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Physical activity is Associated with Reduced Fatigue in Adults Living with HIV/AIDS

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Abstract

Aims—To describe the relationships among home-based physical activity, fatigue, sleep, gender and quality of life in people living with HIV/AIDS

Background—Fatigue is a common and distressing symptom among people living with HIV/AIDS. Few interventions exist that effectively reduce fatigue in this population. Physical activity has shown promise to reduce fatigue in other populations, but its impact on fatigue in HIV/AIDS has not yet been explored.

Design—This study was conducted using a prospective, descriptive cohort design.

Methods—Overall, 90 adults living with HIV/AIDS completed cross-sectional measures. Home-based physical activity was measured using a seven-day self-report diary. Fatigue was measured

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Author Contributions:

All authors have agreed on the final version and meet at least one of the following criteria (recommended by the ICMJE*):

1. substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data;
2. drafting the article or revising it critically for important intellectual content.

* <http://www.icmje.org/recommendations/>

using the self-reported HIV-Related Fatigue Scale. Sleep was assessed using wrist actigraphy and quality of life was assessed using the HIV-Associated Quality of Life Scale. Data were collected from December 2012 – April 2013 and analyzed using correlations and multiple linear regression.

Results—The number of minutes of home-based physical activity was significantly associated with reduced fatigue among people living with HIV/AIDS. Additionally, increased fatigue was associated with decreased quality of life. No associations were found among fatigue, sleep or gender.

Conclusions—Our study demonstrates that physical activity in the home setting is an effective strategy to reduce fatigue among people living with HIV/AIDS. Future work developing and testing interventions to improve home-based physical activity in this population is needed.

Keywords

symptom management; HIV/AIDS; sleep; nurses; nursing

Background

Fatigue is among the most prevalent and distressing symptoms reported by people living with a chronic illness (Solano *et al.* 2006), especially by people living with HIV/AIDS (PLHIV) (Barroso & Voss 2013). In the current era of effective antiretroviral therapy and despite stable immune functioning, up to 88% of PLHIV/AIDS are fatigued, negatively impacting their ability to work, their daily functioning and quality of life (Barroso & Voss 2013, Pence *et al.* 2008). Given its significant consequences to the individual PLHIV and to society, it is essential to develop, test and implement targeted, effective intervention strategies to mitigate the fatigue reported by PLHIV.

Fatigue is defined as a ‘subjective, unpleasant symptom that incorporates feelings ranging from tiredness to exhaustion, creating an unrelenting overall condition that interferes with individuals’ abilities to function to their normal capacities’ (Ream & Richardson, 1996 p. 527). Fatigue is a chronic, stable symptom which does not appear to resolve spontaneously (Barroso *et al.* 2015b, Pence *et al.* 2008) and its etiology in PLHIV remains unknown. The prevalence and severity of fatigue in PLHIV is associated with lower socioeconomic status (Barroso & Voss 2013), longer time since HIV diagnosis (Pence *et al.* 2008) and systemic inflammation (Lee *et al.* 2014). Yet the evidence of the relationships among fatigue and CD4+T-cell counts, HIV/AIDS viral loads and ART therapy are conflicting (Barroso *et al.* 2015b, Barroso & Voss 2013). Some investigators report relationships between high HIV viral loads, low CD4+ T-cell counts and increased fatigue while other investigators have found fatigue to be a persistent symptom regardless of HIV disease progression or medication status (Barroso & Voss 2013). Research on sleep disturbance, a phenomenon comprised of both biological and psychological components, has found that fatigue is closely connected to insomnia and lack of restful nocturnal sleep common in people with HIV/AIDS (Barroso *et al.* 2015b). Research is ongoing to identify biomarkers and other physiological correlates to HIV/AIDS-associated fatigue (Jensen *et al.* 2014, Voss *et al.* 2013, Voss *et al.* 2011).

