Exploring the correlates of health-related quality of life in older persons on HIV antiretroviral therapy attending the Aids Support Organisation in Uganda

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ABSTRACT

Introduction: Despite advancements in Anti-retroviral Therapy (ART), older persons living with HIV (OPLWHIV) continue to face significant challenges, including poor health outcomes and lower quality of life. This study aimed to explore the correlates of health-related quality of life (HRQoL) for older persons on HIV ART attending the Aids Support Organization (TASO) in Uganda. **Methods**: We conducted a cross-sectional survey among OPLHIV enrolled in care at 11 stand-alone TASO centres between February to August 2024. Data was analyzed using STATA 15, employing an Ordinal Logistic Regression model to identify HRQoL correlates for individuals over 50 years old living with HIV. **Results:** Ordinal Logistic Regression results revealed that various demographic, social, and clinical indicators significantly correlated with different HRQoL domains. General health perception was associated with multiple sexual partners (p=0.038), advanced HIV disease (p=0.011), and a viral load >200 copies/ml (p=0.003). Physical functioning correlated with tertiary education (p=0.049), being separated (p=0.004), 11-15 years on ART (p=0.027), and WHO clinical stage II (p=0.050). Factors for role functioning included age 60+ (p=0.002), secondary education (p=0.021), unemployment (p=0.001), WHO clinical stage II (p=0.002), and TB history (p=0.037). Social functioning linked to secondary education (p=0.004), being widowed (p<0.001), viral load >200 copies/ml (p=0.008), and WHO clinical stage II (p=0.011). Pain was associated with age 60+ (p=0.014), tertiary education (p=0.004), and unemployment (p=0.005). Energy correlated with secondary education (p=0.062), being separated (p=0.021), viral load >200 copies/ml (p=0.003), and WHO clinical stage II (p=0.028). Health distress was tied to secondary education (p<0.001), tertiary education (p<0.001), unemployment (p=0.033), and WHO stage II (p<0.001). Finally, mental health was associated with secondary education (p=0.017), being widowed (p=0.043), multiple sexual partners (p=0.015), and WHO stage II (p=0.001). Overall HRQoL specifically correlated with age 60+ (p<0.001), secondary education (p<0.001), and WHO stage II (p=0.008). **Conclusion**: Significant correlates across multiple HRQoL domains consistently included age (60+ years), educational attainment (secondary and tertiary), unemployment, separated or widowed marital status, specific HIV markers (advanced HIV disease, viral load >200 copies/ml, ART duration), and WHO clinical stage II. Having multiple sexual partners and a history of TB also factored into certain domains. Given these findings, TASO Uganda, with its extensive regional presence, is exceptionally well-positioned to implement multifaceted interventions. These should prioritize comprehensive support for older adults, promote health education and social support, enhance comprehensive HIV care, and provide integrated geriatric HIV health services to improve the HRQoL of OPLWHIV in Uganda.

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Introduction

The World Health Organization (WHO) incorporated health-related quality of life (HRQoL) into its global HIV strategy, recognizing its vital role as a monitoring tool, particularly for ageing individuals living with HIV [1]. In Uganda, it is vital to monitor the growing population of older individuals living with HIV. This ongoing assessment provides crucial insights to inform treatment decisions and to enhance health outcomes as they age with HIV [1, 2]. HRQoL offers insights into an individual's subjective health experience, the long-term effects of HIV and its treatment on their daily lives, and aids in identifying specific subgroups in Uganda requiring targeted support [2]. Studies indicate that older adults with HIV (OPLHIV) often experience poorer HRQoL compared to other groups [3], although some research suggests older persons with HIV might report better health in certain domains compared to other chronic conditions [3, 4]. Factors such as a history of AIDS, longer time on ART, and frailty are linked to lower HRQoL [4]. As a key indicator of the overall well-being, HRQoL does not always correlate with disease progression, so emphasising comprehensive assessment is crucial in Uganda's clinical settings [5]. Despite its limitations in poor-resource settings like Uganda, the routine use of standardized HRQoL measures in clinical practice can reveal unmet needs and ultimately enhance care provided to older adults with HIV [4].

While ART improves HRQoL among older adults with HIV in Uganda, with documented increases in physical and mental scores over time [6], the aging cohort experiences significant challenges stemming from multiple comorbidities and long-term effects of antiretroviral therapy [7]. In Uganda, HIV infection appears to hasten age-related comorbidities by 5 to 10 years and introduces substantial psychosocial stressors, including low income, loss of partners, social isolation, poor economic conditions, employment barriers, loss of household heads, depression, anxiety, and rising healthcare expenses [7, 8, 9]. These stressors contribute to increased risks of polypharmacy, drug-drug interactions, and non-AIDS complications such as cardiovascular disease, oncological, and renal disease [7, 8]. Consequently, despite the clinical benefits of ART, comorbidities, frailty, and neurocognitive decline negatively impact the HRQoL of older Ugandan adults living with HIV [7]. Addressing this, and improving the health-related quality of life (HRQoL) for older people living with HIV on antiretroviral therapy is crucial, requiring routine assessments to guide public health interventions, enhance the well-being, and close service gaps by 2030 [8, 9]. There has been limited examination of factors influencing HRQoL in OPLHIV in Uganda [17].

This study explored the correlates of HRQoL in OPLHIV attending TASO centers in Uganda, utilizing the Wilson and Cleary model as its theoretical foundation. This comprehensive model outlines a pathway where biological variables, symptom status, functional status, and general health perception all contribute to overall health outcomes. The Medical Outcomes Study HIV Health Survey (MOS-HIV) tool's domains were well-suited to this framework, as they specifically capture symptoms, functional abilities, and health perceptions—elements central to the Wilson and Cleary model. Furthermore, the model's inclusion of individual characteristics (such as age, education, and marital status) and environmental factors (like social support and employment) was particularly relevant, as these were found to significantly impact MOS-HIV scores in this study, thereby offering a robust lens for interpreting the complex relationships between measured factors and broader HRQoL. The specific objectives included identifying socio-demographic factors (e.g., age, education, employment) and clinical correlates (e.g., ART duration, WHO clinical stage, viral load, TB status, ART adherence) associated with HRQoL among OPLHIV.

