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Sex Differences in the Prevalence of Geriatric Syndromes Among Older People Living with HIV Attending an Urban Outpatient Clinic in Kampala, Uganda

Phoebe Mbabazi[1], Grace Banturaki[1], Suzan Naikoba[1], Esther M Nasuuna[1], Yukari C Manabe[1,2], Meredith Greene[3], Barbara Castelnuovo[1]

[1]Research Department, Infectious Disease Institute, College of Health Sciences, Makerere University, Kampala, Uganda; [2]Division of Infectious Diseases, Department of Medicine, John Hopkins University, Baltimore, MD, USA; [3]Division of General Internal Medicine & Geriatrics, Indiana University School of Medicine, Indianapolis, Indiana, USA

Correspondence: Phoebe Mbabazi, Infectious Disease Institute, College of Health Sciences, Makerere University, P.O.box 22418, Kampala, Uganda, Email pmbabazi@idi.co.ug

Background: Older people living with HIV (PLHIV) are at high risk of developing geriatric syndromes. Data on geriatric syndromes among older PLHIV in sub-Saharan Africa are scarce. We examined sex differences in the prevalence and correlates of geriatric syndromes among PLHIV aged ≥60 years on antiretroviral therapy in Kampala, Uganda.

Methods: This cross-sectional study analyzed data obtained during the enrollment of older PLHIV into a prospective observational cohort in Kampala. We used the Poisson regression model to explore the association between the number of geriatric syndromes and non-communicable diseases (NCDs), sociodemographic factors, and HIV-related factors.

Results: We included 500 participants (48.8% women) with a median age of 64 years (interquartile range, IQR: 62.68). Almost all (94.4%) participants had at least one geriatric syndrome. More women were frail (13.1% vs 5.1%, P-value = 0.01) and had lower physical performance measured using the Short Physical Performance Battery (43.3% vs 26.6%, P-value < 0.01). Similarly, more women had cognitive impairment (83.2% vs 62.9%, P-value < 0.01) and reported falling (48.8% vs 34.0%, P-value < 0.01). Women (adjusted mean ratio, AMR 1.17, 95% CI 1.05–1.30, P-value < 0.01), older age (AMR 1.11, 95% CI 1.07–1.16, P-value < 0.01), no formal education (AMR 1.39, 95% CI 1.06–1.82, P-value = 0.01), underweight (AMR 1.49, 95% CI 1.26–1.76, P-value < 0.01), World Health Organization (WHO) stage 3 or 4 (AMR 1.11, 95% CI 0.01–1.22, P-value = 0.04) and having two or more NCDs (AMR 1.11, 95% CI 1.00–1.23, P-value = 0.04) were associated with a higher number of geriatric syndromes.

Conclusion: The prevalence of geriatric syndromes was high among older PLHIV and was more common in women. There is a need to incorporate the screening and management of geriatric syndromes into the care of older PLHIV in sub-Saharan Africa, with a particular focus on women.

Keywords: geriatric syndromes, HIV, older adults, sub-Saharan Africa

Introduction

Sub-Saharan Africa (SSA) is experiencing a steep increase in the number of older people living with HIV (PLHIV) because of the expansion of antiretroviral therapy (ART).[1] Older PLHIV are at a higher risk of developing age-related conditions, such as non-communicable diseases (NCDs)[2,3] and geriatric syndromes,[4,5] compared to those without HIV. Geriatric syndromes, such as frailty, falls, and cognitive impairment, are common in older persons and are multifactorial in origin with shared risk factors.[6,7] Geriatric syndromes greatly affect the morbidity, mortality, and quality of life of older PLHIV.[8,9] Despite this, NCDs and other non-HIV age-related conditions among PLHIV in SSA are underrecognized due to a lack of screening.[10,11]

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Although some reports from sub-Saharan Africa have described geriatric syndromes in the general population,[12,13] data on older PLHIV in SSA are scarce.[14,15] Most information on geriatric syndromes among PLHIV is from predominantly male participants in high-income countries.[4,16,17] The prevalence and correlates of geriatric syndromes in PLHIV in our setting may differ from those described elsewhere due to differences in genetic and environmental factors. In addition, there may be sex differences in the prevalence and risk factors of geriatric syndromes. Women with HIV may be more susceptible to age-related conditions than men, partly because of higher levels of residual inflammation.[18] In a study conducted among older persons with and without HIV in Uganda, men reported better health and functional status and a lower prevalence of chronic diseases than women.[19] We recently reported that geriatric syndromes were associated with a lower quality of life for older PLHIV in Kampala, and women expressed poorer quality of life than men.[9] To expand on that work, we studied sex differences in the prevalence and correlates of geriatric syndromes among older people living with HIV aged ≥60 in Kampala, Uganda. We hypothesized that women would have a higher prevalence of geriatric syndromes than men.

