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Food Security Status is related to Mental Health Quality of Life among Persons Living with HIV

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Abstract

This study evaluated the association between health related quality of life and food security among persons living with HIV (PLHIV). We studied 167 PLHIV who completed questionnaires assessing food security, disease symptomatology, and several domains of the SF-36 health related quality of life survey. HIV disease state was assessed from medical records. Associations between independent and outcome variables were determined through linear regression models. Compared to food security, very low food security was significantly associated with lower mental component summary scores, [average difference: -4.98 (95% CI: -9.85 , -0.10); mental health, [average difference: -5.44 (95% CI: -10.08 , -0.81); and general health, [average difference: -5.13 (95% CI: -9.65 , -0.65)] after adjusting for covariates. About a fourth of participants experienced severe food insecurity, which negatively influenced their mental health and general wellbeing. The inclusion of resources for food assistance in HIV treatment programs may help ameliorate mental health challenges faced by PLHIV.

Keywords

health related quality of life; HIV infection; food security; persons living with HIV

INTRODUCTION

Health related quality of life (HRQoL) is a broad multidimensional concept that captures the perceived impact of disease on an individual's physical, mental, and social wellbeing (1). Though subjective in measurement, assessment of HRQoL among individuals living with

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

chronic disease is essential. It is an important non-clinical indicator of disease burden and outcome, and determines the effectiveness of treatment in terms of returns with cost investments (2). Infection with the human immunodeficiency virus (HIV) and subsequent disease progression reduces physical functionality and mental wellbeing as related to quality of life (3–6). HIV infected individuals who are symptomatic and those with the acquired immunodeficiency syndrome (AIDS) have worse quality of life compared to asymptomatic individuals and the general public (2, 4, 7). When compared to individuals with other chronic diseases, persons living with HIV (PLHIV) have poorer physical functioning and emotional wellbeing (4). Illicit drug use (8, 9), psychiatric conditions (10–12), limited social support (11, 13–15), presence of HIV-related symptoms (4, 7, 13), and poor socioeconomic status (16, 17), worsen HRQoL when they co-exist with HIV infection. HRQoL is a known predictor of survival among HIV infected individuals (18).

Food insecurity is an indicator of poor socioeconomic conditions and it is a measure of the availability and access to safe, nutritionally adequate, affordable and culturally relevant foods (19). Among non-HIV infected populations, individuals who are food insecure have poorer mental and physical wellbeing (20–22). In a study of 1488 households in 36 rural counties in the Delta region of Arkansas, Louisiana, and Mississippi, adults from food insecure households scored significantly lower on the physical and mental health scales measured by Short Form 12-item Health Survey (SF-12) (22). Similarly, among 1006 individuals in rural Appalachia food insecure individuals reported significantly poorer functional status compared to those food secure (23). In a recent study of a large sample of urban and rural women, Sharkey et al. (21), found that household food insecurity was associated with increased poor physical health and increased odds of frequent mental disorders.

Approximately 37 million individuals live with HIV globally (24) and regardless of setting (i.e. resource-limited or resource-rich country), exhibit high prevalence of food insecurity (25). Prevalence for food insecurity among PLHIV range from 24% – 81% (26–35). Food insecurity may promote HIV transmission because it compromises nutritional status, and consequently, functioning of the immune system (36). Engaging in risky sexual behaviors, also encourages HIV disease transmission, and is more likely among infected individuals who are food insecure (37–39). Among PLHIV, food insecurity is also negatively associated with access to care (40, 41), adherence to treatment (32,42), CD4 levels (28, 31), viral load suppression (30, 32), opportunistic infections and hospitalization (41), common mental disorders including depression (33–35,43), and mortality (44, 45).