Methods

Study design and setting

A cross-sectional study was carried out among older people living with HIV at eleven stand-alone TASO Centers of Excellence (COEs) across major regions in Uganda, including Entebbe, Gulu, Jinja, Masaka, Masindi, Mbale, Mbarara, Mulago, Rukungiri, Soroti, and Tororo. TASO, founded in 1987 as a non-governmental organization, was established to address the HIV epidemic and has since transitioned from providing social support to offering comprehensive care and treatment services for individuals living with HIV and AIDS in Uganda [10]. TASO Centers of Excellence are primary providers of ART in Uganda, offering services free of charge at major public health facilities across the country. Patients can walk in to access these services,

and, depending on available resources, they may periodically receive additional support such as seedlings, animals, and food rations [10].

Study population and sample

This sub-study included 439 older adults living with HIV (≥50 years) enrolled in TASO HIV care programs between February to August 2024 across eleven districts in Uganda (Entebbe, Gulu, Jinja, Masaka, Masindi, Mbale, Mbarara, Mulago, Rukungiri, Soroti, and Tororo) [11]. A sample of 440 OPLHIV was determined using Yamane's sample size formulae [18]. The minimum sample size (n) was calculated using the population size (N), representing 78% of Uganda's HIV population is on ART [19], and a 5% margin of error (e). To account for potential 10% non-response rate, the estimated sample size was determined to be 440 individuals. Only 439 respondents took part in the study. Participants were selected based on age and willingness to participate, with eligibility criteria including language proficiency. Interviews were conducted at TASO ART Clinics.

Data collection and management

Data for the study were gathered from older individuals living with HIV using the Medical Outcomes Study HIV Health Survey (MOS-HIV), a standardized instrument administered verbally. The MOS-HIV is a concise and comprehensive measure of health-related quality of life specifically tailored for individuals with HIV/AIDS. The MOS-HIV user manual offers guidance on assessing how the virus, medications, and treatment regimens affect patients' quality of life, and it was validated in Uganda in 2011 [12, 13]. The survey questions were developed from a pool of extensively tested items derived from the Medical Outcomes Study, a significant multisite research initiative exploring the effects of various medical care delivery methods [13, 14].

Originally developed in 1987, the Medical Outcomes Study HIV Health Survey was one of the first disease-specific instruments created for individuals living with HIV. It is widely utilized in clinical trials as well as various research and evaluation studies [13]. The 35-item MOS-HIV assesses multiple dimensions of functioning and well-being, including physical functioning, social and role functioning (work), cognitive functioning, recent pain experiences, mental health, energy levels, health-related distress, quality of life, and overall health. Prior to enrollment, clinicians briefed respondents on the significance of the study, and participation was entirely voluntary [13, 14, 15]. The questionnaires were pilot-tested at TASO ART Clinics to ensure clarity and relevance. Data collection took place from February to August 2024, with the assistance of TASO counsellors who were trained as research assistants.

Variables and measures

Health-related quality of life was assessed based on the modified EQ-5D-3L questionnaire using mobility, self-care, usual activities, recently experienced pain/discomfort, and anxiety/depression on a scale of 1-3, indicating a 1-No problem, 2-some problems, and 3-Extreme problems. These variables were combined and recoded into a binary variable (1-Good vs 2 Poor).

The eight domains were assessed as follows:

In the general health perception section, respondents were asked to evaluate their health based on the following statements: a) "I am somewhat ill," b) "I have been feeling bad lately," c) "I am as healthy as anybody I know," and d) "My health is in excellent shape." For questions a and b, responses were measured on a scale from 1 (definitely true) to 5 (definitely false). For questions c and d, responses were rated from 1 (excellent) to 5 (poor)

Physical functioning was assessed through several statements regarding the respondents' abilities to perform various activities, including a) vigorous activities (e.g., lifting heavy goods like bananas, potatoes, rice, or beans, running, or participating in strenuous sports), b) moderate activities (e.g. moving a table or carrying groceries), c) walking uphill or climbing hills, d) bending, lifting, or stooping, and e) eating, dressing, bathing, or using the toilet. Responses were measured on a scale of 1 (yes, limited a lot), 2 (yes, limited a little), and 3 (no).

Role functioning was evaluated through two questions: a) "Does your health keep you from working at a job, doing work around the house, or going to the garden?" and b) "Have you been unable to do certain kinds or amounts of work, housework, garden work, or business because of your health?" Responses were recorded as either "Yes" or "No."

Recently experienced pain was assessed using two questions: How much bodily pain have you generally had during the past 4 weeks?" This was measured on a scale of 1 (none) to 6 (very severe).

During the past 4 weeks, how much has pain interfered with your normal work (including gardening, housework, digging, and slashing the grass)?" Responses were captured on a scale of 1 (not at all) to 5 (extremely).

Social functioning was assessed by asking respondents how much their health had limited their social activities (such as visiting friends, close relatives, or traveling) over the past 4 weeks. Responses were measured on a scale from 1 (all the time) to 6 (none of the time).

Mental health was assessed using the following questions: Have you been a very nervous person? Have you felt downhearted or blue? Have you felt so downtrodden that nothing could cheer you up? Have you felt calm and peaceful, and have you been a happy person? Responses were measured on a scale from 1 (all the time) to 6 (none of the time).

Energy and fatigue were assessed using the following questions: a) How often in the last 4 weeks did you feel full of pep? b) Did you have enough energy to do the things you want to do? c) "Did you feel tired?" d) "Did you feel worn out?" Responses were measured on a scale from 1 (all the time) to 6 (none of the time).

