Lower Self-Reported Quality of Life in HIV-Infected Patients on cART and With Low Comorbidity Compared With Healthy Controls

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Background: Self-reported quality of life (QoL) has previously been found to be impaired in patients living with HIV and associated with viral replication, degree of immunodeficiency, and comorbidity. We aimed at investigating QoL in a group of HIV-infected patients with suppressed viral replication and with low comorbidity, compared with healthy controls. We furthermore aimed to identify factors associated with QoL.

Design and Methods: Cross-sectional study of 52 HIV-infected patients and 23 healthy controls matched on age, gender, education, and comorbidity. HIV-infected patients and healthy controls had previously been examined regarding cognitive, physical, metabolic, and immunological parameters. QoL was investigated using the Medical Outcomes Study HIV Health Survey (MOS-HIV). Linear multiple regression models were created to find factors associated with mental health summary score (MHS) and physical health summary score (PHS).

Results: HIV-infected patients reported lower QoL compared with controls. In HIV-infected patients, female gender and depression score were associated with lower MHS. In controls, years of education, depression score, and cognitive test performance were associated with lower MHS. In HIV-infected patients, years of education, depression score, and body mass index were associated with lower PHS, whereas in controls, years of education and fitness level were associated with PHS.

Conclusions: Even well-treated HIV-infected patients with low level of comorbidity reported lower QoL compared with healthy controls. Especially, depression score and body mass index were associated with QoL in HIV-infected patients.

Key Words: HIV infection, MOS-HIV, quality of life

(*J Acquir Immune Defic Syndr* 2015;70:16–22)

INTRODUCTION

The introduction of combination antiretroviral therapy (cART) has improved health and prolonged survival in patients infected with HIV. As a consequence of an increased life expectancy, treatment of people living with HIV is aiming not only at prolonging life but also at improving quality of life (QoL). Although effective cART has reduced the incidence of AIDS and AIDS-related mortality, increased morbidity and mortality caused by non–AIDS-related comorbidity such as cardiovascular disease, kidney- and liver-related diseases, cognitive decline, and osteoporosis have been reported.[1,2] Comorbidity may influence QoL.

Although QoL is not easily measured, methods have been developed and validated for this purpose.[3–5] The Medical Outcomes Study HIV Health Survey (MOS-HIV) was developed in 1987 as an instrument to assess health-related QoL in HIV-infected patients. The questionnaire has been expanded twice and now consists of 35 items that assess 10 dimensions of health. A mental health summary score (MHS) and physical health summary score (PHS) can be generated based on the 10 dimensions. The MOS-HIV Health Survey is one of the most widely used instruments in assessing QoL in HIV-infected patients. The items included are from the MOS that were designed to assess QoL in patients with chronic conditions. The dimensions included in the MOS-HIV is especially affected in HIV-infected individuals. The MOS-HIV are available in several different languages and has been validated.[4–7] It can be used in HIV-negative individuals.[8]

In chronic disease that requires lifelong treatment and care, QoL becomes a key point in care and it is of importance to identify factors that influence QoL. Previous studies on

Received for publication October 10, 2014; accepted April 16, 2015.

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Supported by the Aase and Ejnar Danielsens Foundation, The Novo Nordisk Foundation, The Research Fund of Rigshospitalet, Copenhagen University Hospital, Janssen-Cilag, the patient association Hiv-Danmark, and Oslo University Hospital.

The authors have no conflicts of interest to disclose.

The funders had no role in the study design, data collection or analysis, preparation of the manuscript, or decision to submit.

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HIV infection have identified sociodemographic factors associated with QoL including age, gender, and years of education,[9–12] HIV-specific factors including CD4$^+$ cell count, nadir CD4, and HIV RNA,[12–15] and psychological factors including depression and other mental illness[9,10,12,13,15–17] as well as addiction to recreational drugs and comorbidity.[3,18] Previous studies on QoL in HIV-infected patients have primarily focused on patients with symptomatic disease.

