A Mixed Methods, Observational Investigation of Physical Activity, Exercise, and Diet Among Older Ugandans Living With and Without Chronic HIV Infection

Chelsea H. Wright, MD • Chris T. Longenecker, MD, FAHA • Rashidah Nazzindah, MBChB, PhD • Cissy Kityo, MBChB, PhD • Theresa Najjuuko, BSN • Kirsten Taylor • Cynthia Robin Rentrope, MSSA, MPH, LSW • Allison Webel, RN, PhD, FAAN*

Abstract

People living with HIV (PLWH) are at increased risk for cardiovascular disease. Physical activity, exercise, and controlled diet can mitigate this risk, yet these behaviors are understudied in sub-Saharan Africa. Our objective was to describe and compare the meaning, value, and patterns of physical activity, exercise, and diet among PLWH and older adults without HIV in Uganda. This mixed methods, observational study included 30 adult PLWH and 29 adults without HIV who (a) wore an accelerometer to measure physical activity; (b) had weight, height, and waist and hip circumference measured; (c) completed physical fitness measures; and (d) used digital cameras to record photographs and videos of their typical diet and physical activities. Participants were approximately 58 years old and 68% female. Approximately 20% of PLWH and 40% of adults without HIV met physical activity guidelines ($p > .05$). Qualitative themes included engaging in a variety of exercise, structural barriers to exercising, and typical meals. Older adults in Uganda have low levels of physical activity and homogenous diets, increasing their risk for cardiovascular disease.

Key words: cardiovascular disease, diet, HIV, low and middle income, physical activity

Background

HIV was once a fatal disease but with the global scale up of effective HIV antiretroviral therapy, the prognosis for people living with HIV (PLWH) has drastically improved over the last few decades (Autenrieth et al., 2018). As PLWH live approximately normal lifespans, the health care management of PLWH now includes long-term health goals and consideration of risks from age-related conditions, including cardiovascular disease (CVD). In 2018, there were approximately 1.4 million PLWH in Uganda; all of whom were at increased risk of developing CVD as a result of HIV (Feinstein et al., 2019; Shah et al., 2018). Healthy living behaviors such as physical activity, exercise, and a healthy daily diet can mitigate this risk (Sanchez, 2018). Yet, in Uganda, the adherence to and drivers of these behaviors are relatively unknown, especially among PLWH.

PLWH in almost every region of the world are aging and now face increased rates of chronic health conditions associated with and exclusive of HIV, including diabetes mellitus, CVD, respiratory disease, and hepatic diseases, compared with those without HIV infection (Lorenc et al., 2014; Wong et al., 2018). PLWH are particularly vulnerable to developing CVD. Global estimates find that PLWH are twice as likely to develop CVD and that HIV infection is associated with a 50% increased risk of acute myocardial infarction (Feinstein et al., 2019; Freiberg et al., 2013; Shah et al., 2018). This increased risk of CVD likely results from a combination of HIV inflammatory responses, HIV antiretroviral therapy, and the traditional cardiovascular risk factors (e.g., hypertension, hyperlipidemia, smoking, poor diet, and physical inactivity; Freiberg et al., 2013; Lloyd-

The work was funded by the NIH (K23 HL123341 to Chris T. Longenecker) and by the Rottman Fund of Case Western Reserve University (to Chelsea H. Wright).

Chelsea H. Wright, MD, is a Family Medicine Resident, MetroHealth Medical Center, Cleveland, Ohio, USA. Chris T. Longenecker, MD, FAHA, is an Associate Professor of Medicine, Case Western Reserve University School of Medicine, Cleveland, Ohio, USA. Rashidah Nazzindah, MBChB, PhD, is a Physician, Joint Clinical Research Center, Kampala, Uganda. Cissy Kityo, MBChB, PhD, is a Director, Joint Clinical Research Center, Kampala, Uganda. Theresa Najjuuko, BSN, is a Research Nurse, Joint Clinical Research Center, Kampala, Uganda. Kirsten Taylor, is an Undergraduate Student, Case Western Reserve University College of Arts and Sciences, Cleveland, Ohio, USA. Cynthia Robin Rentrope, MSSA, MPH, LSW, is a Research Assistant IV, Case Western Reserve University, Cleveland, Ohio, USA. Allison Webel, RN, PhD, FAAN, is an Associate Professor of Nursing, Case Western Reserve University, Cleveland, Ohio, USA.

**Corresponding author: Allison Webel, RN, PhD, FAAN, e-mail: arw72@case.edu*

Supplemental digital content is available for this article. Direct URL citations appear in the printed text and in the HTML and PDF versions of the article at www.janacnet.org.

http://dx.doi.org/10.1097/JNC.0000000000000221

Jones et al., 2004). Among PLWH, these risk factors are potential targets for interventions tailored to reduce CVD risk and could more effectively be incorporated into HIV primary care.

To help address these risk factors, the American Heart Association developed the "Life's Simple 7" (Sanchez, 2018). This initiative focuses on targeting the seven most influential CVD risk factors, including managing blood pressure, controlling cholesterol, reducing blood sugar, getting active, eating better, losing weight, and stopping smoking. Among these risk factors, five can be addressed by physical activity, exercise, and diet. In 2017, Feinstein et al. (2017) examined these cardiovascular health metrics by measuring body mass index, smoking, self-reported physical activity, healthy diet score, total cholesterol, blood pressure, and fasting blood glucose in PLWH and those without HIV in Uganda. They reported that PLWH had more of these cardiovascular health metrics at ideal (or healthier) levels compared with adults without HIV and speculated it may be due to increased and regular primary care access for PLWH. However, in Uganda, little is known about the drivers of these behaviors, especially among PLWH. A substantive understanding of the meaning, value, and practice of physical activity, exercise, and diet intake is important to mitigate the risk of CVD among PLWH. Furthermore, the interpersonal, environmental, and sociocultural characteristics that influence physical activity, exercise, and diet intake among older PLWH in a country striving to transition from a rural agricultural to urbanized service economy, is likely to provide critical insights into how to reduce cardiovascular risk among this, and similar, populations.