Health distress was assessed through the following questions: a) "Did you feel weighed down by your health problems?" b) "Were you discouraged by your health problems?" c) "Did you feel despair over your health problems?" d) "Were you afraid of your health?" Responses were measured on a scale from 1 (all the time) to 6 (none of the time). The quality of life (QoL) domains were evaluated following the MOS-HIV Health Survey Users' Manual [13, 14].

The analysis examined various individual participant attributes, including gender (Male, Female), age groups (50-55, 56-60, 60+ years), educational level attained as per the Uganda system (none, primary, secondary, tertiary), marital status (currently married/cohabiting, separated/divorced, widowed), number of current sexual partners (none, one, two or more), employment status (employed, unemployed), duration on ART (less than 10 years, 11-15 years, more than 15 years), WHO clinical stage (Stage I, II, III, IV), ART adherence status (less than 85%, 85-95%, more than 95%), HIV suppression (viral load: less than 200 copies/ml vs. more than 200 copies/ml), and Tuberculosis (TB) status (coinfection vs. no TB symptoms).

Ethical approval and consent to participate

This study was approved by TASO Institutional Review Board on June 27, 2022 with Ref. No. TASO REC/ADMC010/2022-UG-REC-009, extended to 2025 and the Uganda National Council for Science and Technology (UNCST) on 30 January 2023 with Ref. No. SS1396ES. The study ensured that all participants were well-informed about its' objectives. Participants were reassured that their confidentiality would be maintained and that their participation was entirely voluntary. Before the interviews, written or thumb-printed informed consent was obtained from each participant, ensuring that they understood the purpose of the study and agreed to take part willingly.

Statistical analysis

Data cleaning and analysis were performed using STATA software. Descriptive statistics summarized the characteristics of OPLHIV and their health-related quality of life. The individual responses in the 8 domains of quality of life were combined to form the outcome variables and were in count form. The outcome variables were general health perception, physical functioning, role functioning, social functioning, recently experienced pain, energy, mental health and health distress. To establish the overall HRQoL; five components of mobility, self-care, usual activities, recently experienced pain/discomfort, and anxiety/depression were combined. HRQoL responses 'No problems' (coded as 1) were recoded to '0' (representing good HRQoL), while 'Some problems' (coded as 2) and 'Extreme problems' (coded as 3) were combined and recoded to '1' (representing poor HRQoL). The variable was created to measure overall quality of life, but was not used in the model.

Multivariate analysis was conducted using ordinal logistic regression to analyze the different domains of HRQoL with the independent variables. The ordinal logistic regression was a preferred method for analyzing quality of life data because it respects the ordered nature of the outcome variables. The independent variables were gender, age, education level, marital status, number of sexual partners, employment status, duration on ART, viral load, WHO HIV clinical stage, adherence status and TB history. These were assessed at a 5% significance

level. The mean variance inflation factor (VIF) was 1.29, indicating moderate multicollinearity.

Results

Descriptive characteristics

The study participants were mostly female (62%) with an average age of 58 (SD ± 6.8 years). Most had a primary education (52%), were unemployed (68%), and engaged in crop cultivation (59%). A significant portion were widowed (44%) and reported having no sexual partner (57%) or one sexual partner in the past year (33%). Concerning HIV status, 35% were not virally suppressed, 40% had been on ART for 10-15 years, and most (90%) were clinically initiated. The majority were in WHO clinical stage II (62%) and reported good ART adherence (89%). Few had recent opportunistic infections (15%) or tuberculosis (4%), but 23% had non-communicable diseases. Over half (58%) reported not having a good quality of life. These findings are reported in Table 1.

Health-Related Quality of Life

Our assessment of HRQoL across eight domains (general health perception, physical functioning, role functioning, social functioning, pain, mental health, health distress, and energy), summarized in Table 2, reveals a concerning picture for OPLHIV on ART. Their average rating of 3.00 for general health indicates a low perception of overall well-being, coupled with consistently lower mean ratings in physical functioning, role functioning, and pain, signifying substantial difficulties with daily activities, responsibilities, and pain management. While they reported higher satisfaction with energy/fatigue (3.65), health distress (4.64), and mental health (3.91).

Correlates of Quality of Life in OPLHIV

Results of factors correlating with the 8 quality of life domains included specific demographic, health, and social indicators, are reported in Table 3.

General health perception: In this study of OPLHIV, several significant factors influenced self-perceived general health. Individuals who reported having multiple sexual partners had 55% lower odds of reporting a better perception of their general health compared to those with no sexual partners (aOR = 0.45, 95% CI: 0.85-0.99). Similarly, advanced HIV disease (WHO clinical stage III) significantly reduced the odds of perceiving better health by 64% compared to those with Stage I (aOR = 0.36, 95% CI: 0.16–0.79, p=0.011), which is consistent with the greater symptom burden and functional limitations experienced at this stage. Among OPLHIV, those with a detectable viral load (greater than 200 copies/ml) had significantly higher odds of reporting a better perception of their general health compared to those with suppressed viral loads (aOR = 2.52, 95% CI: 1.42–4.46, p=0.003).

Physical functioning: Our analysis of OPLHIV revealed several complex associations with limited physical functioning. Older adults with tertiary education were twice as likely to experience limited physical functioning as compared to those with no formal education (aOR = 2.09; 95% CI:1.00–4.39, p=0.049). In contrast, marital status appeared protective, with separated/ divorced individuals showing 56% lower odds (aOR = 0.44; 95% CI: 0.25–0.76, p=0.004) and widowed individuals 53% lower odds (aOR = 0.47; 95% CI: 0.27–0.82, p=0.008) of limited physical functioning as compared to the marrieds. The duration of antiretroviral therapy (ART) also played a positive role, as those on ART for 11-15 years had 39% lower odds of limited physical functioning as compared to those below 10 years (aOR = 0.61; 95% CI: 0.40–0.94, p=0.027). Regarding HIV clinical staging, individuals with WHO HIV clinical stage II had 45% increased odds of limited physical functioning (aOR = 1.45; 95% CI: 1.00–2.11, p=0.050), yet, paradoxically, those with stage III showed an 83% lower odds compared to stage I (aOR = 0.17; 95% CI: 0.06–0.45, p<0.001).

