Published in final edited form as:

J Acquir Immune Defic Syndr. 2015 June 1; 69(2): 187–192. doi:10.1097/QAI.0000000000000562.

The Impact of Marijuana Use on the Successful Aging of HIV-Infected Adults

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Abstract

Objective—To determine the impact of self-reported marijuana use on the components of successful aging of human immunodeficiency virus-infected persons.

Methods—Cross-sectional study of 45- to 65-year-old HIV-infected subjects on anti-retroviral therapy >6 months with undetectable HIV-1 viral load. Successful aging was defined as absence of disease; adequate physical function; high Quality of Life (QOL) and social engagement. Clinical characteristics, physical function assessments, and QOL from short-form 36 (SF-36) were compared between groups defined by self-reported Recent Marijuana Use (RMU), adjusted for tobacco use, CD4+ T-cell count and time since HIV diagnosis, using logistic or linear regression for binary or continuous measures.

Results—93 of 359 total subjects (26%) reported RMU. Demographically, patients reporting RMU had been diagnosed with HIV less recently (14 [13–16] vs 11 [10–12] years), reported smoking (48% vs 25%) and lower income (92% vs 80%) with greater prevalence than non-RMU patients; other demographics and clinical characteristics (age, CD4+ T-cell count) were similar. Gender, race/ethnicity, physical outcomes, physical function and disease burden were not significantly different. Patients reporting RMU demonstrated lower mental QOL and increased odds of low social engagement and un- or underemployment compared to non-users.

Conclusions—The negative association between RMU and mental or social QOL should be considered when assessing the success with which HIV patients reporting RMU are aging.

Introduction

With combination antiretroviral therapy (ART), longer life expectancy is changing the demographics of the human immunodeficiency virus (HIV) epidemic, and by 2015 half of those living with HIV in the United States will be 50 years or older¹. Compared to HIV-uninfected populations, HIV-infected persons, even while receiving effective ART, experience excess morbidity and mortality^{2–4}. Subsequently, the focus of HIV care has shifted to the management of chronic diseases and mechanisms to promote healthier,

“successful aging”. Although no standard definition exists, successful aging is a concept that includes three main components: 1) the absence of disease, 2) a high level of physical function or lack of disability, and 3) healthy emotional status, often defined by active social engagement⁵. The extent that new or existing therapies impact these components of successful aging will be of increasing significance.

Marijuana use, recreationally or medicinally, is touted for its benefits in stimulating appetite and relieving pain^{6–8}. However, no current literature exists regarding the use of medicinal or recreational marijuana in the context of the successful aging of persons with or without HIV. Among persons with HIV infection, a Cochrane Review explored the impact of marijuana or synthetic derivatives of marijuana on morbidity or mortality, however many of these studies predated the current era of effective ART. Of the seven randomized controlled trials included in the review, data for improvement in morbidity and mortality were limited by small study size and short study duration⁹. Marijuana use among persons with HIV infection has primarily been described in the context of palliative therapy, in addition to studies exploring risk behavior, non-adherence with ART, and association of marijuana use with other substances^{10–12}. Indeed, marijuana has been reported to alleviate commonly-reported symptoms often seen in the course of HIV infection including improvements in appetite, weight loss, nausea, constipation, pain, neuropathy, tremors, anxiety, depression, and fatigue⁸. In the longitudinal Women’s Interagency HIV Study (WIHS), marijuana use was greater among persons with neuropathy and was not associated with differences in ART adherence¹³. Not surprisingly, with these perceived benefits of marijuana, the prevalence of marijuana use among HIV patients is reportedly almost 25%¹⁰, higher than the national average for adults in states with high prevalence marijuana use (9–13%)¹⁴.

