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Age-related disparities in viral suppression among older individuals living with HIV in rural Uganda

Jonan Tumwesigire^{1*}, Eliza Passell², Flavia Atwiine¹, Edna Tindimwebwa⁵, Zahra Reynolds², Godfrey Masette¹, Okello Samson^{1,9}, Crystal M. North^{2,3}, Robert Paul^{8,11,13}, Janet Seeley⁶, Noeline Nakasujja⁷, Susanne Hoepfner^{2,3}, Meredith Greene¹⁴, Alexander C. Tsai^{1,2,3,4}, Deanna Saylor^{9,10}, Jeremy A. Tanner¹², Stephen Asiimwe^{1,5}, Francis Bajunirwe¹ and Mark J. Siedner^{1,2,3}

Abstract

Background The number of people living with HIV (PLWH) in sub-Saharan Africa who are over 50 years old is increasing rapidly, and expected to triple by 2040. Yet, how older PLWH sustain access to care and viral suppression is not well known. We examined the prevalence and correlates of viral suppression in a cohort of older PLWH in Uganda.

Methods We analyzed data from the Quality of Life and Aging with HIV in rural Uganda study, which follows PLWH over 50 years old who are in care at public HIV clinics in Uganda. Our outcome of interest was viral suppression, defined as HIV-1 RNA viral load less than 200 copies/mL. We estimated the prevalence of viral suppression and fitted multivariable log binomial regression models to identify correlates of viral suppression.

Results The mean cohort age was 59.7 years (standard deviation [SD] 6) and participants had been taking HIV therapy for a mean of 13.3 years (SD 3). Viral suppression was relatively high overall (87%, 240/277). In multivariable models, people aged ≥ 60 years were less likely to be virally suppressed than those aged 50–59 years (78% vs. 93%, adjusted prevalence ratio [APR] 0.85, 95% CI: 0.76, 0.93, $P=0.001$). By contrast, having one or more comorbidities was positively associated with viral suppression (APR 1.10, 95% CI: 1.01, 1.18, $P=0.021$).

Conclusion We found a decreased prevalence of viral suppression among PLWH aged ≥ 60 years at least in Uganda. Public health interventions that address the adherence support needs of older individuals should be evaluated and, if successful, incorporated into HIV care services, given the significant number of older people living with HIV in the region.

*Correspondence:

Jonan Tumwesigire
jtumwesigire@must.ac.ug

¹Mbarara University of Science and Technology, Mbarara, Uganda

²Massachusetts General Hospital, Boston, MA, USA

³Harvard Medical School of Medicine, Boston, MA, USA

⁴Harvard T.H. Chan School of Public Health, Boston, MA, USA

⁵Kabwohe Clinical Research Centre, Kabwohe, Uganda

⁶London School of Hygiene & Tropical Medicine, London, UK

⁷Makerere University, Kampala, Uganda

⁸University of California, San Francisco, CA, USA

⁹University of North Carolina, Chapel Hill, NC, USA

¹⁰Department of Medicine, University of Zambia School of Medicine, Lusaka, Zambia

¹¹Yale School of Medicine, United States of America, New Haven, CT, USA

¹²Glenn Biggs Institute of Alzheimer's & Neurodegenerative Diseases, Department of Neurology, University of Texas Health San Antonio, San Antonio, TX, USA

¹³University of Missouri, St. Louis, USA

¹⁴Indiana University School of Medicine, Indianapolis, IN, USA



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Background

Two decades of global investments in HIV care has resulted in a 20-year increase in life expectancy in people living with HIV (PLWH) [1, 2]. This in turn has led to a higher prevalence of older PLWH. In sub-Saharan Africa, the number of older PLWH is projected to triple by 2040, surpassing 15 million people [3–6]. In Uganda, over 18% of adult PLWH are at least 50 years old. Estimates of viral suppression have ranged between 85% and 97% among women and 79%–91% among men in this age group [7]. As PLWH reach advanced age, they may be at heightened risk for multiple factors that impede viral suppression such as comorbidities, cognitive impairment, social isolation, reduced household income, and age-related conditions like frailty and diminished physical functioning [8–15]. Yet, there are limited data on virologic suppression among PLWH older than 50 in the sub-Saharan African region, and few studies that stratify older adults (≥ 50 years) into more specific age bands [16, 17]. Despite the demographic shift toward older PLWH in rural Uganda, evidence on how ageing influences viral suppression remains limited. To fill this gap, we analyzed data from a cohort of older PLWH on long-term ART in Uganda. We hypothesized that advanced age (≥ 60 years) is associated with a lower prevalence of viral suppression in rural Uganda.

