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A Cross-Sectional Description of Age and Gender Differences in Exercise Patterns in Adults Living with HIV

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Abstract

People living with HIV (PLWH) are living longer and are at greater risk for chronic comorbidities (e.g., cardiovascular disease, cancer) compared to those not living with HIV. Regular, sustained exercise can prevent and/or mitigate the severity of these comorbidities. Our purpose was to describe patterns of planned exercise implemented in the home setting (i.e., free-living exercise) in PLWH by gender and age. PLWH ($n = 102$) completed a sociodemographic survey and a 7-day exercise diary documenting daily exercise duration, frequency, and intensity. Women exercised an average of 2.4 (IQR: 0.5, 6.0) hours per week compared to men who exercised 3.5 (IQR: 0.5, 7.5) hours per week ($p = 0.18$). This relationship was particularly evident during middle adulthood for women versus for men ($p = 0.05$). PLWH exercised regularly but at less than recommended levels. This is among the first evidence describing free-living exercise patterns of PLWH.

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Keywords

behavior; cross-sectional; physical activity; HIV; self-care

In the United States, 1.1 million people are currently living with HIV, a number expected to rise over the next decade (Centers for Disease Control and Prevention [CDC], 2012). While HIV is now considered a chronic disease, a new threat has emerged for this population: people living with HIV (PLWH) develop chronic comorbidities earlier and more frequently than their non-HIV-infected counterparts. A recent analysis found that PLWH experience more co-morbid conditions and these occur, on average, 5 years earlier than those not living with HIV (Schouten & Group, 2012). The most prevalent comorbidities in this population are hypertension, chronic obstructive pulmonary disease, cancers, arthritis, osteoporosis, and liver disease (Schouten & Group, 2012). Additionally, a study of more than 80,000 veterans (27,000 PLWH) found that, after adjusting for Framingham risk, comorbidities, and substance use, PLWH had a 50% increased risk of an acute myocardial infarction (Freiberg et al., 2013). Current dominant hypotheses link the increased incidence of comorbidities to HIV-related chronic inflammation, adipose tissue abnormalities, and modifiable lifestyle factors (e.g., increased tobacco use and decreased physical activity; High et al., 2012; Vidal et al., 2012). Exercise can help prevent and/or mitigate the severity of these chronic comorbidities by improving insulin sensitivity, decreasing visceral fat, mitigating the inflammatory response and oxidative stress, increasing endothelial function, and optimizing lipid profiles (Hand, Lysterly, Jaggers, & Dudgeon, 2009; Kokkinos & Myers, 2010; Kruk, 2007; Roberts & Barnard, 2005; Yahiaoui, McGough, & Voss, 2012). In order for the exerciser to achieve these benefits, regular, sustained exercise, often in the individual's home setting, is required; yet free-living exercise is rarely studied in PLWH (Foster, Hillsdon, & Thorogood, 2005; O'Brien, Nixon, Tynan, & Glazier, 2010).

Positive Effects of Exercise in PLWH

Several systematic reviews have examined the impact of exercise on health in PLWH. O'Brien et al. (2010) found that aerobic exercise, or a combination of constant aerobic exercise and progressive resistance exercise for at least 20 minutes, 3 times per week for at least 5 weeks, was safe and led to significant improvements in cardiopulmonary fitness, body composition, and psychological status in PLWH. Hand et al. (2009) reviewed 26 studies (both randomized clinical trials and observational studies, publication range 1989–2007), examining the impact of aerobic and resistance exercise on the health of PLWH. They found that aerobic, resistance, and combined aerobic and resistance physical activity led to improvements in body composition, functional capacity, muscular strength, total and HDL cholesterol, cognitive function, depression and anxiety, overall health, and quality of life. They did not analyze the participant age, exercise setting, supervision, frequency, or duration of physical activity but did examine intensity. Their study suggested that moderate-to-high intensity physical activity was most beneficial (Hand et al., 2009). Yahiaoui et al. (2012) conducted a review of 20 randomized clinical trials with the purpose of developing guidelines on the frequency, intensity, and duration of physical activity for older adults living with HIV. They found that exercise led to significant improvements in maximal

aerobic capacity (VO_{2max}) and that resistance training led to improvements in muscle strength and function. They concluded that moderate-to-high intensity activity (70–80% of maximum heart rate) was the most beneficial and recommend 20–40 minutes of activity, at least 3 days per week, for at least 6 weeks (Yahiaoui et al., 2012). These studies were limited by small sample sizes, short duration of follow-up, high attrition, and having mostly male participants.