Interventions for HIV-associated fatigue include both pharmacological and non-pharmacological strategies. Pharmacological interventions found to improve fatigue in PLHIV/AIDS include: testosterone, stimulants (dextroamphetamine, methylphenidate hydrochloride, pemoline, modafinil) dehydroepiandrosterone and fluoxetine (Barroso *et al.* 2015b, Jong *et al.* 2010). These interventions have primarily been tested in short open-label trials and placebo controlled trials to determine efficacy at improving HIV-associated fatigue (Jong *et al.* 2010). People living with HIV have also reported the use of vitamins and supplements to prevent or counteract fatigue symptoms (Corless *et al.* 2002). While the results demonstrate improvement in HIV-associated fatigue, the studies have been limited by small samples and an inability to assess long-term efficacy (Barroso *et al.* 2015b, Barroso & Voss 2013), Jong *et al.* 2010). Further, PLHIV today often experience significant multimorbidity and polypharmacy which is a major concern; additional medications to reduce fatigue may interact with current regimens and may be less acceptable than non-pharmacological options (Edelman *et al.* 2013).

Non-pharmacological interventions to mitigate fatigue include cognitive behavioral therapy (CBT) strategies such as a 10-week stress-management intervention (Lechner *et al.* 2003), relaxation techniques (Fukunishi *et al.* 1997) and supervised exercise interventions (O'Brien *et al.* 2010). Studies evaluating these interventions were limited by multiple factors including lacking a valid fatigue measurement and sample characteristics (e.g. people with major depressive disorder or diagnosed hormonal imbalance) that obscure the impact of the interventions on HIV-associated fatigue (Barroso *et al.* 2015b, Barroso & Voss 2013, Jong *et al.* 2010). Exercise has shown promise as a symptom self-management strategy with which individuals with chronic diseases can combat fatigue (McMillan & Newhouse 2011, Zou *et al.* 2014) and may be more tolerable than medications. However, studies examining the impact of exercise and sleep on HIV/AIDS-associated fatigue have been limited by small samples and attrition (O'Brien *et al.* 2010). There is a need for rigorous studies that examine the impact of exercise on HIV/AIDS-associated fatigue, overcoming these methodological weaknesses.

Given recent evidence demonstrating the safety of regular exercise in PLHIV (Yahiaoui *et al.* 2012, Webel *et al.* 2015b) and its emphasis in the HIV/AIDS Clinical Care Guidelines (HRSA, 2011, Aberg *et al.* 2014), it is an opportune time to examine relationship between HIV/AIDS-associated fatigue, sleep and exercise in the home setting. By basing this investigation in the PLHIV's natural setting, where they practice their everyday symptom and self-management behaviors, we will be able to better understand the natural patterns of this relationship and uncover subgroups of PLHIV that may benefit the most from exercise interventions designed to reduce fatigue.

THE STUDY

Aim

The aim of our study was to describe the relationships among home-based exercise, fatigue, sleep, gender and quality of life in people living with HIV/AIDS. We hypothesized that home-based exercise would be associated with reduced fatigue, improved sleep and quality

of life. We further hypothesize that these relationships would be greater in women than in men.

Design

We conducted a prospective, descriptive cohort study to examine the relationships among fatigue, sleep, home-based exercise, gender and quality of life in PLHIV/AIDS (Webel *et al.* 2014b).

Participants

Participants were purposively enrolled into four strata: men <50 years, men ≥ 50 years, women <50 years and women ≥ 50 years. We purposively enrolled subjects by age and gender to enroll a more representative sample to address the need for evidence on symptom self-management in women and older adults living with HIV/AIDS (Warren-Jeanpiere *et al.* 2014, Justice 2010). The inclusion criteria were having a documented HIV/AIDS diagnosis, taking HIV/AIDS antiretroviral therapy, being 18 years of age or older and speaking and understanding English. The exclusion criteria were being unable to provide written informed consent, having insulin dependent diabetes and have a cardiac pacemaker. We excluded participants with insulin dependent diabetes and a cardiac pacemaker because it confounded additional study measures (not reported here) (Webel *et al.* 2014a).

Data Collection

Screening and Enrollment—Potential participants were screened via telephone to determine initial eligibility and consented to medical chart abstraction to confirm study eligibility. All eligible subjects were scheduled for an enrollment appointment at the research offices at Case Western Reserve University.

Procedures—At this research visit, participants completed a release of medical information from their HIV clinic and several self-reported measures assessing demographics, fatigue and quality of life on the web-based data management tool REDCap (Harris *et al.* 2009). A trained, research nurse obtained anthropomorphic (height, weight, hip and waist circumference) measures in triplicate and drew blood. A dietician helped the participant complete a 24-hour dietary recall interview and all results were recorded. Finally, a research assistant gave each participant an actigraph to measure sleep and corresponding sleep and physical activity diary to complete for the next seven days. The research assistant called the participant on days 3 and 6 to remind them to complete the daily diary, to answer any questions about the actigraph or diary and to remind them of the date and time of their return visit. Participants returned one week later to return the completed diary and actigraph (Actiwatch). At the return visit, a research assistant collected the diary, checked for completion, clarified any questionable data and gave participants a \$50 cash card for their time. All data were collected between December 2012 and April 2013.

