Depressive symptoms, physical symptoms, and health-related quality of life among older adults with HIV

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Abstract

Purpose In the United States, approximately 45% of persons living with HIV (PLHIV) are ≥ 50 years of age. Many older PLHIV have multi-morbidities that complicate HIV infection and/or interfere with, or are exacerbated by, antiretroviral treatment. Physical health symptoms and psychiatric disorders, particularly depression, can worsen life quality in older PLHIV.
Methods This study assessed associations among physical symptoms, indicators of HIV-related health status (i.e., time since diagnosis; ever diagnosed with AIDS; having attained viral suppression), depressive symptoms, and health-related quality of life (HRQoL) in older PLHIV. Regression analyses examined data from 296 PLHIV ≥ 50 years of age living in Cincinnati, OH, Columbus, OH, and New York City.
Results Depressive symptoms and physical symptoms, particularly those related to appearance and sexual functioning, most strongly predicted HRQoL. Indicators of HIV health status did not significantly predict HRQoL. Depressive symptoms were a particularly robust predictor of HRQoL, even when accounting for physical health symptoms.
Conclusion Findings suggest that symptom management is critical to HRQoL in older PLHIV, and symptoms related to physical appearance and sexual functioning should not be overlooked in this growing population.

Keywords HIV/AIDS · Aging · Quality of life · Depression · Physical symptoms

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Introduction

Antiretroviral therapy (ART) has allowed many persons living with HIV (PLHIV) to achieve viral suppression and extended survival periods [1, 2]. PLHIV aged 50 years and over comprised 45% of adults living with diagnosed HIV in the USA [1, 3] and 17% of new infections in 2014 [4]. The proportion of older PLHIV is predicted to increase annually through 2025 [5]. Accordingly, the treatment of HIV infection has increasingly focused on improving patients' quality of life as many confront multiple comorbidities [6] and "accelerated aging" [7] as indicated by biological markers [7] and earlier onset of age-related illness and physical [8] and neurocognitive [9] performance declines, rather than merely achieving survival [2].

Health-related quality of life (HRQoL) considers both the biological and psychological aspects of an illness and includes a patient's physical, functional, emotional, and social quality of life [2]. Self-reported quality of life is a significant and independent predictor of survival in PLHIV on ART [10]. Health-related quality of life, along with clinical

health indicators (e.g., diagnosis; specific symptoms) and demographic characteristics, are useful in evaluating and predicting chronic disease prognosis in patients on ART [10].

Some research has examined factors associated with HRQoL in older PLHIV. Unfortunately, the unique influences of specific physical and cognitive symptoms—henceforth called *physical symptoms*—as opposed to broader diagnostic categories, on HRQoL are typically not considered when investigating correlates of HRQoL [11, 12]. Symptoms, whether related to HIV/AIDS, treatment side effects, or normal aging, are important predictors of quality of life, physical functioning, and mortality in PLHIV [13]. Different types of physical symptoms may play greater roles in HRQoL for PLHIV than others. For example, symptoms related to appearance or sexual functioning may affect HRQoL differently than symptoms related to pain or fatigue.

In addition to physical symptoms, mental health and substance use are important factors in HRQoL in older PLHIV. For example, older adults have an elevated risk for depression compared to younger adults [14–16], and depression is strongly related to reduced HRQoL and worsening of disease progression in PLHIV [17–19]. Depression may also affect social, functional, and cognitive aspects of HRQoL, which may be of particular concern to older PLHIV.

The current study hypothesized that (1) the type of HIV health status indicators (i.e., longer time since diagnosis; ever being diagnosed with AIDS; not being virally suppressed), (2) having physical symptoms, (3) engaging in substance use, and (4) having depressive symptoms would be associated with lower HRQoL. In addition to these explanatory hypotheses, the present study described the prevalence of physical symptoms in the current sample to add to the growing body of knowledge about multi-morbid health conditions in older PLHIV.