Objective

The purpose of this mixed methods study was to describe and compare the meaning, value, and patterns of physical activity, exercise, and diet intake in older Ugandans living with and without HIV and describe their impact on physical fitness. Consistent with the socioecological model of health, the study goal was to identify the interpersonal, environmental, and sociocultural characteristics that influence physical activity, exercise, and diet (Bronfenbrenner, 1994; Huck et al., 2015).

Methods

Broad and complex questions lend themselves to mixed methods. Questions looking at health outcomes influenced by human behavior, such as physical activity and diet intake, are multifaceted, which can benefit from the humanistic and contextual approach of qualitative work and the statistical approach of quantitative work. We integrated quantitative and qualitative research at every stage of the research process, from development to data analysis to manuscript writing.

Study Design

We conducted a mixed methods, cross-sectional, observational study nested within an ongoing longitudinal cohort study that used convenience sampling to identify eligible participants. The parent study is a multi-year cohort study investigating cardiovascular risk in PLWH and persons without HIV in Uganda (Alencherry et al., 2019). Participants in the present study were recruited at the time of their Year 2 visit. Participants were offered the opportunity to participate in a mixed methods, observational study examining physical activity, exercise, and diet intake. We incorporated photovoice, a process of providing cameras to participants to help obtain visual data, in the qualitative portion of this study, to enable participants to record and reflect on their experiences (Wang & Burris, 1997). This design allowed the research team to combine rich, qualitative data with the quantitative data of the overall parent study, providing insight into the lives of people living in resource-limited settings through mixed methods results. All study procedures were approved by the University Hospital, Cleveland Medical Center Institutional Review Board (01-14-06), the Joint Clinical Research Centre Research Ethics Board (Uganda), and the Uganda National Council for Science and Technology.

Sample

Participants were consecutively sampled from a subset of participants from the parent cohort and included 30 PLWH and 29 adults without HIV. Sample size was based on previous experience from a prior qualitative study to allow for data saturation on all themes (Huck et al., 2015). Participants were consecutively sampled from the existing cohort of the parent study until sample size was obtained. We defined older adults as older than 45 years based on the World Health Organization (WHO) 2016 life expectancy of 62.5 years for Uganda (WHO, 2016). Inclusion criteria were: (a) age older than 45 years, (b) one or more CVD risk factors (i.e., hypertension, low high-density lipoprotein cholesterol [$<$40 mg/dL for men or $<$50 mg/dL for women], diabetes mellitus, smoking, or family history of coronary heart disease) determined by chart review. Additionally, PLWH had to have (a) a documented HIV-1 infection prior to study entry, (b) be on a stable HIV antiretroviral

medication regimen for at least the last 12 weeks prior to study entry (based on chart review), (c) have a cumulative duration of antiretrovirals for at least 6 months (also based on chart review), and (d) have documentation of at least one HIV-1 RNA level of ≤1,000 copies/mL within 6 months prior to study entry (also based on chart review).

Potential participants were excluded if they (a) were currently pregnant, (b) were experiencing an active uncontrolled chronic inflammatory condition, (c) were receiving chemotherapy or immunomodulating agents, except for low-dose aspirin, (d) had history of known coronary disease, peripheral artery disease, ischemic stroke, or heart failure, or (e) had an estimated glomerular filter rate <30 mL/min/1.73 m^2 determined by chart review.

Procedures and Measures

Prior to any procedures, written informed consent was obtained from all study participants. Participants were consented in English or Luganda by a research team member who received a 2-day standardized training in all study procedures (e.g., interviewing, photovoice, sactigraphy, and physical fitness measures). Participants received 80,000 Ugandan Shillings (approximately $22 USD) to cover transportation costs and 40,000 Ugandan Shillings (approximately $11 USD) as compensation for their time. Data were collected between May 2017 and September 2018. Prior to enrolling participants, research staff completed a 2-day in-person training and protocol adherence assessment to standardize all assessments and ensure validity.

At the initial photovoice sub-study visit, a research assistant interviewed each participant about their physical activity, dietary intake, socioeconomic status, and lifestyle behaviors. Dietary intake questions involved (a) number of meals per day, (b) food availability, (c) cooking styles, and (d) types and quantities of food consumed during a typical week. Physical activity questions involved the frequency, intensity, duration, and type of activity. Study participants had their weight, height, waist circumference, and hip circumference recorded using standardized procedures as per study protocol. Physical fitness was assessed by the 6-minute walk test (6MWT), a validated measure of physical fitness in the general population and, recently, among PLWH (Oliveira et al., 2018). The 6MWT was conducted according to the American Thoracic Society guidelines (Crapo et al., 2002) and included having the participant rest for 15 minutes prior to starting, recording vital signs, providing scripted instructions on how to complete the test, and monitoring the participant's symptoms during the test. Participants rested in a chair for 10 minutes prior to measurement of their blood pressure, heart rate, and overall fatigue using the Borg Perceived Exertion Scale ($\alpha = 0.64$ for VO_2 max; Chen et al., 2002). Next, participants walked as far as possible for 6 minutes, back and forth in a 30-m-long corridor, with the distance marked using cones, without running or jogging. After each test, a research assistant recorded the post-walk heart rate, fatigue/exertion levels, and the distance covered. Total distance walked was calculated as the sum of the number of laps (×30 m) and any additional distance in the final partial lap. Total distance was rounded to the nearest meter. Handgrip strength was assessed as another measure of physical fitness and measured as the static force in kilograms that a participant's hand could squeeze around a dynamometer.