In a recent study of HIV-infected patients on cART and with low level of comorbidity, we measured cognitive, physical, metabolic, and immunological parameters.[19–21] A group of healthy controls matched for age, gender, education, and comorbidity was included. In this well-treated group of HIV-infected patients with low level of comorbidity and no drug abuse, we aimed to determine whether HIV infection per se was associated with impaired QoL compared with matched controls. HIV infection has been associated to certain environmental factors that can be difficult to adjust for. For this reason, a group of relatives was invited to participate as well. Depression is tightly linked with QoL, and it has been suggested that depression is driven by inflammation and immune activation.[22–24] Furthermore, studies have shown a possible link between microbial translocation and depression.[25] We therefore aimed to determine whether cognitive function, physical activity and fitness, or measures of inflammation, immune activation, and microbial translocation were associated with QoL.

METHODS

Participants

Sixty-one HIV-infected patients and 31 controls participated in a study regarding cognitive function and cardiovascular risk profile with measurements of cognitive function, physical, immunological, and inflammatory parameters as described below. Patients were included during the period October 2010 to June 2011. Results from the study have previously been published in detail.[19–21] Nineteen of the controls also participated in a study on diabetes.[26]

At the end of inclusion, participants received the MOS-HIV Health Survey questionnaire by post. Two months after the first questionnaire was posted, a reminder together with a new questionnaire was sent to the nonresponders. To investigate the possible environmental effects, HIV-infected patients were further asked to distribute a questionnaire to a partner, sibling, or close friend who was HIV-negative, forwardly referred to as relatives.

Fifty-two (85%) HIV-infected patients, 32 (52%) relatives, and 23 (74%) controls completed and returned the questionnaire. One relative was HIV-infected and was therefore excluded.

The study was approved by the National Committee on Health Research Ethics of the Capital Region of Denmark (H-2-2010-089) and was performed in accordance with the Helsinki Declaration of 1975, as revised in 2000.

Questionnaire

The survey consisted of the MOS-HIV Health Survey[18] (MOS-HIV; Dr. Albert Wu, 1977). A validated Danish version was obtained. The questionnaire consists of 35 items that assess 10 dimensions of health including general health, physical functioning, role functioning, social functioning, pain, mental health, vitality, distress, cognitive functioning, and overall QoL. For each dimension, the scale ranges from 0 to 100 points, with a higher score indicating better self-reported health. When half or more of the items in a dimension were missing, the scale score was set as missing (2 cases: 1 HIV-infected patient and 1 relative). When less than half of the items for a dimension were missing, the missing values were substituted using the mean of the remaining (7 cases: 4 HIV-infected patients and 3 relatives) according to the published guidelines.[27] PHS and MHS were calculated based on the 10 health dimensions.[27] To the questionnaire, questions regarding smoking and alcohol consumption were added.

Comorbidity was assessed in HIV-infected patients and controls according to Charlson comorbidity index.[28,29] HIV-infected patients and controls furthermore completed a questionnaire regarding education and Major Depression Inventory[30] as well as the International Physical Activity Questionnaire (IPAQ)[31] at the time of inclusion.[19] Data from IPAQ are expressed as metabolic equivalent of task (in minutes per week) and have been processed according to guidelines; truncation was not done as data are presented as a continuous variable.[32] Data on IPAQ were available for 44 (85%) HIV-infected patients and all controls. The remaining was excluded due to missing answers.

Neurocognitive Testing

Fifty-one (98%) of HIV-infected patients who replied the MOS-HIV Health Survey and all the controls also participated in neurocognitive testing. One HIV-infected patient did not attend the neurocognitive testing due to immigration. The neurocognitive test battery included the Rey Auditory Verbal Learning Test (RAVLT) to assess verbal learning and memory, Verbal and Category Fluency Test[33] to assess verbal language skills, Trail Making Test Part A (TMT-A)[33] and the Symbol Digit Modalities Test (SDMT)[33] to assess attention and speed of information processing, and Trail Making Test Part B (TMT-B)[33] to assess executive functioning. In previously published reports from the study, the aim was to investigate cognitive function in HIV-infected patients without comorbidity compared with healthy controls, and therefore 8 patients were excluded due to previous head trauma, infections involving the central nervous system, or psychiatric disorders.[19] In this study, these patients were included as the aim was to compare cognitive function with self-reported QoL.

