Title

Prevalence and Correlates of Frailty Among Older People With and Without HIV in Rural Uganda.

Journal

Journal of Acquired Immune Deficiency Syndromes, 97(4)

Authors

Mbabazi, Phoebe
Chen, Geoffrey
Ritchie, Christine
et al.

Publication Date

2024-12-01

DOI

10.1097/QAI.0000000000003513

Peer reviewed

HHS Public Access

Author manuscript

J Acquir Immune Defic Syndr. Author manuscript; available in PMC 2025 January 15.

Published in final edited form as:

J Acquir Immune Defic Syndr. 2024 December 01; 97(4): 402–408. doi:10.1097/QAI.0000000000003513.

Prevalence and correlates of frailty among older people with and without HIV in rural Uganda

Phoebe Mbabazi, MBChB, MMED[a], **Geoffrey Chen, BA**[b], **Christine S. Ritchie, MD, MSPH**[c,d], **Alexander C. Tsai, MD**[c,e], **Zahra Reynolds, MPH**[b], **Robert Paul, PhD**[f], **Janet Seeley, PhD**[g,h], **Yao Tong, MS**[b], **Susanne Hoeppner, PhD**[c,e], **Samson Okello, MBChB, MS**[i,j,k], **Noeline Nakasujja, MBChB, PhD**[l], **Brianne Olivieri-Mui, PhD**[m], **Jeremy A. Tanner, MD**[n], **Deanna Saylor, MD, MHS**[o], **Stephen Asiimwe, MBChB, MS, DrPH**[b,i], **Mark J. Siedner, MD, MPH**[b,c,i,h], **Meredith Greene, MD**[p]

[a]Research Department, Infectious Disease Institute, Makerere University, Kampala, Uganda

[b]Medical Practice Evaluation Center, Mongan Institute, Department of Medicine, Massachusetts General Hospital, Boston, USA

[c]Harvard Medical School, Boston, MA, USA

[d]Division of Palliative Care and Geriatric Medicine, Department of Medicine, Massachusetts General Hospital, Boston, MA, USA

[e]Department of Psychiatry, Massachusetts General Hospital, Boston, MA, USA

[f]Department of Psychological Sciences, University of Missouri - St Louis, St Louis, USA

[g]Department of Global Health and Development, Faculty of Public Health and Policy, London School of Hygiene & Tropical Medicine, London, UK

[h]Africa Health Research Institute, KwaZulu-Natal, South Africa

[i]Department of Internal Medicine, Mbarara University of Science and Technology, Mbarara, Uganda

[j]Department of Global Health and Population, Harvard T. H.Chan, School of Public Health, Boston, MA, USA

[k]Department of Epidemiology, Gillings School of Global Public Health, University of North Carolina at Chapel Hill, Chapel Hill, NC, USA.

[l]Department of Psychiatry, College of Health Sciences, Makerere University, Kampala, Uganda

[m]Department of Health Sciences, Bouve College of Health Sciences, Northeastern University, Boston, MA, USA

[n]Glenn-Biggs Institute for Alzhimer's and Neurodegenerative Diseases, University of Texas, San Antonio, Texas, USA

Corresponding Author: Phoebe Mbabazi, Infectious Disease Institute, Makerere University, Kampala, Uganda, pmbabazi@idi.co.ug.

Conflict of Interest and Source of Funding

All authors declare no competing interests.

[o]Department of Neurology, Johns Hopkins University School of Medicine, Baltimore, USA

[p]Division of General Internal Medicine & Geriatrics, Indiana University School of Medicine, Indiana, USA

Abstract

Background—The relationship between HIV and frailty, a predictor of poor outcomes in the face of stressors, remains unknown in older people in sub-Saharan Africa.

Methods—We analysed data from the Quality of Life and Ageing with HIV in Rural Uganda cohort study to estimate the prevalence and correlates of frailty among older people with HIV (PWH) on long-term antiretroviral therapy and among age and sex-similar HIV-uninfected comparators. Frailty was defined as a self-report of 3 or 4 (and pre-frailty as 1 or 2) of the following phenotypic variables: weight loss, exhaustion, low activity, and slowness. We estimated the prevalence of frailty and pre-frailty and fitted logistic regression models to estimate the association between HIV and frailty, adjusting for sociodemographic factors, depression, and other comorbidities.

Results—We enrolled 599 participants (49% women) with a mean age of 58 years. PWH had a similar prevalence of frailty (8.1% vs. 10.9%, p=0.24) but a lower prevalence of pre-frailty (54.2% vs. 63.2%, p=0.03) compared with their HIV-uninfected comparators. In multivariable regression models, people with depression (AOR 7.52 [95% CI: 3.67–15.40], p<0.001) and those with ≥1 comorbidities (AOR 3.15 [95% CI: 1.71–3.82], p<0.001) were more likely to be frail. HIV serostatus was not significantly associated with frailty (AOR 0.71 [95% CI: 0.37–1.34], p=0.29).