Materials and Methods

Study Setting and Design

The study was conducted at the adult HIV Clinic of the Infectious Diseases Institute (IDI), in Kampala, Uganda, which has been a center of excellence for HIV care and treatment since 2004.[20] We performed a cross-sectional analysis of data obtained during the enrollment of participants into a prospective observational cohort called Diagnosis and Treatment of NCDs and Geriatric Syndromes in the HIV Aging Population in Sub-Saharan Africa (HASA). The HASA cohort was set up to describe NCDs and geriatric syndromes and their risk factors in older PLHIV in Uganda.

Sample Size and Sampling Approach

The HASA cohort enrolled 500 participants aged ≥60 (the United Nations definition of older persons which Uganda adopted)[21] between December 2020 and December 2021. PLHIV aged ≥60 years, on ART, and willing to participate were considered eligible for the study. These participants were consecutively approached and informed about the study by the study nurse upon entering the IDI clinic for routine care.

The sample size for the HASA cohort was based on the projected number of persons aged ≥60 in the IDI clinic and no formal sample size calculations were made. For this sub-study, we considered all the 500 cohort participants. This sample size was adequate to detect a difference in the outcomes of interest such as frailty in males and females at a power of > 80%.

Study Procedures

A trained study nurse and physician performed all study procedures. Participants were interviewed for a detailed medical history and physical examination. We collected data on sociodemographic factors, economic status, comorbidities, medications, HIV history, past or present history of smoking, and alcohol intake. Comorbidities of interest included hypertension, diabetes mellitus, arthritis, cancer, and renal impairment (defined as an estimated glomerular filtration rate (GFR) <60mL/min/1.73m^2 using the chronic kidney disease (CKD) Epidemiology Collaboration 2009 equation).[22]

Medication history was obtained via self-reporting of over-the-counter and herbal drugs, whereas prescription drugs were validated using the clinic database. HIV history included the World Health Organization (WHO) stage, pre-ART CD4 count, ART duration, and past and present ART regimens. Laboratory tests were performed at the IDI Core Laboratory, which is certified by the College of American Pathologists. They included CD4 count measured using BD FACS Calibur (Becton Dickinson, CA, USA), HIV viral load measured using COBAS TaqMan (Roche, Germany), serum creatinine, and urine dipstick.

Evaluation of Geriatric Syndromes

Participants were screened for functional impairment, frailty, cognitive impairment, falls, depression, urinary incontinence and nutrition.

Functional impairment was measured in two ways; by objectively measuring lower extremity physical performance using the Short Physical Performance Battery (SPPB) and self-reported instrumental activities of daily living (IADL).

The SPPB measures balance, gait speed, and chair stands,[23] with a score of 0–9 considered low physical performance, and 10–12 high physical performance.

IADL were measured using the Lawton scale, which explores eight domains.[24] Participants with a score <8 were considered to have an impairment in IADL.

Frailty was assessed using the frailty phenotype proposed by Fried et al, which includes five parameters,[25] with a modification for physical activity, as has been done in other studies.[26,27]

1) Involuntary weight loss, defined as self-reported unintentional weight loss ≥4.5kg or documented weight loss ≥5% in the year.

2) Weakness was assessed using hand grip strength measured using a Jamar Plus Digital Hand dynamometer. The mean of three measurements obtained using the dominant hand was used, and the results were categorized using sex- and body mass index-specific cutoffs.

3) Self-reported exhaustion, assessed using two items from the Center for Epidemiological Studies Depression Scale (CES-D) scale:[28] *1. During the last week, how often have you felt that everything was an effort? 2. During the last week, how often have you felt that you could not* "get going"*?*

We considered participants to have exhaustion if they answered "occasionally or a moderate amount of the time" (3–4 days) or "most or all of the time" (5–7 days) to at least one of the two questions.