Physical Parameters

Physical fitness was assessed in 47 (90%) HIV-infected patients and all controls by the single-stage submaximal Aastrand test.[34,35] Five HIV-infected patients did not participate in the fitness test (2 declined to participate, 1 was injured, 1 was excluded due to malfunctioning of equipment, and 1 based on the physical evaluation before the test). The

test was performed on an ergometer bike (Monark Ergomedic 839 E; Monark Ltd., Varberg, Sweden), and based on gender, body weight, age, workload, and heart rate, VO_2max (in $mL \cdot min^{-1} \cdot kg^{-1}$) was estimated. Weight and height were measured in 50 (96%) HIV-infected patients and all controls, and body mass index (BMI) (in kg/m^2) was calculated.

Inflammation, Immune Activation, and Markers of Microbial Translocation

Venous blood samples were obtained. Routine analyses included $CD4^+$ cell count and HIV RNA as previously described.[19] Nadir CD4 was recorded from patient's records.

Interleukin 6 was measured using Meso Scale Discovery MULTI-SPOT plate (MSD, Gaithersburg, MD) and available in 49 (94%) HIV-infected patients and all controls.[19] The proportion of chronically activated $CD8^+$ cells was determined by flow cytometry (6-color FACSCanto, FACSDiva software; BD). Chronically activated $CD8^+$ cells were defined as $CD8^+CD38^+$HLA-DR+ and available in all HIV-infected patients and 11 (48%) controls. The method has previously been described.[19] LPS was analyzed by limulus amebocyte lysate colorimetric assay (Lonza, Walkersville, MD) and available in 43 (83%) HIV-infected patients and all controls, and sCD14 analyses were measured by enzyme-linked immunosorbent assay (R&D, Minneapolis, MN) and available in 48 (92%) HIV-infected patients and all controls as previously described.[20,21]

Measurements of cognitive and physical function as well as blood samples were not available for relatives. Relatives only contributed with QoL, age, and gender.

Statistical Analysis

MOS-HIV dimensions were not all normally distributed, and data are given as median (interquartile range). Categorical variables were examined using Fisher exact test, and continuous variables were analyzed using Mann–Whitney *U* test as appropriate. A *P* value of <0.05 was considered statistically significant.

Univariate analyses were used to investigate the associations between MHS and PHS, respectively, and sociodemographic and psychological factors (years of education and depression score), HIV-specific factors ($CD4^+$ cell count, nadir CD4), neurocognitive tests (TMT-A, TMT-B, Verbal and Category Fluency test, RAVLT, SDMT), physical parameters [fitness level (VO_2max), BMI, IPAQ], and markers of inflammation, immune activation, and microbial translocation (interleukin 6, chronic activated $CD8^+$ cells, sCD14, LPS). Multivariate linear regression models were then created with MHS and PHS as dependent factors. Age and gender were added to the model. Subsequently, variables associated with MHS and PHS in univariate analyses were added to the model one at the time. Analyses were performed separately for HIV-infected patients and controls to investigate the differences in factors associated with QoL. Furthermore, analyses were performed for the groups together with HIV status as a nominal variable. In linear regression, only MHS and PHS were used and the assumptions for linear regression analysis were met. Thus, samples were independent, associations were linear, the variance was constant, tested by a residual plot, and the residuals followed a normal distribution. Analysis was performed using GraphPad Prism 6 (GraphPad Software, CA) and SPSS 19 (SPSS Inc., Hong Kong, China).