Participants were then given an ActiGraph accelerometer (Actigraph; LLC, Fort Walton Beach, FL) to measure physical activity with instructions on proper placement on the hip as well as proper care of the device. Participants were instructed to wear the accelerometer every day for 7 consecutive days. Accelerometer data were sampled at 30 Hz, using 60-second epochs and the normal filter to ensure all activity was ascertained and analyzed according to best practices (Webel et al., 2019). A research nurse described the difference between physical activity and exercise along with providing prompts for taking daily photographs and videos. Study-provided cameras were distributed to all participants who were asked to take photographs or video of physical activity, which is the daily activities requiring bodily movement; exercise, activity done for the purpose of physical health or fitness (Caspersen et al., 1985), and pictures of diet, including where, with whom, and what people eat. Participants also received instructions for returning the photographs or videos to the research team. The participants were given instructions about limiting images of other people to maintain privacy of those who had not consented to be in the study and also informed that all identifying features would be blurred.

Seven days later, participants returned for a second visit with the research team. A team member reviewed the pictures and conducted a semi-structured, digitally recorded interview. Questions focused on probes about how typical an activity pattern or diet was and any contextual features that may promote or inhibit these behaviors (please refer to Digital Supplemental Material, Supplemental Digital Content 1, http://links.lww.com/JNC/A10). Interviews were conducted in Luganda or English, depending on participants' preferences, by a trained, female research assistant. The average interview

Table 1. Demographics Between HIV Status and Gender[a]

	People Living With HIV Frequency (%)[a]			People Without HIV Frequency (%)[a]		
	Female ($n = 19$)	Male ($n = 11$)	p-Value	Female ($n = 21$)	Male ($n = 8$)	p-Value
Mean age (years)	56.7	57.1	.875	59.3	59.5	.957
Socioeconomic indicators[b]						
Own housing	15 (79)	11(100)	.102	20 (95)	8 (100)	.530
Own land	13 (68)	11 (100)	.037	21 (100)	8 (100)	
Grow produce for self or sale	10 (53)	10 (91)	.032	12 (57)	6 (74)	.454
Own livestock	6 (32)	7 (64)	.088	5 (24)	3 (38)	.591
Mean monthly income (UGX schillings)[c]	682,778	3,450,000	.078	1,956,000	450,000	.278
Family goes hungry			.619			.545
Often	3 (16)	1 (9)		0 (0)	0 (0)	
Sometimes	3 (16)	1 (9)		2 (10)	1 (13)	
Seldom	0 (0)	0 (0)		3 (14)	0 (0)	
Never	11 (58)	9 (82)		15 (71)	6 (75)	
Where is the cooking done			.101			.657
Outside	10 (53)	2 (18)		5 (24)	3 (38)	
In house but not in separate kitchen	1 (5)	0 (0)		0 (0)	0 (0)	
Kitchen	8 (42)	9 (82)		15 (71)	5 (63)	
Where do you get water			.277			.229
Piped into dwelling (in-home tap)	7 (37)	7 (64)		2 (10)	0 (0)	
Communal tap	3 (16)	0 (0)		2 (10)	0 (0)	
Open tap	2 (11)	2 (18)		15 (71)	5 (63)	
Protected	3 (16)	0 (0)		1 (5)	2 (25)	
Public borehole	2 (11)	2 (18)		0 (0)	0 (0)	
Median distance to water source (m)[d]	30 (0, 175)	0 (0, 6)	.426	5 (3, 15)	7.5 (5, 16)	.148

[a] Data are presented as frequency and percent unless otherwise noted.
[b] Participants could select all that apply.
[c] 20 of 49 participants reported monthly income.
[d] Due to data distribution, the median, 25% and 75% are presented.

time was 30 minutes. Interview transcripts were transcribed verbatim and translated to English by a bilingual team member (T.N.) for qualitative analysis. The transcripts were then stripped of any protected health information and coded. The accelerometers were collected and checked to ensure data were recorded for at least four valid wear days, defined as least 10 hours of wear time per day (Webel et al., 2019). Fifty-five participants (93%) met these wear time criteria. Moderate-to-vigorous physical activity was defined as activity of at least 2,690 counts/min for a minimum of 10 consecutive minutes (Migueles et al., 2017). ActiLife software was used to calculate the amount of physical activity per valid wear day using the adult cutpoints for tri-axial accelerometers proposed by Sasaki et al. 2011 (Webel et al., 2019).

Table 2: Health Characteristics by HIV Status and Gender[a]

	People Living With HIV		People Living Without HIV		
	Female (n = 19)	Male (n = 11)	Female (n = 21)	Male (n = 8)	Difference Between People Living With HIV and Those Without HIV[b]
Other comorbidity (%)					
Cardiovascular disease	0 (0)	1 (9)	1 (5)	0 (0)	0.98
Diabetes mellitus	3 (16)	4 (36)	7 (33)	4 (50)	0.22
Hypertension	18 (95)	9 (82)	19 (90)	6 (75)	0.65
High cholesterol	1 (5)	1 (9)	1 (5)	3 (38)	0.37
Chronic kidney disease	0 (0)	1 (9)	0 (0)	0 (0)	0.32
Tuberculosis	3 (16)	3 (27)	0 (0)	0 (0)	0.01
	Median (25% and 75%)		Median (25% and 75%)		
Median BMI (kg/m^2)[c]	29.5 (26.4, 32.3)	24.6 (22.7, 26.2)	31.3 (29.8, 33.9)	30.2 (26.2, 31.0)	0.02
Median waist circumference (inches)[c]	96.7 (91.5, 100.5)	94.0 (85.5, 99)	97.5 (94, 104.5)	106.6 (102, 106)	0.11
Median waist-to-hip ratio[c]	0.89 (0.85, 0.93)	0.98 (0.93, 1.01)	0.87 (0.83, 0.90)	0.97 (0.94, 0.98)	0.26

Note. BMI = body mass index.
[a] Data are presented as frequency and percent unless otherwise noted.
[b] Categorical variables were analyzed using chi-square tests and continuous variables were analyzed using t-tests.
[c] Due to data distribution, the median, 25% and 75% are presented.