An emerging body of research (mainly from resource-limited settings) has begun exploring the relationship between food insecurity and quality of life among PLHIV (33,35,46,47). All the studies found a negative association between food insecurity and quality of life, however, only one study (47) assessed this relationship with respect to the multidimensional nature of HRQoL. A study by Weiser et al. (31) of marginally housed PLHIV is the only known study that has explored the relationship between food insecurity and HRQoL in the US among persons living with HIV. The study found food insecurity to be associated with poor physical and mental health as well as poor social functioning. This current study extends the evidence base and also builds on the previous study by investigating which subdomains of HRQoL are

more critically associated with each level of food security (food security, low food security and very low food security). This level of examination provides a clearer and more comprehensive understanding of the influence of food insecurity on the physical and mental wellbeing of PLHIV. The findings may aid researchers, practitioners and policy makers to target additional services and interventions related to these subdomains at food insecure PLHIV in an effort to improve their HRQoL. We evaluated health related quality of life among PLHIV, comparing scores of the various components of HRQoL between individuals with varying severity of food insecurity.

METHODS

Study Design and Sample

This was a cross-sectional study involving HIV infected patients living in Miami, FL. The study was conducted between April 2011 and August 2012. Participants were recruited primarily through the Florida International University HIV and Nutrition Research Clinic (HNRC), located in Borinquen Health Care Center (BHCC). HNRC conducts numerous large HIV-related studies and as a result, evaluates several HIV infected patients a day. BHCC provides HIV-related care and services to low-income infected patients in Miami-Dade County. Flyers, referrals from case workers, and word-of-mouth were used in participant recruitment. Participation was limited to individuals with medical proof of HIV-seropositive status, with sequential CD4 cell count and viral load values, and who were 18 years or older. Approval for this study was obtained from the Institutional Review Board at Florida International University.

All participants signed a written informed consent prior to inclusion in the study. Each participant completed detailed questionnaires that consisted of a sociodemographic survey (age, gender, ethnicity, marital status, education, employment status, monthly income, living conditions, smoking status, alcohol and illicit drug use and the use of antiretroviral medications), as well as validated food security and health related quality of life questionnaires. HIV disease state was assessed from medical records as CD4 cell counts and viral load. The most recent (within 3 months of study visit) measures of these parameters were assessed. Each participant was given a \$10 incentive for completing the study visit.

Measures

Food security—Food security status was determined using the 6-item short form US household food security survey module, which measured food availability, access, and sufficiency over a 12 months period (48). Following standard procedures, responses were coded and food security scores were calculated. This was used to classify patients into the following categories:

- For scores of 0–1: high/marginal food security – little or no indication of limitation with food access or changes in diet quality and food intake;
- For scores of 2–4: low food security-reports of reduction in diet quality, with little or indication for reduction in food intake;

- For scores of 5–6: very low food security—Several indications of disruptions with eating patterns reported, in addition to reduction in food intake (48).

Disease state—Each participant's most recent (assessed within 3 months of study visit) viral load and CD4 cell count were obtained from medical records. Study participants signed a medical release form which was used to obtain data on clinical immunological markers.

Symptoms—Occurrence of symptoms such as diarrhea, constipation, fever, fatigue, nausea, and unexplained weight changes were assessed among participants using a medical history survey developed for use among PLHIV (49). The number of symptoms ranged from 0–9.

Health related quality of life—Each participant completed the Medical Outcomes Study 36-Item Short Form Version 2 (SF-36v2; QualityMetric, Lincoln, RI) health survey which was used to evaluate health related quality of life, measured as physical and mental wellbeing (50). Physical wellbeing was assessed under domains of physical functioning (PF), role-physical (RP), bodily pain (BP), and general health, and further aggregated into the physical component summary score (PCS). Mental wellbeing was measured by the following domains: vitality (VT), social functioning (SF), role-emotional (RE), and mental health (MH), and aggregated into the mental component summary score (MCS) (44). Scoring for each domain was achieved using the Quality Metric Health Outcome Software. Scoring was norm-based, using a t-score transformation (ranging from 0–100) with a mean of 50 and a standard deviation of 10. This allowed for comparison of scores from the eight domains and also with the summary scores. Higher scores are indicative of better functioning and wellbeing (51).