RESULTS

Clinical characteristics are displayed in Table 1. Between HIV-infected patients and controls, there were no significant differences in age, gender, years of education, comorbidity index, fitness level (VO_2max/kg), BMI, activity level [IPAQ (metabolic equivalent of task, minutes per week)], or consumption of alcohol. HIV-infected patients had a higher depression score assessed by the Major Depression Inventory compared with controls ($P = 0.002$).[19] Fourteen HIV-infected patients had a depression according to the *International Classification of Diseases, Tenth Revision* (*ICD-10*); of these, 12 individuals were receiving treatment. In contrast, only 1 control had a depression and was receiving treatment. There was a significantly lower proportion of smokers among controls compared with HIV-infected patients ($P = 0.008$). Relatives only participated in the MOS-HIV Health Survey and were significantly younger than HIV-infected patients ($P = 0.016$).

HIV-infected patients had a median $CD4^+$ cell count of 525 cells per milliliter (interquartile range: 395–729), nadir CD4 of 140 cells per milliliter (55–260), and HIV RNA of 19 copies per milliliter (19–20). All HIV-infected patients were on treatment with cART and had been on treatment for a median of 8 years (4–10.5). Results regarding HIV-infected patients and controls have previously been

TABLE 1. Characteristics of the Study Population

	HIV-Infected (n = 52)	Relatives (n = 31)	Controls (n = 23)
Age, yrs	50 (46–58)	46 (43–53)*	51 (45–58)
Female, n (%)	5 (10)	8 (26)	4 (17)
Education, yrs	16 (13–17)	—	17 (14–17)
Depression score (MDI)	6 (3–14.5)	—	2 (1–5)†
Comorbidity index	1 (0–1.5)	—	1 (0–1)
VO_2max/kg, $mL \cdot min^{-1} \cdot kg^{-1}$	35 (29.4–41.4)	—	33.7 (27.7–43.8)
BMI, kg/m^2	23.4 (22.2–24.8)	—	24.5 (23.6–26)
IPAQ (MET, min/wk)	3374 (2047–8469)	—	5058 (3018–9511)
Smoking, n (%)	17 (33)	12 (39)	1 (4)†
Alcohol, n (%)‡	17 (33)	13 (42)	9 (39)

Data are given as median (IQR). Mann–Whitney *U* test and Fisher exact test were used to compare relatives and controls with HIV-infected patients.

Comorbidity was assessed by Charlson comorbidity index.

Relatives only participated in the MOS-HIV Health Survey, and data on the remaining variables are missing.

*$P < 0.05$.

†$P < 0.01$.

‡Consumption of alcohol more than twice a week.

IQR, interquartile range; MDI, Major Depression Inventory; MET, metabolic equivalent of task.

published.[19–21] Route of transmission was men who have sex with men (n = 34), heterosexual contact (n = 13), blood transfusion (n = 3), hospitalization abroad (n = 1), and unknown (n = 1).

Nine HIV-infected patients did not respond to the MOS-HIV Health Survey. Compared with the participating HIV-infected patients, nonresponders were younger (45 vs. 50 years, $P = 0.013$) and had a lower comorbidity index (0 vs. 1, $P = 0.043$). There were no differences in current $CD4^+$ cell count, nadir CD4, treatment duration, depression score, or years of education.

Lower MHS in HIV-Infected Patients Compared With Controls but Not Compared With Relatives

In the 10 dimensions of health, HIV-infected patients scored lower compared with controls regarding general health ($P = 0.028$), physical functioning ($P = 0.047$), role functioning ($P = 0.036$), mental health ($P = 0.051$), vitality ($P = 0.025$), health distress ($P = 0.005$), and cognitive functioning ($P = 0.011$). No differences were found between relatives and HIV-infected patients in any of the dimensions (Table 2). Controls scored higher than relatives in mental health ($P = 0.049$) and health distress ($P = 0.047$).

HIV-infected patients scored lower in MHS compared with controls ($P = 0.023$), but not compared with relatives (Table 2). No differences in PHS were observed between the 3 groups. No significant differences were found in MHS and PHS between relatives and controls.

To further investigate the differences in QoL between the groups, a regression model was created, including all groups, with MHS as the dependent variable. Group status (HIV/relatives/controls) was added to the model as a nominal variable. Group status was associated with MHS (B-coefficient = 3.03, $P = 0.007$). This association remained significant after adjusting for age and gender. When PHS was used as the dependent variable, group status (HIV/relatives/controls) was not associated with PHS (B-coefficient = 1.359, $P = 0.125$). Adjusting for age and gender did not alter the results.