Data Analysis

Quantitative data describing the demographic and medical characteristics and physical activity and dietary patterns were analyzed using descriptive statistics. Comparisons between PLWH and HIV-uninfected persons were made using chi-square tests for categorical variables and t-tests or for continuous variables. Interview transcripts, digital photographs, and videos were entered into Dedoose, a commercially available, secure data management program for qualitative data (SocioCultural Research Consultants, 2018). Data were analyzed using standard analytic techniques for qualitative data: identification of themes/domains, coding or classification of participants' responses by these themes/domains performed independently by two team members (J.H. and C.H.W.) who have graduate-level training in qualitative coding, and resolution of any coding discrepancies by a third team member (A.W.). Demographic and medical data were used to describe the sample.

The qualitative data coding team used the domains of the Social Ecological Model to inform the development of the preliminary codes for analysis. Byrman's coding approach (Bryman, 2006) guided the coding process, and after agreeing on the basic coding framework, the coders initially coded 10% of the transcripts. This provided interpreter reliability and ensured coders became familiar with the coding software. Codes were then applied to the transcripts, photographs, and videos in monothematic chunks with a focus on overall ideas and themes. Multiple codes could be applied to the same section if appropriate. The same codebook was used for photographs, videos, and interview transcripts. Coders reviewed the transcript, photographs, and video to give a context of the interview and then consecutively coded each media source.

Inductive codes could be proposed and applied to the data if they were agreed on by the entire coding team. When coding was complete, the coders met to review their codes, memos, and insights from the process. Atypical aspects of interviews were also reviewed for consistency. The coders used this process to identify common themes and anomalies within the transcripts. To assure transferability, study outcomes were presented to a Community Advisory Board in Uganda so they could offer feedback on whether the themes resonated within the

Table 3. HIV Characteristics by Gender

	Female (n = 19)	Male (n = 11)	All Participants (n = 30)
Mean time since HIV diagnosis (years)	15.53	15.73	15.6
Median current CD^{4+} T-cell count (25%, 75%)	705 (498, 810)	466 (371, 537)	566 (400, 756)
Currently taking HIV antiretroviral therapy (%)	19 (100)	11 (100)	30 (100)
Undetectable HIV viral load (%)	17 (89)	10 (91)	27 (90)

local context. A final codebook of themes, definitions, and exemplar codes was created to aid analysis. Data were coded and analyzed using Dedoose v 8.0.35 (Los Angeles, CA; SocioCultural Research Consultants, 2018). Data saturation was obtained for all themes. Study procedures are presented consistent with the Good Reporting of a Mixed Methods Study standards (O'Cathain et al., 2008).

Results

Thirty PLWH and 29 adults without HIV were enrolled. On average, participants were 58 (±7) years old, female (n = 40; 68%), owned housing (n = 54, 92%), and owned land (n = 53; 59%). The majority of participants grew their own produce (n = 38; 65%), whereas less than half of the participants owned livestock (n = 21; 36%; Table 1). The average BMI for PLWH was 27.41 kg/m^2 and for those without HIV infection BMI was 32.0 kg/m^2 ($p < .05$; Table 2). Participants had been living with HIV on average 15.6 years, and over 90% had an undetectable HIV viral load (n = 27; Table 3).

There were no significant differences in rates of comorbid chronic diseases between groups except for tuberculosis ($p < .05$), and hypertension was the most common comorbidity among all participants (Table 2). Approximately 20% of the PLWH compared with 40% of the HIV-negative cohort met recommended weekly physical activity guidelines of 150 minutes of moderate physical activity per week ($p > .05$; WHO, 2011). On average, those without HIV infection engaged in similar amounts of minutes of light physical activity and moderate-to-vigorous physical activity compared with those with HIV ($p > .05$). The 6MWT distance was also similar between both groups ($p > .05$; Table 4).

Several key major themes emerged from the qualitative data, including diverse types and meaning of exercise, barriers to exercising, and dietary intake patterns.

Participants Engage in Diverse Types and Meaning of Exercise

Common types of exercise observed among all participants were stretching, walking, aerobic exercise, and at-home weights. The digital images revealed that physical activity consisted of low-intensity activities, often activities of daily living. Yet although the activity intensity was low, there was more physical activity due to high rates of farming and procuring needed resources; often everyday activities involved physical exercise such as collecting water for the day. One male participant with HIV mentioned, "it had just stopped raining and I was collecting water…because the water is deep in the tank, so I would have to bend to collect and then straighten to pour it out in the jerry can…I personally carry two jerry cans at once to take them inside the house. That's another form of exercise in itself; carrying two jerry cans into the house."

Exercise, intentional activity designed to increase physical fitness, was often done in the morning and evening at a duration of less than 15 minutes. One female participant with HIV described motivation for exercising in the morning, stating "my appeal to people out there is that they shouldn't just try but actually do physical exercises because every time you do them, you sweat. When you sweat and go to the bathroom and bathe, you will spend the entire day fresh." Study participants engaged in more outdoor physical activities (Figure 1). Gender differences in physical activity were observed with women engaging in more physical activity related to activities of daily living, whereas men engaged in more intentional exercise. Although the quantitative data suggest a trend toward PLWH engaging in less physical activity (p = .13), we did not observe any differences in the qualitative data pertaining to meaning, value, and patterns of physical activity and exercise by HIV status.