Conclusion—Older PWH had a similar prevalence of frailty as those without HIV. These findings call for additional study of the factors that contribute to the robustness of older PWH in sub-Saharan Africa.

Keywords

frailty; HIV; aging; sub-Saharan Africa

BACKGROUND

The life expectancy of people with HIV (PWH) has improved with the scale-up of antiretroviral therapy (ART) in sub-Saharan Africa. In Uganda, PWH have a life expectancy that now approaches that of the general population.[1] In high income countries in North America and Europe , compared to older persons without HIV (PWOH), older PWH have a greater frequency and earlier onset of, age-related conditions, including non-communicable diseases such as cardiovascular disease [2,3] and geriatric syndromes such as frailty.[4] Of particular concern for older PWH is an increased risk of frailty, a state of heightened vulnerability to poor outcomes in the face of stressors resulting from a decline in physiological reserves.[5] Frail PWH and PWOH have an increased risk of adverse outcomes such as falls,[6,7] hospitalizations,[8,9] incident morbidity, and mortality.[10]

In North America, PWH have been observed to have higher rates and earlier onset of frailty, especially before the advent of ART.[9,11] With the widespread use of ART, the rates

of frailty among older PWH may be on the decline. For example, the Multicenter AIDS Cohort Study reported a 50% reduction in frailty prevalence following the introduction of ART.[12] However, there are limited data from sub-Saharan Africa on frailty among older PWH, particularly since ART became more widely available.[13] Should frailty be found to be more common in sub-Saharan Africa, where over 26 million PWH reside,[14] it could greatly impact the region's already overburdened healthcare systems.[15] Initial studies on frailty from sub-Saharan Africa are conflicting. Some suggest higher rates of frailty among PWH compared to PWOH,[16,17] while others indicate lower rates of frailty among older PWH or rates similar to those of PWOH.[18,19] Consequently, there is a need to better characterize the prevalence and correlates of frailty among older PWH on long-term ART.

We recently reported that older PWH in rural Uganda had greater health-related quality of life than their age- and sex-similar peers.[20,21] Building upon that work, we estimated the prevalence and correlates of frailty among older PWH and PWOH in rural Uganda. We hypothesized that frailty would be similar or less common in older PWH than in older PWOH.

METHODS

Study setting and design

We conducted a cross-sectional analysis of data from the first year of the Quality of Life and Ageing with HIV in Rural Uganda study, a prospective observational cohort in Western Uganda. Full cohort details have been previously described.[21] In brief, we recruited older-aged PWH (≥49 years) in ambulatory care at the Mbarara Regional Referral Hospital and Kabwohe Immune Suppression Syndrome Clinics in southwestern Uganda between October 2020 and October 2021. To be eligible, PWH had to be active in care at the recruitment clinics and on ART for a minimum of three years. We then enrolled PWOH from the communities around the HIV clinics who were matched by region (Mbarara and Kabwohe) and quartile of age and sex to PWH in the cohort using local population census information from a population-based cohort.[22] Aside from attendance at study visits and facilitated referral to local health centers for treatment of co-morbidities (e.g., elevated blood pressure) when identified, study participants do not receive any additional services.

Study procedures

Data were collected by phone because of social distancing regulations in place during the COVID-19 pandemic. All study participants were called on a mobile phone of their choice. Participants completed questionnaires on sociodemographic information including age, gender, level of education, household wealth as determined by household asset ownership, marital status, number of household members, and alcohol use using the AUDIT-C questionnaire.[23] We also collected data on the number of self-reported comorbidities including; hypertension, diabetes mellitus, high cholesterol, heart attack/heart failure, kidney disease, cancer, chronic obstructive airway disease (COPD), asthma, and tuberculosis (TB). We measured the symptoms of depression using a modified version of the Hopkins Symptom Checklist for Depression (HSCL-D), in which scores ≥1.75 indicated a positive screen for depression.[24,25]

For our outcome of interest, we defined frailty using an adaptation of Fried's frailty phenotype,[26] as this is the most common measure for frailty assessment among PWH. As has been done in prior studies of PWH,[11] we used a modified frailty phenotype because data during this period were collected via self-report. A 4-item self-reported modified frailty phenotype that assessed the same domains was recently developed by the Centers for AIDS Research Network of Integrated Clinical Systems (CNICS) and demonstrated good performance when validated against the original 5-item frailty phenotype.[27]

Our modified frailty phenotype included four subscales: 1) shrinking (weight loss), 2) exhaustion, 3) low activity, and 4) slowness. Weakness (grip strength), the 5th component of the frailty phenotype, was not assessed. As such, we adopted a strategy similar to one used by the Multicenter AIDS Cohort study[11] and CNICS[27] using the following criteria:

1. Shrinking was defined as a self-reported unintentional weight loss of ≥4.5kg (10 pounds) in the past year. Individuals who were unsure of weight changes were considered to have not experienced this degree of weight loss.
2. Exhaustion was defined as self-reported exhaustion using two items from the Center for Epidemiological Depression Scale (CES-D)[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"?