Method

Sample recruitment

Between November 2004 and February 2007, PLHIV ≥ 50 years of age were recruited into a randomized controlled trial (RCT) of a mental health intervention trial for older adults living with HIV that was conducted in Columbus and Cincinnati, OH and New York City [20]. For the present paper, data from the baseline assessments of these participants were used. Older adults living with HIV were operationalized as 50 years of age or older as defined by the National Institutes of Health [3] and the Centers for Disease Control and Prevention [1]. After recruitment via AIDS service organizations, local medical and mental health care providers, and print and online media, 405 individuals

expressed interest in participating. Individuals recruited for the RCT were screened for study eligibility via face-to-face interviews and were eligible to enroll if they: (1) were ≥ 50 years of age; (2) were living with diagnosed HIV (via self-report); (3) scored ≥ 10 on the Beck Depression Inventory (BDI) so that reductions in depressive symptoms as a result of the RCT could be assessed; (4) scored ≥ 75 on the Modified Mini Mental State Examination; and (5) provided written and voluntary informed consent. In all, 349 persons were eligible for participation, of whom 310 advanced to the baseline assessment. Of these, 14 observations (4.5%) were excluded from final analyses due to missing values on the surveys. Thus, 296 completed assessments with valid responses and were included in study analyses.

Procedures

Upon being screened and deemed eligible for participation in the RCT, participants completed the baseline assessment via audio computer-assisted self-interviews (A-CASI) in a community-based setting, which was an AIDS service organization or a local community health center. In health care settings, the baseline assessment was administered prior to any clinical assessments unrelated to the study. The computer provided a visual display and audio reading of each question and its response options. Participants used audio headsets to minimize interruptions in the environment and circumvent literacy limitations. A-CASI assessment techniques increase participants' understanding of questions, honesty when answering sensitive questions, and the fidelity of skip patterns in surveys [21]. Each assessment required approximately 90 min to complete and participants completed the assessment in one sitting with the aid of the A-CASI interface. There were no known instances in which participants requested or appeared to require more than one session to complete the assessment. Refreshments were provided to participants to minimize assessment burden. Participants received a $30 honorarium for completing the survey.

Generally, participants began the intervention 1–2 weeks after completing the baseline assessments used for the present analyses because the sample was recruited in waves of 30 participants in each city. Each time 30 participants completed the baseline assessment, 10 of these participants were randomized to a control condition that consisted of optional individual therapy, 10 were randomized to a coping improvement group intervention, and 10 were randomized to an interpersonal support group intervention. The goal was to have 10 participants in each group. This allowed each group to begin with a sufficient number of participants and maintain an adequate number of group members over the 12 sessions of the intervention. Once randomized, the group then began the treatment condition in which they were assigned.

Measures

Participants were characterized in terms of six general domains: demographics, indicators of HIV health status, substance use, type of HIV-related physical symptom, depressive symptoms, and health-related quality of life (HRQoL). Participants completed self-report measures of these variables via A-CASI (see "Procedures" section).

Demographics

Participants provided data on their age, gender, race/ethnicity, years of formal education achieved, and annual income.

HIV health status

Time since diagnosis was calculated based on self-reported year of HIV diagnosis. Participants also indicated whether they had progressed to AIDS (*yes/no*). As a marker of viral suppression, participants indicated their most recent viral

load results; participants with reported viral load of less than 400 copies/mL were categorized as virally suppressed.

Substance use

Participants indicated whether they used any of the following substances (*yes/no*): alcohol, marijuana, cocaine/crack, heroin, crystal methamphetamine, overused prescription drugs, and "club drugs" (i.e., ecstasy, GHB, ketamine, poppers) during the past 60 days.