Methods

Study design and participants

We analyzed baseline data from the Quality of Life and Aging with HIV in Rural Uganda Study [18–20]. We used convenience sampling to enroll individuals at least 50 years old and taking ART for at least three years from one of two public HIV clinics in Uganda: The Mbarara Regional Referral Hospital Immune Suppression Syndrome Clinic and the Kabwohe Clinical Research Centre Immune Suppression Syndrome Clinic. At both clinics, HIV care services and antiretroviral therapy (ART) were provided at no cost by the Ministry of Health and implementation partners.

Study procedures

Trained study nurses, who completed training from study investigators and used standard operating procedures for all visits, administered structured questionnaires to collect data on socioeconomic status; history of opportunistic infections and non-AIDS comorbidities; household asset ownership [21, 22]; internalized HIV stigma using the Internalized AIDS Related Stigma Scale [23, 24]; depression symptom severity using the Hopkins Symptom Checklist for Depression (HSCL) [25, 26]; and alcohol use using the Alcohol Use Disorders Identification Test consumption subset (AUDIT-C) [27, 28]. Frailty and physical functioning measures were collected using

a modified frailty scale [19, 29] and the Short Physical Function Battery (SPFB) [30], respectively. Study nurses measured participants' weight and height and collected blood on scheduled study visits, which was tested for CD4 count (Alere PIMA) and HIV-1 RNA (Cepheid Xpert) at Mbarara University of Science and Technology Research Laboratory. Medical chart reviews were conducted to extract data on ART regimens and duration of therapy.

Statistical analysis

The primary outcome of interest was viral suppression, defined as a viral load of less than 200 copies/mL. Our primary predictor of interest was age, which was dichotomized as 50–59 years and 60 and above to achieve two similar-sized groups. Other correlates included sex, marital status, education level, ART regimen (defined as the three medication combination the participant was on at the time of data collection), years on ART, number of non-HIV comorbidities (hypertension, diabetes mellitus, cancer, kidney disease, heart disease, stroke, and high cholesterol); high HIV stigma, defined as an internalized stigma score in the highest tertile for the sample; a positive depression screen, defined as a mean HSCL score over 1.75; heavy alcohol use, defined as an AUDIT-C score of 4 or more in men and 3 or more in women; household asset ownership tertile; frailty or pre-frailty, defined as 1 or more components of the Fried scale; and reduced physical function, defined by a score under 10 on the SPFB [14, 30]. We first estimated the crude prevalence of viral suppression and then fitted univariable log binomial regression models with viral suppression as the outcome of interest and each explanatory variable separately. All variables that had a p -value < 0.25 on univariable analysis were then included simultaneously in a multivariable model. The $p < 0.25$ threshold was based on earlier work showing that a more stringent $p < 0.05$ threshold often fails to identify variables known to be important [31, 32].

Ethical considerations

The study was approved by the Institutional Review Committees at Mbarara University of Science and Technology and Mass General Brigham, and Uganda National Council of Science and Technology (UNCST). All participants provided written informed consent.

Results

Out of 281 total PLWH, in the cohort, 277 had viral load data available and were included in the analysis. The mean age was 59.7 years (standard deviation [SD] = 6) and 44% (121) were aged at least 60 years. About half (51%) of the participants were female, only 75 (27%) had attained education greater than primary school, and

about half (51%) were married or cohabiting with a partner. The majority (89%) were taking an ART regimen that included tenofovir, lamivudine, and dolutegravir, and mean ART duration was 13.3 years (SD=3). Additional sample characteristics and their proportions by age category are reported in Table 1.

The crude prevalence of HIV viral load suppression (<200 copies/mL) in the study was 87% (240/277, Fig. 1).

Viral suppression was higher among participants aged 50–59 years (93%, 145/156) compared to those aged ≥60 years (79%, 95/121, $P=0.0002$). In adjusted regression models, PLWH ≥60 years had a 15% lower adjusted prevalence of viral suppression compared to those aged 50–59 years (APR 0.85, 95% CI: 0.76, 0.93, $P=0.001$). By contrast, having at least one non-HIV comorbidity was associated with a 10% higher adjusted prevalence of