    Possible response*s* included: *rarely or none of the time (<1 day), some or a little of the time (1–2 days), occasionally or a moderate amount of the time (3–4 days),* and *most or all of the time (5–7 days).*

    We considered participants to have exhaustion if they replied "occasionally or a moderate amount of the time" or "most or all of the time" to at least one of the two questions.
3. Low physical activity was measured by asking the participants:

    Does your health significantly limit physical activity like lifting heavy things, running, and doing strenuous work?

    Possible responses included*: not at all; yes, limited a little;* and *yes, limited a lot* Participants who indicated that they were "limited a lot" were defined as having low activity.
4. Slowness was assessed using the mobility section of the EQ-5D health-related quality of life questionnaire.[27,29]

    What best describes your health today?

    Possible responses included*: I have no problems in walking about, I have some problems in walking about,* and *I am confined to bed.*

    Participants who answered "I have some problems in walking about" and "I am confined in bed" were considered to have slowness.

Study participants were defined as frail if three or four of the subscales were positive, pre-frail if one or two of the subscales were positive, and non-frail if none of the subscales were positive.

Statistical methods

The primary outcome of interest was frailty and the primary exposure of interest HIV serostatus. We first compared PWH and PWOH using chi-squared testing for categorical variables, Student's t-tests for normally distributed continuous variables, and rank sum tests for non-normally distributed continuous variables. We compared the crude prevalence of frailty and pre-frailty by HIV serostatus. To estimate the correlates of frailty, we fitted logistic regression models with the following explanatory variables; age, gender, marital status, positive depression screen, and presence of one or more comorbidities. We anticipated that there would be a small number of participants with frailty, therefore, we also looked at a combined model of both frailty and pre-frailty. Factors that were associated with the outcomes in univariable models with a $p<0.25$, were included in multivariable models.We did not include household size in the regression model because it was correlated with marital status and wanted to avoid collinearity. Analyses were performed using Stata version 17.0.

Ethical Considerations

This study was approved by the institutional review boards of Mbarara University of Science and Technology and Mass General Brigham. We obtained clearance to conduct the study from the Uganda Council of Science and Technology. Written consent was waived because of the COVID-19 pandemic. Verbal informed consent was obtained from all participants for this phone-based interview study. All study methods were conducted in accordance with the ethical principles stated in the Declaration of Helsinki.

RESULTS

Cohort characteristics

We enrolled 599 participants with a mean age of 58 years: 297 PWH and 302 PWOH (Table 1). By design, PWH and PWOH were comparable in terms of age and sex, with a mean age of 58 years and 49% women in both groups. Marital status categories differed between the groups ($p<0.001$) where PWH were less likely to be married (54% vs. 80%) and more likely to be widowed (34% vs. 14%). PWH also had a smaller median household size (3 vs. 4, $p=0.01$). PWH also had a lower frequency of comorbid hypertension (16% vs 26%, p 0.005) and elevated cholesterol (4% vs 9%, $p=0.03$) and a higher frequency of prior tuberculosis (10% vs 0.3%, $p<0.001$).

Prevalence of frailty, pre-frailty, and frailty subscales

There was no significant difference in the prevalence of frailty among PWH and PWOH (PWH: 8.1% [95% CI: 5.0 – 11.2], PWOH: 10.9% [95% CI: 7.4 – 14.4], $p=0.24$). By contrast, PWH had a significantly lower prevalence of pre-frailty than PWOH (PWH: 54.2% [95% CI: 48.3 – 60.1], PWOH: 63.2% [95% CI: 57.4 – 69.0], $p=0.03$) (Figure 1). For the frailty subscales, PWH reported less exhaustion compared to PWOH (PWH: 34.7% [95%

CI: 29.3 – 40.1], PWOH: 43.0% [95% CI: 37.5 – 48.6], p=0.04) (Table 2). Other differences on the frailty subscales were not statistically significant, but the only subscale with a higher prevalence among PWH was shrinking (PWH: 12.1% [8.4 – 15.8], PWOH: 10.9% [7.4 = 14.4], p=0.65).

Correlates of frailty

In the multivariable logistic regression model with frailty as the outcome, participants with a positive depression screen (AOR 7.52 [95% CI: 3.67–15.40], p<0.001) and those with ≥ 1 comorbidities (AOR 3.15 [95% CI: 1.71–3.82], p<0.001) were more likely to be frail. Frailty was less common among PWH, but the difference was not statistically significant (AOR 0.71 [95% CI: 0.37 – 1.34], p=0.029). (Table 3). The multivariable estimates for the frailty or pre-frailty model were largely similar to the estimates for frailty (Table, Supplementary Digital Content 1, which shows the logistic regression model of the correlates of frailty or pre-frailty among older people in Uganda). In addition to participants with a positive depression screen, frailty or pre-frailty was more common among female participants (adjusted odds ratio [AOR] 2.27 [95% CI: 1.48 – 3.49], p<0.001).