TABLE 2. Medical Outcomes Study HIV Health Survey[17]

	HIV-Infected (n = 52)	Relatives (n = 31)	Controls (n = 23)
MHS	57 (51–62)	57 (55–61)	62 (57–65)*
PHS	57 (50–61)	57 (54–61)	58 (53–61)
General health	75 (50–90)	85 (70–95)	90 (75–100)*
Physical functioning	96 (83–100)	100 (83–100)	100 (92–100)*
Role functioning	100 (100–100)	100 (100–100)	100 (100–100)*
Social functioning	100 (100–100)	100 (100–100)	100 (80–100)
Pain	94 (69–100)	89 (67–100)	78 (67–100)
Mental health	86 (69–92)	84 (76–92)	92 (84–96)*
Vitality	65 (55–80)	70 (60–80)	80 (70–90)*
Health distress	98 (90–100)	100 (90–100)	100 (100–100)†
Cognitive functioning	95 (75–100)	90 (80–100)	100 (90–100)*
QoL	75 (50–75)	75 (75–100)	75 (75–100)

Data are given as median (IQR). Mann–Whitney *U* test was used to compare relatives and controls with HIV-infected patients.

*$P < 0.05$.

†$P < 0.01$.

IQR, interquartile range.

Gender and Depression Score Were Associated With MHS in HIV-Infected Individuals

In univariate analyses, years of education and depression score were associated with MHS in HIV-infected individuals. No associations were found between MHS and HIV-specific factors ($CD4^+$ cell count, nadir CD4), neurocognitive tests, or markers of inflammation, immune activation, and microbial translocation (data not shown). A multiple linear regression model was created with MHS as the dependent variable. Years of education and depression score were added to the model one at the time, while adjusting for gender and age. The model showed that gender ($P = 0.025$) and depression score ($P < 0.001$) were associated with MHS in HIV-infected patients (Table 3).

In healthy controls, univariate analyses revealed that years of education, depression score, and SDMT were associated with MHS. A multiple linear regression model was created with MHS as the dependent variable. Years of education, depression score, and SDMT were added to the model one at the time, while adjusting for gender and age. Years of education ($P = 0.003$), depression score ($P = 0.031$), and SDMT ($P = 0.001$) were associated with MHS in healthy controls (Table 3).

Adjusting for smoking and alcohol consumption did not alter the results. When considering the dimension "cognitive functioning" separately, no associations to any of the neurocognitive tests were found (data not shown).

BMI, Years of Education, and Depression Score Were Associated With PHS in HIV-Infected Individuals

In univariate analyses, years of education, depression score, and BMI were associated with PHS in HIV-infected patients. No associations were found to HIV-specific factors ($CD4^+$ cell count, nadir CD4), fitness, IPAQ, or markers of inflammation, immune activation, and microbial translocation (data not shown). A multiple linear regression model was created with PHS as the dependent variable. Years of education, depression score, and BMI were added to the model one at the time, while adjusting for gender and age. Years of education ($P = 0.002$), depression score ($P < 0.001$), and BMI ($P = 0.006$) were associated with PHS (Table 4).

In healthy controls, univariate analyses revealed associations between PHS and years of education, depression score, and fitness level. A multiple linear regression model was created with PHS as the dependent variable. Years of education, depression score, and fitness level were added to the model one at the time, while adjusting for gender and age. Years of education ($P = 0.014$) and fitness ($P = 0.017$)

TABLE 3. Multiple Linear Regression Model With MHS as the Dependent Variable

	HIV-Infected (n = 51) MHS			Controls (n = 23) MHS		
	Unstandardized B-Coefficient (95% CI)	Adj. R^2	*P*	Unstandardized B-Coefficient (95% CI)	Adj. R^2	*P*
Gender (male)	11.913 (1.552 to 22.275)	—	0.025	2.061 (−4.247 to 8.369)	—	0.503
Age, yrs	0.001 (−0.409 to 0.411)	—	0.996	−0.110 (−0.454 to 0.235)	—	0.513
Factors added to the model one at the time						
Education, yrs	0.639 (−0.459 to 1.736)	0.07	0.248	1.442 (0.538 to 2.347)	0.30	0.003
Depression score (MDI)	−1.018 (−1.254 to −0.782)	0.63	<0.001	−0.569 (−1.079 to −0.058)	0.14	0.031
SDMT	—	—	—	5.496 (2.498 to 8.494)	0.38	0.001