When aggregating the 29 unique studies identified by these reviews, several conclusions can be drawn. First, exercise appears to improve a number of important health-related outcomes in PLWH, including cardiovascular fitness, body composition, muscular strength, cardiovascular risk factors, and psychological status. Second, only two interventions were in the subject's home setting (i.e., free living exercise; Baigis et al., 2002; Dolan et al., 2006), and it appears that all exercise interventions were supervised by a trained member of the research team, although some did not report supervision status (LaPerriere et al., 1990; MacArthur, Levine, & Birk, 1993; Stringer, Berezovskaya, O'Brien, Beck, & Casaburi, 1998; Terry, Sprinz, & Ribeiro, 1999). Only Fillipas, Oldmeadow, Bailey, and Cherry (2006) used an unsupervised walking program as a control group. Participants were told to walk for 20 minutes, twice a week, starting at 60% of the maximum heart rate and progressing to 75%. These participants were also to attend a monthly peer support group. The participants completed 85% of the self-initiated walking sessions and 60% of the support groups (Fillipas et al., 2006). Third, none of the studies included baseline measurements of exercise amount, frequency, or intensity so it is impossible to know the physical activity patterns of PLWH outside of a highly controlled research setting. Finally, most of the participants were men, leaving a gap in our understanding of physical activity patterns by gender. Gender has been found to influence exercise patterns in the general U.S. population, with women exercising less than men (Nomaguchi & Bianchi, 2004). Further, exercise patterns at one stage of life do not correlate with patterns at other stages of the lifespan (Telama, 2009), and these patterns vary by gender indicating that there might be differences in exercise patterns by both gender and age.

Potential Advantages of Free-Living Exercise In PLWH

Regular, sustained, free-living exercise (e.g., exercise performed in and around the home environment) may be a cost-effective and sustainable approach to help reduce comorbidity risk in PLWH. Free-living exercise can help PLWH overcome structural barriers, including a lack of transportation and cost of fitness facilities, to regular exercise. Additionally, it also may help to decrease barriers caused by HIV-related symptoms and the increased work associated with necessary HIV self-management (Corless et al., 2012; Nokes et al., 2012; Webel, Asher, et al., 2012).

Two studies have examined the impact of supervised exercise in the home setting on key measures of fitness in PLWH. Baigis et al. (2002) conducted a randomized clinical trial on a home-based intervention in 99 adult PLWH. This structured exercise program was supervised by a trainer and included a 20-minute continuous aerobic exercise session, three times a week for 15 weeks. The investigators found small but statistically insignificant improvements in cardiorespiratory endurance (VO_{2max}), statistically significant

improvements in quality of life, and no changes in immune function. In contrast, Dolan et al. (2006) developed a 4-month (3 times per week), home-based aerobic and progressive resistance-training program and tested it in a randomized clinical trial of 40 women living with HIV. At 4 months, they found improvements in strength, cardiorespiratory fitness, endurance, and body composition. Both studies tried to overcome significant limitations to physical activity including a lack of transportation and childcare, which can significantly reduce physical activity and other self-management behaviors in this population (Webel & Higgins, 2012). A major criticism of supervised exercise is that it is expensive and not sustainable.

Improvements in free-living exercise, therefore, may be required to obtain exercise benefits outside of the research setting. As existing evidence on free-living exercise in PLWH is weak, the question of how to improve free-living exercise in PLWH remains. Because this population is at particularly high risk for developing costly chronic comorbidities, there is a need to better understand their free-living exercise patterns to help improve and sustain these exercise behaviors.

Given that the present literature has neither examined existing patterns of free-living exercise in PLWH nor compared these patterns by gender or age, we aimed to describe free-living exercise patterns (amount, intensity, frequency, and type) in adults living with HIV by gender and age. We hypothesized that free-living exercise patterns would differ by gender and by age in adult PLWH.

Methods

Sample and Recruitment

We used purposive sampling to examine differences in free-living exercise patterns between older and younger men and women living with HIV. PLWH were recruited from HIV clinics, HIV service organizations, and a northeast Ohio HIV research registry; recruits were organized into four equally sized strata (27 males < 51 years of age, 27 males ≥ 51 years, 30 females < 51 years, 18 females ≥ 51 years) to ensure adequate representation of both males and females, and older and younger PLWH. Individuals with a documented HIV diagnosis who were 18 years of age or older and on antiretroviral therapy (ART) were recruited from November 2011 to June 2012 ($N = 102$). Those with previously diagnosed diabetes and pacemakers were excluded because of the significant confounding effect on heart rate variability, which was measured as part of the primary study (Webel et al., 2013). The primary study examined differences in stress and isolation in older and younger PLWH. All participants in the primary study were eligible for the present analysis.

Procedures

The study was approved by the institutional review board of University Hospitals (Cleveland, OH). Written informed consent was obtained from eligible PLWH at a baseline visit. Height, weight, and vital signs were measured. The participants were given a 7-day exercise diary and returned 1 week later to return the diary and complete a survey addressing other socio-demographic questions. Participants were called on days 3 and 6 to remind them

to complete the daily diary, answer any questions, and remind them of the date and time of their return visits. At the return visits, a research assistant collected the diaries, checked for completion, and clarified any questionable data. Participants completed the demographic survey, which was collected via computer-assisted delivery, to enhance the accuracy of self-report. Participants were compensated for their time with a \$50 cash gift card.

Measures

Demographic characteristics were obtained by self-report. Clinical data (Medical History and Cardiovascular Risk Factors) were abstracted directly from the participant's medical chart.

Exercise duration, frequency, and intensity were assessed using a daily diary completed by each participant for 7 days. The diary contained four questions about (a) whether a participant exercised at all, (b) what times the participant started and ended exercise, (c) the perceived intensity of exercise, and (d) 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. Frequency was calculated as the number of exercise bouts greater than 10 minutes per day and per week. Intensity was calculated as the average (mean) perceived intensity of the exercise bouts.