DISCUSSION

In a cohort of PWH on long-term ART in Uganda compared to demographically similar PWOH from the same community, PWH had a similar prevalence of frailty and a lower prevalence of pre-frailty compared with PWOH. Despite being on long-term ART, PWH seem to have similar, if not improved, robustness than PWOH, which may indicate the effectiveness of the HIV treatment program as frailty rates have been reported to decline with HIV viral load suppression.[12,30] Additionally, there is greater utilization of health services by PWH compared to PWOH in sub-Saharan Africa[31] and reports of lower rates of non-communicable diseases like hypertension,[31–33] as observed in our cohort, among PWH compared to PWOH. The lower rates of frailty and pre-frailty in PWH may, in part, be due to better management of comorbidities as they receive routine ART care, as seen in our cohort, where a higher proportion of PWH who reported hypertension also reported being treated than those without HIV. The differences could also reflect a greater resiliency to frailty among PWH in this region, but this alternative hypothesis requires further exploration.

Our findings are consistent with a recent report describing better health-related quality of life among PWH than among PWOH in this cohort of rural Ugandans,[21] and a separate study in rural and peri-urban Uganda which found similar health and functional status between PWH and PWOH.[34] Similarly, a study in rural KwaZulu-Natal in South Africa assessed for frailty using a modified frailty phenotype and found similar rates of frailty in PWH and PWOH.[19] However, data on HIV and frailty in sub-Saharan Africa are conflicting. A 2011 study in South Africa found that PWH had a nearly 50% increased prevalence of frailty compared to PWOH[16] Importantly, that study largely evaluated PWH before ART was made widely available, while all our study participants were on ART for at least 3 years. In a more recent study in southern Ethiopia, frailty was more common among PWH, with a prevalence of 9.1% among PWH compared to 5.9% among PWOH.[17] A direct comparison

of this report with ours is difficult because a different instrument was used, the Brief Frailty Screening tool (BFIT-2)[35], which includes assessment for social support, cognition, and sensory impairment, which were not assessed in our modified frailty phenotype. In contrast, a report from Tanzania found a low prevalence of frailty among older PWH (2.78%) and attributed the findings to the primary health care services utilised by PWH[18].

Similar to other studies from sub-Saharan Africa and elsewhere, we found frailty to be more common in people with depression[9,36,37] and participants with one or more comorbidities[9,26] whereas frailty or pre-frailty was more common among women[16,18,19,38] in addition to participants with a positive depression screen. Depression and frailty are interlinked, with each condition being a risk factor for the development of the other.[37,39] The finding of comorbidities as an association is of concern because we used self-reported comorbidities in a setting with relatively sparse preventive health care, which may have underestimated the actual prevalence of comorbidity. These findings augment the need to incorporate the screening and management of depression and other comorbidities into the routine care of older PWH. Factors associated with frailty in other studies, such as older age[16,18] and being single,[18] were not observed in our study.

A strength of this study is that we had a large sample of PWH and community-based PWOH that were comparable by age and gender. Nonetheless, as with other observational studies comparing PWH and PWOH, residual confounding cannot be excluded. Another limitation is that we assessed frailty and pre-frailty using a modified frailty phenotype with four self-reported measures and did not perform objective measurements of grip strength and gait speed. Although a self-reported modified frailty phenotype assessment that considered the same domains showed good performance when compared with the 5-item frailty phenotype, it is not fully comparable to our self-reported measure because different scales were used for the domains.[27] We plan to validate this self -reported measure of frailty in our population against the full frailty phenotype.

There is a possibility that study participants (particularly PWH) who are in routine care felt obliged to please the research team by reporting better outcomes. In our study, participants' self-reported data could not be corroborated with physician assessments. Additionally, we did not explore associations of frailty that require physical measurements (e.g., body mass index), which may be of relevance in sub-Saharan Africa. However, the he observation of higher depression and a higher number of comorbidities in frail PWH, as has been observed in other studies,[26,37] provides confidence that the self-report method has sufficient sensitivity to detect important associations. This self-reported measure is of particular value in sub-Saharan Africa because it provides an opportunity for rapid and low-cost frailty assessments.

In summary, we found that older PWH in rural Uganda had a similar prevalence of frailty and lower rates of pre-frailty than PWOH. Factors contributing to this shift toward better health among older PWH in sub-Saharan Africa require further study.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

We thank the study participants for their time and contribution to this study and the clinical staff at Kabwohe Clinical Research Center and the Mbarara Immune Suppression Syndrome Clinic for their contribution to this project.

This work was supported by the U.S. National Institutes of Health (R01HL141053, R01AG059504, K43TW010715, K24HL166024, K43TW010715, K24DA061696, and R01MH125667).