Ethical considerations

At the enrollment appointment, study staff obtained written informed consent for study participation before commencing with the data collection procedures. All procedures were approved by the local Institutional Review Board.

Data analysis

All data were directly imported from the web-based data collection system, REDCap, into a data management program (Harris *et al.* 2009). Distributions of all demographic, medical, health, sleep, exercise and quality of life variables were checked using frequency analyses and graphs. Summary statistics (means and standard deviations for continuous variables and frequencies and percentages for categorical variables) were computed for presentation. Correlations among continuous variables were estimated. Statistical significance was tested at 10% level. Multiple linear regression analysis was performed for studying association between fatigue (outcome variable) and exercise after adjusting for a set of covariates known to be associated with fatigue (i.e., age, sex, race, waist-to-hip ratio and CD4 T-cell Nadir). All the analyses were performed using statistical software Stata 13.0 (StataCorp 2013).

Validity, reliability and rigour

Fatigue—Fatigue was assessed using the self-report *HIV-Related Fatigue Scale (HRFS)*, a psychometrically sound scale measuring the intensity and impact of HIV-specific fatigue (Barroso 2002, Pence *et al.* 2008, Barroso *et al.* 2015a). As we were mostly interested in fatigue intensity, we administered the 8-item HIV-specific fatigue intensity subscale. Each of the items is scored on a 10-point Likert-style scale and all eight items are averaged, with higher scores indicating greater fatigue. To compare those with low fatigue with higher fatigue, we dichotomized the average fatigue score to those with low fatigue (<4.0) and high fatigue (≥ 4.0).

Demographic and Medical Characteristics—Demographic characteristics (gender, age, race, employment status) were obtained by self-report. Medical data (current medications, HIV medication adherence, plasma HIV/AIDS RNA levels, year of HIV diagnosis) was abstracted directly from the participant's medical chart.

Health and Sleep Characteristics—Height, weight, blood pressure, hip and waist circumference were measured, in triplicate, by staff on the local clinical research unit using standard protocols. Serum measures of inflammatory serum markers (IL-6, hsCRP and d-dimer) were also obtained using the standard research protocol on the clinical research unit and analyzed in the clinical laboratory.

Sleep characteristics were assessed using wrist actigraphy (Actiwatch Spectrum, Respironics, Inc.). Subjects were taught proper use of the actigraph and were asked to wear the device continuously for seven days and to return it one week later. Bedtime intervals were manually set in a standardized fashion by a technician and then quantitative sleep measures were obtained using a validated sleep scoring algorithm (Kushida *et al.* 2001). Our measures of sleep characteristics were mean sleep duration, sleep fragmentation index and sleep efficiency. All three are widely used and validated measures of sleep duration and

quality (Lauderdale *et al.* 2006, Montgomery-Downs *et al.* 2010). Mean sleep duration was defined as the average over seven days of the total amount of sleep obtained in the main sleep period as defined by the subject. The sleep fragmentation index measured the degree to which sleep is fragmented by periods of wake (van den Berg *et al.* 2008, McLean *et al.* 2005). Sleep efficiency is a measure of the proportion of time spent asleep between sleep onset and waking. Both sleep efficiency and sleep fragmentation index were calculated for the main sleep period of each 24-hour interval and then averaged for the week of recording.

Exercise—Consistent with established definitions, we defined exercise as the planned, structured movement undertaken to improve or maintain aspects of physical fitness (Caspersen *et al.* 1985). Exercise duration was assessed using a daily diary completed by each participant for seven days (Webel *et al.* 2015a). The diary contained four questions about: (1) whether a participant exercised at all; (2) what times the participant started and ended exercise; (3) the perceived intensity of exercise; and (4) the type of exercise. For perceived intensity participants completed a scale ranging from 1, very low intensity and 10, heavy activity that caused a participant to become short of breath. The duration of each exercise bout (>10 minutes) per day was calculated by subtracting the time each exercise ended from the time it started. The cumulative duration of these bouts was summed for a daily total and then all of the daily totals were summed to obtain weekly total exercise duration.