Multiple linear regression model: The model was adjusted for gender and age. Variables associated with MHS in univariate analyses were added one at the time.
CI, confidence interval; MDI, Major Depression Inventory; SDMT, symbol digit modalities test.

remained associated with PHS (Table 4). Adjusting for smoking and alcohol consumption did not alter the results.

DISCUSSION

The main finding in this study was lower self-reported QoL in well-treated HIV-infected patients receiving cART compared with healthy controls. Previous studies on QoL in HIV-infected patients have reported lower scores compared with HIV-negative individuals,[36] especially in symptomatic HIV infection along with associations between insufficient immune reconstitution and continuous viral replication and reduced QoL.[12–15] This study expands the knowledge by investigating QoL in a group of well-treated HIV-infected patients with viral suppression and low comorbidity. HIV-infected patients reported lower MHS compared with healthy controls, and among the 10 dimensions in the MOS-HIV Health Survey, HIV-infected patients reported lower general health, physical functioning, role functioning, mental health, vitality, health distress, and cognitive functioning. However, no differences were found in PHS between HIV-infected patients and healthy controls.

Compared with their relatives, no significant differences were found in self-reported QoL. Detailed characteristics on relatives were not obtained and the group included both partners, siblings, and close friends. This finding could indicate that environmental factors might play a role in QoL besides HIV status. It has been shown that HIV infection is associated with environmental factors that may in part explain increased comorbidity found in HIV infection as reflected in studies on parents of HIV-infected persons having higher risk of cancer and cardiovascular disease than the background population.[37,38] In line with this, Bing et al[39] found in a large cohort of 2295 homosexual men that merely being HIV-positive did not markedly reduce QoL compared with HIV-negative individuals. Hence, comparing HIV-infected patients with relatives may reduce some of these confounders and may explain why no differences were found between HIV-infected patients and their relatives. However, this study is limited by number and a low response rate among relatives, making conclusions difficult.

Depression score was associated with lower MHS and PHS in HIV-infected patients, whereas in controls especially, years of education was associated with higher MHS and PHS. HIV-infected patients had a significantly higher depression score compared with controls, with more than 20% of HIV-infected patients receiving treatment. Depression and years of education have previously been shown to be strongly associated to self-reported QoL.[9–13,15–17] This suggests that especially a higher prevalence of depression among HIV-infected patients might explain the lower self-reported QoL. Inflammation, immune activation, and microbial translocation are strongly associated with morbidity and mortality in HIV

TABLE 4. Multiple Linear Regression Model With PHS as The Dependent Variable

	HIV-Infected (n = 51) PHS			Controls (n = 23) PHS		
	Unstandardized B-Coefficient (95% CI)	Adj. R^2	*P*	Unstandardized B-Coefficient (95% CI)	Adj. R^2	*P*
Gender (male)	7.214 (−0.418 to 14.846)	—	0.063	1.496 (−3.331 to 6.323)	—	0.525
Age, yrs	−0.090 (−0.392 to 0.212)	—	0.550	0.024 (−0.240 to 0.287)	—	0.854
Factors added to the model one at the time						
Education, yrs	1.189 (0.447 to 1.931)	0.20	0.002	0.959 (0.219 to 1.700)	0.18	0.014
Depression score (MDI)	−0.539 (−0.771 to −0.308)	0.33	<0.001	−0.342 (−0.754 to 0.069)	0.02	0.098
BMI, kg/m^2	−1.0879 (−1.837 to −0.321)	0.18	0.006	—	—	—
VO_2max/kg, $mL \cdot min^{-1} \cdot kg^{-1}$	—	—	—	0.213 (0.042 to 0.384)	0.17	0.017

Multiple linear regression model: The model was adjusted for gender and age. Variables associated with PHS in univariate analyses were added one at the time.
CI, confidence interval; MDI, Major Depression Inventory.

infection and have previously been associated to cognitive function, cardiovascular disease, osteoporosis, cancer, and depression,[22–25,40–44] conditions that all potentially could influence QoL. However, we found no associations between QoL and markers of inflammation, immune activation, or microbial translocation.