REFERENCES

1. Mills EJ, Bakanda C, Birungi J, et al. Life expectancy of persons receiving combination antiretroviral therapy in low-income countries: a cohort analysis from Uganda. Ann Intern Med 2011;155(4):209–216. [PubMed: 21768555]
2. Schouten J, Wit FW, Stolte IG, et al. Cross-sectional comparison of the prevalence of age-associated co-morbidities and their risk factors between HIV-infected and uninfected individuals: the AGEhIV cohort study. Clinical Infectious Diseases. 2014;59(12):1787–1797. [PubMed: 25182245]
3. Maciel RA, Klück HM, Durand M, Sprinz E. Comorbidity is more common and occurs earlier in persons living with HIV than in HIV-uninfected matched controls, aged 50 years and older: A cross-sectional study. Int J Infect Dis 2018;70:30–35. [PubMed: 29476902]
4. Greene M, Covinsky KE, Valcour V, et al. Geriatric Syndromes in Older HIV-Infected Adults. Journal of acquired immune deficiency syndromes (1999). 2015;69(2):161–167. [PubMed: 26009828]
5. Clegg A, Young J, Iliffe S, Rikkert MO, Rockwood K. Frailty in elderly people. Lancet. 2013;381(9868):752–762. [PubMed: 23395245]
6. Bartosch PS, Kristensson J, McGuigan FE, Akesson KE. Frailty and prediction of recurrent falls over 10 years in a community cohort of 75-year-old women. Aging Clinical and Experimental Research. 2020;32(11):2241–2250. [PubMed: 31939201]
7. Tassiopoulos K, Abdo M, Wu K, et al. Frailty is strongly associated with increased risk of recurrent falls among older HIV-infected adults. Aids 2017;31(16):2287–2294. [PubMed: 28991026]
8. Theou O, Sluggett JK, Bell JS, et al. Frailty, Hospitalization, and Mortality in Residential Aged Care. J Gerontol A Biol Sci Med Sci 2018;73(8):1090–1096. [PubMed: 29985993]
9. Önen NF, Abayomi A, Shacham E, Stamm KE, Önen AR, Overton TE. Frailty among HIV-infected persons in an urban outpatient care setting. Journal of Infection. 2009;59(5):346–352. [PubMed: 19706308]
10. Verheij E, Kirk GD, Wit FW, et al. Frailty is associated with mortality and incident comorbidity among middle-aged HIV-positive and HIV-negative participants. Journal of Infectious Diseases. 2020;222(6):919–928. [PubMed: 31956893]
11. Desquilbet L, Jacobson LP, Fried LP, et al. HIV-1 Infection Is Associated With an Earlier Occurrence of a Phenotype Related to Frailty. J Gerontol A Biol Sci Med Sci 2007;62(11):1279–1286. [PubMed: 18000149]
12. Desquilbet L, Margolick JB, Fried LB, et al. Relationship Between a Frailty-Related Phenotype and Progressive Deterioration of the Immune System in HIV-infected Men. Journal of acquired immune deficiency syndromes (1999). 2009;50(3):299–306. [PubMed: 19194312]
13. Bernard C, Dabis F, de Rekeneire N. Physical function, grip strength and frailty in people living with HIV in sub-Saharan Africa: systematic review. Trop Med Int Health. 2017;22(5):516–525. [PubMed: 28170120]
14. Autenrieth CS, Beck EJ, Stelzle D, Mallouris C, Mahy M, Ghys P. Global and regional trends of people living with HIV aged 50 and over: Estimates and projections for 2000–2020. PloS one. 2018;13(11).