Quality of Life—Quality of Life was assessed with the 34-item *HIV/AIDS Targeted Quality of Life Instrument* is a disease-specific quality of life measure assessing nine distinct dimensions. We assessed two of the nine dimensions- overall functioning and life satisfaction (Sousa 1999). Each dimension is scored and reported individually and reliability coefficients ranged from 0.83 to 0.88 for all dimensions (Holzemer 2000).

RESULTS

Ninety participants completed all procedures of which 36 (39%) reported high levels of fatigue. Overall, 52 (56%) participants were male, 81 (85%) were African American and the average age was 48.6 (SD 9.4) years. Those with high fatigue were significantly older (45 years *vs* 51 years), female (53% *vs* 37%), more recently diagnosed with HIV (12 years *vs* 15 years and had a higher CD4 T-cell nadir (mean 206 *vs* 150); all *P* values <0.05. Participants in both groups reported equal amounts of sleep duration (~5.8 hrs per night), sleep efficiency (~67%) and sleep fragmentation (~33%). Additional sample characteristics can be found in Table 1.

In examining the associations among fatigue, sleep, exercise and quality of life, we found that among those reporting high fatigue, increased exercise was significantly associated with decreased fatigue ($r=-0.39$, $P=0.10$) and among those with low fatigue, fatigue was associated with decreased quality of life (life satisfaction $r=-0.41$, $P<0.01$; overall functioning $r=0.35$, $P=0.02$). There were no associations among sleep variables, exercise and quality of life (all *P*s >0.10). Full association results can be found in Table 2.

Exercise had a significant effect on HIV-associated fatigue intensity ($\beta = -1.39, P < 0.01$) controlling for covariates known to influence fatigue (age, sex, race, waist-to-hip ratio) and CD4 T-cell Nadir ($F(7, 44) = 2.50, P = 0.03$) (Table 3). As the range of the HIV/AIDS-Related Fatigue Scale (0–8), this translates into a 17% reduction in fatigue for each 150 minutes of moderate intensity exercise (e.g., walking) per week.

DISCUSSION

Consistent with our hypothesis, we found that home-based exercise helps to reduce fatigue in people living with HIV/AIDS. Further, we found that PLHIV who meet the current U.S. physical activity guidelines of 150 minutes per week of moderate physical activity had a 17% reduction in fatigue, compared with those PLHIV not achieving the same level of exercise. This is among the first empirical evidence defining the effect of home-based exercise on fatigue in a contemporary HIV context. Exercise is a promising strategy for reducing fatigue in PLHIV globally. It is safe for and acceptable to PLHIV, can be done in their every-day home setting, can be targeted for the populations' needs and interests and is associated with a 'living well' paradigm that is emerging in this population (Webel *et al.* 2015a). Yet despite the inclusion of physical activity and sleep hygiene techniques in HIV/AIDS Care Guidelines, these components are minimally addressed in clinical care, (HRSA 2011, Aberg *et al.* 2014) and thus underused as fatigue management strategies. Nurses caring for patients living with HIV/AIDS and reporting fatigue should consider assessing and prescribing exercise, similar to those caring for patients undergoing cardiac rehabilitation (Mezzani *et al.* 2013) and those with chronic heart failure (Carvalho & Mezzani, 2011). Though time constraints can be significant barrier (Swinburn *et al.* 1997), growing evidence on the pleiotropic benefits of exercise, to which this study adds, suggests the benefits of assessing and prescribing exercise over the long term are worth overcoming such barriers (Yahiaoui *et al.* 2012, Dufour *et al.* 2013, Montoya *et al.* 2015).

In contrast to our hypothesis, sleep was not related to fatigue or home-based exercise in this population. Lee *et al.* (2001) examined sleep, exercise and fatigue in women living with HIV/AIDS and found that women with high levels of fatigue spent a greater amount of their time sleeping (Lee *et al.* 2001). Siegel *et al.* (2004) reported that people living with HIV/AIDS tend to attribute fatigue as a measure of overall health status (Siegel *et al.* 2004). These findings suggest that if PLHIV feel they are able to engage in regular exercise and do, they may view their overall health status more positively and report less fatigue. Though these studies were conducted in a time when HIV treatment was more burdensome, they underscore the complexities of trying to mitigate fatigue in this population and also highlight the pivotal role of exercise in accomplishing this goal.