Improving or maintaining health was the primary reason for engaging in exercise. As illustrated by one female participant without HIV, "exercise is the best thing you can have because you know you are making yourself

Table 4. Physical Fitness by HIV Status and Gender[a]

	People Living With HIV Frequency (%)[a]		People Living Without HIV Frequency (%)[a]		Difference (*p*-Value) Between People Living With HIV and Those Without HIV[b]
	Female (*n* = 19)	Male (*n* = 11)	Female (*n* = 21)	Male (*n* = 8)	
Participants meeting WHO/DHHS weekly physical activity guidelines (%)	3 (16)	3 (27)	7 (33)	4 (50)	0.13
Median minutes of light physical activity in the past week (Q1, Q3)	870 (697, 1296)	728 (520, 1112)	1041 (733, 1234)	659 (465, 923)	0.629
Median minutes of moderate-to-vigorous physical activity in the past week (Q1, Q3)	15.4 (0, 47)	19 (0, 128)	12 (0, 43)	0 (0, 19)	0.22
Median steps per day (Q1, Q3)	4365 (2818, 7376)	5813 (5113, 7078)	4345 (3304, 7381)	3714 (3636,4964)	0.32
Distance on the 6-min walk test (m)	421 (397, 438)	441 (406, 488)	413 (371, 450)	463 (434, 508)	0.96
Age- and Gender-predicted distance (m)	2504 (2342, 2539)	2673 (2510, 2772)	2380 (2316, 2472)	2713 (2531, 2780)	Female: 0.06 Male: 0.27
% achieved of predicted 6-min walk test	37.0 (35, 40)	17.1 (15, 18)	37.7 (34, 41)	17.7 (16, 18)	Female: 0.44 Male: 0.56
Median hand grip strength (kg) (25, 75)	22.0 (18, 26)	29.0 (22, 38)	23.0 (18, 32)	35.0 (36, 31)	Female: 0.22 Male: 0.58

Note. WHO = World Health Organization; DHHS = US Department of Health and Human Services.
[a] Data are presented as frequency and percent unless otherwise noted.
[b] Categorical variables were analyzed using chi-square tests, and continuous variables were analyzed using *t*-tests.

healthy. It is a preventive thing; you get healthy, you strengthen your heart, you lose weight and also you become very healthy." Another female participant with HIV summed up the need to exercise and reduce sedentary time, with "if you don't sit, you benefit," whereas a different participant expressed the importance to keep moving with "the position in which you make your bones used to is how they will permanently be." A male participant living with HIV described that when first starting HIV antiretroviral therapy, the participant went to a counselor who explained that "the most important thing with HIV is having a good diet and maintaining your body to do important things to prevent you from getting weak. One of the things [the counselor] told me is that this virus has cells that it destroys in the body, which enables illnesses to attack you which then leaves you unhealthy."

Contextual Barriers to Exercise

The common exercise barriers were a lack of time, expense, and safety concerns, which were not specific to HIV status. Concerns of safety often manifested as an explanation for limited outdoor exercise. One male participant with HIV described fear of crime as a primary reason for not exercising outside: "Recently, I had an experience. I usually go to my poultry and pig farm around 8:00 p.m. and then come back at around 10:00, so while returning home armed thugs took my phone [and] the car." This sentiment was echoed by others indicating threats to safety as the reasons for not going outdoors to exercise. Our qualitative data did not suggest any specific barriers unique to PLWH that would explain the differences in physical activity observed in the actigraph data.

Typical Dietary Intake Patterns

A typical diet consisted of three meals per day where lunch was the largest meal. Food choices were determined by what was available and certain foods were not necessarily planned for specific meals. Participants

Figure 1. Diverse types and meanings of exercise. This figure is available in color online www.janacnet.org.

expressed a desire to have reason behind what they eat, "it would be nice to have a purpose while preparing your food; what you eat must have nutrients instead of eating whatever you [find]" stated a male living with HIV. The main diet was uniform and homegrown, consisting of matoke [a type of banana] and sweet potato (Figure 2). One male participant with HIV described the food recommended for a diabetic person, "The best food for you as a diabetic is greens, vegetables, and fish. Chicken without the skin is okay, once in a while. Meat, I would not advise." Most meals consisted of minimal meat, although when present, it was most often chicken or fish. Another male PLWH explained that a counselor recommended, "to try to have a good diet and eat on time, which will help reduce side effects from the medicine."

Data Verification

To establish credibility and transferability of the findings, all data were presented to a local Community Advisory Board (CAB) to elicit feedback on whether the themes were culturally relevant. The CAB consisted of 10 members, 80% women, all laypersons without training in health care, half of whom were PLWH. A number of themes in the photographs (with blurred faces), interviews, and quantitative data needed further verification, including typical exercise in Uganda, meals provided at work, traditional Ugandan diets, motivations for exercising, religion affecting diet and exercise, and the typical setting to eat a meal. When asked whether the sample was representative of the general population, the study staff responded that people living in urban settings were more willing to participate and that this sample is representative of a wealthier Ugandan demographic. The CAB expressed that, in general, PLWH are likely to be more informed about their health than the general population.

There was a discrepancy when the CAB was asked about the participants' answers that they engaged in exercise to "be healthier" rather than to lose weight. Some CAB members suggested the focus on health benefits from exercise was an emerging trend, whereas others commented that weight loss for aesthetic reasons was more commonly the goal, especially among women. When asked about one participant's statement, if you "don't sit, you benefit," the CAB response was the person likely meant that you need to keep active and keep moving.

To help verify the types of physical activities typical of this population, we showed the CAB photographs of participants exercising. They indicated that skipping rope is common. One CAB member expressed that they had been told about the benefits of "skipping" since

Figure 2. Typical dietary patterns and intake. This figure is available in color online www.janacnet.org.

childhood. Weight-lifting was explained to be not common among women because they do not want to gain muscle mass. Men are more likely to lift weights. Exercise equipment at home was suggested to be uncommon among the general population.