4) Low physical activity was considered for participants reporting "Limited a lot" when asked whether their health limited vigorous activities such as lifting heavy things, running, and strenuous work.

5) Slowness was measured as the time taken by participants to walk a distance of 4.57 meters at their normal pace. The average of two consecutive measurements was used, and the result was determined according to sex- and height-specific cutoffs.

Participants with ≥3 criteria were considered frail; 1 or 2 criteria were pre-frail, and no criteria were non-frail.

Cognitive impairment was measured using the Montreal Cognitive Assessment (MoCA), which assesses attention and concentration, executive functions, memory, language, visuoconstructional skills, conceptual thinking, calculations, and orientation, with the addition of 1 point if ≤ 12 years of education.[29] We considered participants with a score < 24 (lowered from 26) to have cognitive impairment to account for cultural differences, as recommended by a validation study conducted in South Africa.[30]

Falls were measured using the History of Falls Questionnaire, a standardized 17-item survey that includes activities before falling, perceived causes, environmental factors, and injuries sustained. Fallers were considered as those with ≥ 1 fall in the past 2 years.[31]

Depression screening was performed using the patient health questionnaires PHQ2 and PHQ9, which have been validated in Uganda.[32] The PHQ2 identifies individuals who require further screening with the PHQ9. We considered participants with minimal, mild, moderate, moderately severe, and severe depression to have depressive symptoms.

Urinary incontinence was measured by asking participants about the frequency, amount, and circumstances of leakage. Participants who reported a history of leaking urine (stress or urge incontinence or mixed) were considered to have urinary incontinence.

Nutrition was assessed using the Mini Nutritional Assessment (MNA), a 6-item short-form screening tool. For a score of ≤ 11, further assessment was done to gain a malnutrition indicator score categorized as normal (score 12–14), at risk of malnutrition (8–11), or malnourished (0–7).[33]

Data Analysis

Participants' characteristics were described using medians and interquartile ranges for continuous variables and frequencies for categorical variables. We compared the characteristics between men and women using the chi-square test for proportions of categorical variables and the Kruskal–Wallis test to compare the medians of continuous variables. To determine the frequencies of geriatric syndromes, we generated binary variables for each syndrome, that is; frail/ pre-frail versus non-frail, malnourished versus at risk of malnutrition/ normal nutrition, and normal versus abnormal physical performance by SPPB or IADL, and the presence or absence of cognitive impairment, falls, depression, and urinary incontinence.

The main outcome was the number of geriatric syndromes as done in previous reports.[4,34] We used the modified Poisson regression model to examine the association between the number of geriatric syndromes and baseline characteristics, which were selected a priori from the literature such as age, sex, and household income. Robust standard errors were used to override over- or under-dispersion under the Poisson assumption. Factors in the univariate models with P-value < 0.2 were included in the multivariate model. We tested for multi-collinearity in the models using the variance inflation factor (VIF), particularly for the SPPB score and IADL and found no multi-collinearity. We also explored the correlates of the number of geriatric syndromes stratified by gender by fitting an interaction model in which gender interacted with other covariates. Additionally, we carried out a sensitivity analysis to examine the correlates of having none and one versus multiple (ie ≥2) geriatric syndromes by fitting an ordinal logistic regression model. Analyses were performed using Stata version 16.0, and P-values < 0.05 were considered significant.

Ethical Considerations

This study was approved by the Research Ethics Committee of the Joint Clinical Research Center (Ref. JC 1319) and, the Uganda National Council for Science and Technology (Ref. HS454ES). Written informed consent was obtained from all participants prior to their enrollment in the study. All study methods were conducted in accordance with the ethical principles stated in the Declaration of Helsinki.

Results

We enrolled 500 participants, 48.8% women, with a median age of 64 years (interquartile range, IQR 62.68), and a median time on ART of 15 years (IQR 10.17) (Table 1). A higher proportion of women were overweight (58.6% vs 28.2%, P-value < 0.01) and had a higher median pre-ART CD4 cell count (223 vs 166 cells/μL, P-value < 0.01) and current CD4 T cell count than men (732 vs 554 cells/μL, P-value < 0.01). Additionally, more women earned <1 $/ day (43.2% vs 19.8%, P-value < 0.01) and had > 1 NCD than men (42.6% vs 29.3%, P-value < 0.01). On the other hand, more men reported current alcohol use (34.5% vs 21.3%, P-value = 0.01) and past or present tobacco use (40.9% vs 5.7%, P-value < 0.01).