We were also interested in the impact that walking as a mode of transportation would have on the free-living exercise patterns of PLWH. Exercise may have a different meaning to people for whom walking is a form of transport and not solely an activity to improve and maintain their health. Furthermore, moderate-high intensity exercise is recommended to achieve maximal cardiovascular benefits (Sallis, Frank, Saelens, & Kraft, 2004). We therefore created a new set of exercise variables where bouts of walking at less than moderate intensity (< 3 on the intensity scale) were excluded.

Participants were divided into three separate groups based upon age: young adulthood (< 35 years), middle adulthood (36–50 years), and older adulthood (> 51 years). We based this categorization on both Erikson's stages of human development and the CDC's historical classification of PLWH over age 50 as elderly (the average age of PLWH is approximately 30 years; CDC, 2008; Erikson, 1964; Nguyen & Holodniy, 2008).

One hundred and two eligible participants completed the study procedures. Of these, there were 27 males younger than 51 years of age, 27 males older than or equal to 51 years of age, 23 females younger than 51 years of age, and 25 females older than or equal to 51 years of age. The mean age of all participants was 48 ($SD = 8.7$) years of age and most were African American (83%).

Statistical Analysis

All data were directly imported from the web-based data collection system, REDCAP, into a data management program (Harris et al., 2009). Variables were summarized using

appropriate descriptive statistics (means and standard deviations for continuous variables and frequencies and percentages for categorical variables). Comparisons between gender and age groups were made using two-sample t-tests or Wilcoxon rank-sum tests as appropriate. Analyses were performed using Stata version 12, and $p < 0.05$ was considered statistically significant.

Results

Demographic and Clinical Characteristics

Participants had been living with HIV for an average of 13.1 ($SD = 6.3$) years. Mean duration of ART was 9.7 ($SD = 5.3$) years, and 78% of participants had an undetectable viral load. Eighty percent had a co-occurring health condition, 31% had been admitted to the emergency department, and 14% had been hospitalized in the previous 12 months. Additional demographic and medical characteristics of participants, including their cardiovascular risk factors, are shown in Table 1.

Amount, Intensity, and Frequency of Free-Living Exercise

Table 2 describes the weekly free-living exercise patterns of study participants by gender and age. Women reported exercising an average of 2.4 hours per week, and men exercised an average of 3.5 hours per week. There were no differences in the quantity of exercise between men and women, except during middle adulthood (women = 2.4 hours per week, men = 4.5 hours per week; $p = 0.05$). When walking was removed, however, this relationship disappeared (women = 1.1 hours per week, men = 4.0 hours per week; $p = 0.20$). Men had more low-intensity walking (4.0) than women (4.9), but this overall difference was not statistically significant ($p = 0.23$). Men and women exercised at different intensities in both young and middle adulthood ($p = 0.02$; $p = 0.04$, respectively). The average exercise frequency for women and men was 3.0 bouts per week ($p = 0.48$). There were no statistically significant differences in the frequency of exercise between men and women. Removing low-intensity walking significantly decreased the average amount and number of bouts of exercise per week for men and women (all < 0.01). Additional detail on the weekly free-living exercise patterns can be found in Table 2.

Type and Occurrence of Exercise

Seventy-eight of the participants reported some type of exercise in the previous week. The most common type of exercise for both men and women was walking ($n = 75$), followed by climbing stairs ($n = 42$), stretching ($n = 29$), and weight-lifting ($n = 13$). A variety of other types of exercise were reported including playing sports, cardiovascular exercises, and strength and muscle toning exercises. A detailed list of the type and occurrence of exercise by gender can be found in Table 3.

Discussion

To the best of our knowledge, this is the first study designed to describe the free-living exercise patterns of adult PLWH. We found that PLWH reported exercising regularly but slightly less than recommended levels, and those in middle adulthood (ages 36–50 years)

exercised the most regularly. During middle adulthood, men exercised more frequently but at lower intensities than women; no other differences were found by gender. In the general U.S. population, epidemiological evidence has demonstrated that more men engaged in regular sustained and regular vigorous exercise than women, and exercise declined with age in both genders (Caspersen, Pereira, & Curran, 2000; Gordon-Larsen, Nelson, & Popkin, 2004). The women in our study reported higher, but not statistically significant, perceived exercise intensity. This higher-intensity exercise is an interesting deviation from national data and should be explored further. It may be related to the type of activity in which men and women engaged. We found that most participants reported walking in the previous week. However, more women than men reported stretching (46% vs. 30%), weight lifting (23% vs. 13%), and swimming (9% vs 3%), as well as additional types of cardiovascular exercise (26% vs. 10%). These findings indicate that women living with HIV may have access to more exercise resources than men or that they are more likely to take advantage of such resources, resulting in higher intensity, more balanced exercise patterns. Exercise intensity is directly related to its public health benefit and should be included in clinical assessments and interventions (Haskell et al., 2007). However, the lower weekly amount of exercise in women, when considered with data suggesting that women may actually benefit from exercise more than men (Kokkinos & Myers, 2010) suggests that additional interventions targeting both the duration and frequency of exercise, specifically in women living with HIV, are important.