Role functioning: The study findings revealed that several demographic, socioeconomic, and clinical factors significantly influenced role functioning among OPLHIV in Uganda. Individuals aged over 60 experienced 55% lower odds of having community roles as compared to those aged 50-55 (aOR = 0.45; 95% CI: 0.27–0.73, p=0.002), suggesting age as a barrier to community engagement. Conversely, higher education strongly supported role functioning, with secondary education increasing the odds by 2.32 times as compared to those with no formal education (aOR = 2.32; 95% CI: 1.13–4.73, p=0.021) and tertiary education by 3.29 times (aOR = 3.29; 95% CI: 1.06–10.17, p=0.038). Unemployment emerged as a critical impediment, reducing the odds of role

functioning by 60% as compared to the employed (aOR = 0.40; 95% CI: 0.23–0.68, p=0.001). Furthermore, advancing WHO HIV clinical stage significantly impaired role functioning; individuals at stage II had 54% lower odds (aOR = 0.46; 95% CI: 0.28–0.76, p=0.002) and those at stage III had 83% lower odds (aOR = 0.17; 95% CI: 0.06–0.47, p=0.001) compared to stage I. Finally, a history of tuberculosis infectionwas also detrimental, as older adults without prior TB had 2.64 times higher odds of better role functioning compared to those who didn't (aOR = 2.64; 95% CI: 1.05–6.59, p=0.037), indicating potential long-term negative impacts from past infection.

Social functioning: Higher education levels consistently predicted increased social participation: individuals with primary education had 1.69 times higher odds (aOR = 1.69, 95% CI: 1.08–2.62, p=0.021), secondary education showed 3.31 times higher odds (aOR = 3.31, 95% CI: 1.80–6.08, p<0.001), and tertiary education 3.36 times higher odds (aOR = 3.36, 95% CI: 1.51–8.58, p=0.004) of engaging in social activities as compared to those with no formal education. Conversely, being widowed or single significantly reduced social engagement, with 73% lower odds (aOR = 0.27; 95% CI: 0.14–0.50, p<0.001), as did having only one sexual partner, resulting in 48% lower odds (aOR = 0.52; 95% CI: 0.29–0.93, p=0.028). Clinical factors also played a crucial role: a detectable viral load (exceeding 200 copies/ml) made individuals 2.27 times more likely to *not* engage in social activities as compared to those virally suppressed (aOR = 2.27; 95% CI: 1.23–4.19, p=0.008), and advancing WHO clinical stages drastically reduced social participation, with stage II showing 42% lower odds (aOR = 0.58; 95% CI: 0.38–0.88, p=0.011) and stage III a profound 94% lower odds (aOR = 0.06; 95% CI: 0.02–0.14, p<0.001) as compared to those with stage I.

Recently experienced pain: Age was positively associated with the likelihood of experiencing pain. Specifically, OPLHIVaged above 60 years were 1.69 times more likely to have recently experienced pain compared to those aged 50-55 years (aOR = 1.69; 95% CI: 1.14–2.58, p=0.014). In contrast, higher levels of education were protective against experiencing pain. Older adults with secondary education were 49% less likely to have experienced pain compared to those with no formal education (aOR = 0.51, 95% CI: 0.29–0.89, p=0.020). This protective effect was even stronger for those with tertiary education, who were 55% less likely to have experienced pain compared to those with no formal education (aOR = 0.45, 95% CI: 0.21–0.96, p=0.004). Employment status also played a significant role. Unemployment among OPLHIV was associated with a 1.76 times higher odds of experiencing pain compared to the employed (aOR = 1.76; 95% CI: 1.19–2.62, p=0.005).

Energy/Fatigue: Older adults with secondary education were 1.7 times more likely to experience fatigue or low energy levels compared to those with no formal education (aOR = 1.70; 95% CI: 0.97–3.00, p=0.062) but this was not statistically significant. Marital status played a statistically significant role, with separated or divorced individuals being 1.89 times more likely to experience fatigue or poor energy levels compared to those who were married or cohabitating (aOR = 1.89; 95% CI: 1.10–3.26, p=0.021). As expected, viral load was a significant predictor. Older adults with high viral loads (>200 copies/ml) were 2.26 times more likely to experience fatigue or low energy compared to those virally suppressed (aRR = 2.26; 95% CI: 1.31–3.88, p=0.003). Conversely, advanced WHO HIV clinical stages were associated with *reduced* odds of experiencing fatigue or low energy levels compared to stage I. Older adults in WHO stage II had 36% lower odds (aOR = 0.64; 95% CI: 0.43–0.95, p=0.028), and those in WHO stage III and IV had 71% lower odds (aOR = 0.29; 95% CI: 0.13–0.64, p=0.002) of reporting fatigue compared to those with Stage I.

Health distress: Education level showed a surprising positive association with experiencing health-related distress. Compared to those with no formal education, older adults with secondary education were 3.08 times more likely to experience health-related distress (aOR = 3.08; 95% CI: 1.73–5.48, p<0.001). This trend was even more pronounced for those with tertiary education, who were 6.11 times more likely to report health-related distress (aOR = 6.11; 95% CI: 2.78–13.40, p<0.001). Conversely, unemployed older adults were 36% less likely to be distressed over their healthcompared to their employed counterparts (aOR = 0.64; 95% CI: 0.43–0.96, p=0.033). Furthermore, advanced WHO HIV clinical stages were associated with significantly reduced odds of health-related distress compared to

stage I. Compared to those at stage I WHO staging, older adults in stage II had 63% lower odds (aOR = 0.37; 95% CI: 0.24–0.55, p<0.001), and those in stage III had a 90% lower odds (aOR = 0.10; 95% CI: 0.04–0.24, p<0.001) of reporting health-related distress.