Marijuana use is illegal in the United States at the federal level, however has been legal medicinally since 2000 in Colorado for use by patients with cancer, glaucoma, or HIV/AIDS diagnoses, as well as the following symptoms: cachexia, persistent muscle spasms, seizures, severe nausea and severe pain. The 2009 federal announcement “it will not be a priority to use federal resources to prosecute patients with serious illnesses or their caregivers who are complying with state laws on medical marijuana” in conjunction with changes in Colorado state policies for dispensaries contributed to a peak of nearly 1200 licensed Colorado medical marijuana dispensaries in 2010¹⁵. In states where marijuana use has now become legal, the use of marijuana will presumably increase¹⁶ both recreationally and medically, thus an understanding of the impact of marijuana use is of increasing importance. Here, we propose to determine the impact of marijuana use on the components of successful aging of HIV-infected persons during a time period where medicinal, but not recreational, marijuana was legal in Colorado. We hypothesized that marijuana would have an impact on the successful aging components 1) absence of disease, 2) physical function, and 3) quality of life (QOL) and social engagement.

Methods

Study population

The current study is a secondary analysis of a cohort that has been described previously¹⁷. Participants were enrolled in a cross-sectional study of physical function between February

and November of 2010. HIV patients in ongoing care at The University of Colorado Infectious Disease Group Practice were included if they met the following criteria: 1) 45 to 65 years of age; 2) able to consent and participate in study procedures; and 3) taking an antiretroviral therapy (ART) combination consisting of two or more antiretroviral medications for at least six months with one undetectable plasma HIV-1 RNA (<48 copies/mL) and no plasma HIV-1 RNA >200 copies/mL in the prior six months, demonstrating effective treatment with ART and adequate compliance. Approval was obtained from the Colorado Multiple Institutional Review Board, and informed consent was obtained from all participants. All participants completed a single study visit that included a medical record review, standardized interview, questionnaires, and a physical function assessment.

Clinical Assessments

All assessments were completed by one of two clinicians. Recent marijuana use (RMU) was assessed by face-to-face standardized interview. All participants were asked "Have you used any drugs in the last month, including marijuana". If the individual responded "yes", then he or she was asked to specify the types of drugs used. We explored three main components for success in aging: 1) absence of disease, 2) physical function, and 3) quality of life (QOL) and social engagement.

The degree of "absence of disease" was quantified by a comorbid disease count and number of concomitant non-ART medications. Comorbid conditions were determined from the electronic medical record and included: neurological disease, cerebral vascular and cardiovascular disease, hypertension, peripheral neuropathy, psychiatric disease, arthritis, osteopenia or osteoporosis, diabetes, kidney disease, malignancy, solid organ transplant, lung disease, viral hepatitis, and chronic liver disease of other etiology. Chronic pain was defined as chronic narcotic use, or chronic pain indicated in medical record. Current medications were determined by medical record review for prescribed medications and self-report for over-the-counter treatments. Medication count excluded current antiretroviral therapy. Weight and height were measured and body mass index (BMI) calculated and categorized as underweight (BMI < 18.5 kg/m²), normal weight (BMI 18.5 to < 25 kg/m²), overweight/pre-obese (BMI 25 to <30 kg/m²), and obese (BMI ≥ 30 kg/m²). Weight loss was defined as unintentional weight loss of ≥ 10 pounds, or decrease of 5% of body weight in the last year¹⁸. The Veterans Aging Cohort Study (VACS) Index, a prediction tool for all cause and cause specific mortality among HIV-infected persons was calculated from the following parameters^{19,20}: CD4+ T-cell count, viral load, age, aspartate aminotransferase, alanine aminotransferase, platelets, hemoglobin, hepatitis C, and estimated glomerular filtration rate. Laboratory values were the most recent values available in the medical record^{19–21}. Of a possible 164 points, higher VACS index values indicate greater mortality risk, and scores of ≤ 34 are associated with the lowest mortality. Because all subjects in the current study had plasma HIV-1 RNA viral load < 500 copies/mL, the highest (worst) possible score was 150. As a blood draw was not included as part of this study visit, lab values were obtained from the clinical records.