Type of physical symptom

Participants indicated whether they experienced any of 18 symptoms (*yes/no*), such as symptoms of the central or peripheral nervous system (e.g., pain, numbness in hands or feet), of appearance (e.g., weight loss or wasting) or sexual functioning (e.g., loss of sexual interest), or fatigue or loss of energy in the past week (Fig. 1). The items indicating physical symptoms were based on commonly reported symptoms, as indicated in the literature at the time that the original
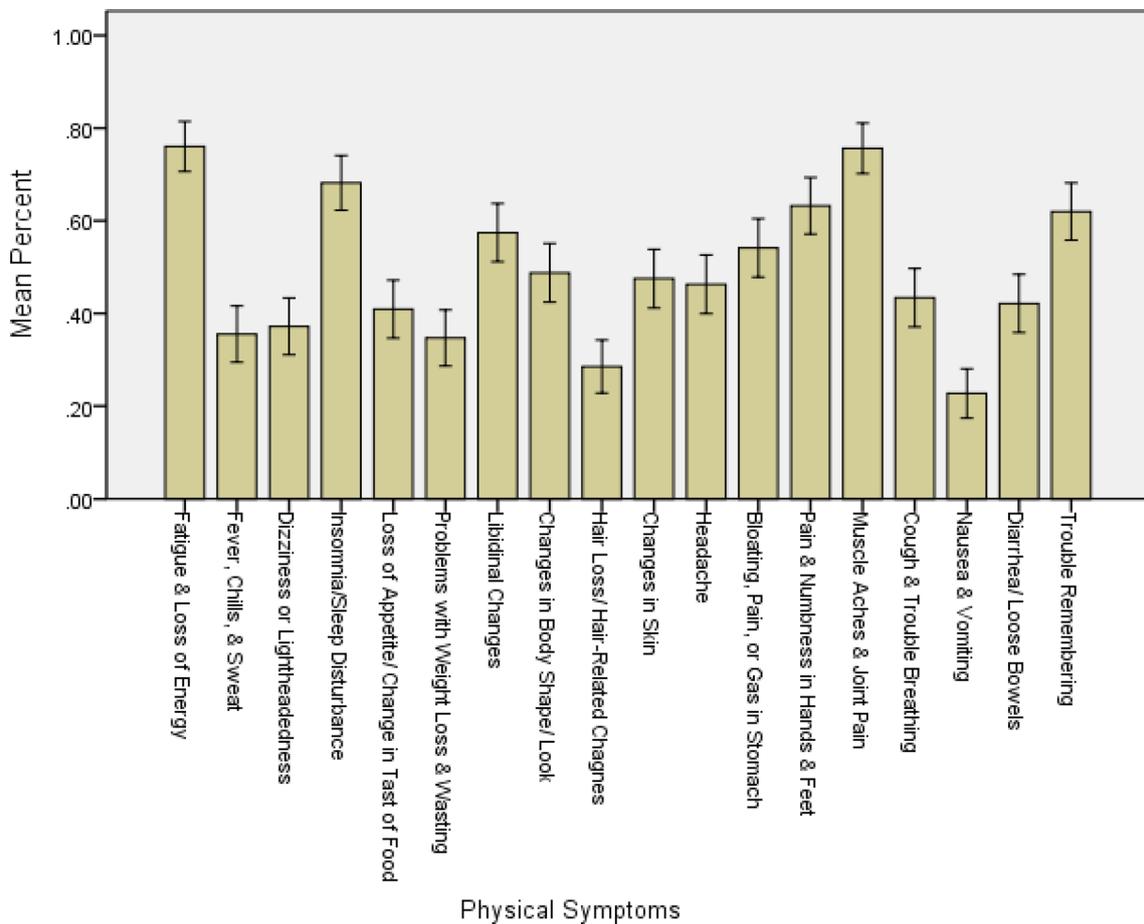

Fig. 1 Proportion of the sample endorsing each of the 18 symptoms. Error bars represent 95% confidence intervals

RCT study was designed—including research on physical symptoms and depressive symptoms among PLHIV [22], HIV-specific HRQoL [23], and physicians' ability to recognize common symptoms in PLHIV [24].

Depressive symptoms

The Geriatric Depression Scale (GDS) is a well-validated, 30-item measure of depressive symptoms in older adults over the past week [25]. The scale distinguishes between true depressive symptoms and somatic symptoms of depression that are associated with normal aging [26]. Participants responded *yes* or *no* to each item. Higher scores indicate greater depressive symptomatology. The GDS demonstrated good reliability ($\alpha = .92$).

Health-related quality of life (HRQoL)

The Functional Assessment of Human Immunodeficiency Virus Infection (FAHI) assessed participants' HRQoL over the past week [27]. Originally adapted from a similar measure for cancer patients, the FAHI is associated with measures of similar constructs, able to distinguish groups of patients based on their levels of activity and disease severity, and sensitive to changes in patients' responsiveness to stress-management interventions [27, 28]. The 47-item FAHI yields a total score of overall HRQoL and includes five HRQoL subscales: Physical Well-Being (13 items), Emotional Well-Being (10 items), Functional and Global Well-Being (13 items), Social Well-Being (eight items), and Cognitive Functioning (three items). Each item uses a 5-point scale 0 (*not at all*) to 4 (*very much*). Higher scores reflect better HRQoL. Alpha coefficients for the total scale in the current sample was .94. Coefficients alpha for the five subscales ranged from .74 (Cognitive Functioning) to .90 (Physical Well-Being).