When examining the influence of age, participants in middle adulthood exercised the most, then older adults, and then young adults. The low level of exercise reported among young adults was surprising when compared to large national studies. Comparing data from the National Longitudinal Study of Adolescent Health, Gordon-Larsen et al. (2004), found that those who engaged in physical activity as adolescents often did not continue to achieve this amount of activity into adulthood, a finding supported by other investigators (Anderssen et al., 1996). However, much of these comparison data are older, was assessed using recall measures, and was collapsed into dichotomous variables, making a true comparison between our sample and national trends difficult.

To help distinguish exercise, defined as “planned structured movement undertaken to improve or maintain one or more aspects of physical fitness” (Caspersen, Powell, & Christenson, 1985, p. 126), from physical activity, defined as “any bodily movement produced by the skeletal muscles that results in energy expenditure” (Caspersen et al., 1985, p.126), we examined the impact of removing walking at less than a moderate intensity on the exercise patterns of PLWH. We did this because we hypothesized that PLWH in the United States frequently use low-intensity walking as a form of transportation and not as a mode of exercise, which may impact the health benefits of exercise. A recent meta-analysis found that walking 3 hours per week at moderate pace produced significant but minimal health benefits (decreased risk for cardiovascular disease and all-cause mortality); however, greater benefits were found with walking at a more intense pace further supporting this line of inquiry (CDC, 2008). Unsurprisingly, we found that removing low-intensity walking from the overall exercise variables significantly decreased the duration and frequency of exercise. This approach to understanding the relationship between activity and exercise indicates the need to incorporate a structured, systematic assessment of physical activity and

exercise into primary health care for PLWH. This assessment should focus on understanding the individual's pattern of and preference for different exercises. Future research examining these patterns should also explore the impact of walking as a mode of transportation on PLWH exercise patterns as well as on health. If appropriate, health care providers can also encourage PLWH to increase the pace of walking to maximize the health benefits of this activity. With recent evidence describing the importance of balanced exercise routines (Katlama et al., 2013), we need a greater understanding of the relationship between exercise, physical activity, and physical inactivity in this population.

There are several limitations to this study. First, this was a single-site, cross-sectional study. PLWH in different geographic areas may have different exercise patterns than those who participated in our study. However, the gap in the literature on this topic makes it challenging to know if variations in free-living exercise patterns in PLWH exist by geography. Second, while our study provides a cross-sectional description of self-reported exercise patterns in PLWH, further longitudinal studies using data not based on self-report are needed to understand these complex patterns (Prince et al., 2008). Finally, we assessed our primary variable, exercise, with exercise diaries and not with objective measures. This could impact the validity of our findings by increasing the likelihood of social desirability bias leading to an overestimation of self-reported exercise. However, a recent report on the science of physical activity assessment by the American Heart Association found several practical and scientific advantages to using diaries to assess physical activity including limiting recall bias and providing comprehensive information on physical activity (Strath et al., 2013). Nonetheless, future analyses of exercise patterns in this population should use a combination of objective and subjective measures to ensure rigorous evidence.

In summary, we found that adult PLWH exercise regularly but at less than recommended levels; however, most of this exercise was low-intensity walking that may have limited health benefits. PLWH may gain from interventions designed to increase vigorous and strength-based exercise in the home setting. Significant differences in the amount and intensity of free-living exercises exist by age, and future studies should explore methods to improve exercise amount and intensity by age or developmental stage.

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References

- Anderssen N, Jacobs DR, Sidney S, Bild DE, Stemfeld B, Slattery ML, Hannan P. Change and secular trends in physical activity patterns in young adults: A seven-year longitudinal follow-up in the Coronary Artery Risk Development in Young Adults Study (CARDIA). *American Journal of Epidemiology*. 1996; 143(4):351–362. [PubMed: 8633619]

