0.96–1.02)	
Male sex at birth[c]	106	**0.56 (0.37–0.84)**	
Non-white race[c]	71	**1.48 (1.06–2.08)**	
Latino ethnicity	19	1.33 (0.82–2.16)	
Annual income			
< $10,000	52	**2.68 (1.64–4.38)**	**2.03 (1.21–3.42)**
$10,000–20,000	53	**2.30 (1.41–3.76)**	**1.90 (1.14–3.17)**
≥ $20,001 (reference)	23	1.0	1.0
VACS index[d] (per 10 point increase)		**1.15 (1.05–1.26)**	**1.14 (1.03–1.25)**
Length of time with HIV infection (years)[e]		1.11 (0.98–1.25)	
Depressive symptoms by PHQ-9[f]			
None (reference)	34	1.0	1.0
Mild	49	**2.31 (1.49–3.58)**	**2.08 (1.27–3.41)**
Mod	29	**2.58 (1.57–4.22)**	**2.26 (1.26–4.06)**
Severe	22	**2.48 (1.45–4.24)**	**2.36 (1.23–4.52)**
Education			
< High school	22	**1.94 (1.04–3.63)**	
High school	33	**2.25 (1.27–4.00)**	
Some college/college degree	63	1.37 (0.81–2.31)	
Some graduate/graduate degree (reference)	18	1.0	
Cognitive impairment[g]	53	1.32 (0.94–1.87)	
At risk alcohol and/or drug use[h]	49	1.26 (0.88–1.79)	
Low physical social support[i]	86	**1.72 (1.21–2.44)**	

[a] Adjusted for income, VACS index (age, race, sex, CD4, viral load, hemoglobin, liver and renal function, Hepatitis C status), depressive symptoms

[b] Per five point increase in UCLA-loneliness score

[c] Age, sex, race are included in VACS index and so were not included separately in final model

[d] Per 10 point increase in VACS index score

[e] Per 5 years of HIV infection

[f] PHQ-9 scores categorized as mild (5–9), moderate (10–14), severe (≥ 15)

[g] Defined as MOCA score < 26, indicating possible mild cognitive impairment

[h] Defined as 2 or more positive answers on CAGE-AID screen

[i] Lubben social network scale score of ≤ 12