Mental health: Counterintuitively, higher education levels were associated with increased odds of poor mental health; for example, compared to those with no formal education those with secondary education were 1.98 times more likely to experience poor mental health (aOR = 1.98; 95% CI: 1.13–3.49, p=0.017), increasing to 2.33 higher likelihood of reporting poor mental health among those with tertiary education (aOR=2.33, 95%CI=1.08-5.04) potentially reflecting greater awareness or reporting of psychological challenges. Conversely, widowed individuals exhibited a protective effect, being 44% less likely to report poor mental health compared to the marrieds (aOR = 0.56, 95% CI: 0.32–0.98, p=0.043). A viral load exceeding 200 copies/ml was a significant risk factor, increasing the likelihood of poor mental health by 2.55 times compared to virally suppressed (aOR = 2.55, 95% CI: 1.44–4.53, p=0.001). Interestingly, having a partner was also protective though the association was only statistically significant among older adults with two or more sexual partners, they had 59% lower odds of poor mental health compared to those with none (aOR = 0.41; 95% CI: 0.20–0.84, p=0.015), suggesting potential psychosocial benefits. Finally, advanced WHO HIV clinical stages were unexpectedly associated with *reduced* odds of poor mental health compared to stage I with stage II: aOR = 0.52, 95% CI: 0.36–0.77, p=0.001; stage III: aOR = 0.20, 95% CI: 0.08–0.47, p<0.001).

Health-related quality of life: Our study on OPLHIV in Uganda revealed that 42% reported good HRQoL, while 58% did not, with several factors significantly influencing this outcome. Age played a clear role, as individuals aged above 60 had a 2.33 times increased risk of poor HRQoL compared to those aged 50-55 (aOR=2.33; 95% CI: 1.54-3.51, p<0.001). Conversely, education appeared protective, with secondary education statistically significantly associated with a 62% reduced risk of poor HRQoL compared to with no formal education (aOR=0.38; 95% CI: 0.21-0.68, p=0.001). Unemployment was strongly linked to poorer HRQoL, increasing the odds by 2.13 times compared to the employed (aOR=2.13; 95% CI: 1.41-3.20, p<0.001). Finally, HIV clinical stage significantly impacted HRQoL, with WHO stage II increasing the odds of poor HRQoL by 1.66 times (aOR=1.66; 95% CI: 1.14-2.42, p=0.008), and stages III& IV was associated with 3.48 times (aOR=3.48; 95% CI: 1.35-8.92, p=0.009) higher odds of poor HRQoL compared to Stage I.

Discussion

The main aim of the study was to explore the correlates of HRQoL of older adults on HIV ART attending the Aids Support Organization (TASO) centres in Uganda. HRQoL in older adults on HIV ART is influenced by a range of demographic, social, and clinical factors. Key negative correlates include advanced HIV disease, high viral load, unemployment, being aged over 60 years, and certain marital statuses (separated/divorced and widowed/single). Conversely, higher education, longer ART duration, and lower WHO clinical stages generally correlated with better HRQoL across various domains like physical, role, social, energy, and mental health.

A substantial majority of OPLHIV in Uganda experience suboptimal HRQoL, despite being on antiretroviral therapy (ART). This finding aligns with studies from across sub-Saharan Africa that highlight persistent HRQoL challenges among OPLHIV, even in the context of improved ART access and viral suppression [4, 17–19]. Although Uganda's "Test and Treat" policy has effectively managed viral suppression, this alone does not address broader determinants of well-being in OPLHIV. Factors such as pervasive poverty, weak family-social support systems, stigma, late HIV diagnosis, inconsistent care access, and malnutrition contribute to diminished quality of life. These clinical and social indicators are insufficient to capture the holistic well-being of OPLHIV [2, 18]. TASO programs must therefore go beyond clinical management to address the full range of social, economic, nutritional, and psychological needs. Making TASO as a comprehensive, one-stop service hub and integrating geriatric care into existing HIV treatment frameworks—alongside multi-sectoral partnerships—are essential for improving long-term well-being and HRQoL among Uganda's aging HIV population.

Advancing age among OPLHIV in Uganda was associated with declines in role functioning and increased experience of pain. This is consistent with the broader literature on aging with HIV, which documents deterioration in physical health and HRQoL in older HIV-positive populations, despite variations across specific HRQoL domains [20, 21]. While ART has extended life expectancy, current HIV care frameworks in Uganda have not fully adapted to the complexities of aging such as comorbidities, long-term ART side effects, and age-related physiological decline exacerbated by resource constraints. Consequently, as PLHIV age, they face compounded burdens of chronic pain, functional impairment, and inadequate access to geriatric support [20]. There is an urgent need for geriatric assessments, pain management services, and rehabilitation programs through TASO by enhancing social support systems and securing policy-level commitment to fund geriatric HIV care within Uganda. And increase training geriatric healthcare providers and expanding the role of community health workers to screen for age-related decline, while embedding these services into TASO's regional infrastructure, could significantly enhance HRQoL for aging population.

Higher educational attainment is positively associated with improved HRQoL among OPLHIV, particularly by enhancing physical functioning, role functioning, social functioning, and mental health, as well as reducing health related distress. These results demonstrate that education not only improves physical and role capabilities but also fosters stronger social engagement and mental well-being while substantially lowering health-related distress. They are consistent with findings from South Africa, Canada, Ghana, and other settings which identify education and health literacy as key determinants of HRQoL in the management of chronic conditions, including HIV [17, 20, 24, 30, 37, 38]. Education likely contributes to better health outcomes by improving individuals' understanding of HIV care, fostering greater adherence to antiretroviral therapy (ART), promoting healthier behaviors, and enhancing their ability to access services and navigate health systems. Furthermore, educated individuals may be better equipped with effective coping mechanisms, stronger health literacy, and greater psychological resilience to manage stigma and emotional stress. The observed improvement in mental and emotional well-being suggests that education plays a vital role beyond physical health, supporting broader psychosocial outcomes. In light of these findings, TASO centers, situated within regional hospitals, are well placed to incorporate structured health literacy and aging-related education into their routine HIV care services. Beyond clinical treatment, TASO can strengthen its support for OPLHIV by developing and disseminating culturally relevant and age-appropriate information, education, and communication (IEC) materials, including translations into local languages. These tools can empower older adults with the knowledge and skills needed to take an active role in managing their health, adhere to treatment, make informed lifestyle choices, and ultimately experience a significantly improved quality of life [6, 17, 20, 24].