- Baigis J, Korniewicz DM, Chase G, Butz A, Jacobson D, Wu AW. Effectiveness of a home-based exercise intervention for HIV-infected adults: A randomized trial. *Journal of the Association of Nurses in AIDS Care*. 2002; 13(2):33–45.10.1016/s1055-3290(06)60199-4 [PubMed: 11936063]
- Caspersen C, Pereira M, Curran K. Changes in physical activity patterns in the United States, by sex and cross-sectional age. *Medicine and science in sports and exercise*. 2000; 32(9):1601–1609. [PubMed: 10994912]
- Caspersen CJ, Powell KE, Christenson GM. Physical activity, exercise, and physical fitness: Definitions and distinctions for health-related research. *Public Health Rep*. 1985; 100(2):126–131. [PubMed: 3920711]
- Centers for Disease Control and Prevention. HIV/AIDS in persons aged 50 and older. 2008. Retrieved April 12, 2013, 2013, from <http://www.cdc.gov/hiv/topics/over50/index.htm>
- Centers for Disease Control and Prevention. Monitoring selected national HIV prevention and care objectives by using HIV surveillance data—United States and 6 U.S. dependent areas—2010. *HIV Surveillance Supplemental Report*. 2012; 17(3)
- Corless IB, Guarino AJ, Nicholas PK, Tyer-Viola L, Kirksey K, Brion J, Sullivan KM. Mediators of antiretroviral adherence: A multisite international study. *AIDS Care*. 2012; 25(3):364–377.10.1080/09540121.2012.701723 [PubMed: 22774796]
- Dolan SE, Frontera W, Librizzi J, Ljungquist K, Juan S, Dorman R, Grinspoon S. Effects of a supervised home-based aerobic and progressive resistance training regimen in women infected with human immunodeficiency virus: a randomized trial. *Archives of Internal Medicine*. 2006; 166(11): 1225–1231.10.1001/archinte.166.11.1225 [PubMed: 16772251]
- Erikson, EH. *Childhood and society*. 2. New York, NY: Norton; 1964.
- Fillipas S, Oldmeadow LB, Bailey MJ, Cherry CL. A six-month, supervised, aerobic and resistance exercise program improves self-efficacy in people with human immunodeficiency virus: a randomised controlled trial. *Australian Journal of Physiotherapy*. 2006; 52(3):185–190.
- Foster C, Hillsdon M, Thorogood M. Interventions for promoting physical activity. *Cochrane Database of Systematic Reviews*. 2005:1.
- Freiberg MS, Chang CC, Kuller LH, Skanderson M, Lowy E, Kraemer KL, Justice AC. HIV infection and the risk of acute myocardial infarction. *JAMA Internal Medicine*. 2013:1–9. [pii]. 10.1001/jamainternmed.2013.37281659742
- Gordon-Larsen P, Nelson MC, Popkin BM. Longitudinal physical activity and sedentary behavior trends: Adolescence to adulthood. *American Journal of Preventive Medicine*. 2004; 27(4):277–283.10.1016/j.amepre.2004.07.006 [PubMed: 15488356]
- Hand G, Lyerly G, Jagers J, Dudgeon W. Impact of aerobic and resistance exercise on the health of HIV-infected persons. *American Journal of Lifestyle Medicine*. 2009; 33(6):489–499. [PubMed: 20508736]
- Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. *Journal of Biomedical Informatics*. 2009; 42(2):377–381.10.1016/j.jbi.2008.08.010 [PubMed: 18929686]
- Haskell WL, Lee IM, Pate RR, Powell KE, Blair SN, Franklin BA, Bauman A. Physical activity and public health. Updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Circulation*. 2007; 116:000–000.10.1161/circulationaha.107.185649
- High KP, Brennan-Ing M, Clifford DB, Cohen MH, Currier J, Deeks SG, Volberding P. HIV and aging: State of knowledge and areas of critical need for research. A report to the NIH Office of AIDS Research by the HIV and Aging Working Group. *Journal of Acquired Immune Deficiency Syndrome*. 2012; 60(Suppl 1):S1–18.10.1097/QAI.0b013e31825a3668
- Katlama C, Deeks SG, Autran B, Martinez-Picado J, van Lunzen J, Rouzioux C, Sekaly RP. Barriers to a cure for HIV: New ways to target and eradicate HIV-1 reservoirs. *The Lancet*. 2013; 381(9333):2109–2117.10.1016/S0140-6736(13)60104-X
- Kokkinos P, Myers J. Exercise and physical activity: Clinical outcomes and applications. *Circulation*. 2010; 122(16):1637–1648.10.1161/circulationaha.110.948349 [PubMed: 20956238]