Physical function or lack of disability was defined using the Short Physical Performance Battery (SPPB). The SPPB measures tandem stand, walking speed, and sit-stand test time, with zero points on each task indicating inability to complete the task and four points indicating performance within the expected range²². Tandem stand was measured by ability to stand heel-to-toe for ten seconds, walking speed by the faster of two 4-m walks at usual pace, and sit-stand test time by five repetitions of sit-to-stand without use of the arms. An SPPB score of less than 9 is highly predictive for subsequent disability^{22,23}. Other measures of physical function included the 400-m walk time, which was measured on a set walking course by asking the participant to walk as quickly as possible to complete the distance²⁴. A dichotomous measure of activity was defined as the equivalent weekly activity of at least five 20-min walks for pleasure (500 kcal/week)²⁵ from a self-reported physical activity questionnaire [2-week recall of Minnesota Leisure Time Physical Activity (LTPA)]. Fall was defined as unintentionally coming to rest on the ground or other lower level, not as a result of a major intrinsic event or external hazard²⁶; frequent faller was defined as an individual sustaining >1 fall during the prior twelve months.

Lastly, QOL and social engagement were assessed by eight domains (Physical Functioning, Role-Physical, Bodily Pain, General Health, Vitality, Social Functioning, Role-Emotional, and Mental Health) and two summary components (Physical and Mental) of the Short Form 36 (SF-36)®²⁷. A t-score (normalized to a population mean of 50) less than 30 was considered “low”. Debilitating pain was defined as responding “moderately”, “quite a bit”, or “extremely” to the SF-36® question “During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?”

Statistical Analysis

Data were collected and managed with Research Electronic Data Capture (REDCap) hosted at the University of Colorado²⁸. Characteristics were summarized with mean and standard deviation (SD) for continuous, and frequency with percentage for categorical outcomes. Differences in measures between RMU and non-RMU groups were reported as mean with standard error (SE) or Odds Ratio (95% CI). Geometric mean (GM) and 95% confidence interval (CI) are reported for skewed measures, with comparisons made on the log scale. Demographics of RMU and non-RMU groups were compared using t-test for continuous and chi-square for categorical measures. Differences in disease burden, functional status, and quality of life between RMU and non-RMU groups were estimated overall and in adjusted analyses using logistic regression for categorical measures, and linear regression for continuous measures. Both clinical input and characteristics by which groups differed significantly in univariate analyses were considered for inclusion in adjusted models of key outcomes; multivariable adjusted analyses included current tobacco use, CD4+ T-cell count, and years since HIV diagnosis as covariates with RMU group. Results from logistic regression are reported as odds ratio and 95% CI, and results from linear regression are reported as mean difference and standard error. In sensitivity analysis, the role of current tobacco use was considered as an effect modifier in adjusted modeling. Analyses were performed in SAS v9.3. A p-value less than 0.05 was considered statistically significant.

Results

Of 542 eligible participants, a total of 359 subjects completed the study visit, of which 85% were male, 74% self-reported Caucasian, and 18% Hispanic or Latino. Sixty-five percent were men having sex with men and 21% had a history of intravenous drug use. The GM age was 51.8 years (95% CI: 51.2–52.3), GM CD4+ T-cell count was 510 (95% CI: 479, 544) cells/ μ L, and 95% had plasma HIV-1 RNA below detection. Twenty-six percent (93 subjects) reported marijuana use within the past 30 days and were considered RMU.

Compared to non-RMU patients, RMU patients were similar in age, but had a significantly longer average duration since diagnosed HIV infection. RMUs were more likely to have an income of less than \$50,000 annually ($p < 0.01$) (median household income in Colorado 2007–2011 \$57,685 QuickFacts²⁹). Reported rates of heavy alcohol use and historic injection drug use were similar between groups, however tobacco use was nearly twice as common among RMUs (Table 1).