OPLHIV who are separated or widowed tend to experience lower HRQoL, especially in physical, social, and mental health domains, likely due to reduced emotional and practical support. While some separated individuals may show increased vitality possibly from adaptive coping, overall marital disruption is linked to poorer well-being. Transitioning out of marriage, particularly through widowhood, is associated with decreased mental health and lower health-related quality of life (HRQoL), especially among men [43, 44]. Also social support, adaptive coping strategies, and lower depression levels are linked to improved HRQoL across multiple dimensions. TASO centers can play a crucial role in addressing these challenges by providing tailored psychosocial support, such as peer groups, grief counseling, and mental health services integrated into routine HIV care, helping OPLHIV better manage their health and improve their quality of life.

Having multiple sexual partners is negatively associated with HRQoL among OPLHIV in Uganda, particularly impairing general health perception, social functioning, and mental health domains. This finding is consistent with existing research linking stable, monogamous relationships to better HRQoL, largely through reduced loneliness and depression [43, 44, 45]. However, the relationship dynamics among OPLHIV remain complex, as some studies suggest that single individuals may report higher HRQoL than those who are married or widowed [31, 32]. Managing multiple sexual partnerships often increases

psychological stress, risk of sexually transmitted infections (STIs), and challenges related to disclosure, all of which undermine well-being [20, 30]. The negative effects may also arise from stigma, fear of rejection, and the emotional burden of managing infidelity concerns. Additionally, older adults may engage in riskier sexual behaviors due to perceived vulnerability, further compromising their HRQoL [20]. TASO Uganda, through its intensive adherence counseling, is well positioned to address these complex psychosocial factors by providing tailored psychosocial counseling, mental health support, and community education focused on safe disclosure and healthy relationship practices. By promoting social support and emotional resilience, TASO can help OPLHIV navigate relationship challenges, enhance mental health, and ultimately improve their overall quality of life.

Unemployment significantly impairs HRQoL among OPLHIV, particularly by reducing role functioning, increasing experiences of pain, yet paradoxically associated with lower health-related distress- possibly due to reduced work-related stressors or more time available for self-care and treatment adherence. This complex pattern mirrors findings from Ethiopia, Pakistan, China, Norway, and Brazil, where unemployment exacerbates financial insecurity, social isolation, and loss of purpose—challenges that are often more pronounced in older adults [23, 25, 26, 27, 28, 33]. Economic instability and social exclusion appear to independently undermine physical, emotional, and social well-being. For many OPLHIV, joblessness fosters feelings of worthlessness and hopelessness that severely compromise overall quality of life. These findings underscore the urgent need to integrate economic empowerment initiatives within HIV care programs. Through TASO's extensive networks, government-supported, interest-free livelihood programs can be implemented to restore financial independence, promote social inclusion, and reinforce dignity, ultimately enhancing HRQoL among this vulnerable population.

A detectable viral load (>200 RNA copies/ml) among OPLHIV is associated with poorer HRQoL, particularly reflected in diminished general health perception, social functioning, energy levels, and mental health. This aligns with global evidence showing that viral suppression through sustained ART adherence significantly improves HRQoL across multiple domains [28, 33]. Maintaining an undetectable viral load is linked to higher CD4+ counts, fewer symptoms, and better immune function, all contributing to enhanced quality of life [33, 34, 40, 41]. Conversely, elevated viral loads indicate active HIV replication, which increases vulnerability to opportunistic infections and symptomatic burdens, leading to reduced physical functioning and energy. Given that HRQoL encompasses physical, mental, and social well-being, it closely correlates with treatment adherence and the degree of viral control [28]. TASO Uganda, with increased funding and resources, can strengthen personalized ART adherence support, expand regular viral load testing access, and integrate mental health services within routine HIV care for OPLHIV. Additionally, establishing community-based adherence groups and addressing structural barriers such as food insecurity and poverty will be vital to sustaining viral suppression and improving HRQoL. By implementing these comprehensive strategies, TASO can leverage its regional presence to deliver effective, holistic care tailored to the needs of aging adults living with HIV.

A significant inverse relationship was observed between WHO clinical staging and health-related quality of life (HRQoL) among older persons living with HIV (OPLHIV), with more advanced stages generally associated with poorer physical functioning and overall well-being. Notably, individuals in WHO clinical stage II exhibited a higher likelihood of impaired physical functioning, indicating that physical health may begin to decline early in disease progression. In contrast, those in more advanced stages showed markedly reduced physical, social, and mental health functioning, reflecting the compounded physical and psychological burdens characteristic of later HIV stages. These findings align with existing literature demonstrating that as HIV progresses, declines in immune function, increased susceptibility to opportunistic infections, and escalating symptom severity contribute to worsening HRQoL [20, 35]. This underscores the critical importance of early diagnosis and timely initiation of antiretroviral therapy to slow disease progression and preserve quality of life in aging populations. Consequently, HIV care programs in Uganda must prioritize prompt HIV testing, effective management of comorbidities, and the integration of stage-appropriate psychosocial support tailored to the

needs of older adults. Additionally, leveraging trained community health workers to support regular monitoring, adherence counseling, and follow-up can help prevent disease advancement and maintain HRQoL among older persons living with HIV.