Table 1 Characteristics of participants

Characteristic	50–59 years old (n = 156)	Over 60 years n = 121	Total cohort
Female (n, %)	82 (53%)	59 (48%)	141 (51%)
Age (Years)			
Mean age (SD)	55.5 (2.4)	65.1(4.8)	59.7 (6)
Education level			
Less than primary (n, %)	17 (11%)	17 (14%)	34 (12%)
Primary level (P1-P6) (n, %)	53 (34%)	46 (38%)	99 (36%)
Completed primary (P7) (n, %)	42 (27%)	27 (22%)	69 (25%)
Greater than primary (n, %)	44 (28%)	31 (26%)	75 (27%)
Marital status			
Married/cohabiting (n, %)	83 (53%)	59 (49%)	142 (51%)
Separated, divorced, or widowed (n, %)	68 (44%)	59 (49%)	127 (46%)
Single, never married (n, %)	5 (3%)	3 (2%)	8 (3%)
ART regimen			
TDF/3TC/DTG (n, %)	141 (91%)	106 (89%)	251 (89%)
Other	14 (9%)	13 (11%)	26 (11.0%)
ART duration (years)			
Mean (SD)	13.3 (3)	13.4 (3)	13.3 (3)
Alcohol consumption			
Non heavy drinkers (n, %)	135 (87%)	109 (90%)	244 (88%)
Heavy drinkers (n, %)	21 (13%)	12 (10%)	33 (12%)
HIV comorbidity			
HIV only (n, %)	106 (68%)	81 (67%)	187 (68%)
≥ 1 comorbidity (n, %)	50 (32%)	40 (33%)	90 (33%)
Depression level			
No depression (n, %)	110 (71%)	78 (64%)	188 (68%)
Probable depression (n, %)	46 (29%)	43 (36%)	89 (32%)
BMI			
Obesity (BMI > 30) (n, %)	22 (14%)	5 (4%)	27 (10%)
Overweight (BMI 25–30) (n, %)	38 (24%)	35 (29%)	73 (26%)
Normal weight (BMI 18.5–25) (n, %)	78 (50%)	70 (58%)	148 (53%)
Under weight (BMI < 18.5) (n, %)	18 (12%)	11 (9%)	29 (11%)
HIV stigma			
Low stigma (n, %)	105 (68%)	79 (65%)	184 (67%)
High stigma (n, %)	50 (32%)	42 (35%)	92 (33%)
Frailty			
No frailty (n, %)	83 (53%)	60 (50%)	143 (52%)
Frailty or pre-frailty (n, %)	73 (47%)	61 (50%)	134 (48%)
Physical function			
Low physical performance (n, %)	36 (23%)	37 (31%)	73 (26%)
High physical performance (n, %)	120 (77%)	84 (69%)	204 (74%)
Household asset ownership(n=275)			
Lowest asset ownership (n, %)	37 (24%)	34 (28%)	64 (23%)
Middle asset ownership (n, %)	79 (50%)	55 (45%)	133 (48%)
Highest asset ownership (n, %)	40 (26%)	32 (27%)	78 (28%)