We observed a negative trend with marijuana use across BMI categories, with the highest proportion of marijuana users in the lower BMI categories. Similarly, RMU patients had lower odds of obesity vs non-RMU patients, however this difference was not significant after adjusting for current tobacco use, CD4+ T-cell count and years since HIV diagnosis (Table 2). RMUs had a lower rate of chronic pain, and a higher rate of neuropathy, and were more likely to be taking 2 or more mental health medications than non-RMUs. After adjusting for current tobacco use, CD4+ T-cell count and years since HIV diagnosis, there were no significant differences by comorbidities between groups (Table 2). Physical function was similar between groups as measured by each individual SPPB component and total SPPB score. While pace of the 400-m walk was similar between groups, failure to complete the 400-m walk was higher among RMUs; this difference was not significant when adjusted for current tobacco use, CD4+ T-cell count and years since HIV diagnosis (Table 3).

Health related QOL was lower than the population normalized mean of 50 in all SF-36[®] domains for both RMU and non-RMU patients. RMUs had lower QOL in all 8 domains, with significantly lower scores in Role-Physical, Social Functioning and Mental Health. These three domains also differed significantly by the proportion of low scores (defined as less than 30), with the odds of RMUs >3.5 times that of a non-RMU for being socially unengaged. RMUs were more likely to work part-time or be unemployed (compared to full-time), but there were not significant differences in the proportion of participants living alone between groups (Table 4). Differences in social functioning and employment persisted when adjusted for current tobacco use, CD4+ T-cell count and years since HIV diagnosis.

In sensitivity analysis, current tobacco use was considered as an effect modifier in adjusted modeling; however an interaction with marijuana use was not statistically significant in any instance.

Discussion

To the best of our knowledge, this is the first analysis of the impact of marijuana use on multi-dimensional components of successful aging, defined here as lower burden of comorbid diseases and medications, high level of physical function, and preserved QOL, in adults with or without HIV infection. Overall, we found a high prevalence of marijuana use (26%), higher than 2010 rates for adults ¹⁴ in Colorado (7.3%) and nationally (4.4%). Interestingly, we found very little association between RMU and disease burden or physical function. Similar to previously published studies that did not show a change before and after marijuana use in CD4+ T-cell count or HIV-1 viral load ⁶, our RMU and non-RMU groups were clinically similar in CD4+ T-cell and viral load.

In contrast, QOL was consistently lower among patients reporting RMU, with differences in social functioning and mental health domains statistically significant. The strong association between RMU and poorer mental health was further strengthened by proportionately more taking 2 or more mental health medications, lower social functioning, and under or unemployment among RMU. Prior studies have shown that older individuals with HIV often live alone ^{30,31}, are less likely to be involved in a long-term relationship ³², frequently have social support networks of HIV-positive individuals, may experience considerable loss of support due to HIV/AIDS associated deaths ³³, and have greater risk of hospitalization and death, in comparison to older adults without HIV ³⁴. Although QOL was lower among patients reporting RMU, we are unable to determine whether the association between RMU and lower QOL is the result of persons with lower social-functioning choosing to use or self-medicate with marijuana, whether the use of marijuana leads to lower social-functioning and QOL, or both. Anxiety-related motivation for using marijuana could be correlated with a predisposition for increased social isolation³⁵ and decreased social engagement. Additionally, among our participants who used marijuana, we do not know if the QOL at the time of evaluation was improved or worsened with marijuana use. Regardless, further social isolation associated with marijuana use among persons in an already fragile social network in the context of aging with HIV could have a negative impact on successful aging among older adults with HIV infection. Interventions to recognize and improve social engagement and QOL could improve the success with which an HIV-infected person ages, particularly those who use marijuana.

While groups did not differ significantly by most measures of functional status, failure to complete the 400-m walk and unadjusted measures of physical QOL differed between groups. These unadjusted differences could indicate the presence of motivational factors in physical activity that are impacted among patients that use marijuana.