The persistent challenges in physical functioning, role functioning, pain, and general health are critical areas demanding targeted interventions. This underscores a vital practical implication for HIV care in Uganda: viral suppression alone is not enough for a good quality of life. To address this, we propose a "Holistic HRQoL Care Package" for OPLHIV in TASO centers and similar facilities, which would integrate routine geriatric and pain screening, establish physiotherapy and occupational therapy referrals/integration, and offer "Pain-Free Living" workshops focused on non-pharmacological pain management and adaptive strategies, thereby directly improving the tangible aspects of daily life that significantly contribute to HRQoL

Study limitation

The lack of qualitative data constrains a comprehensive understanding of participants' subjective experiences and the nuanced psychosocial factors influencing the outcomes. Furthermore, the cross-sectional study design inherently prevents the establishment of causal relationships and limits the ability to analyze individual changes in HRQoL over time. The reliance on self-reported measures also introduces the potential for response biases. Finally, the study did not account for potential confounding variables such as social support networks and prior mental health history, which could independently affect the observed associations.

Recommendation

Future research should prioritize longitudinal study designs to accurately determine temporal changes in HRQoL and establish causal pathways. Furthermore, incorporating qualitative methodologies into investigations would offer more in-depth understanding of individual lived experiences and the specific mechanisms underlying resilience. To develop more comprehensive intervention strategies, greater emphasis should be placed on rigorously evaluated stigma reduction initiatives and accessible psychosocial support programs.

Conclusion

The findings show that the overall health-related quality of life (HRQoL) among older Ugandans living with HIV is unsatisfactory. This suggests that while antiretroviral therapy (ART) addresses the virological aspects of HIV, comprehensive interventions are needed to improve the holistic well-being, encompassing physical, psychological and social domains.

What is already known about the topic

- Health-related quality of life (HRQoL) is a critical outcome in the care of OPLHIV, a population that is growing due to the success of antiretroviral therapy (ART) leading to increased survival and longevity.
- Global evidence links HRQoL viral suppression, mental health status, social support, and comorbidities such as non-communicable diseases and geriatric syndromes significantly influence HRQoL among
- However, significant research gaps exist in understanding HRQoL specifically among OLPHIV in low-resource settings like Uganda. Most existing studies in sub-Saharan Africa tend to prioritize clinical outcomes and comorbidity prevalence, often overlooking the determinants of well-being, including psychosocial and socio-economic factors critical for the ageing HIV population's quality of life.

What this study adds

- This study provides insights by identifying key correlates of HRQoL among older adults receiving HIV care at The AIDS Support Organization (TASO) in Uganda.
- It highlights the importance of both clinical factors, like viral load, and non-clinical factors, like employment, social support, and mental health in shaping perceived quality of life.
- The findings emphasise the need to move beyond standard ART to a more holistic, person-centred HIV care models that integrate psychosocial and socio-economic support to improve the overall well-being of this population in Uganda.

Competing Interest

The authors of this work declare no competing interests.

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Availability of data and materials

Data is subject to third–party restrictions

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Authors´ contributions

CA, LKA and CM conceived and designed the study. CA, LA, and CM contributed to proposal development. CA conducted the analysis, LA and CA wrote the first draft of the paper. All authors contributed to writing of the paper. The authors read and approved the final manuscript.

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Table 1: Characteristics of Older Persons Living with HIV		
Socio-demographic characteristics	**Number (n=439)**	**Percent (%)**
Gender		
Male	167	38.0
Female	272	62.0
Age (Mean 58.3 years, SD ± 6.8 years)		
50-55 Years	182	41.2
56-60 Years	117	26.7
>60 Years	141	32.1
Level of education		
None	99	22.6
Primary	227	51.7
Secondary	82	18.7
Tertiary	31	7.1
Marital status		
Currently married/cohabiting	168	38.3
Separated/divorced	77	17.5
Widow/widower	194	44.2
Number of current sexual partners		
None	252	57.4
One	145	33.0
Two or more	42	9.6
Currently employed		
Yes	139	31.7
No	300	68.3
Clinical characteristics		
Viral load		
<200 copies	388	88.4
≥200 copies	51	11.6
Duration on ART		
<10 Years	121	27.6
10-15 Years	164	37.4
>15 Years	154	35.1
WHO HIV clinical stage		
Stage I	145	33.0
Stage II	256	58.3

Table 1: Characteristics of Older Persons Living with HIV		
Socio-demographic characteristics	**Number (n=439)**	**Percent (%)**
Stage III and IV	28	6.4
Adherence status		
Poor <85%	9	2.1
Fair 85-95%	31	7.1
Good >95%	399	90.9
History of Opportunistic Infections		
Yes	89	20.3
No	350	79.7
Tuberculosis status		
Coinfection	31	7.1
No TB symptoms	408	92.9
Has NCD (diabetes or hypertension)		
Yes	102	23.2
No	337	76.8

Table 2: Summary statistics on health-related quality of life						
Domains	**n**	**Items[a]**	**Mean[b]**	**Std. Deviation**	**Min**	**Max**
General health perceptions	439	4	12.88 (3.00)	4.31	4	20
Physical functioning	439	6	12.88 (2.14)	3.52	6	18
Role functioning	439	2	3.52 (1.76)	0.76	2	4
Social functioning	439	1	5.11 (-)	1.21	1	6
Pain	439	2	7.85 (2.58)	2.35	2	11
Energy/Fatigue	439	4	16.07 (3.65)	3.90	5	24
Health Distress	439	4	18.54 (4.64)	4.64	4	24
Mental health	439	5	19.54 (3.91)	3.13	7	30
Note: Summary statistics are based on MOS (Medical Outcomes Study) HIV Survey summated scale. [a] Number of questions in the domain. [b] Mean values based on summated and average scores.						