Statistical analyses

Descriptive analyses characterized the sample's demographics. Univariate statistics then identified the proportion of participants that endorsed each of the 18 physical symptoms. Primary data analyses were conducted using multiple linear regression analyses to model whether HIV health status indicators, particularly viral suppression, physical symptoms, and depressive symptoms predicted HRQoL. The outcome variable of the total FAHI score was regressed on six, sequentially added blocks of variables: demographic characteristics as covariates, HIV/AIDS status (i.e., time since diagnosis, diagnosis of AIDS), whether the participant was virally suppressed, substance use, type of symptom (e.g., cough and breathing symptoms), and depressive symptoms. For each regression model, each block of variables was

entered while controlling for all previous blocks included in the model. In post hoc analyses, the regression models were repeated for each of the five dimensions of HRQoL (i.e., the five subscales of the FAHI) as separate, respective outcome variables.

Results

Preliminary analyses

All continuous variables were normally distributed and, with the exception of the *age* variable, satisfied assumptions of multiple regression. The Box Cox transformation procedure [29, 30] was used to determine an ideal power transformation for age, which was the natural log. Missing values within scale measures were replaced using the expectation–maximization approach for participants who completed at least 20% of the items on a given scale. Participant characteristics, including HIV-related diagnostic and treatment characteristics, are presented in Table 1.

Physical symptom prevalence

Figure 1 displays the proportions of participants who endorsed each symptom. Respondents endorsed an average of eight symptoms (SD = 4.00). Most participants experienced multiple symptoms, with 78% reporting fatigue or energy loss, 75% endorsing achiness and pain in joints and muscles, and 65% numbness or pain in their hands and/or feet. The least common symptom was nausea or vomiting, although this latter symptom was still present in 23% of participants.

Indicators of depression and substance use

The mean GDS score was 12.30 (SD = 7.90), indicating mild depression with participants' scores ranging widely from 0 to the maximum score of 30. More participants reported ongoing alcohol (44%) and cocaine/crack (36%) use than ongoing use of other drugs such as heroin (8%) or crystal methamphetamine (10%).

Primary analyses

Table 2 summarizes results from regression models predicting overall HRQoL. The final adjusted model was significant, $F(23, 260) = 24.17$, $p < .001$, adjusted $R^2 = .65$. The demographic variables (Block 1), time since diagnosis and ever diagnosed with AIDS (Block 2), viral suppression (Block 3), and substance use behaviors (Block 4) did not account for a significant amount of variance in overall HRQoL. Type of physical symptom (Block 5) accounted for

Table 1 Participants characteristics

Characteristic	
Mean current age (SD)[a]	54 (4.9)
Mean years living with HIV (SD)[a]	13.11 (5.4)
Gender, *n* (%)	
Male	200 (67.6)
Female	96 (32.4)
Race/ethnicity, *n* (%)	
Non-Hispanic white	86 (29.1)
Hispanic/Latino	20 (6.8)
Non-Hispanic black	146 (49.3)
Hispanic black	26 (8.8)
Native American	7 (2.4)
Other	11 (3.7)
Years of education, *n* (%)	
8th grade or lower	8 (2.7)
Some high school	63 (21.3)
High school graduate	78 (26.4)
Some college	88 (29.7)
College graduate	59 (19.9)
Income	
$0–$10,000	157 (53.0)
$10,001–$20,000	99 (33.4)
$20,001–$30,000	20 (6.8)
$30,001–$40,000	6 (2.0)
Over $40,000	12 (4.1)
Declined to answer	2 (.7)
HIV exposure category, *n* (%)	
Unprotected sex	195 (65.9)
Injection drug use	52 (17.6)
Blood transfusion	8 (2.7)
Don't know/other	41 (13.8)
Ever diagnosed with AIDS[a], *n* (%)	177 (59.8)
Age at HIV diagnosis, *n* (%)	
Below age 50	243 (82.1)
At or above age 50	47 (15.9)
Missing/unknown	6 (2.0)
Viral load classification, *n* (%)	
Undetectable (<200 copies/mL)	157 (53.0)
Otherwise virally suppressed (≥200, <400 copies/mL)	8 (2.7)
Not virally suppressed (>400 copies/mL)	64 (21.6)
Missing/unknown	67 (22.6)
Prescribed ART, *n* (%)	
Yes	238 (80.4)
No	8 (2.7)
Missing/unknown	50 (16.9)