The cross-sectional non-randomized nature of this study comes with difficulty in knowing whether observed group differences are related to marijuana use itself, characteristics of those who opt to use marijuana, or some other factor. Also, given the secondary nature of the analysis, data were not available on: frequency of use, volume and route of consumption, prescribed/non-prescribed use, source (medical dispensary, home grown, etc), primary reason for marijuana use, and associated behavioral risks such as unprotected sex with multiple sexual partners. Although medicinal use of marijuana was permitted at the time of

the study, the source or legality of marijuana use was not collected as part of this study. While self-reported marijuana use was not verified through clinical testing, we anticipate that patient-reported information on marijuana use was unbiased in this population given the potential for legal access. With the legalization of recreational marijuana in Colorado, the implications of increased social acceptance and lessened “illegal” stigma of marijuana use could change the association with social isolation, thus our study findings may not apply to the current state of marijuana legalization. Lastly, we cannot assess the effect of marijuana use on compliance with HIV medication nor whether the impact of marijuana use on social isolation may differ among persons not on ART, as compliance was a criteria for study inclusion. However it is of note that the RMU prevalence was still quite high among a population compliant with HIV medication.

Conclusion

Among middle-aged HIV-infected persons on effective antiretroviral therapy, the impact of recent marijuana use on successful aging is associated with select measures of both physical and mental quality of life although the directionality is unclear; however RMU was not significantly associated with differences in disease burden or physical function. Self-reported marijuana use could be used as a “red flag” for a need to evaluate the mental health and social resources available for the older adult with HIV. Future prospective, randomized studies should evaluate the impact of legalization of recreational marijuana on the social isolation of older adults with HIV. Considering marijuana use when identifying potential barriers to successful aging, such as utilization of social resources and support, may improve successful aging among older adults with HIV infection.

Acknowledgements

Supported in part by NIH/NCATS Colorado CTSI Grant Number UL1 TR000154, NIH/NCATS Colorado CTSI Grant Number UL1 TR001082, NIH/NIA K23AG050260 & R03AG040594 (KME), and the Hartford Foundation Center of Excellence (KME). Contents are the authors’ sole responsibility and do not necessarily represent official NIH views.

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Table 1

Demographics for Recent Marijuana Users (RMU) and no-RMU group

Variable	RMU n=93	No RMU n=266	p-value
Age (years) ^I	51.8 (50.8, 52.8)	51.8 (51.1, 52.4)	0.95
Years since diagnosis ^I	14.1 (12.5, 15.8)	11.2 (10.2, 12.4)	0.004
White Race n (%)	72(77)	193(73)	0.41
Hispanic or Latino Ethnicity n (%)	18(19)	47(18)	0.76
Female gender n (%)	10(11)	44(17)	0.24
College or graduate Education n (%)	26(28)	82(31)	0.69
Household income \$50,000 n (%)	86(92)	212(80)	0.006
Current/prior heavy alcohol use n (%)	4(4)	11(4)	1
Current tobacco use n (%)	45(48)	78(29)	0.001
Injection Drug Use history n (%)	24(26)	52(20)	0.24
CD4+ t-cell count ^I (cells/μL)	513 (445.6, 591.1)	509 (474.8, 546.1)	0.92
Nadir CD4 ^I (cells/μL)	86.0 (63.6, 116.2)	89.0 (74.2, 106.7)	0.85
HIV-1 RNA <50 copies/mL n (%)	90(97)	252(95)	0.58

P-values are reported from chi-square or t-test, <0.05 considered statistically significant

^I Geometric Mean (95%CI) for continuous measures

Current/prior alcohol use: drinking > 7 drinks per week or abuse history.

Use of Alcohol, tobacco, and injection drugs, and income all self-reported.