Statistical Methods

Descriptive statistics summarized each categorical and continuous covariates of interest by food security group (food secure, low food security and very low food security). Unadjusted associations between food security levels and categorical variables were assessed by the Fisher's exact test and by linear regression for associations between food security categories and continuous variables. Unadjusted and adjusted associations between food security and each outcome measure including health related quality of life domains were estimated through linear regression models.

A priori demographic and clinical variables (age, gender, race, ethnicity, number of pathologic symptoms, viral load and CD4 cell count) that could confound the relationships were selected based on literature and included in all adjusted models exploring the associations between food security and all the health related quality of life domains. Food insecurity has been associated with viral load and CD4 cell count, and therefore current viral load and CD4 cell count were included as potential confounders (hypothesizing that poor disease status affects food security) (25,52). Additional variables, including income, employment status, marital status, living arrangements and ART use were tested for their confounding effects by including them in the adjusted models and observing if the estimates or standard errors of these estimates for food security were changed by more than 10%. All

presented p-values are two-sided and are unadjusted for multiple comparisons. All analyses were conducted in STATA, Stata Statistical Software: Release 13 (StataCorp, College Station, TX).

RESULTS

Of the 178 participants in the study, 167 had complete data for all variables (including CD4 count and viral load) which were used in the final regression models. Participants with missing data were not included in the analyses and did not differ significantly in characteristics compared to those included in our analyses. Among 167 participants, 41% reported being food secure, 36% experienced low food security and 23%, very low food security. Tables 1 and 2 describe the demographic, socioeconomic, and health-related characteristics of study participants. Participants were more often male (66%), had less than high school education (71%), and a monthly income of \$1000 or less (81%). The majority of participants (62%) smoked cigarettes, however, only 29% used illicit drugs. Approximately 17% of study participants lived in a shelter or were homeless. The distribution of participants' age group ($p=0.04$), living arrangement category ($p=0.04$), marital status group ($p=0.08$), viral load group ($p=0.001$) and number of symptoms ($p=0.02$) varied considerably between food security groups. Participants who reported being food insecure (i.e. those with low or very low food security) tended to be younger, i.e. under 50 years of age, (73%, 95% CI: 64.7%, 82.2%) than those who indicated that they were food secure (52%, 95% CI: 40.4%, 63.9%), $p=0.005$). Participants who reported food security had significantly lower viral load (viral load 75: VLFS: 23% (95% CI: 11.1%, 39.3%), LFS: 44% (95% CI: 31.1%, 57.6%), FS: 61% (95% CI: 48.4%, 72.4%). Approximately 47% of participants reported not working, and 42% were on disability; however, being food insecure was not associated with working status.

In unadjusted analyses, mental component summary score (MCS) was significantly lower for participants with very low food security compared to their food secure counterparts (Average (SD): 38.4 (12.9) vs. 48.4 (11.8), Average difference: -10.05 [95% CI: -15.04 , -5.06]). Participants who had very low food security also had significantly lower scores for vitality (Average (SD): 47.5 (10.4) vs. 54.7 (10.7), Average difference: -7.14 [95% CI: -11.50 , -2.78]), social functioning (Average (SD): 38.8 (11.0) vs. 46.0 (10.6), Average difference: -7.21 [95% CI: -11.66 , -2.76]), role emotional (Average (SD): 33.9 (15.6) vs. 42.5 (14.3), Average difference: -8.62 [95% CI: -14.54 , -2.70]), and mental health (Average (SD): 40.3 (12.0) vs. 49.9 (11.3), Average difference: -9.67 [95% CI: -14.32 , -5.01]) compared to those who were food secure. With the exception of scores from the role-emotional domain, similar results were observed for those with low food security (results not shown). Although reduced in magnitude, the estimated differences in the MCS and the mental health domain between those with very low food security and those who were food secure remained strong even after adjusting for age, gender, race/ethnicity, number of pathologic symptoms, viral load and CD4 cell count (Average adjusted differences: -4.98 (95% CI: -9.85 , -0.10) and -5.44 (95% CI: -10.08 , -0.81), respectively) (Table 3). This suggests a strong and detrimental association between severe food insecurity and mental wellbeing. After adjustment, social functioning, vitality and role emotional

scores trended toward being lower for those with very low food security compared to those who were food secure, but these associations were not as strongly significant (Table 3).