Table 1 Characteristics of a Cohort of Older People with HIV in Kampala Stratified by Sex

Variables	All N = 500	Men N = 256	Women N = 244	P-value
Age in years, median (IQR)	64 (62, 68)	65 (62, 69)	63 (62, 67)	0.08
WHO stage III or IV, n (%)	240 (48.1)	134 (52.6)	106 (43.4)	0.04*
BMI (kg/m^2), n (%) <18.5 18.5–24.9 >25	28 (5.6) 254 (50.9) 217 (43.5)	18 (7.1) 165 (64.7) 72 (28.2)	10 (4.1) 91 (37.3) 143 (58.6)	<0.01*
Pre-ART CD4 in cells/ μL, Median (IQR)	191 (82, 350)	166 (63, 322)	223 (106, 383)	<0.01*
Current CD4 in cells/μL, Median (IQR)	645 (462, 850)	554 (424, 730)	732 (539, 961)	<0.01*
Time on ART in years, Median (IQR)	15 (10, 17)	15 (10, 17)	14 (10, 17)	0.25
ART, n % DTG-based PI-based NNRTI	356 (71.8) 72 (14.5) 68 (13.7)	184 (72.7) 34 (13.4) 35 (13.8)	172 (70.8) 38 (15.6) 33 (13.6)	0.79
Income < 1$/day ≥ 1$/day	154 (31.2) 340 (68.8)	50 (19.8) 203 (80.2)	104 (43.2) 137 (59.9)	<0.01*

(*Continued*)

Table 1 (Continued).

Variables	All N = 500	Men N = 256	Women N = 244	P-value
Education No Formal Education	17 (3.4)	5 (2.0)	12 (4.9)	<0.01*
Primary	211 (42.5)	86 (34.1)	125 (51.2)	
Secondary	171 (34.5)	90 (35.7)	81 (33.2)	
Technical/University	97 (19.6)	71 (28.2)	26 (10.7)	
Viral load <1000 copies/mL	496 (99.6)	254 (99.6)	242 (99.6)	1.00
<50 copies/mL	459 (92.2)	231 (90.6)	228 (93.8)	0.18
Co-medication Median (IQR)	2 (0, 2)	1.5 (0, 2)	2 (0, 2)	0.84
NCDs Diabetes	70 (14.0)	41 (16.1)	29 (11.9)	0.18
Hypertension	250 (50.1)	125 (49.0)	125 (51.2)	0.62
Cancer	5 (1.0)	2 (0.8)	3 (1.2)	0.62
Renal impairment	193 (46.2)	93 (44.3)	100 (48.1)	0.44
Arthritis	79 (15.8)	13 (5.1)	66 (27.1)	<0.01*
> 1NCD	179 (35.8)	75 (29.3)	10.7 (42.6)	<0.01*
Present alcohol use	140 (28.1)	88 (34.5)	52 (21.3)	0.01*
Past or present tobacco use	118 (23.7)	104 (40.9)	14 (5.7)	<0.01*

Notes: Older is defined as ≥60 years. * Indicates statistically significant P-value < 0.05.
Abbreviations: N, Number; IQR, Interquartile range; WHO, World Health Organization; BMI, body mass index; ART, antiretroviral therapy; DTG, dolutegravir; PI, protease inhibitor; NNRTI, Non-nucleoside reverse transcriptase inhibitors; NCDs, non-communicable diseases.

Sex Differences in the Prevalence of Geriatric Syndromes

The prevalence of geriatric syndromes in the entire cohort stratified by sex is presented in Table 2. Cognitive impairment (72.8%) and pre-frailty (45.8%) were the most prevalent geriatric syndromes. Only 28 participants (5.6%) did not have any geriatric syndrome, whereas 374 (74.8%) had ≥ 2 geriatric syndromes.