Percentages represent the percentage of valid response, not including missing data. These may not equal 100.0 due to rounding. *ART* antiretroviral medication

[a]Defined as CD4 ≤ 200 or diagnosed AIDS-defining opportunistic infection

29.2% of variance in overall HRQoL. On average, participants who endorsed symptoms associated with changes in their appearance or in their sexual functioning scored lower on overall HRQoL than participants who did not endorse these symptoms ($\beta = -.15$, $b = -11.38$, $SE = 2.98$, $p < .001$). Additionally, respondents who reported symptoms of coughing and trouble catching one's breath endorsed lower levels of overall HRQoL than did respondents who did not report these symptoms ($\beta = -.10$, $b = -5.73$, $SE = 2.32$, $p = .014$). Depressive symptoms (Block 6) while controlling for all previous blocks, accounted for 31.4% of variance in overall HRQoL, and higher scores on depressive symptoms were associated with lower scores on overall HRQoL ($\beta = -.71$, $b = -2.67$, $SE = .17$, $p < .001$). We also considered the effect of the overall number of physical symptoms instead of type of physical symptoms reported by participants on HRQoL. However, findings did not differ substantively from the model above that was based on type of physical symptom.

Post hoc analyses

Post hoc analyses were also conducted using multiple linear regression analyses. Specifically, the same covariates and predictors in the primary analyses (e.g., type of physical symptom; depressive symptoms) were entered as potential predictors of the respective dimensions of HRQoL, as represented by FAHI subscales.

Results of post hoc analyses using dimensions of HRQoL as outcome variables regressed on all predictors and covariates are displayed in Tables 3 and 4. Overall, type of physical symptom, depressive symptoms and covariates accounted for the most variance when predicting Physical Well-Being ($F[23, 260] = 13.86$, $p < .001$, adjusted $R^2 = .51$), Emotional Well-Being ($F[23, 260] = 10.89$, $p < .001$, adjusted $R^2 = .45$), and Functional and Global Well-Being ($F[23, 260] = 16.23$, $p < .001$, adjusted $R^2 = .55$). In contrast, predictors and covariates accounted for 25% of the variance in Social Well-Being ($F[23, 260] = 5.07$, $p < .001$), and 33% of the variance in Cognitive Functioning ($F[23, 260] = 6.95$, $p < .001$). As shown in Table 4, Depression was the most consistent, robust predictor across all five dimensions of HRQoL, with effect sizes ranging from moderate when predicting Physical Well-Being ($\beta = -.37$, $b = -.46$, $SE = .06$, $p < .001$) to large when predicting Functional and Global Well-Being ($\beta = -.77$, $b = -.07$, $SE = .01$, $p < .001$). In regard to substance use, participants who reported heroin use endorsed lower Functional and Global Well-Being than participants who did not endorse heroin use ($\beta = -.12$, $b = -.54$, $SE = .20$, $p = .008$). Additionally, participants who reported alcohol use scored higher on Cognitive Functioning than participants who did not report alcohol use ($\beta = .12$, $b = .62$, $SE = .29$, $p = .034$). Among the types of symptom, the presence of appearance and sexual functioning-related

Table 2 Primary multiple linear regression model with predictors, including type of symptom and depressive symptoms, of health-related quality of life (FAHI total score)