Finally, as hypothesized, our evidence also demonstrates that higher fatigue is associated with lower quality of life, even among those experiencing lower levels of fatigue. This data add to the growing evidence that fatigue continues to be a significant clinical problem and renews the urgency to effectively address this clinical problem (Barroso *et al.* 2015a, Barroso & Voss 2013).

Limitations

Limitations of our study include being conducted in one geographic site. As HIV is a global epidemic with approximately 35 million people affected worldwide, our results need to be considered in the context where the data were collected. As an urban, well-resourced community, it is possible that PLHIV in other geographic sites experience different causes of and subsequent levels of fatigue than participants at our site. Additionally, significant differences were noted in the number of years living with HIV between those with high and low fatigue. Those with higher levels of fatigue had been living with HIV for an average of three years less than those reporting low levels of fatigue. This suggests that time living with HIV may have an effect on fatigue and that our results may not be generalizable to those living with HIV for less than 12 years.

Conclusion

As HIV has become a chronic disease with simpler treatment regimens, the symptoms and side effects associated with HIV/AIDS have improved. Yet, fatigue remains almost unchanged and is still one of the most distressing and prevalent symptoms in this population. Effective, acceptable interventions targeted to this population are needed to help people living with HIV/AIDS achieve their highest possible health. Our study demonstrates that exercise in the home setting is an effective strategy to reduce fatigue. Future work developing and testing interventions to improve home-based exercise in this population is needed.

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SUMMARY STATEMENT

Why is this research needed?

- Fatigue is a prevalent and distressing symptom reported by people living with HIV/AIDS.
- Effective, acceptable, non-pharmacological interventions are needed to reduce fatigue and increase the quality of life of people living with HIV/AIDS.
- Physical activity has been found to reduce fatigue in other populations, but there is no evidence to describe the effect of physical activity on fatigue in people living with HIV/AIDS

What are the key findings?

- For every 150 minutes of moderate intensity physical activity (e.g., walking) per week, there was a 17% reduction in fatigue among people living with HIV/AIDS
- Even in an era where HIV medications are simpler and less burdensome than in the past, fatigue continues to significantly and negatively impact quality of life among people living with HIV/AIDS

How should the findings be used to influence policy/practice/research/education?

- Nurses caring for people living with HIV/AIDS should assess fatigue and physical activity patterns
- If appropriate, nurses should prescribe home-based physical activity for their patients experiencing distressing fatigue
- Additional research is needed to determine how to effectively target physical activity interventions to people living with HIV

Table 1Demographic, HIV/AIDS, and Health Characteristics, by Fatigue Group¹

	High Fatigue (>4.0) n=36 Mean (SD)	Low Fatigue (<3.99) n=54 Mean (SD)	p-value ³
Demographic Characteristics			
Age	45.4 (8.9)	50.5 (9.2)	<0.01
Gender Male (%)	17 (47.2)	34 (63.0)	0.12
Race (%)			
African American	35 (97.2)	44 (81.5)	0.02
White	1 (2.78)	9 (16.67)	
Employed (%)	6 (16.6)	7 (12.9)	0.56
HIV/AIDS Characteristics			
Years Since HIV/AIDS Diagnosis	12.03 (6.9)	15.15 (7.2)	0.02
Years on HIV/AIDS Medication	7.29 (5.4)	10.64 (5.2)	0.01
Current CD4 count	530.36 (290)	635.21 (372)	0.33
CD4 Nadir	205.73 (141.2)	150.13 (165.9)	0.03
HIV/AIDS Virally Suppression (%) ²	27 (77)	34 (71)	0.39
Number of People with >90% ART Adherence (%)	33 (92)	53 (98)	0.80
Health and Sleep Characteristics			
BMI	29.40 (10.6)	27.31 (6.5)	0.81
Waist-Hip Ratio	0.92 (0.09)	0.94 (0.08)	0.05
Blood Pressure	122.3/77.7	123.2/79.5	0.70
hgA1c	5.33 (0.81)	5.57 (0.86)	0.02
IL-6	2.28 (2.50)	2.21 (1.53)	0.91
d-dimer ng/mL	269.2 (173)	274.8 (292)	0.24
Number of Hours of Sleep per night	5.95 (1.24)	5.75 (1.96)	0.94
Sleep Efficiency	67.7% (18.1)	66.9% (20.5)	0.97
Sleep Fragmentation	28.27 (17.7)	38.4 (10.1)	0.61
Total Physical Activity hours per week	6.98 (7.17)	8.03 (5.93)	0.40

¹Data are presented as means and standard deviations, unless otherwise noted;

²HIV/AIDS Viral Suppression is when the most recent HIV/AIDS Viral load was <400 copies;

³Continuous variables are compared using Wilcoxon-Mann-Whitney test (a non-parametric test) and frequencies of categorical variables are compared in two groups using chi-square test.