With regard to the physical component summary score (PCS), unadjusted analyses showed no significant difference in scores between food secure, low food security and very low food security groups (Average (SD): 47.9 (11.3) vs. 45.8 (10.3) vs. 44.8 (10.1), Average difference: -2.08 [95% CI: $-5.86, 1.69$] and -3.05 [95% CI: $-7.32, 1.22$]). In unadjusted analyses of the various domains of the physical functioning component of HRQoL, participants with very low food security had significantly lower scores on several domains: role physical (Average (SD): 39.0 (12.1) vs. 44.7 (12.1), Average difference: -5.66 [95% CI: $-10.37, -0.94$]), bodily pain (Average (SD): 44.9 (12.9) vs. 50.1 (12.1), Average difference: -5.18 [95% CI: $-10.17, -0.18$]), and general health (Average (SD): 42.9 (10.9) vs. 50.1 (10.0), Average difference: -7.13 [95% CI: $-11.53, -2.73$]). However, in multivariable models, only the general health domain remained significantly and inversely associated with very low food security (Adjusted average difference: -5.13 [95% CI: $-9.65, -0.62$]) (Table 4). With the exception of bodily pain (Adjusted average difference: -6.39 [95% CI: $-10.90, -1.86$]), no significant associations were observed between low food security and any of the physical functioning domains. For all outcomes under study, when models are not adjusted for viral load and CD4 cell count, results remain similar, but are less attenuated toward 0, resulting in larger estimated effects for differences in outcomes between food secure and insecure groups.

DISCUSSION AND CONCLUSIONS

This study examined the relationship between food security status and the physical and mental wellbeing of persons living with HIV (PLHIV). Our findings support strong associations between food insecurity and poor mental wellbeing among HIV infected adults in Miami, FL. We found food insecurity to be associated with only 4 of the 10 dimensions of HRQoL. Specifically, mental component summary (MCS), mental health, bodily pain, and general health scores were worse with increasing severity of food insecurity. With the exception of the general health domain, we did not find any significant reduction in physical functioning domains as food insecurity worsened.

Our findings differ somewhat from the study by Weiser et al. (31), who found associations of food insecurity with both MCS and PCS among marginally housed HIV infected adults in San Francisco. This current study used the USDA food security survey module in assessing food security status (48) as opposed to the Household Food Insecurity Access Scale (HFIAS) used by Weiser et al. (31). The difference in assessment tool may have contributed to differences in study findings. A study among PLHIV in Uganda also found that those from households with severe food insecurity had significant decreases in both physical and mental health status, although the relationship was more significant for mental health status (47). That study measured HRQoL using the Medical Outcomes Study HIV Health Survey- a variant of the Short Form-36 Health survey used in this current study- and found severe food insecurity to be correlated to 9 of 11 domains (general health, pain, mental health, health distress, health transitions and quality of life) measured (47). This is more than reported in our study. However, participants in the Ugandan study were ART-naïve, and had

poorer clinical outcomes. It is therefore plausible that the burden of food insecurity may be more expressed among this cohort of PLHIV living in poor environments with limited to no availability of food assistance.

The findings of this study are consistent with the evidence that a severe lack of access to food may produce emotional and psychological stress which negatively impacts mental functioning (53). Food insecurity has been associated with distress, depression, and anxiety (33–35,54–56). This may be a plausible explanation to the lack of adherence to treatment observed among food insecure HIV infected adults when compared to their food secure counterparts (32, 57). Previous evidence points in part, to psychological stress as a factor for reduced adherence to treatment among PLHIV (58, 59). The greater the non-adherence to treatment, the lower the odds of viral suppression (32).