Variable	R^2	ΔR^2	p	β	p
Block 1—demographic factors	.035	.035	.126		
Age				−.069	.066
Race (black = referent)				−.043	.306
Ethnicity (Hispanic = referent)				.000	.996
Gender (male = referent)				−.043	.314
Years of education				−.012	.769
Income (≤ $10,000 = referent)				.015	.685
Block 2—HIV	.056	.021	.051		
Years since diagnosis				.052	.174
Ever been diagnosed with AIDS				−.005	.894
Block 3	.056	.000	.924		
Viral suppression				.035	.331
Block 4—substance use	.075	.020	.586		
Alcohol				.033	0432
Marijuana				−.042	.313
Cocaine/crack				.020	.640
Heroin				−.062	.104
Crystal methamphetamine				−.028	.507
Prescription drug misuse				−.028	.442
Club drugs				.031	.482
Block 5—type of symptom	**.367**	**.292**	**.000**		
Constitutional				.030	.478
Central/peripheral nervous system				.038	.344
Gastrointestinal				−.054	.185
Appearance or sexual functioning-related				**−.146**	**.000**
Cough or trouble catching breath				**−.095**	**.014**
Myalgias/arthralgias				−.075	.068
Block 6	**.681**	**.312**	**.000**		
Depressive symptoms				**−.712**	**.000**
Final model adjusted R^2	.653				

$N = 296$

Significant values ($p < .05$) are indicated in the table in bold text. For dichotomous demographic variables, referent groups listed in parentheses. For other dichotomous variables (i.e., Substance Use and Type of Symptoms variables), "No" is referent

Table 3 Secondary multiple linear regression models with predictors, including type of symptom and depressive symptoms, of components of health-related quality of life (FAHI subscales): R^2 values and changes in R^2 values with the addition of each block of variables

Variables	Physical well-being		Emotional well-being		Functional and global well-being		Social well-being		Cognitive functioning	
	R^2	ΔR^2	R^2	ΔR^2	R^2	ΔR^2	R^2	ΔR^2	R^2	ΔR^2
Block 1—demographic factors	.065	**.065[b]**	.031	.031	.013	.013	.042	.042	.034	.034
Block 2—HIV/AIDS diagnostic history	.075	.010	.062	**.031[a]**	.020	.007	.070	**.028[a]**	.052	.018
Block 3—viral suppression	.076	.001	.062	.062	.020	.000	.072	.002	.061	.009
Block 4—substance use variables	.088	.011	.076	.014	.053	.032	.093	.021	.106	.045
Block 5—type of symptom	.465	**.377[c]**	.228	**.151[c]**	.223	**.171[c]**	.182	**.089[b]**	.276	**.170[c]**
Block 6—depressive symptoms	.551	**.086[c]**	.491	**.263[c]**	.589	**.366[c]**	.309	**.128[c]**	.381	**.104[c]**
Final model adjusted R^2	.511		.446		.553		.248		.326	

$N = 296$

Significant values ([a]$p < .05$, [b]$p < .01$, [c]$p < .001$) are indicated in the table in bold text

Table 4 Secondary multiple linear regression models with predictors, including type of symptom and depressive symptoms, of components of health-related quality of life (FAHI subscales): regression coefficients for variables added in each, successive block of variables

Variables	Physical well-being	Emotional well-being	Functional and global well-being	Social well-being	Cognitive functioning
	β	β	β	β	β
Block 1—demographic factors					
Age	− .062	− .024	**− .094[a]**	− .039	− .024
Race (black = referent)	**− .126[a]**	.003	.069	− .087	− .027
Ethnicity (Hispanic = referent)	− .008	.014	− .023	.031	− .026
Gender (male = referent)	**− .116[a]**	.040	− .074	.025	− .009
Years of education	− .026	− .008	− .025	− .010	.115
Income (≤ $10,000 = referent)	.024	− .003	− .036	.079	− .012
Block 2—HIV					
Years since diagnosis	.044	.087	− .040	.069	.077
Ever been diagnosed with AIDS	**− .093[a]**	.043	− .014	.046	.059
Block 3—viral suppression	− .006	.009	.068	.079	− .095
Block 4—substance use					
Alcohol	.096	.014	− .005	− .043	**.123[a]**
Marijuana	− .021	.003	− .070	− .037	− .049
Cocaine/crack	.027	− .001	.063	− .014	− .060
Heroin	− .026	.024	**− .115[b]**	− .068	− .075
Crystal meth	− .008	.013	− .070	− .057	.079
Prescription drug overuse	− .006	− .001	− .052	− .018	− .051
Club drugs	.030	− .019	.056	.057	− .077
Block 5—type of symptom					
Constitutional	**− .114[a]**	**.117[a]**	.031	.092	− .022
Central/peripheral nervous system	− .071	.062	.079	.112	**− .137[a]**
Gastrointestinal	− .046	− .025	− .050	− .054	− .015
Appearance or sexual functioning-related	**− .138[b]**	− .077	**− .088[a]**	**− .159[b]**	− .101
Cough or trouble catching breath	**− .244[c]**	− .052	− .005	− .011	− .028
Myalgias/arthralgias	**− .117[a]**	− .097	− .015	− .036	− .045
Block 6—depressive symptoms	**− .373[c]**	**− .652[c]**	**− .769[c]**	**− .454[c]**	**− .411[c]**