Examples of photographs of food taken by study participants were shown to the CAB members who agreed that these photographs represented a typical Ugandan meal. Consistent with our data, they indicated that overall people strive to incorporate a vegetable, starch, and protein into most meals. Yet proteins are eaten less due to cost and a common belief that meat is less healthy. A common phrase used by the CAB was "to eat health is to not eat meat." When asked whether people were more likely to eat fast food (i.e., "street food"—samosas, chapatti) or traditional Ugandan food, the response was in general, fast food is more expensive ($3–4 for fast food compared with $1 for local food). When asked why there were limited pictures of meals at a table, the response was that it likely depended on the culture and upbringing. Sitting on a floor mat is traditional and sitting anywhere there is room, including on/in beds is not uncommon. The CAB was asked about meals at the workplace and indicated that food vendors were a common practice among businesses to improve worker efficiency. Taking time to walk to and wait for lunch offsite can be time-consuming, so some employers prefer offering food vendors.

Discussion

Our objective was to describe and compare the meaning, value, and patterns of physical activity, exercise, and diet in older Ugandans with and without HIV. Given the significant and growing population of PLWH in Uganda, understanding these factors has the potential to affect CVD prevention in a critical low-resource setting. If locally tailored, patient-centered CVD prevention and treatment strategies can be identified for the PLWH in Uganda, there is a higher likelihood of adherence to this treatment. Our findings on the types and meaning of physical activity, barriers to engaging in physical activity in low-resource settings, and dietary patterns can help us better understand cardiovascular health in this population, identify potential prevention methods, and help guide future public health and nursing interventions.

Greater understanding of the meaning of physical activity and exercise can inform the development of programs to encourage healthy living. Our qualitative data suggested that the participants exercised because it can improve their health; however, the recorded activity levels did not reflect this understanding. Phrases such as, "if you don't sit, you benefit" were common in participant interviews, yet the majority of study participants in both groups did not meet WHO/U.S. Department of Health and Human Services weekly physical activity guidelines. Vancampfort et al. (2018) reviewed physical activity levels globally among PLWH and found that approximately half of PLWH met the physical activity guidelines of 150 minutes of moderate physical activity per week and walked an average of 5,798 steps per day (Vancampfort et al., 2018). These data are consistent with our findings, suggesting that the lower levels of physical activity among PLWH are not unique to older Ugandans alone. There were no differences between the median minutes of light physical activity,

moderate-to-vigorous physical activity, or median steps per day by HIV status. As suggested by the CAB, this may have been due to the higher socioeconomic status of our participants living with HIV, which has been observed in other settings and populations (Cascino et al., 2019; Medeiros et al., 2017). Although participants performed a range of exercises, including aerobic exercise, light exercise, strength training, and stretching, the average duration of exercise at any given time was less than 15 minutes, which shows that duration of activity is likely the reason participants did not meet physical activity guidelines. Contextually appropriate interventions aimed at increasing the duration of this ongoing physical activity may help to reduce cardiovascular risk.

We explored potential barriers that could prevent individuals from being physically active, including time, expense, and safety concerns. More participants exercised outdoors despite commonly expressed concerns of safety limiting outdoor exercise. Few participants mentioned using equipment during exercise, which could be due to lack of funds to allocate toward exercise or lack of interest in using equipment. We saw examples of participants creating their own, inexpensive exercise equipment. Vancampfort et al., 2018, considered predictors of dropping out of physical activity and recommended that qualified exercise professionals be incorporated as key members of the health care team. One way to address the identified barriers could be for nurses caring for PLWH to educate participants on effective methods for exercising when one has limited time and to identify methods to create less expensive, homemade exercise equipment for indoor exercising.

Many participants understood the importance of a healthy diet but lacked diversity in their daily diet. Although many participants never had a family member go hungry, what determined their food choices was availability of food with limited meal planning. A majority of participants grew produce for themselves or for others with diets consisting mainly of matoke and sweet potato. Providing individuals with the necessary information and training to grow a wider variety of produce may increase the likelihood of people increasing variety in their diets. Additional foods high in fiber, lean protein, and other nutrients could reduce their cardiovascular risk. There was little indication that fast food or Western diet foods were commonly consumed. The CAB noted this may be due to the higher expense of fast food compared with local food. This supports interventions focused on increasing the accessibility of a variety of high-nutrient, local foods.

Limitations

Our study's novel findings should be considered in the context of some limitations. First, interviewers occasionally provided education during the interview process when a participant had limited or inaccurate health knowledge. This education may have affected the participants' responses to interview questions. Additionally, due to limited resources, we were unable to dual code each transcript and photograph to confirm reliability of coding, which is a threat to the confirmability of findings. Instead, we dual coded 10% of the media to ensure a consistent coding approach was used by each member of the study team. It would also have been helpful to have time-stamped photographs so that we could triangulate the accelerometer data with the pictures of diet and activity. Instead, overall levels of activity and the summation of the digital photographs were used to give a detailed picture of the context of diet and activity. Finally, the study took place in an urban setting with potentially higher income participants, and these data may not fully capture the experience of more rural or lower income Ugandans. We did not intentionally select a wealthier Ugandan sample and, due to less than half of participants reporting yearly income, the collective income level could not be determined. However, by living in an urban setting, this population has greater access to medical care, jobs, and resources than the rural populations.

Conclusion

Aging with HIV is a dynamic process. A better understanding of the physical activity, exercise, and diet of the older Ugandan population can help guide treatment goals and plans. These results have the potential to inform interventions to improve chronic care management for a vulnerable segment of the Ugandan population. To help stem the rising tide of CVD around the globe, future work should rigorously and richly explore these relationships in younger populations and in more geographic areas in low-resource settings.