Table 2

Clinical characteristics of Recent Marijuana Users (RMU) and No RMU group

Modeled Outcome	RMU n=93	No RMU n=266	Unadjusted		Adjusted*	
			Difference or Odds Ratio	P-value	Difference or Odds Ratio	P-value
# Comorbidities**	2.9 (1.8)	2.6 (1.8)	0.29 (0.21)	0.17	0.14 (0.21)	0.52
Neuropathy, n (%)	44(47)	92(35)	1.7(1.1, 2.7)	0.035	1.6(1.0, 2.6)	0.08
Chronic pain, n (%)	33(35)	63(24)	1.8(1.1, 2.9)	0.03	1.5(0.9, 2.5)	0.17
Osteoarthritis/Joint Pain, n (%)	31(33)	98(37)	0.9(0.5, 1.4)	0.53	0.7(0.4, 1.3)	0.28
Seizure disorder, n (%)	1(25)	7(54)	0.3(0.0, 3.5)	0.58	0.3(0.0, 6.7)	0.46
History of malignancy, n (%)	13(14)	26(10)	1.5(0.7, 3.0)	0.33	1.6(0.8, 3.3)	0.22
# 2+ Current Medications [†] **	78(84)	220(83)	1.1(0.6, 2.1)	0.87	2.0(0.7, 5.9)	0.72
# 2+ Mental Health Meds**	40(43)	80(30)	1.8(1.1, 2.9)	0.030	2.0(0.9, 4.3)	0.13
Hospitalizations, n (%)	20(22)	57(22)	1.0(0.6, 1.8)	1.0	1.1(0.6, 1.9)	0.82
BMI kg/m ² **	25.1 (4.3)	26.8 (6.5)	-1.7 (0.72)	0.004	-1.4 (0.74)	0.07
Underweight BMI n (%)	3(3)	5(2)	1.7(0.4, 7.4)	0.69	1.4(0.3, 6.1)	0.68
Obese n (%)	12(13)	60(23)	0.5(0.3, 1.0)	0.05	0.5(0.3, 1.1)	0.09
Unintentional Weight loss n (%)	12(13)	23(9)	1.6(0.7, 3.3)	0.31	1.5(0.7, 3.2)	0.31
VACS Index**	18.0 (12.7)	18.3 (15.0)	-.31 (1.75)	0.85	0.03 (1.65)	0.98

P-values are reported from linear or logistic regression models, p<0.05 considered statistically significant

* Adjusted for current tobacco use, CD4 count and years since HIV diagnosis.

** Mean (SD) for continuous measures, and Mean (SE) for difference

[†] Number of current medications excludes antiretroviral therapyBMI: body mass index; VACS: Veterans Aging Cohort Study, Obese: BMI (BMI ≥ 30 kg/m²)

Table 3

Physical Function of Recent Marijuana Users (RMU) and No RMU group

Modeled Outcome	RMU n=93	No RMU n=266	Unadjusted		Adjusted*	
			Difference or Odds Ratio	P-value	Difference or Odds Ratio	P-value
4-m walk (score<3), n (%)	2(2)	5(2)	1.1(0.2, 6.0)	1	1.2(0.2, 6.5)	0.83
5-times chair rise (score<3), n (%)	16(17)	41(15)	1.1(0.6, 2.1)	0.74	0.9(0.5, 1.8)	0.79
Tandem Stand (score<3), n (%)	3(3)	16(6)	0.5(0.1, 1.8)	0.42	0.4(0.1, 1.5)	0.17
SPPB Score (0–12 points possible) **	11.1 (1.6)	11.1 (1.6)	0.04 (0.20)	0.85	0.16 (0.20)	0.42
SPPB Score < 9, n (%)	13(14)	32(12)	1.2(0.6, 2.4)	0.72	1.0(0.5, 2.0)	0.93
400-m walk pace, m/s ***	1.4 (0.4)	1.4 (0.3)	−.04 (0.04)	0.38	−.02 (0.05)	0.72
Incomplete 400-m walk, n (%)	6(6)	5(2)	3.6(1.1, 12.1)	0.038	2.6(0.8, 9.3)	0.13
Activity, n (%)	27(29)	81(31)	0.9(0.6, 1.6)	0.79	0.9(0.5, 1.5)	0.58
Frequent faller, n (%)	22(24)	44(17)	1.6(0.9, 2.8)	0.16	1.3(0.7, 2.4)	0.35

P-values are reported from linear or logistic regression models, p<0.05 considered statistically significant

* Adjusted for current tobacco use, CD4 count and years since HIV diagnosis.