$N = 296$

Significant values ([a]$p < .05$, [b]$p < .01$, [c]$p < .001$) are indicated in the table in bold text

symptoms significantly predicted three of the five dimensions of HRQoL: Physical Well-Being ($\beta = − .14$, $b = − 3.49$, $SE = 1.15$, $p = .003$), Functional and Global Well-Being ($\beta = − .09$, $b = − .17$, $SE = .08$, $p = .044$), and Social Well-Being ($\beta = − .16$, $b = − .41$, $SE = .15$, $p = .005$).

Discussion

The present findings highlight the differential roles of specific types of physical symptoms in HRQoL, particularly those that affect appearance or sexual functioning in older PLHIV. Findings also highlight the important role of mental health, specifically depressive symptoms, even when accounting for physical symptoms. The type of physical symptoms and the level of depressive symptoms reported were more strongly predictive of lower levels of quality of life than substance use or HIV status indicators, including viral suppression. Across all analyses, including the post hoc analyses with the five dimensions of overall HRQoL as respective outcomes, physical symptoms were significant: older PLHIV who endorsed higher levels of physical symptoms tended to report worse HRQoL than older PLHIV who endorsed lower levels of symptoms. Of these symptoms, appearance and sexual functioning-related symptoms were particularly robust, predicting Physical, Functional and Global, and Social Well-Being. These results are consistent with findings from existing research, which suggest that having symptoms related to appearance and sexuality—symptoms which may also be related to stigma experienced by PLHIV as well as self-shame—are associated with lower quality of life and greater psychological distress in both

PLHIV and older adults, respectively [31–36]. Furthermore, depressive symptoms were a particularly robust predictor of overall quality of life and all five dimensions of HRQoL; effect sizes were moderate to very large. These findings are consistent with extant studies on general quality of life and HIV disease progression [17, 18, 37].

Heroin use was associated with lower Functional and Global Well-Being, whereas use of alcohol was associated with higher Cognitive Functioning. Use of heroin likely interfered with the everyday functioning of older adults in the sample. Regarding alcohol, this study did not assess the degree of alcohol use or the type of alcohol consumed and substance use was not the focus of the RCT. It is possible that many participants might have used alcohol, but did not meet clinical criteria for problem drinking.

In general, there was a high prevalence of physical symptoms in participants. These figures are higher than in previous samples of older PLHIV [12]. Consistent with prior research with adults living with HIV of all ages [38], fatigue was the most common physical symptom in patients with HIV. The high prevalence of fatigue might also be attributed to the inclusion criterion of the present study that participants must have at least mild depressive symptoms to enter the study.

Strengths and limitations

There were many strengths to this study. First, a large and ethnically diverse group of adults over the age of fifty comprised the sample. Also, the depth of the baseline questionnaire allowed us to assess multiple dimensions of HRQoL. A third strength of this study is that multiple regression models were used to examine the effects of physical symptoms and depressive symptoms on one outcome (i.e., HRQoL) and then multiple dimensions of this outcomes, offering a comprehensive assessment of the importance of symptoms and mental health in older PLHIV. In so doing, we were able to account for factors such as demographics, HIV status, and substance use. Finally, this study supports the assertion that mental health is a crucial aspect of patients' perceptions of their physical, emotional, social, cognitive, and global well-being above and beyond their experience of physical symptoms and medical diagnoses.