Disclosures

The authors report no real or perceived vested interests related to this article that could be construed as a conflict of interest. As with all peer reviewed manuscripts published in *JANAC*, this article was reviewed by two impartial reviewers in a double-blind review process. *JANAC's* Editor-in-Chief managed the review process for the paper, and the Associate Editor, Allison Webel, had no access to the paper in her role as an editor or reviewer.

Author Contributions

All authors have made substantial contributions to this manuscript, have approved the final version, and have agreed to be accountable for the work and be named as an author; as such they all meet the ICJME criteria for authorship. These are detailed below. C. H. Wright contributed in the acquisition, analysis, and interpretation of the results. She obtained funding for this work, drafted the manuscript, and approved the final version of this manuscript. C. T. Longenecker contributed to the design and acquisition of this work; contributed to the drafting of the manuscript and approved the final version of this manuscript. R. Nazzindah contributed in the acquisition and analysis of data; contributed to the drafting of the manuscript and approved the final version of this manuscript. C. Kityo contributed in the acquisition and analysis of data; contributed to the drafting of the manuscript and approved the final version of this manuscript. T. Najjuuko contributed in the acquisition and analysis of data; contributed to the drafting of the manuscript and approved the final version of this manuscript. K. Taylor contributed in the analysis and interpretation of data; contributed to the drafting of the manuscript and approved the final version of this manuscript. C. R. Rentrope contributed in the analysis and interpretation of data; contributed to the drafting of the manuscript and approved of the final version of this manuscript. A. R.Webel contributed to the design and interpretation of this manuscript. She drafted and revised the manuscript and approved the final version of this work.

Acknowledgments

The authors wish to acknowledge the participants of this study who gave so generously of their time; the entire staff at the Joint Clinical Research Unit; and Jan E Hanson (JEH) whose expertise in coding was instrumental in completing this study.

Key Considerations

- ❍ Aging adults with HIV in Uganda are at high risk for CVD but face barriers to meeting physical activity and diet recommendations.
- ❍ Integrating photovoice methods with quantitative data allowed us to more fully understand these challenges and identify precise intervention targets.
- ❍ There were no differences in physical activity and diet patterns in older Ugandans by HIV status.

References

Alencherry, B., Erem, G., Mirembe, G., Ssinabulya, I., Yun, C. H., Hung, C. L., Siedner, M. J., Bittencourt, M., Kityo, C., McComsey, G. A., Longenecker, C. T. (2019). Coronary artery calcium, HIV and inflammation in Uganda compared with the USA. *Orvosi Hetilap*, *6*(1), e001046. doi:10.1136/openhrt-2019-001046

Autenrieth, C. S., Beck, E. J., Stelzle, D., Mallouris, C., Mahy, M., & Ghys, P. (2018). Global and regional trends of people living with HIV aged 50 and over: Estimates and projections for 2000-2020. *PLos One*, *13*(11), e0207005. doi:10.1371/journal.pone.0207005

Bronfenbrenner, U. (1993). Ecological models of human development. *Readings on the development of children*, 4th edition (Gauvain & Cole, editors), 37-43.

Bryman, A. (2006). Integrating quantitative and qualitative research: How is it done? *Qualitative Research*, *6*(1), 97-113. doi: 10.1177/1468794106058877

Cascino, T., Ashur, C., Richardson, C., Jackson, E., & McLaughlin, V. (2019). Lower socioeconomic status associated with decreased completion of exercise rehabilitation in patients with pulmonary hypertension. *The Journal of Heart and Lung Transplantation*, *38*(4, suppl), S493. doi: 10.1016/j.healun.2019.01.1255

Caspersen, C. J., Powell, K. E., & Christenson, G. M. (1985). Physical activity, exercise, and physical fitness: Definitions and distinctions for health-related research. *Public Health Reports*, *100*(2), 126.

Chen, M. J., Fan, X., Moe, S. T. (2002). Criterion-related validity of the Borg ratings of perceived exertion scale in healthy individuals: A meta-analysis. *Journal of Sports Sciences*, *20*(11), 873-899. doi: 10.1080/026404102320761787

Crapo, R. O., C. R., Coates, A. L., Enright, P. L.,, & MacIntyre, N. R., McKay, R. T., Johnson, D., Wanger, J. S., Zeballos, R. J., Bittner, V. & Mottram, C. (2002). ATS statement: Guidelines for the six-minute walk test. *Journal of Respiratory and Critical Care*, *166*(1), 111-117

Feinstein, M. J., Hsue, P. Y., Benjamin, L. A., Bloomfield, G. S., Currier, J. S., Freiberg, M. S., Grinspoon, S. K., Levin, J., Longenecker, C. T., & Post, W. S. (2019). Characteristics, prevention, and management of cardiovascular disease in people living with HIV: A scientific statement from the American Heart Association. *Circulation*, *140*(2), e98–e124. doi: 10.1161/CIR.0000000000000695

Migueles, J. H., Cadenas-Sanchez, C., Ekelund, U., Delisle Nyström, C., Mora-Gonzalez, J., Löf, M., Labayen, I., Ruiz, J. R., Ortega, F. B. (2017). Accelerometer data collection and processing criteria to assess physical activity and other outcomes: A systematic review and practical considerations. *Sports Medicine*, *47*(9), 1821-1845. doi: 10.1007/s40279-017-0716-0

Freiberg, M. S., Chang, C. C., Kuller, L. H., Skanderson, M., Lowy, E., Kraemer, K. L., Butt, A. A., Bidwell Goetz, M., Leaf, D., Oursler, K. A., Rimland, D., Rodriguez Barradas, M., Brown, S., Gibert, C., McGinnis, K., Crothers, K., Sico, J., Crane, H., Warner, A., Gottlieb, S., … Justice, A. C. (2013). HIV infection and the risk of acute myocardial infarction. *JAMA Internal Medicine*, *173*(8), 614-622. doi: 10.1001/jamainternmed.2013.3728