15. Ambagtsheer RC, Moussa RK. Association of frailty with health service utilisation and health care expenditure in sub-Saharan Africa: evidence from Côte d'Ivoire. BMC Geriatrics. 2021;21(1):446. [PubMed: 34330220]
16. Pathai S, Gilbert C, Weiss HA, et al. Frailty in HIV-infected Adults in South Africa. Journal of acquired immune deficiency syndromes (1999). 2013;62(1):143–151. [PubMed: 23018377]
17. Woldesemayat EM, St Clair-Sullivan N, Kassa A, et al. Frailty status and associated factors among older PLHIV in Southern Ethiopia. Plos one. 2023;18(4):e0284376. [PubMed: 37093810]
18. Bristow C, George G, Hillsmith G, et al. Low levels of frailty in HIV-positive older adults on antiretroviral therapy in northern Tanzania. J Neurovirol 2021;27(1):58–69. [PubMed: 33432552]
19. Edwards A, Siedner MJ, Nash S, et al. HIV serostatus, inflammatory biomarkers and the frailty phenotype among older people in rural KwaZulu-Natal, South Africa. African Journal of AIDS Research. 2020;19(3):177–185. [PubMed: 32892699]
20. Reynolds Z, Gilbert R, Sentongo R, et al. Priorities for health and wellbeing for older people with and without HIV in Uganda: a qualitative methods study. Journal of the International AIDS Society. 2022;25 Suppl 4(Suppl 4):e26000. [PubMed: 36176017]
21. Olivieri-Mui B, Hoeppner SS, Tong Y, et al. Associations of the COVID-19 pandemic with quality of life: A cross-sectional study of older-age people with and without HIV in rural Uganda. Journal of global health. 2023;13:06003. [PubMed: 36655920]
22. Takada S, Nyakato V, Nishi A, et al. The social network context of HIV stigma: Population-based, sociocentric network study in rural Uganda. Soc Sci Med 2019;233:229–236. [PubMed: 31229909]
23. Bush K, Kivlahan DR, McDonell MB, Fihn SD, Bradley KA. The AUDIT alcohol consumption questions (AUDIT-C): an effective brief screening test for problem drinking. Ambulatory Care Quality Improvement Project (ACQUIP). Alcohol Use Disorders Identification Test. Arch Intern Med 1998;158(16):1789–1795. [PubMed: 9738608]
24. Ashaba S, Kakuhikire B, Vořechovská D, et al. Reliability, Validity, and Factor Structure of the Hopkins Symptom Checklist-25: Population-Based Study of Persons Living with HIV in Rural Uganda. AIDS and Behavior. 2018;22(5):1467–1474. [PubMed: 28667469]
25. Mushavi RC, Burns BFO, Kakuhikire B, et al. "When you have no water, it means you have no peace": A mixed-methods, whole-population study of water insecurity and depression in rural Uganda. . Social Science and Medicine. 2020;245:112561. [PubMed: 31790879]
26. Fried LP, Tangen CM, Walston J, et al. Frailty in older adults: evidence for a phenotype. J Gerontol A Biol Sci Med Sci 2001;56(3):M146–156. [PubMed: 11253156]
27. Ruderman SA, Webel AR, Willig AL, et al. Validity properties of a self-reported modified frailty phenotype among people with HIV in clinical care in the United States. The Journal of the Association of Nurses in AIDS Care: JANAC. 2023;34(2):158. [PubMed: 36652200]
28. Radloff LS. The CES-D Scale: A Self-Report Depression Scale for Research in the General Population. Applied Psychological Measurement. 1977;1(3):385–401.
29. EuroQol Group. EuroQol-a new facility for the measurement of health-related quality of life. Health Policy. 1990;16(3):199–208. [PubMed: 10109801]
30. Melo GC, Carvalho ACA, Mendes MLT, et al. Association between frailty phenotype, quantification of plasma HIV-1 RNA, CD4 cell count and HAART in HIV-positive subjects: a systematic review and meta-analysis of observational studies. AIDS Care. 2022;34(9):1159–1168. [PubMed: 34292108]
31. Manne-Goehler J, Montana L, Gómez-Olivé FX, et al. The ART Advantage: Health Care Utilization for Diabetes and Hypertension in Rural South Africa. Journal of acquired immune deficiency syndromes (1999). 2017;75(5):561–567. [PubMed: 28696346]
32. Kwarisiima D, Balzer L, Heller D, et al. Population-Based Assessment of Hypertension Epidemiology and Risk Factors among HIV-Positive and General Populations in Rural Uganda. PLoS One. 2016;11(5):e0156309. [PubMed: 27232186]
33. Niwaha AJ, Wosu AC, Kayongo A, et al. Association between Blood Pressure and HIV Status in Rural Uganda: Results of Cross-Sectional Analysis. Global Heart. 2021.
34. Scholten F, Mugisha J, Seeley J, et al. Health and functional status among older people with HIV/AIDS in Uganda. BMC Public Health. 2011;11(886).

35. Gray WK, Orega G, Kisoli A, et al. Identifying frailty and its outcomes in older people in rural Tanzania. J Experimental aging research. 2017;43(3):257–273.

36. Vecchio A, Nakigozi G, Nakasujja N, et al. Assessment, prevalence, and correlates of frailty among middle-aged adults with HIV in rural Uganda. J Neurovirol 2021;27:487–492. [PubMed: 33788138]

37. Soysal P, Veronese N, Thompson T, et al. Relationship between depression and frailty in older adults: A systematic review and meta-analysis. Ageing Research Reviews. 2017;36:78–87. [PubMed: 28366616]

38. Gordon EH, Peel NM, Samanta M, Theou O, Howlett SE, Hubbard RE. Sex differences in frailty: A systematic review and meta-analysis. Exp Gerontol. 2017;89:30–40. [PubMed: 28043934]

39. Mayerl H, Stolz E, Freidl W. Frailty and depression: Reciprocal influences or common causes? Soc Sci Med 2020;263:113273. [PubMed: 32810695]