While this study had many strengths, there were also limitations. First, given the study's cross-sectional design, definitive conclusions regarding causal and temporal associations among study variables cannot be made. In addition, participants were recruited into an intervention study and eligibility requirements included a minimum level of depressive symptoms (BDI ≥ 10). Though this is well below the clinical cutoff for depression, there may have been a higher prevalence of depressive symptoms in this sample than the general population of PLHIV. In addition, all measures

were self-report and, in particular, participants may have under-reported their income and alcohol use. Additionally, there may have been self-selection bias, as indicated by the attrition that occurred from original recruitment of participants to inclusion in the RCT. There may also have been bias introduced by excluding approximately five percent of participants of the 310 participants who were included in the original RCT but had incomplete surveys. Also, although indicators of HIV health status, such as viral suppression, were not linked to HRQoL, the use of biological markers as measures (e.g., laboratory test results) may yield an association with HRQoL. However, beyond biological markers, the unique physical symptoms experienced by older PLHIV may be more critical for HRQoL than the number of copies of the virus at a given point in time. Additionally, medication adherence and comorbidities were not included in the study, but participants' HRQoL could have been affected by these unmeasured constructs. Finally, the data were collected 10 years ago when first-line regimens included more complicated and difficult to tolerate ART. More recently diagnosed PLHIV may not be exposed to these regimens. Further study is needed.

Implications

Health care professionals must not discount or overlook the importance of symptoms that affect appearance and sexual functioning in older PLHIV. These symptoms have been found in prior studies to be associated with psychological distress, particularly depressive symptoms, and poor quality of life for adults of all ages [31–35]; these findings appear to generalize to older PLHIV.

The influence of mental health, for which depressive symptoms were used as a marker in the present study, on patients' experience of physical health suggests that mental health treatment may help to reduce overall costs of health care services. Indeed, the literature indicates that mental health treatment may not only be a means of improving quality of life, but it may also be a form of prevention to reduce transmission of HIV and AIDS in psychologically distressed PLHIV [39, 40]. For example, given the well-established link between mental health issues and increased sexual risk and poor ART adherence, mental health treatment may be valuable to overall "treatment as prevention" with PLHIV [39]. Additionally, mental health challenges adversely affect other health outcomes, including health care utilization and disease progression among PLHIV [40].

Although not many in number, there are a few interventions that have specifically addressed HRQoL in ways that are applicable to older PLHIV. A randomized controlled trial of a mindfulness-based cognitive therapy program for long-term diagnosed PLHIV showed large, statistically significant improvement in quality of life along with emotional and

immune status [41]. In reviewing literature on emotional and Social Well-Being and Cognitive Functioning among older PLHIV, Rueda et al. [42] emphasized coping mechanisms used by older PLHIV that could inform intervention development. This included disease coping (e.g., getting educated on HIV medications and how to remain adherent, maintaining good communication with one's health care providers), practical coping (e.g., seeking social support, using solution-focused coping strategies), emotional coping (e.g., staying positive, managing negative emotions), and relying on one's spirituality or faith or one's spiritual or faith-based social connections (e.g., searching for inner peace, relying on friends who can provide support them based on shared spiritual beliefs) [42]. Interventions that have successfully addressed coping for older PLHIV have included in-person individual or group therapies, such as Project REFLECT [20] and tele-health interventions, such as tele-SEGT and tele-CET [42, 43]. Such interventions also address potential predictors of HRQoL for older PLHIV, such as depression.

Given the increasing proportion of adults aged 50 years and older among the population of PLHIV in the United States [1, 3, 4], the present findings are particularly meaningful. Additional research is needed to build on the present findings and similar findings from other studies. Also, new interventions focused on the needs of older adults living with HIV as well as work that distinguishes between the varied experiences of, say, adults between the ages of 50 and 60 versus adults over the age of 75 will enrich the field of HIV prevention and intervention with older adults. The present study may add to the existing literature that is guiding the way on this future work.

As the population of adults with HIV ages, there will be many opportunities to intervene to improve their lived experience with the disease. Symptom management and the unique contributions of mental health issues, specifically depressive symptoms, are important areas that warrant further exploration and intervention.

Compliance with ethical standards

Conflict of interests No competing financial interests exist.

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