We found the prevalence of food insecurity in this cohort of HIV infected individuals to be 58.7% (95% CI: 50.8%, 66.2%). This rate is more than four times higher than the current national rate of 14.0% (60). Previous literature has reported prevalence rates consistent with our findings (26–34). This suggest that food insecurity remains a significant problem among PLHIV even in resource adequate settings. A recent study, however, showed that about 70% of PLHIV participate in food assistance programs in the US (61). We also found severe food insecurity to be associated with being homeless or living in a shelter. This finding is consistent with that reported by another study among HIV infected individuals in San Francisco (31). Although homelessness does not always overlap with food insecurity, being low income and having housing instability predisposes homeless populations to severe forms of food insecurity. Currently, there is no national data on food insecurity levels among homeless individuals and families, however, data from emergency food assistance programs shows a high prevalence of food insecurity rates among homeless populations (62). Federal and private nutrition programs are available to alleviate food issues among various vulnerable populations including the homeless. However a recently study showed that being homeless or marginally housed could be a barrier to participating in a federal nutrition assistant program among PLHIV (61). To reach PLHIV, several of whom experience homelessness, HIV care and treatment programs need to develop avenues for including resources for food aid in their programs. An example of such an avenue will be collaborations with public and private programs that provide food assistance to individuals and households.

Our study has several limitations: first, the study population was a small sample recruited from one city in the United States. As such, findings may not be generalizable to other HIV infected populations. Second, our study design was cross-sectional in nature and hence cannot be used to determine causality. Poor health related quality of life can be both a cause and effect of food insecurity. Hence, future longitudinal studies are warranted to ascertain causal directions of these variables. In spite of these limitations however, our study shows that food insecurity is inversely associated with mental health domains of quality of life among HIV infected adults. As stated earlier, these findings have implication for HIV care and treatment. For providers in HIV care and treatment programs to successfully promote holistic health and wellbeing for PLHIV, the inclusion of direct resources for food aid and resources for mental health during care and treatment must be an important consideration.

Since food insecurity has detrimental consequences on HIV disease state, progression and outcome, and health related quality of life is a predictor of survival during HIV infection (18), our findings also support the recommendation to integrate food insecurity screening as part of HIV treatment strategies.

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Table 1

Characteristics of participants by food security status

Characteristic	Food Security Status			p-value
	Food Secure (n=69)	Low Food Security (n=59)	Very Low Food Security (n=39)	
Age ⁺	48.9 (8.1)	46.4 (7.8)	44.8 (6.9)	0.03
% (n)				
19–30	5.8 (4)	5.1 (3)	7.7 (3)	0.04
31–50	46.4 (32)	64.4 (38)	71.8 (28)	
51–70	47.8 (33)	30.5 (18)	20.5 (8)	
Gender				0.46
Male	65.2 (45)	71.2 (42)	59.0 (23)	
Female	34.8 (24)	28.8 (17)	41.0 (16)	
Race/Ethnicity				0.99
African American, Non- Hispanic	73.9 (51)	74.6 (44)	74.4 (29)	
All Other	26.1 (18)	25.4 (15)	25.6 (10)	
Education				0.98
Less than High School	72.5 (50)	69.5 (41)	71.8 (28)	
High School or more	27.5 (19)	30.5 (18)	28.2 (11)	
Employment status				0.59
Not employed	43.5 (30)	44.1 (26)	56.4 (22)	
Employed	10.1 (7)	15.3 (9)	7.7 (3)	
On disability	46.4 (32)	40.7 (24)	35.9 (14)	
Monthly income				0.85
\$1000	79.7 (55)	79.7 (47)	84.6 (33)	
> \$1000	20.3 (14)	20.3 (12)	15.4 (6)	
Living arrangement				0.04
Alone	39.1 (27)	32.2 (19)	46.2 (18)	
With family	49.3 (34)	52.5 (31)	25.6 (10)	
Shelter or homeless	11.6 (8)	15.3 (9)	28.2 (11)	
Child Status				0.03
Children at home	17.4 (12)	13.6 (8)	0 (0)	
Children not at home	33.3 (23)	44.1 (26)	51.3 (20)	
No children	49.3 (34)	42.4 (25)	48.7 (19)	
Marital status				0.08
Married	10.1 (7)	17.0 (10)	2.6 (1)	
Single/divorced/widowed	89.9 (62)	83.1 (49)	97.4 (38)	

⁺Continuous covariates summarized by the mean (sd).