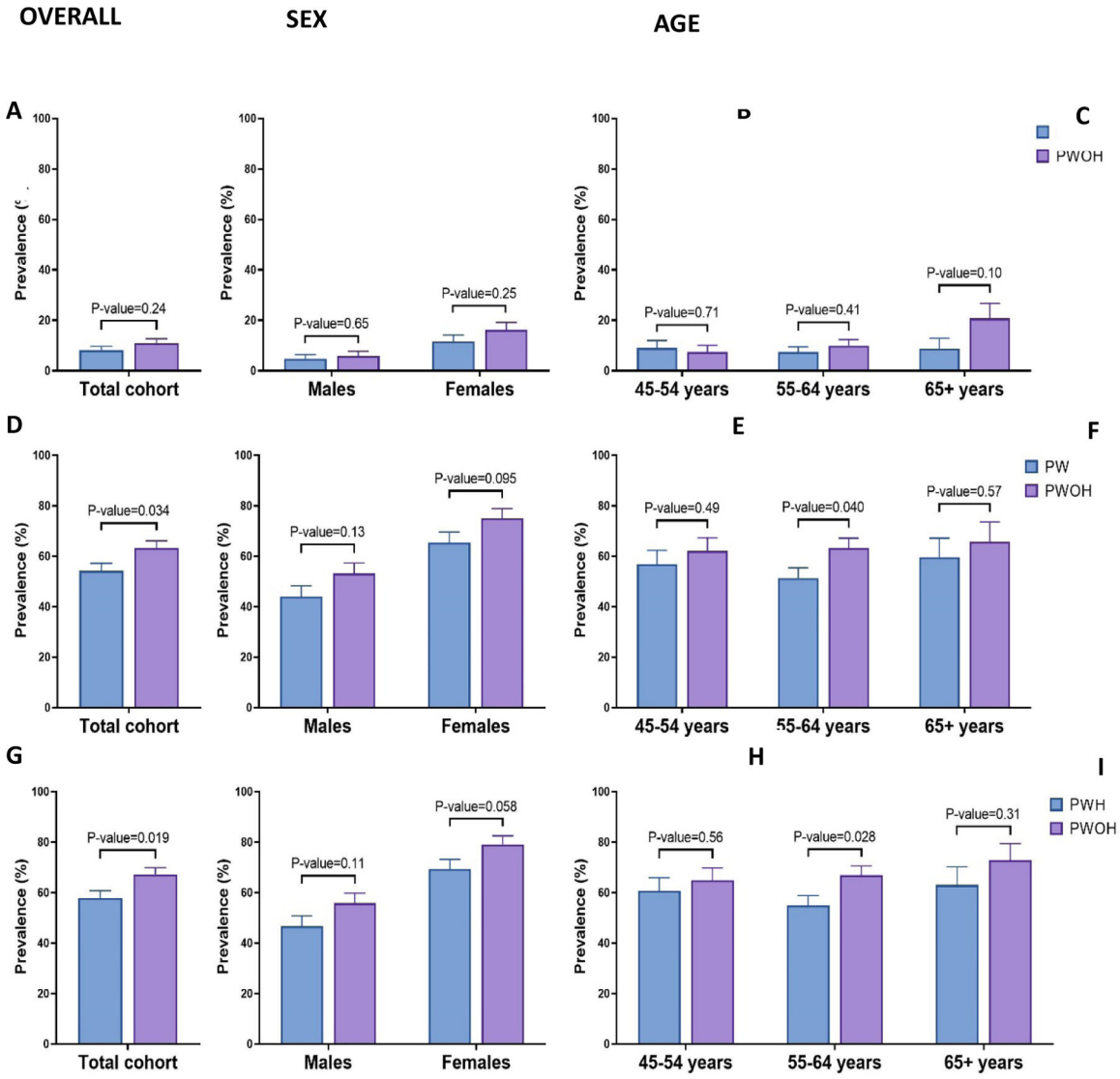

Figure 1.

Prevalence of frailty (A-C), pre-frailty (D-F), and frailty or pre-frailty (G-I) among individuals with and without HIV, overall (left) and stratified by sex (middle) and age (right) in Uganda.

Table 1.