Huck, D. M., Nalubwama, H., Longenecker, C. T., Frank, S. H., Okello, E., & Webel, A. R. (2015). A qualitative examination of secondary prophylaxis in rheumatic heart disease: Factors influencing adherence to secondary prophylaxis in Uganda. *Global Heart*, *10*(1), 63-69. e61. doi: 10.1016/j.gheart.2014.10.001

Lloyd-Jones, D. M., Wilson, P. W., Larson, M. G., Beiser, A., Leip, E. P., D'Agostino, R. B., & Levy, D. (2004). Framingham risk score and prediction of lifetime risk for coronary heart disease. *The American Journal of Cardiology*, *94*(1), 20-24. doi: 10.1016/j.amjcard.2004.03.023

Lorenc, A., Ananthavarathan, P., Lorigan, J., Jowata, M., Brook, G., & Banarsee, R. (2014). The prevalence of comorbidities among people living with HIV in Brent: A diverse London Borough. *London Journal of Primary Care*, *6*(4), 84-90. doi: 10.1080/17571472.2014.11493422.

Medeiros, R., Medeiros, J. A., Silva, T., Andrade, R. D., Medeiros, D. C., Araújo, J. S., Oliveira, A., Costa, M., & Dantas, P. (2017). Quality of

life, socioeconomic and clinical factors, and physical exercise in persons living with HIV/AIDS. *Revista de Saude Publica*, *51*, 66. doi: 10.1590/S1518-8787.2017051006266

Feinstein, M. J., Kim, J. H., Bibangambah, P., Sentongo, R., Martin, J. N., Tsai, A. C., Bangsberg, D. R., Hemphill, L., Triant, V. A., Boum, Y., II, Hunt, P. W., Okello, S., & Siedner, M. J. (2017). Ideal cardiovascular health and carotid atherosclerosis in a mixed cohort of HIV-infected and uninfected Ugandans. *AIDS Research and Human Retroviruses*, *33*(1), 49-56. doi: 10.1089/AID.2016.0104

O'Cathain, A., Murphy, E., & Nicholl, J. (2008). The quality of mixed methods studies in health services research. *Journal of Health Services Research & Policy*, *13*(2), 92-98. doi:10.1258/jhsrp.2007.007074

Oliveira, V. H. F., Perazzo, J. D., Josephson, R. A., Deminice, R., & Webel, A. R. (2018). Association between the 6-minute walk test distance and peak cardiorespiratory fitness among people living with hiv varies by fitness level. *The Journal of the Association of Nurses in AIDS Care*, *29*(5), 775-781. doi:10.1016/j.jana.2018.05.005

Sanchez, E. (2018). Life's simple 7: Vital but not easy. *Journal of the American Heart Association Electronic Resource*, *7*(11), e009324. doi: 10.1161/JAHA.118.009324

Sasaki, J. E., John, D., & Freedson, P. S. (2011). Validation and comparison of ActiGraph activity monitors. *Journal of Science and Medicine in Sport*, *14*(5), 411-416. doi: 10.1016/j.jsams.2011.04.003

Shah, A., Stelzle, D., Lee, K. K., Beck, E. J., Alam, S., Clifford, S., Longenecker, C. T., Strachan, F., Bagchi, S., Whiteley, W., Rajagopalan, S., Kottilil, S., Nair, H., Newby, D. E., McAllister, D. A., & Mills, N. L. (2018). Global burden of atherosclerotic cardiovascular disease in people living with HIV: Systematic review and meta-analysis. *Circulation*, *138*(11), 1100-1112. doi: 10.1161/CIRCULATIONAHA.117.033369

SocioCultural Research Consultants, L. (2018). *Dedoose Version 8.0.35, web application for managing, analyzing, and presenting qualitative and mixed method research data*. Los Angeles, CA: SocioCultural Research Consultants, LLC. www.dedoose.com.

Vancampfort, D., Mugisha, J., De Hert, M., Probst, M., Firth, J., Gorczynski, P., & Stubbs, B. (2018). Global physical activity levels among people living with HIV: A systematic review and meta-analysis. *Disability and Rehabilitation*, *40*(4), 388-397. doi: 10.1080/09638288.2016.1260645

Wang, C., & Burris, M. A. (1997). Photovoice: Concept, methodology, and use for participatory needs assessment. *Health Education & Behavior*, *24*(3), 369-387. doi: 10.1177/109019819702400309

Webel, A. R., Jenkins, T., Vest, M., Oliveira, V., Longenecker, C. T., Liu, J., Currie, J., Sattar, A., & Josephson, R. (2019). Cardiorespiratory fitness is associated with inflammation and physical activity in HIV+ adults. *AIDS (London, England)*, *33*(6), 1023-1030. doi: 10.1097/QAD.0000000000002154

Wong, C., Gange, S. J., Moore, R. D., Justice, A. C., Buchacz, K., Abraham, A. G., Rebeiro, P. F., Koethe, J. R., Martin, J. N., Horberg, M. A., Boyd, C. M., Kitahata, M. M., Crane, H. M., Gebo, K. A., Gill, M. J., Silverberg, M. J., Palella, F. J., Patel, P., Samji, H., Thorne, J.; North American AIDS Cohort Collaboration on Research and Design (NA-ACCORD) (2018). Multimorbidity among persons living with human immunodeficiency virus in the United States. *Clinical Infectious Diseases*, *66*(8), 1230-1238. doi: 10.1093/cid/cix998

World Health Organization. (2011). *Global Recommendations on Physical Activity for Health*. https://www.who.int/dietphysicalactivity/physical-activity-recommendations-18-64years.pdf?ua=1

World Health Organization. (2016). *Life expectancy and Healthly Life Expectancy: Data by country*. https://apps.who.int/gho/data/view.main.SDG2016LEXv?lang=en

DOI: 10.1097/JNC.0000000000000282