- Kruk J. Physical activity in the prevention of the most frequent chronic diseases: An analysis of the recent evidence. *Asian Pacific Journal of Cancer Prevention: APJCP*. 2007; 8(3):325–338. [PubMed: 18159963]
- LaPerriere AR, Antoni MH, Schneiderman N, Ironson G, Klimas N, Caralis P, Fletcher MA. Exercise intervention attenuates emotional distress and natural killer cell decrements following notification of positive serologic status for HIV-1. *Biofeedback Self Regulation*. 1990; 15(3):229–242. [PubMed: 2223891]
- MacArthur RD, Levine SD, Birk TJ. Supervised exercise training improves cardiopulmonary fitness in HIV-infected persons. *Medicine & Science in Sports & Exercise*. 1993; 25(6):684–688. [PubMed: 8100607]
- Nguyen N, Holodniy M. HIV infection in the elderly. *Clinical Interventions in Aging*. 2008; 3(3):453–472. [PubMed: 18982916]
- Nokes K, Johnson MO, Webel A, Rose CD, Phillips JC, Sullivan K, Holzemer WL. Focus on increasing treatment self-efficacy to improve human immunodeficiency virus treatment adherence. *Journal of Nursing Scholarship*. 2012; 44(4):403–410.10.1111/j.1547-5069.2012.01476.x [PubMed: 23121723]
- Nomaguchi KM, Bianchi SM. Exercise time: Gender differences in the effects of marriage, parenthood, and employment. *Journal of Marriage and Family*. 2004; 66(2):413–430.10.1111/j.1741-3737.2004.00029.x
- O'Brien K, Nixon S, Tynan A-M, Glazier R. Aerobic exercise interventions for adults living with HIV/AIDS. *Cochrane Database of Systematic Reviews*. 2010; (8)10.1002/14651858.CD001796.pub3
- Prince SA, Adamo KB, Hamel ME, Hardt J, Connor Gorber S, Tremblay M. A comparison of direct versus self-report measures for assessing physical activity in adults: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity*. 2008; 5:56.10.1186/1479-5868-5-56 [PubMed: 18990237]
- Roberts CK, Barnard RJ. Effects of exercise and diet on chronic disease. *Journal of Applied Physiology*. 2005; 98(1):3–30.10.1152/jappphysiol.00852.2004 [PubMed: 15591300]
- Sallis JF, Frank LD, Saelens BE, Kraft MK. Active transportation and physical activity: Opportunities for collaboration on transportation and public health research. *Transportation Research Part A: Policy and Practice*. 2004; 38(4):249–268.10.1016/j.tra.2003.11.003
- Schouten, J.; Group, AS. Comorbidity and ageing with HIV: A prospective comparative cohort study. Paper presented at the XIX International AIDS Conference; Washington, DC. 2012 Jul. Retrieved from <http://pag.aids2012.org/session.aspx?s=201#5>
- Strath SJ, Kaminsky LA, Ainsworth BE, Ekelund U, Freedson PS, Gary RA, Swartz AM. Guide to the assessment of physical activity: Clinical and research applications: A scientific statement from the American Heart Association. *Circulation*. 2013; 128(20):2259–2279.10.1161/01.cir.0000435708.67487.da [PubMed: 24126387]
- Stringer WW, Berezovskaya M, O'Brien WA, Beck CK, Casaburi R. The effect of exercise training on aerobic fitness, immune indices, and quality of life in HIV+ patients. *Medicine & Science in Sports & Exercise*. 1998; 30(1):11–16. [PubMed: 9475639]
- Telama R. Tracking of physical activity from childhood to adulthood: A review. *Obesity Facts*. 2009; 3:187–195. [PubMed: 20054224]
- Terry L, Sprinz E, Ribeiro JP. Moderate and high intensity exercise training in HIV-1 seropositive individuals: A randomized trial. *International Journal of Sports Medicine*. 1999; 20(2):142–146.10.1055/s-2007-971108 [PubMed: 10190777]
- Vidal F, Domingo P, Villarroja F, Giralt M, Lopez-Dupla M, Gutierrez M, Gallego-Escuredo JM, Peraire J, Vilades C, Veloso S, Mateo G, Guallar J, Richart C. Adipogenic/lipid, inflammatory, and mitochondrial parameters in subcutaneous adipose tissue of untreated HIV-1-infected long-term nonprogressors: Significant alterations despite low viral burden. *Journal of Acquired Immune Deficiency Syndrome*. 2012; 61(2):131–137.10.1097/QAI.0b013e31825c3a68
- Webel AR, Asher A, Cuca Y, Okonsky JG, Kaihura A, Dawson Rose C, Salata RA. Measuring HIV self-management in women living with HIV/AIDS: A psychometric evaluation study of the HIV

Self-management Scale. *Journal of Acquired Immune Deficiency Syndrome*. 2012; 60(3):e72–81.10.1097/QAI.0b013e318256623d

Webel AR, Higgins PA. The relationship between social roles and self-management behavior in women living with HIV/AIDS. *Womens Health Issues*. 2012; 22(1):e27–33.10.1016/j.whi.2011.05.010 [PubMed: 21798762]

Webel AR, Longenecker CT, Gripshover B, Hanson JE, Schmotzer BJ, Salata RA. Age, stress, and isolation in older adults living with HIV. *AIDS Care*. 2013; 25(5):523–531.10.1080/09540121.2013.845288 [PubMed: 24116852]

Yahiaoui A, McGough EL, Voss JG. Development of evidence-based exercise recommendations for older HIV-infected patients. *Journal of the Association of Nurses in AIDS Care*. 2012; 23(3):204–219.10.1016/j.jana.2011.06.001 [PubMed: 21803606]

Key Considerations

- People living with HIV report exercising regularly but slightly less than recommended levels with variation noted by age and gender.
- Walking is the most common form of exercise, but it often occurs at low intensities.
- Regular clinical assessment of type, frequency, and intensity of exercise is important.