Sixty-five percent of HIV-infected patients were men who have sex with men. Homosexuals, bisexuals, and transgendered individuals have higher prevalence of anxiety, agitation, and nervousness. Furthermore, they have an increased prevalence of suicidal behavior.[45,46] This could possibly explain some of the differences observed in depression score and MHS between HIV-infected patients and controls, although sexual preference in the control group was not known.

HIV-infected patients reported lower cognitive functioning and MHS compared with controls. In a previous study, HIV-infected patients and controls were tested thoroughly with neurocognitive tests and no evidence of neurocognitive impairment was found.[19] In HIV-infected patients, no associations were found between performance in neurocognitive tests and QoL. In controls, attention and speed of information processing (SDMT) were associated with MHS. Self-reported QoL has previously been shown to be associated with performance in neurocognitive testing.[47–51] It has been suggested that applying the MOS-HIV Health Survey could help screen patients for further neurocognitive testing because these tests are time and personnel consuming. However, in this study, no strong associations were found between neurocognitive function and QoL. One explanation could be that HIV-infected patients in this study showed no signs of neurocognitive impairment compared with healthy controls[19] and that more severe cognitive impairment is necessary to influence QoL. In agreement with our findings, Trépanier et al[52] showed that depression had a larger influence on QoL than neurocognitive impairment.

There were no significant difference in self-reported physical health as measured by PHS between HIV-infected patients, relatives, and healthy controls. Furthermore, no significant differences were found in BMI, IPAQ, or fitness level between HIV-infected patients and controls. In HIV-infected patients, however, BMI was found to be associated with PHS, and in healthy controls, fitness level was associated with PHS. The reason for this difference between HIV-infected patients and controls remains unclear, but could be a question of power. Roubenoff and Wilson[53] has previously shown that resistance training in HIV-infected patients with and without wasting was able to increase self-reported QoL, and Wu et al[54] showed associations between PHS and oxygen consumption.

Previous studies have shown associations between $CD4^+$ cell count, nadir CD4, and QoL.[12–15] We were not able to find these associations. One could speculate that these factors have a higher impact in cART naive patients and in patients who recently initiated cART. Furthermore, studies on QoL in HIV infection are often performed in symptomatic disease. In our study, all patients had been on treatment for at least 2 years (median: 8 years) and had suppressed viral load.

This study was explorative and limited by the sample size and the cross-sectional design. Larger and prospective studies are warranted because factors that influence QoL are important to identify in order to provide a better service of care. This study investigated a population of well-treated HIV-infected patients compared with healthy controls. Some of the dimensions of the MOS-HIV have been shown to exhibit ceiling effects in healthy populations. The summary scores, however, have been shown to avoid these effects.[8]

This study aimed at investigating QoL in a population of HIV-infected patients on cART with low level of comorbidity. Despite this, HIV-infected patients reported lower QoL compared with healthy well-matched controls. In addition to female gender, depression score, years of education, and BMI were associated with lower self-reported QoL in HIV-infected patients. This study suggests that besides treatment of HIV with cART, awareness of depression and self-reported QoL are important in HIV-infected patients.

ACKNOWLEDGMENTS

The authors thank all the patients, relatives, and controls for their participation in this study; Bente Baadegaard and Lene Pors Jensen as well as the personnel at the outpatient clinic at the Department of Infectious Diseases, Rigshospitalet, for their work with recruitment of participants; and Ruth Rousing and Hanne Villumsen from The Centre of Inflammation and Metabolism at the Department of Infectious Diseases, Rigshospitalet, for technical assistance.

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