Overall differences in continuous variables between food security groups were assessed through linear regression models/ANOVA. Overall differences in the distribution of categorical variables between food security groups were made by Fisher's exact test.

Table 2

Health related characteristics of participants by food security status

Variables	Food Secure (n =69)	Low Food Security (n = 59)	Very Low Food Security (n = 39)	p-value
Smoke Tobacco				0.98
	Yes	60.9 (42)	62.7 (37)	
	No	39.1 (27)	37.3 (22)	
Alcohol use				0.1–0
	Yes	58.0 (40)	40.7 (24)	
	No	42.0 (29)	59.3 (35)	
Recreational drug use				0.50
	Yes	24.6 (17)	33.9 (20)	
	No	75.4 (52)	66.1 (39)	
ART use				0.99
	Yes	87.0 (60)	88.1 (52)	
	No	13.0 (9)	11.9 (7)	
CD4 count <i>cells/μL</i>				0.49
	< 200	15.9 (11)	18.6 (11)	
	200–499	27.5 (19)	37.3 (22)	
	500 +	56.5 (39)	44.1 (26)	
Viral load <i>copies/mL</i>				0.001
	75	60.9 (42)	44.1 (26)	
	76–9999	15.9 (11)	37.3 (22)	
	10000	23.2 (16)	18.6 (11)	
Number of symptoms ⁺		1.7 (1.7)	2.2 (2.0)	0.02
BMI ⁺ <i>kg/m²</i>		27.4 (6.2)	28.2 (4.8)	0.70

⁺Continuous covariates summarized by the mean (sd). Overall differences in continuous variables between food security groups were assessed through linear regression models/ANOVA. Overall differences in the distribution of categorical variables between food security groups were made by Fisher's exact test.

Table 3

Associations between Food Security Status and HRQoL Mental Wellbeing

	MCS	Vitality	Social Functioning	Role Emotional	Mental Health
	β (95% CI)				
FS	Reference	Reference	Reference	Reference	Reference
LFS	-1.64 (-5.83, 2.55)	-2.91 (-6.96, 0.92)	-2.66 (-6.52, 1.99)	0.08 (-5.09, 5.24)	-2.37 (-6.31, 1.57)
VLFS	-4.98 (-9.85, -0.10) *	-3.47 (-7.97, 1.04)	-4.24 (-8.77, 0.30)	-4.73 (-10.80, 1.35)	-5.44 (-10.08, -0.81) **
Age	0.14 (-0.09, .38)	0.09 (-0.12, 0.30)	0.04 (-0.18, 0.25)	-0.22 (-0.51, 0.06)	0.12 (-0.09, 0.34)
Female	1.94 (-1.95, 5.84)	-0.30 (-3086, 3.25)	-0.80(-4.39, 2.77)	-1.10 (-5.90, 3.70)	3.41 (-0.25, 7.07)
Other race/ethnicity	-3.26 (-7.31, 0.79)	-1.46(-5.16, 2.23)	-3.88 (-7.60, -0.16) *	0.05 (-4.93, 5.04)	-4.06 (-7.86, -0.25) **
college education	5.22 (1.52, 8.91) **	2.66 (-0.72, 6.04)	2.49 (-0.91, 5.88)	5.96 (1.41, 10.52) **	3.78 (0.31, 7.26) **
Viral load (log scale)	-1.62 (-3.15, -0.09) *	-1.17(-2.57, 0.23)	-0.15 (-1.56, 1.26)	-1.51 (-3.40, 0.38)	-1.76 (-3.20, -0.31) **
CD4 cell count (square root scale)	0.01 (-0.25, 0.28)	-0.08 (-0.32, 0.16)	0.05 (-0.20, 0.29)	0.13 (-0.20, 0.45)	-0.06 (-0.31, 0.19)
HIV symptoms	-2.42 (-3.38, -1.47) ***	-1.94 (-2.82, -1.07) ***	-2.04 (-2.90, -1.15) ***	-2.39 (-3.57, -1.21) ***	-1.99 (-2.88, -1.09) ***
Intercept	46.07 (30.75, 61.38)	57.24 (43.25, 71.23)	46.78 (32.69, 60.87)	54.96 (36.09, 73.83)	50.35 (35.94, 64.75)