** Mean (SD) for continuous measures, and Mean (SE) for difference

SPPB: Short Physical Performance Battery

Table 4
Health Related Quality of Life and Social Engagement of Recent Marijuana Users (RMU) and No RMU group

Modeled Outcome	RMU n=93	No RMU n=266	Unadjusted		Adjusted*	
			Difference	P-value	Difference	P-value
SF-36 Domain or Summary T-score**						
Physical Functioning	43.9 (12.4)	46.4 (11.7)	-2.5 (1.43)	0.09	-1.4 (1.43)	0.34
Role-Physical	43.1 (12.6)	46.5 (11.8)	-3.4 (1.45)	0.024	-2.9 (1.48)	0.050
Bodily Pain	44.6 (11.7)	47.2 (11.8)	-2.7 (1.42)	0.06	-2.0 (1.45)	0.17
General Health	45.5 (12.6)	45.8 (10.9)	-3.6 (1.36)	0.81	0.66 (1.34)	0.62
Physical Component Summary	44.8 (12.5)	46.8 (10.4)	-2.0 (1.33)	0.17	-1.1 (1.33)	0.40
Vitality	46.2 (11.9)	48.8 (11.1)	-2.6 (1.37)	0.07	-1.8 (1.38)	0.20
Social Functioning	42.0 (13.9)	45.6 (11.5)	-3.6 (1.47)	0.027	-2.9 (1.48)	0.048
Role-Emotional	43.0 (13.3)	45.4 (12.9)	-2.5 (1.57)	0.13	-2.0 (1.60)	0.22
Mental Health	43.7 (12.4)	47.3 (11.5)	-3.6 (1.42)	0.015	-2.8 (1.42)	0.05
Mental Component Summary	43.7 (13.1)	46.8 (11.5)	-3.1 (1.44)	0.044	-2.6 (1.46)	0.08
<30 points per domain or summary			Odds Ratio		Odds Ratio	
Physical Functioning n (%)	17(18)	33(12)	1.6(0.8, 3.0)	0.17	1.3(0.7, 2.6)	0.42
Role-Physical n (%)	31(34)	56(21)	1.9(1.1, 3.2)	0.017	1.7(1.0, 2.9)	0.05
Bodily Pain n (%)	9(10)	26(10)	1.0(0.4, 2.2)	1	0.8(0.3, 1.8)	0.58
General Health n (%)	16(17)	26(10)	1.9(1.0, 3.7)	0.06	1.7(0.8, 3.3)	0.16
Physical Component Summary n (%)	11(12)	19(7)	1.7(0.8, 3.8)	0.19	1.3(0.6, 2.9)	0.57
Vitality n (%)	5(5)	12(5)	1.2(0.4, 3.5)	0.78	1.0(0.3, 3.1)	0.97
Social Functioning n (%)	23(25)	20(8)	4.0(2.1, 7.7)	<.001	3.6(1.8, 7.2)	<.001
Role-Emotional n (%)	23(25)	52(20)	1.3(0.8, 2.3)	0.37	1.2(0.7, 2.2)	0.46
Mental Health n (%)	13(14)	17(6)	2.4(1.1, 5.1)	0.03	2.0(0.9, 4.4)	0.09
Mental Component Summary n (%)	18(19)	29(11)	1.9(1.0, 3.7)	0.05	1.8(0.9, 3.5)	0.08
Social Engagement Measures			Odds Ratio		Odds Ratio	
Currently Living Alone n (%)	40(43)	99(37)	1.3(0.8, 2.1)	0.32	1.3(0.8, 2.1)	0.37
Un-/under employed n (%)	75(81)	160(60)	2.8(1.6, 4.9)	<.001	2.6(1.5, 4.7)	0.001

P-values are reported from linear or logistic regression models, p<0.05 considered statistically significant

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Adjusted for current tobacco use, CD4 count and years since HIV diagnosis.
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** Mean (SD) for continuous measures, and Mean (SE) for difference