Associations among Physical activity, Fatigue, Sleep and quality of life by Fatigue Group¹

Table 2

	Mean Score (SD)	Fatigue	Hours of sleep per night	Hours of Physical activity per Week	Quality of Life /Life Satisfaction	Quality of Life overall functioning
High Fatigue (n=36)						
Hours of Physical activity per Week	6.98 (7.17)	-0.39, p=0.10	-0.14, p=0.60	1.0	0.31, p=0.21	0.22, p=0.39
Fatigue	5.56 (0.99)	1.0	-0.22, p=0.38	-0.39, p=0.10	0.22, p=0.39	-0.36, p=0.14
Sleep in Hours	5.95 (1.24)	0.08, p=0.75	1.0	-0.14, p=0.60	0.04, p=0.86	-0.03, p=0.89
Quality of Life/Life Satisfaction	66.84 (20.85)	-0.22, p=0.39	0.04, p=0.86	0.31, p=0.21	1.0	-0.02, p=0.92
Quality of Life overall functioning	55.09 (18.87)	-0.36, p=0.14	-0.03, p=0.89	0.22, p=0.39	-0.02, p=0.92	1.0
Low Fatigue (n=54)						
Hours of Physical activity per week	8.03 (5.93)	-0.18, p=0.26	0.13, p=0.43	1.0	0.19, p=0.22	0.14, p=0.39
Fatigue	2.26 (0.93)	1.0	0.06, p=0.70	-0.18, p=0.26	-0.41, p<0.01	-0.35, p=0.02
Sleep in Hours	5.75 (1.96)	0.06, p=0.70	1.0	0.13, p=0.43	-0.04, p=0.82	-0.05, p=0.76
Quality of Life /Life Satisfaction	85.34(14.94)	-0.41, p<0.01	-0.04, p=0.82	0.19, p=0.22	1.0	0.33, p=0.02

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	Mean Score (SD)	Fatigue	Sleep Hours	Hours of Physical activity per Week	Quality of Life Satisfaction	Quality of Life overall functioning
Quality of Life overall functioning	76.90 (18.73)	-0.35, p=0.02	-0.05, p=0.76	0.14, p=0.39	0.33, p=0.02	1.0
Overall Group (n=90)						
Hours of Physical activity per week	7.52 (6.3)	-0.24, p=0.07	0.06, p=0.64	1.0	0.25, p=0.05	0.19, p=0.16
Fatigue	3.50 (1.8)	1.0	-0.01, p=0.94	-0.24, p=0.07	-0.68, p<0.01	-0.61, p<0.01
Sleep in Hours	5.81 (1.72)	-0.01, p=0.94	1.0	0.06, p=0.64	-0.01, p=0.97	0.004, p=0.97
Quality of Life/Life Satisfaction	78.36 (19.65)	-0.68, p<0.01	-0.01, p=0.97	0.25, p=0.05	1.0	0.42, p<0.001
Quality of Life overall functioning	68.46 (21.52)	-0.61, p<0.01	0.004, p=0.97	0.19, p=0.16	0.42, p<0.001	1.0

✓ Spearman correlation methods used in estimation of correlations and *p*-values

Table 3

Regression of physical activity and select covariates on fatigue intensity (n=90)

Variable	Coefficient	T score	95% confidence interval	p-value
Physical activity	-1.39	-2.91	-2.36 -0.43	<0.01
Age	0.00	0.02	-0.05 0.05	0.99
Female	-0.49	-0.92	-1.55 0.58	0.36
Caucasian	-0.30	-1.85	-0.63 0.28	0.07
Waist-Hip Ratio	0.95	0.31	-5.32 7.23	0.76
CD4 Nadir	0.56	2.14	0.03 1.09	0.04
		F (7,44)	2.50	0.03

Physical activity variable was dichotomized into those meeting current physical activity guidelines (150 minutes of moderate physical activity per week); CD4 T-cell Nadir was transformed by dividing it by its standard deviation to assist in interpretation.