p<0.001,**
p<0.01,*
p<0.05

Note: Adjusted for age, gender, race/ethnicity, number of pathologic symptoms, viral load on log scale and CD4 cell count (square root transformed). HRQoL: Health Related Quality of Life; FS: Food Security; LFS: Low Food Security; VLFS: Very Low Food Security; MCS: Mental component summary score.

Table 4

Associations between Food Security Status and HRQoL Physical Wellbeing*

	PCS	Physical Functioning	Role Physical	Bodily Pain	General Health
	β (95% CI)				
FS	Reference	Reference	Reference	Reference	Reference
LFS	-2.65 (-6.47, 1.16)	0.01 (-4.16, 4.16)	-1.88 (-6.11, 2.35)	-6.39 (-10.91, -1.86)**	-1.65 (-5.49, 2.19)
VLFS	-3.23 (-7.72, 1.26)	-3.01 (-7.91, 1.88)	-3.80 (-8.77, 1.18)	-4.33 (-9.65, 0.98)	-5.13 (-9.65, -0.62)*
Age	-0.34 (-0.56, -0.13)**	-0.44 (-0.67, -0.21)***	-0.23 (-0.46, 0.01)	-0.20 (-0.45, 0.05)	-0.13 (-0.03, 0.09)
Female	-2.27 (-5.82, 1.27)	-3.51 (-7.37, 0.36)	-0.08 (-4.01, 3.85)	-2.88 (-7.08, 1.32)	2.81 (-0.75, 6.38)
Other race/ethnicity	-0.53 (-4.22, 3.15)	1.28 (-2.74, 5.30)	-0.57 (-4.65, 3.52)	-2.47 (-6.84, 1.90)	-3.87 (-7.58, -0.16)*
college education	-0.43 (-3.80, 2.94)	0.79 (-2.87, 4.47)	2.26 (-1.47, 5.99)	0.27 (-3.71, 4.26)	1.11 (-2.28, 4.49)
Viral load (log scale)	0.06 (-1.33, 1.46)	-0.52 (-2.04, 0.10)	-0.70 (-2.25, 0.84)	0.16 (-1.50, 1.81)	-0.66 (-2.07, 0.74)
CD4 cell count (square root scale)	0.03 (-0.21, 0.27)	-0.02 (-0.28, 0.25)	0.05 (-0.21, 0.32)	0.04 (-0.25, 0.32)	0.08 (-0.16, 0.33)
HIV symptoms	-0.99 (-1.86, -0.12)***	-0.96 (-1.91, -0.01)***	-1.67 (-2.63, -0.71)***	-1.32 (-2.35, -0.29)**	-1.72 (-2.59, -0.84)***
Intercept	66.79 (52.84, 80.75)	70.77 (55.56, 85.98)	57.86 (42.40, 73.32)	62.44 (45.92, 78.97)	58.31 (44.28, 72.34)

p<0.001,**
p<0.01,*
p<0.05

Note: Adjusted for age, gender, race/ethnicity, number of pathologic symptoms, viral load on log scale and CD4 cell count (square root transformed). HRQoL: Health Related Quality of Life; FS: Food Security; LFS: Low Food Security; VLFS: Very Low Food Security; MCS: Mental component summary score.