Cohort Characteristics of older adults with and without HIV in rural Uganda

Characteristic	Total Cohort (n = 599)	PWH (n = 297)	PWOH (n = 302)	P-value*
Age, mean (SD)	58 (7)	58 (6)	58 (7)	0.81
Age category, n (%)				0.93
45–54 years	183 (30)	89 (30)	94 (31)	
55–64 years	322 (54)	162 (55)	160 (53)	
65+ years	94 (16)	46 (15)	48 (16)	
Female, n (%)	295 (49)	147 (49)	148 (49)	0.90
Education, n (%)				0.34
Less than primary education	306 (51)	143 (48)	163 (54)	
Primary education	223 (37)	116 (39)	107 (35)	
Secondary and higher education	70 (12)	38 (13)	32 (11)	
Rurality, n (%)				0.56
Semi-urban	249 (42)	127 (43)	122 (40)	
Rural	350 (58)	170 (57)	180 (60)	
Asset index, n (%)				0.11
Quartile 1	150 (25)	62 (21)	88 (29)	
Quartile 2	150 (25)	76 (26)	74 (25)	
Quartile 3	148 (25)	76 (26)	72 (24)	
Quartile 4	149 (25)	82 (27)	67 (22)	
Marital status, n (%)				<0.001
Single	8 (1)	2 (1)	6 (2)	
Married/cohabitating	405 (68)	162 (54)	243 (80)	
Divorced/separated	44 (7)	32 (11)	12 (4)	
Widowed	142 (24)	101 (34)	41 (14)	
Household size, median (IQR)	3 (2, 5)	3 (2, 5)	4 (3, 5)	0.010
Alcohol consumption				
AUDIT-C score, mean (SD)	0.8 (1.7)	0.6 (1.5)	0.9 (1.9)	0.027
Positive score, n (%)	58 (10)	22 (7)	36 (12)	0.060
Depression				
HSCL-D score, mean (SD)	1.6 (0.4)	1.6 (0.4)	1.7 (0.4)	0.12
SCID positive, n (%)	203 (35)	92 (33)	111 (38)	0.17
Comorbidity, n (%)				
Hypertension	127 (21)	49 (16)	78 (26)	0.005
Diabetes	36 (6)	19 (6)	17 (6)	0.69
Cholesterol	40 (7)	13 (4)	27 (9)	0.025
Heart attack	8 (1)	4 (1)	4 (1)	0.98
Kidney disease	7 (1)	5 (2)	2 (1)	0.25
Asthma	5 (1)	4 (1)	1 (0)	0.17
Tuberculosis	32 (5)	31 (10)	1 (0)	<0.001
Presence of 1 or more comorbidities, n (%)	195 (33)	98 (33)	97 (32)	0.82

Characteristic	Total Cohort (n = 599)	PWH (n = 297)	PWOH (n = 302)	P-value*
Receiving treatment for comorbidities, n (%)				
Hypertension	64 (50.4)	36 (73.5)	28 (35.9)	<0.001
Diabetes Mellitus	26 (72.2)	13 (68.4)	13 (76.5)	0.59
CD4 count, median (IQR)		556 (430,697)		
Virally suppressed, n (%)		196 (84)		

Abbreviations: PWH, people with HIV; PWOH, people without HIV; SD, standard deviation; IQR, interquartile range; AUDIT-C, Alcohol Use Disorders Identification Test-Concise; HSCL-D, Hopkins Symptom Checklist for Depression; SCID, Structured Clinical Interview for DSM. Virally suppressed refers to HIV viral load < 40 copies/ml.

*P-value indicates comparison between people with and without HIV

Table 2.

Crude prevalence of frailty, pre-frailty, and frailty sub-scales among older people with and without HIV in Uganda

	PWH (n = 297)	PWOH (n = 302)	P-value*
Frailty, % [95% CI]	8.1% [5.0% - 11.2%]	10.9% [7.4% - 14.4%]	0.24
Pre-frailty	54.2% [48.3% - 60.1%]	63.2% [57.4% - 69.0%]	0.03
Shrinking	12.1% [8.4% - 15.8%]	10.9% [7.4% - 14.4%]	0.65
Exhaustion	34.7% [29.3% - 40.1%]	43.0% [37.5% - 48.6%]	0.04
Low physical activity	13.5% [9.6% - 17.4%]	18.9% [14.5% - 23.3%]	0.07
Slowness	31.0% [25.7% - 36.2%]	35.8% [30.4% - 41.2%]	0.21

Abbreviations: PWH, people with HIV; PWOH, people without HIV; CI, confidence interval

*P-value indicates a comparison between people with and without HIV. A chi-squared test was conducted for categorical variables.

Table 3.

Logistic regression model of correlates of frailty among older people in Uganda

Variable	Frail (n, %)	Univariable Model			Multivariable Model		
		OR	95% CI	P-value	AOR	95% CI	P-value
Age							
45–54 years	15 (8)	-ref-					
55–64 years	28 (9)	1.07	(0.55–2.05)	0.85	1.15	(0.56–2.37)	0.70
65+ years	14 (15)	1.96	(0.90–4.26)	0.089	2.02	(0.82–4.96)	0.12
Sex							
Male	16 (5)	-ref-					
Female	41 (14)	2.91	(1.59–5.30)	<0.001	1.85	(0.84–4.06)	0.13
Marital status							
Single/living alone	31 (16)	-ref-					
Married/cohabitating	26 (6)	0.36	(0.21–0.63)	<0.001	0.72	(0.34–1.54)	0.40
Rurality							
Urban	24 (10)	-ref-					
Rural	33 (9)	0.98	(0.56–1.70)	0.93			
Presence of depression	44 (22)	9.08	(4.57–18.04)	<0.001	7.52	(3.67–15.40)	<0.001
Presence of 1 or more comorbidities	33 (17)	3.23	(1.85–5.63)	<0.001	3.15	(1.71–5.82)	<0.001
HIV serostatus							
HIV negative	33 (11)	-ref-					
HIV positive	24 (8)	0.72	(0.41–1.24)	0.24	0.71	(0.37–1.34)	0.29

Abbreviations: OR, odds ratio; AOR, adjusted odds ratio; CI, confidence interval