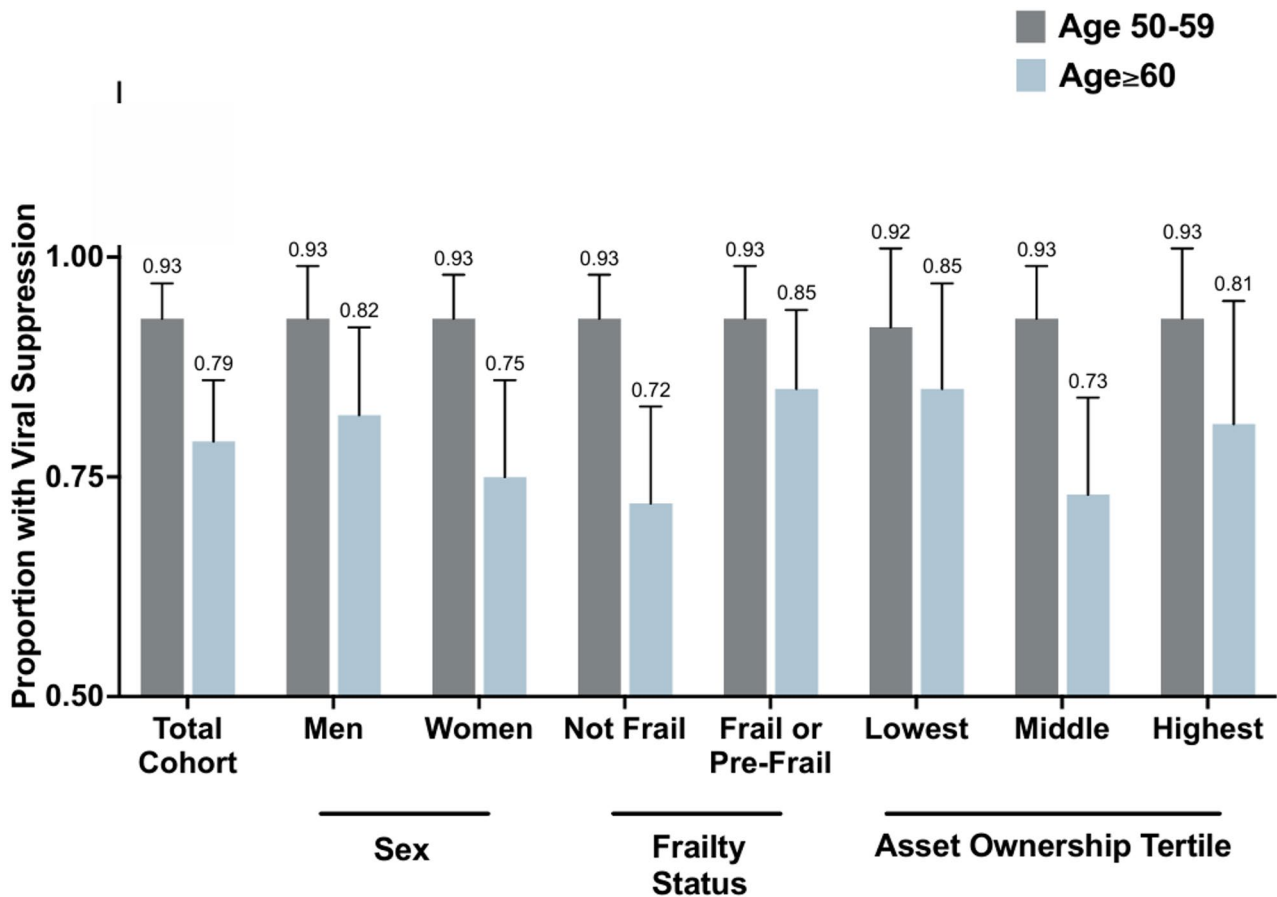


Fig. 1 Prevalence of viral suppression by age among older people living with HIV in sub-Saharan Africa ($n=277$)

viral suppression (APR 1.10, 95% CI: 1.01, 1.18, $P=0.021$) (Table 2). Frailty, alcohol use, and HIV stigma were not associated with viral suppression in this cohort.

Discussion

In this cohort of older PLWH in long-term HIV care in Uganda, we found a high overall rate of viral suppression (87%), but those aged ≥ 60 years had a significantly lower adjusted prevalence of viral suppression (79% vs. 93%, APR 0.85, 95% CI: 0.76–0.93). These data suggest challenges with maintaining ART adherence among the oldest PLWH and signal a need to consider special support services for this population.

While some studies suggest that adherence and suppression improve with age, particularly in high-income settings [33], findings from sub-Saharan Africa have been mixed with some studies showing lower, and others higher viral suppression rates among older PLWH [34–36]. However, few studies like ours have specifically looked at older populations. Studies in other regions have suggested that frailty, physical decline, social support and cognitive functioning all may be adversely impacted by HIV in older populations [9, 14]. By contrast, in this cohort, we have observed a sense of resilience among

older PLWH, who have similar rates of frailty as those without HIV and high health-related quality of life and sleep quality [19, 20]. Nonetheless, frailty and physical functioning were not found to be associated with viral suppression in this study. Thus, additional work is needed to better understand the reasons for the reduced viral suppression among PLWH over 60 years that we observed. We are currently conducting comprehensive assessments of cognition in this cohort. Nevertheless, our findings reinforce the importance of exploring additional factors that impact health, health behavior, and health care access for older-aged PLWH in the region.

We also found that having more non-HIV comorbidities was associated with higher rates of viral suppression. We suspect this may be due to the increased health care visits, greater engagement with healthcare providers, and/or greater attention to medication adherence from spillover of multiple conditions, as some studies also have documented [15, 37]. Other studies have similarly shown that treatment of HIV along with secondary co-morbidities was associated with increased odds of viral suppression [38].