Table 1

Demographic and Medical Characteristics of Study Participants¹

	Male (<i>n</i> = 54)		Female (<i>n</i> = 48)		Total (<i>n</i> = 102)
	<i>n</i> (%)		<i>n</i> (%)		<i>n</i> (%)
	< 51 years (<i>n</i> = 27)	51 years (<i>n</i> = 27)	< 51 years (<i>n</i> = 30)	51 years (<i>n</i> = 18)	
Mean age in years (<i>SD</i>)	41 (7.8)	54 (6.8)	44 (7.7)	56 (4.1)	48 (8.7)
Race					
African American/Black	22 (82)	20 (77)	27 (90)	15 (83)	85 (84)
Hispanic/Latina	0	0	1(3)	1 (6)	2 (2)
Native American/Indian	1 (4)	0	0	0	1 (1)
White/Anglo (non-Hispanic)	4 (15)	3 (12)	1(3)	2 (11)	10(10)
Other	0	3 (11)	1 (3)	0	3 (3)
Education Level					
11 th grade or less	6 (22)	2 (8)	12 (40)	4 (22)	26 (26)
High school or General Equivalency Degree	11 (41)	5 (19)	9 (30)	3 (17)	28 (28)
Some college or Associate Degree	6 (22)	11 (42)	7 (23)	9 (50)	33 (33)
College degree (BS, BA, MS, or MA)	4 (15)	8 (31)	2 (7)	2 (12)	16 (16)
Income					
No monthly income	6 (22)	3 (12)	5 (17)	3 (17)	17 (17)
Less than \$200	4 (15)	2 (8)	1 (3)	0	7 (7)
\$200–\$599	0	3 (11)	6 (20)	0	9 (9)
\$600–\$799	11 (41)	6 (23)	14 (47)	9 (50)	40 (40)
\$800–\$999	5 (19)	4 (15)	0	2 (11)	11 (11)
\$1,000 or more	1 (4)	8 (31)	4 (13)	4 (22)	17 (17)
Have Health Insurance	23 (85)	24 (96)	30 (100)	18 (100)	95 (94)
Paid Employment	3 (11)	3 (11)	7 (23)	1 (6)	14 (14)
Permanent Housing	23 (85)	23 (85)	27 (90)	17 (94)	91 (91)
Medical History					
Mean years Living with HIV (<i>SD</i>)	11.1 (5.5)	17 (5.6)	12 (6.9)	12 (6.1)	13.1 (6.3)

	Male (<i>n</i> = 54)		Female (<i>n</i> = 48)		Total (<i>n</i> = 102)
	<i>n</i> (%)		<i>n</i> (%)		<i>n</i> (%)
	< 51 years (<i>n</i> = 27)	51 years (<i>n</i> = 27)	< 51 years (<i>n</i> = 30)	51 years (<i>n</i> = 18)	
Mean 3-day HIV antiretroviral medication adherence (<i>SD</i>)	91.25 (18.0)	96 (7.0)	94 (12.0)	91 (26.7)	93.2 (16)
Mean years since initiation of HIV antiretroviral treatment (<i>SD</i>)	8.4 (3.9)	12.5 (5.1)	8.5 (5.9)	9.5 (5.3)	9.7 (5.3)
Recent CD4+ T-cell count (cells/ μ L)	488 (265)	584 (373)	662 (351)	707 (444)	602 (359)
Undetectable HIV Viral Load	20 (74)	19 (76)	24 (80)	15 (83)	78 (76)
Visited the Emergency Department in the past 12 months	8 (29)	6 (25)	11 (37)	7 (39)	32 (31)
Hospitalized in the past 12 months	3 (11)	4 (14)	3 (10)	4 (22)	14 (14)
One or more chronic co-morbidities	22 (82)	23 (85)	23 (77)	13 (72)	81 (80)
Number of Participants Diagnosed					
Type of co-morbid health condition ²					
Bone Disorders	23				
Cancer	6				
Cardiovascular Disease	22				
Hypertension	35				
Pulmonary Disorder	17				
Kidney Disease	4				
Mental Health Disease	23				
Depression	37				
Cardiovascular Risk Factors					
Mean Systolic/Diastolic Blood Pressure (<i>SD</i>)	133/84 (13.1, 9.6)	134/84 (16.0, 8.9)	128/81 (27.5, 13.9)	127/78 (20.1, 14.2)	130/82 (20.1, 11.8)
Mean BMI (<i>SD</i>)	24 (3.5)	25 (4.3)	33 (11.0)	28 (9)	28 (7.9)
Mean Triglycerides (<i>SD</i>)	166 (138.7)	158 (67)	140 (62.5)	141 (77)	152 (93.7)
Mean HDL (<i>SD</i>)	50 (15.4)	46 (15.8)	53 (14.0)	60 (27.4)	52 (17.6)
Mean LDL (<i>SD</i>)	92 (39.8)	94 (32)	121 (44.5)	116 (33.8)	106 (40.7)
Ever smoke cigarettes ³	19 (86)	14 (87)	13 (59)	7 (54)	53 (73)
Mean 10-year Framingham Risk Score (<i>SD</i>)	7.3 (4.4)	11.4 (3.8)	4.0 (3.4)	7.7 (3.7)	7.3 (4.7)

¹ Demographic data were self-reported by participants. Medical characteristics and cardiovascular risk was abstracted from the participant's medical chart;

² Participants were often diagnosed with more than one co-morbid condition so the total number of participants is reported only;

³ Data from chart abstraction for the variable *ever smoke cigarettes* were available for 38 men and 35 women for a total sample of 73 subjects included in this analysis.