Compared with men, more women were frail (13.1% vs 5.1%, P-value = 0.01), had functional impairment by SPPB (43.3% vs 26.6%, P-value < 0.01), had cognitive impairment (83.2% vs 62.9%, P-value < 0.01), and reported a fall (48.8% vs 34.0%, P-value < 0.01). Women had a higher mean number of geriatric syndromes than men (3 SD 2.0 vs 2 SD 2.0, P-value < 0.01).

Table 2 Prevalence of Geriatric Syndromes in a Cohort of Older People with HIV in Kampala Stratified by Sex

Geriatric syndromes	All N = 500	Male N = 256	Female N = 244	P-value
Depressive symptoms, n %	51 (10.2)	27 (10.6)	24 (9.8)	0.79
Frailty, n % Prefrail	229 (45.8)	118 (46.1)	111 (45.5)	
Frail	45 (9.0)	13 (5.1)	32 (13.1)	0.01*
Cognitive impairment, n %	364 (72.8)	161 (62.9)	203 (83.2)	<0.01*
Falls, n %	206 (41.2)	87 (34.0)	119 (48.8)	<0.01*
Urinary incontinence, n%	146 (29.2%)	75 (29.3)	71 (29.1)	0.96

(*Continued*)

Table 2 (Continued).

Geriatric syndromes	All N = 500	Male N = 256	Female N = 244	P-value
Malnutrition, n %				
At risk of malnutrition	66 (13.2)	39 (15.3)	27 (11.1)	
Malnourished	17 (3.4)	9 (3.5)	8 (3.3)	0.37
Functional Impairment (SPPB), n % high (10–12)	327 (65.4)	188 (73.4)	139 (57.0)	<0.01*
Low (0–9)	173 (34.6)	68 (26.6)	105 (43.3)	
IADL Impairment, n %	71 (14.2)	35 (14.3)	36 (14.1)	0.91
Number of Geriatric syndromes				
0	28 (5.6)	15 (5.86)	13 (5.33)	
1	98 (19.6)	64 (25.0)	34 (13.9)	
≥2	374 (74.8)	177 (69.1)	197 (80.7)	0.006*
Geriatric Syndromes, mean(sd)	3 (2.0)	2 (2.0)	3 (2.0)	<0.01*

Notes: Older is defined as ≥60 years. * Indicates statistically significant P-value < 0.05. Geriatric syndromes refer to falls, frailty, cognitive impairment, depressive symptoms, functional impairment, urinary incontinence, impairment in activities of daily living, and malnutrition.
Abbreviations: SPPB, short physical performance battery; IADL, instrumental activities of daily living; sd, standard deviation.

Factors Associated with Geriatric Syndromes

After adjusting for sex, age, household income, education level, body mass index, NCDs, and WHO stage; women, older participants, those with no education or primary education, underweight participants, those with 2 or more NCDs and WHO stage III–IV had a higher mean number of geriatric syndromes. (Table 3)

Among men, increased age (AMR 1.09, CI: 1.024–1.17, P-value = 0.01) and being underweight (AMR 1.63, CI: 1.28–2.08, P-value <0.01) were associated with a higher mean number of geriatric syndromes. Among women, an increase in age (AMR 1.16, CI: 1.09–1.23, P-value < 0.01), being underweight (AMR 1.32, CI: 1.02–1.69, P-value 0.03), WHO stages 3 and 4 (AMR 1.19, CI: 1.04–1.37, P-value 0.01), and having no formal education (AMR 1.42, CI: 1.02–1.97, P-value 0.04) were associated with a higher mean number of geriatric syndromes. (Table 4)

Findings were similar using the ordinal logistic regression model; being female, increasing age, primary education, and being underweight were associated with a higher likelihood of a higher number of geriatric syndromes. (Supplementary Table S1)

Table 3 Factors Associated with Geriatric Syndromes in a Cohort of Older People with HIV in Kampala Estimated Using a Poisson Regression Model

Variable	Unadjusted MR (CI)	P-value	Adjusted MR (CI)	P-value
Sex				
Male	Ref		Ref	
Female	1.21 (1.10–1.35)	<0.01	1.17 (1.05–1.30)	<0.01*
Age (per 5 years increase)	1.13 (1.09–1.18)	<0.01	1.11 (1.07–1.16)	<0.01*
Household income				
≥ 1$/ day	Ref		Ref	
< 1$/day	1.22 (1.09–1.36)	<0.01	1.05 (0.95–1.18)	0.30

(*Continued*)

Table 3 (Continued).