The study should be interpreted within the context of limitations. Most notably, because the data are

Table 2 Log binomial regression results showing the relationship of participants' characteristics and viral suppression among older individuals living with HIV in Uganda

Characteristic	Percent suppressed	Univariable models			Multivariable model		
		PR	95% CI	P-Value	APR	95% CI	P-value
Age category							
50–59 years	93% (145/156)	REF	–	–	REF	–	–
60 years and above	79% (95/121)	0.84	0.76, 0.94	0.001	0.85	0.76, 0.93	0.001
Sex							
Male	88% (120/136)	REF	–	–	–	–	–
Female	85% (120/141)	0.96	0.87, 1.06	0.444	–	–	–
Comorbidity category							
HIV only	84% (157/187)	REF	–	–	REF	–	–
≥ 1 comorbidity	92% (83/90)	1.10	1.01, 1.20	0.034	1.10	1.01, 1.18	0.021
HIV stigma							
Low stigma	85% (156/184)	REF	–	–	REF	–	0.156
High Stigma	90% (83/92)	1.06	0.97, 1.17	0.181	1.06	0.97, 1.15	–
Alcohol consumption							
Non-heavy drinker	86% (209/244)	REF	–	–	-REF	–	0.228
Heavy drinker	94% (31/33)	1.10	0.99, 1.21	0.073	1.07	0.96, 1.19	–
Frailty							
No frail	84% (120/143)	REF	–	–	REF	–	0.256
Frailty or pre-frailty	90% (120/134)	1.07	0.97, 1.17	0.168	1.05	0.96, 1.14	–
Physical function							
High physical performance	87% (178/204)	REF	–	–	–	–	–
Low physical performance	85% (62/72)	0.97	0.86, 1.10	0.604	–	–	–
Marital status							
Single	88% (7/8)	REF	–	–	–	–	–
Married/cohabiting	88% (125/142)	1.00	0.77, 1.32	0.965	–	–	–
Divorced/separated/widowed	85% (108/127)	0.97	0.74, 1.28	0.837	–	–	–
Education level							
Less than primary	85% (29/34)	REF	–	–	–	–	–
Primary level (P1-P6)	87% (86/99)	1.02	0.86, 1.19	0.822	–	–	–
Completed primary (P7)	88% (61/69)	1.04	0.87, 1.22	0.668	–	–	–
Greater than primary	85% (64/75)	1.00	0.84, 1.18	0.996	–	–	–
BMI							
Underweight	86% (25/29)	0.99	0.84, 1.16	0.892	–	–	–
Normal	87% (129/148)	REF	–	–	–	–	–
Overweight	84% (61/73)	0.96	0.85, 1.08	0.488	–	–	–
Obesity	93% (25/27)	1.06	0.94, 1.20	0.338	–	–	–
Depression category							
No depression	87% (163/188)	REF	–	–	–	–	–
Probable depression	87% (77/89)	1.00	0.90, 1.10	0.966	–	–	–
Household asset ownership							
Lowest asset ownership	89% (63/71)	1.04	0.93, 1.16	0.450	–	–	–
Middle asset ownership	85% (114/134)	REF	–	–	–	–	–
Highest asset ownership	88% (63/72)	1.03	0.91, 1.15	0.625	–	–	–

PR prevalence ratio, APR adjusted prevalence ratio, BMI body mass index

cross-sectional, we cannot make inferences about the causal pathways between the risk factors and our outcome, or the mechanisms by which older people had lower adherence. Moreover, our analysis was based on a viral load measurement at a single point in time and

therefore did not consider persistent virologic suppression. Because we found high rates of viral suppression, we had limited power to detect correlates of non-suppression, particularly for factors which may have a relatively small magnitude of association. We did not have

available data on neurocognition at the time of this analysis. In future work, we plan to determine if and how cognition, memory, and executive function, as measured by comprehensive neuropsychiatric batteries, impact viral suppression in older Ugandans. Finally, our data should be interpreted within the context of two clinical sites in rural and peri-urban regions of southwestern Uganda, and among older people who have been in HIV care for over 10 years on average, and might not be generalizable to other populations.

In summary, in a cohort of PWLH over 50 in Uganda, we found a 15% lower prevalence of viral suppression among people aged 60 years and above compared to those aged 50–59 years. As the population of PWLH ages in the region, targeted interventions, such as differentiated care models, and enhanced adherence support, should be evaluated as means of sustaining viral suppression in older populations of PLWH.

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Author contributions

J.T. developed the concept, conducted analysis and wrote the main manuscript, M.J.S. the PI of the parent study, reviewed the manuscript, assisted in analysis, reviewed the main manuscript and provided mentorship through the concept development and manuscript writing, and E.P. prepared the dataset and assisted in the analysis. All authors reviewed the manuscript, provided edits, and approved of the final version.

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Data availability

No datasets were generated during the current study. Data are available upon reasonable request to the corresponding author.

Declarations

Competing interests

ACT reports receiving financial honoraria from Elsevier (for his work as Co-Editor in Chief of the Elsevier-owned journal *SSM – Mental Health*) and from the BMJ Publishing Group Ltd (for his work as Clinical Editorial Advisor of *The BMJ*). All other authors declare no competing interests.

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