Table 2

Free-Living Weekly Exercise Patterns in People Living with HIV

All Physical Activity								
Variable	Women			Men			Overall Median (IQR)	p-value ¹
	n	Median (IQR)	Range	n	Median (IQR)	Range		
Average Exercise (hour per week)								
18–35 years	4	3.1 (0.6, 7.7)	0, 10.3	6	1.3 (0.5,2.0)	0.2, 4.3	1.3 (0.5, 4.3)	0.67
36–50 years	23	2.4 (0.2, 6.0)	0, 21.1	21	4.5 (1.5, 9.3)	0, 18.5	3.6 (0.5, 7.3)	0.05 ²
51	16	2.4 (0.8,3.7)	1, 17.6	23	2.0 (0.3, 9.3)	0, 20.4	2.2 (0.4, 5.7)	0.73
Total	43	2.4 (0.5, 6.0)	0, 21.1	50	3.5 (0.5, 7.5)	0, 20.4	2.4 (0.5, 6.3)	0.18
Average Intensity								
18–35 years	3	1.0 (0.0, 2.0)	0, 2.0	6	5.4 (3.8, 6.0)	3.5, 8.0	3.75 (2.0, 6.0)	0.02 ²
36–50 years	23	5.0 (3.0, 5.9)	0, 7.3	17	4.0 (3.1, 4.5)	1.1, 6.3	4.2 (3.1, 5.5)	0.04 ²
51 years	16	4.7 (4.0, 5.4)	2.3, 6.0	22	4.0 (2.8,5.0)	0, 8.0	4.3 (3.3, 5.4)	0.22
Total	42	4.9 (3.5,5.5)	0, 7.3	45	4.0 (3.1, 5.0)	0, 8.0	4.3 (3.2, 5.5)	0.23
Exercise Frequency (bouts per/week)								
18–49 years	4	3.0 (1.0, 5.5)	0, 7	6	3.5 (1.0, 5.0)	1, 5	3.5 (1.0, 5.0)	0.91
36–50 years	26	2.5 (1.0, 5.0)	0, 9	22	4.0 (1.0, 7.0)	0, 21	3.0 (1.0, 6.0)	0.31
51 years	18	4.0 (1.0, 6.0)	0, 15	25	3.0 (1.0, 7.0)	0,19	3.0 (1.0, 6.0)	0.94
Total	48	3.0 (1.0, 7.0)	0, 15	53	3.0 (1.0, 7.0)	0, 21	3.0 (1.0, 6.0)	0.48
Removing Walking Activity								
Average Exercise								
18–35 years	4	0.45 (0.18, 1.3)	0, 2	6	0.52 (0.35, 1.4)	0, 4.3	0.5 (0.4, 1.4)	0.59
36–50 years	25	1.1 (0.0, 6.0)	0, 17.1	22	4.0 (1.3, 6.3)	0, 18.5	2.4 (0, 6.0)	0.20
51 years	17	2.4 (0.45, 3.3)	0, 17.6	25	1.0 (0.0, 6.3)	0, 20.4	1.3 (0, 4.5)	0.53
Total	46	1.4 (0.0, 4.0)	0, 17.6	53	1.4 (0.15, 6.1)	0, 20.4	1.4 (0, 5.0)	0.48
Exercise Frequency (bouts/week)								
18–35 years	4	1.5 (0.5, 2.0)	0, 2.0	6	2.5 (1.0, 4.0)	1.0, 5.0	2.0 (1.0, 3.0)	0.20
36–50 years	26	2.5 (1.0,5.0)	0, 9.0	22	3.0 (1.0, 5.0)	0, 21.0	3.0 (1.0, 5.0)	0.66

All Physical Activity							
Variable	Women			Men			Overall <i>Median (IQR)</i>
	<i>n</i>	<i>Median (IQR)</i>	<i>Range</i>	<i>n</i>	<i>Median (IQR)</i>	<i>Range</i>	
<i>51 years</i>	18	3.0 (2.0, 6.0)	0, 12.0	25	3.0 (1.0, 5.0)	0, 12.0	3.0 (1.0, 6.0)
<i>Total</i>	48	2.0 (1.0, 5.0)	0, 12.0	53	3.0 (1.0, 5.0)	0, 21.0	3.0 (1.0, 7.0)
							0.79
							0.68

¹ Compared results of t-tests with the results of Wilcoxon rank-sum (Mann-Whitney) test and the significance values did not change; given the ubiquity and robustness of the t-test, we decided to present the t-test.

² Significant results found between men and women at the 0.05 *p*-value.

Table 3

Type and Occurrence of Physical Activity by Gender

Type of Exercise	Number of Participants Reporting ¹		
	Males (n = 40)	Females (n = 35)	Total (n = 77)
Walking	40	35	75
Climbing stairs	21	21	42
Stretching	12	16	29
Weight lifting	5	8	13
Swimming	1	3	4
Other	17	21	38
Sports			
Playing sports	2	0	2
Basketball	1	0	1
Tennis	1	0	1
Cardiovascular Exercises			
Treadmill	0	3	3
Climber	1	0	1
Roller Blading	1	0	1
Bike/Spinning	0	2	2
Jumping jacks	0	1	1
Water aerobics	1	1	2
Nordic Track	0	1	1
Sprint	0	1	1
Calisthenics	1	0	1
Strength/Muscle Toning			
Tai Chi	0	1	1
Push-ups	2	0	2
Sit-ups	2	0	2
Leg Lifts	0	1	1
Shelving Exercise	1	0	1

¹ Each exercise was only counted once per week per subject;² Activities of Daily Living including housework and shopping were removed;³ Similar exercises that were written in were collapsed into one category if possible (e.g., cardiovascular and calisthenics).