Variable	Unadjusted MR (CI)	P-value	Adjusted MR (CI)	P-value
Education level				
No formal education	1.68 (1.29–2.20)	<0.01	1.39 (1.06–1.82)	0.01*
Primary	1.24 (1.06–1.45)	<0.01	1.21 (1.04–1.41)	0.01*
Secondary	1.13 (0.97–1.33)	0.12	1.09 (0.94–1.27)	0.24
Technical/University	Ref			
BMI (kg/m^2)				
<18.5	1.56 (1.32–1.85)	<0.01	1.49 (1.26–1.76)	<0.01*
18.5–24.9	Ref		Ref	
≥25	1.06 (0.95–1.18)	0.27	1.02 (0.92–1.13)	0.73
NCDs				
<=1 NCDs	Ref		Ref	
2 or more NCDs	1.16 (1.05–1.26)	0.01	1.11 (1.00–1.23)	0.04*
WHO stage				
I–II	Ref		Ref	
III–IV	1.11 (1.00–1.23)	0.05	1.11 (0.01–1.22)	0.04*

Notes: Older is defined as ≥60 years. * Indicates statistically significant P-value < 0.05. Geriatric syndromes refer to falls, frailty, cognitive impairment, depression, functional impairment, urinary incontinence, impairment in activities of daily living, and malnutrition.

Abbreviations: Ref, Reference Category; MR, Mean ratio; CI, Confidence interval; BMI, Body mass index; NCDs, Non-communicable diseases; WHO, World Health Organization.

Table 4 Factors Associated with a Higher Number of Geriatric Syndromes in a Cohort of Older People with HIV in Kampala Stratified by Sex Estimated Using a Poisson Regression Model

Variable	Men	P-value	Women	P-value
	AMR (CI)		AMR (CI)	
Age 5 years	1.09 (1.024–1.17)	0.01*	1.16 (1.09–1.23)	<0.01*
Household Income				
Above $1/day	Ref		Ref	
Below $1/day	1.14 (0.95–1.38)	0.16	1.01 (0.87–1.15)	0.93
BMI (kg/m^2)				
<18.5	1.63 (1.28–2.08)	<0.01*	1.32 (1.02–1.69)	0.03*
18.5–24.9	Ref		Ref	
≥25	0.89 (0.75–1.04)	0.14	1.12 (0.97–1.30)	0.14
NCDs				
0 or NCD	Ref		Ref	
2 or more NCDs	1.18 (0.99–1.40)	0.06	1.02 (0.89–1.17)	0.75
Baseline CD4				
<200	0.92 (0.79–1.08)	0.30	0.87 (0.75–1.00)	0.05
≥200	Ref		Ref	
WHO stage				
I–II	Ref		Ref	
III–IV	1.05 (0.91–1.22)	0.48	1.19 (1.04–1.37)	0.01*

(*Continued*)

Table 4 (Continued).

Variable	Men	P-value	Women	P-value
	AMR (CI)		AMR (CI)	
Educational Level				
No formal	1.22 (0.66–2.26)	0.52	1.42 (1.02–1.97)	0.04*
Education	1.21 (0.99–1.47)	0.05	1.21 (0.99–1.47)	0.05
Primary	1.02 (0.84–1.2)	0.85	1.08 (0.83–1.40)	0.55
Secondary Technical/University	Ref		Ref	

Notes: Older is defined as ≥60 years. * Indicates statistically significant P-value < 0.05. Geriatric syndromes refer to falls, frailty, cognitive impairment, depression, low physical function, urine incontinence, impairment in activities of daily living, and malnutrition.

Abbreviations: Ref, Reference Category; MR, Mean ratio; CI, Confidence interval; BMI, Body mass index; WHO, World Health Organization; NCDs, Non-communicable diseases.

Discussion

To our knowledge, we report the first comprehensive assessment of several geriatric syndromes among older PLHIV in SSA. Almost all (94.4%) study participants had at least one geriatric syndrome, which is consistent with reports from North and South America indicating high levels of geriatric syndromes in older PLHIV.[4,5] We found high levels of cognitive impairment, pre-frailty, and falls whereas malnutrition and frailty were relatively uncommon. In line with our hypothesis, women were affected more than men. Older age, women, low education level, underweight, two or more NCDs, and WHO stages 3 and 4 were associated with a higher mean number of geriatric syndromes. The association between comorbidities and a history of AIDS with geriatric syndromes is consistent with previous reports.[4,5]

Our findings add to the limited literature about individual geriatric syndromes in SSA. Similar to a report from Tanzania among older PLHIV which indicated 46.2% of participants were pre-frail and 7.2% of those ≥ 60 years frail, almost half of the cohort participants (45.8%) were pre-frail while 9% were frail.[35] We found a high rate (72.8%) of possible cognitive impairment, which is consistent with reports that used the same screening tool in East Africa, where cognitive impairment ranged from 67–81.1%;[36,37] however, few participants (14.2%) had impairment in the instrumental activities of daily living. Although there is a high prevalence of cognitive impairment among PLHIV in SSA,[38] the observed result may indicate the need for cultural adaptation of the MoCA. We found relatively low rates of malnutrition (3.4%) and underweight (5.6%), which may be attributable to the excellent HIV viral suppression rates in this cohort.[39] Additionally, this was an urban population with a high likelihood of being overweight, as reported in a prior study in our center, in which almost half (46%) of PLHIV were found to be overweight or obese.[40] Despite occurring in only a few participants, being underweight was associated with a high likelihood of a higher number of geriatric syndromes, particularly in men. Malnutrition in older individuals is associated with several geriatric syndromes, such as depression, cognitive impairment, functional dependence, and frailty.[41,42]

Women had a higher prevalence of geriatric syndromes despite attaining better immunological recovery. In other studies among PLHIV, women had higher rates of falls,[43] cognitive impairment,[44,45] frailty, and lower physical function than men.[26,35,46] The presence of a higher number of comorbidities, lower income, and lower levels of education in women, which are risk factors for geriatric syndromes, are possible contributors to the higher prevalence of geriatric syndromes observed in women.[4,47] For example, having a lower income and level of education than men possibly contributed to the higher rate of cognitive impairment in women.[38,48] Low education levels contribute to low socio-economic status, which disproportionately affects women and older persons in low-income countries[49] and is associated with geriatric syndromes, such as frailty,[50] falls,[51] cognitive impairment,[48] and depression.[52]

A strength of this study is that, unlike reports from high-income countries in which most study participants are men,[4,5,17] we had similar numbers of men and women in the cohort, which allowed us to make sex comparisons regarding the prevalence of geriatric syndromes. Having similar numbers of men and women was not done on purpose but reflects the demographics in the IDI clinic where we have similar numbers of men and women. Nonetheless, this urban population may not fully represent all older PLHIV in Uganda. In addition, geriatric syndromes, such as frailty, falls, malnutrition, and functional impairment, frequently occur together and may be highly correlated because they are based on the same domain. However, we checked

for correlations among the syndromes and found none. Although an effort was made to use tools that have been validated in Uganda or sub-Saharan Africa, the finding of a high level of cognitive impairment using the MoCA highlights the need for validated tools for screening geriatric syndromes in SSA.

Conclusion

We found a high prevalence of geriatric syndromes among older PLHIV in Uganda, particularly women. Efforts to incorporate the screening and management of geriatric syndromes into the care of older PLHIV in SSA, with a particular focus on women, are warranted.

List of Abbreviations

ART, antiretroviral therapy; BMI, body mass index; CES-D, Center for Epidemiological Studies Depression Scale; CKD, chronic kidney disease; GFR, glomerular filtration rate; HASA, Diagnosis and Treatment of NCDs and Geriatric Syndromes in the HIV Aging Population in Sub-Saharan Africa Cohort; IADL, Instrumental activities of daily living; IDI, Infectious Disease Institute; MoCA, Montreal cognitive assessment; NCDs, noncommunicable diseases; PHQ, patient health questionnaire; PLHIV, people living with HIV; SPPB, short physical performance battery; SSA, sub-Saharan Africa; WHO, World Health Organization.

Data Sharing Statement

Additional data are stored at the Infectious Disease Institute and are available upon reasonable request from the corresponding author, Phoebe Mbabazi.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis, and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

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