Table 3: Regression estimates of health-related quality of life of older persons living with HIV attending TASO Centres, Uganda									
Independent variables	**Health-Related Quality of life Domains**								
	General Health	**Physical functioning**	**Role functioning**	**Social functioning**	**Recently experienced pain**	**Energy/ fatigue**	**Health distress**	**Mental health**	**HR-QoL**
Gender									
Male	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Female	0.80 (0.51-1.24)	0.81(0.52-1.25)	1.23(0.71-2.12)	1.05(0.66-1.67)	1.10(0.71-1.70)	0.86(0.56-1.33)	0.83(0.54-1.28)	1.00(0.65-1.55)	1.20(0.78-1.85)
Age									
50-55 Years	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
56-60 Years	0.82 (0.54-1.24)	1.03(0.68-1.57)	0.91(0.54-1.55)	1.03(0.66-1.60)	0.87(0.58-1.32)	0.85(0.56-1.28)	1.14(0.75-1.73)	1.08(0.71-1.65)	1.27(0.84-1.93)
>60 Years	0.70(0.46-1.07)	0.97(0.64-1.47)	0.45(0.27-0.73)	0.82(0.52-1.27)	1.69(1.14-2.58)	1.13(0.75-1.71)	0.77(0.51-1.17)	0.82(0.55-1.25)	2.33(1.54-3.51)
Education status									
None	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Primary	0.84(0.54-1.31)	0.88(0.57-1.36)	1.00(0.60-1.67)	1.69(1.08-2.62)	0.95(0.61-1.48)	1.25(0.80-1.95)	1.26(0.82-1.94)	1.37(0.88-2.12)	0.68(0.43-1.06)
Secondary	1.28(0.73-2.24)	1.48(0.85-2.57)	2.32(1.13-4.73)	3.31(1.80-6.08)	0.51(0.29-0.89)	1.70(0.97-3.00)	3.08(1.73-5.48)	1.98(1.13-3.49)	0.38(0.21-0.68)
Tertiary	0.62(0.28-1.36)	2.09(1.00-4.39)	3.29(1.06-10.1)	3.36(1.51-8.58)	0.45(0.21-0.96)	1.49(0.70-3.19)	6.11(2.78-13.4)	2.33(1.08-5.04)	0.62(0.29-1.33)
Marital status									
Married	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table 3: Regression estimates of health-related quality of life of older persons living with HIV attending TASO Centres, Uganda									
Independent variables	**Health-Related Quality of life Domains**								
	General Health	**Physical functioning**	**Role functioning**	**Social functioning**	**Recently experienced pain**	**Energy/ fatigue**	**Health distress**	**Mental health**	**HR-QoL**
Separated/ divorced	1.05(0.60-1.85)	0.44(0.25-0.82)	2.02(0.95-4.30)	0.47(0.25-0.88)	1.22(0.69-2.15)	1.89(1.10-3.26)	1.19(0.68-2.09)	0.60(0.34-1.05)	0.86(0.49-1.52)
Widowed/single	0.84(0.48-1.46)	0.47(0.27-0.82)	1.02(0.52-2.00)	0.27(0.14-0.50)	1.31(0.64-1.98)	1.60(0.94-2.72)	0.77(0.43-1.35)	0.56(0.32-0.98)	0.82(0.48-1.41)
No. of partners									
None	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
One	1.00(0.95-1.04)	0.78(0.46-1.31)	1.36(0.71-2.62)	0.52(0.29-0.93)	0.72(0.42-1.23)	1.22(0.74-2.02)	1.19(0.70-2.01)	0.69(0.41-1.15)	0.78(0.47-1.30)
Two or more	0.45(0.85-0.99)	0.68(0.32-1.41)	2.05(0.79-5.28)	0.46(0.20-1.04)	0.64(0.30-1.35)	0.63(0.31-1.30)	1.29(0.61-2.73)	0.41(0.20-0.84)	0.79(0.37-1.67)
Employment									
Employed	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Unemployed	0.79(0.94-1.01)	0.84(0.56-1.25)	0.40(0.23-0.68)	1.18(0.77-1.81)	1.76(1.19-2.62)	0.84(0.57-1.25)	0.64(0.43-0.96)	0.80(0.54-1.20)	2.13(1.41-3.20)
Viral load									
<200 copies/ml	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
>200 copies/ml	2.52(1.42-4.46)	1.01(0.57-1.80)	1.07(0.53-2.15)	2.27(1.23-4.19)	0.84(0.47-1.48)	2.26(1.31-3.88)	1.52(0.86-2.69)	2.55(1.44-4.53)	1.00(0.56-1.78)
ART Duration									
<10 Years	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
11-15 Years	1.00(0.95-1.03)	0.61(0.40-0.94)	0.72(0.42-1.22)	1.12(0.71-1.76)	1.23(0.80-1.89)	1.46(0.96-2.22)	0.88(0.57-1.35)	0.96(0.63-1.47)	1.26(0.82-1.94)

Table 3: Regression estimates of health-related quality of life of older persons living with HIV attending TASO Centres, Uganda									
Independent variables	**Health-Related Quality of life Domains**								
	General Health	**Physical functioning**	**Role functioning**	**Social functioning**	**Recently experienced pain**	**Energy/ fatigue**	**Health distress**	**Mental health**	**HR-QoL**
>15 Years	0.90(0.94-1.02)	0.68(0.44-1.05)	0.64(0.37-1.10)	0.84(0.53-1.33)	1.46(0.98-2.24)	1.41(0.92-2.17)	0.78(0.50-1.20)	0.67(0.44-1.04)	1.35(0.87-2.09)
WHO stage									
Stage I	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Stage II	1.26(0.86-1.88)	1.45(1.00-2.11)	0.46(0.28 - 0.76)	0.58(0.38-0.88)	1.15(0.79-1.68)	0.64(0.43-0.95)	0.37(0.24-0.55)	0.52(0.36-0.77)	1.66(1.14-2.42)
Stage III and IV	0.36(0.16-0.79)	0.17(0.06-0.45)	0.17(0.06-0.47)	0.06(0.02-0.14)	1.68(0.75-3.76)	0.29(0.13-0.64)	0.10(0.04-0.24)	0.20(0.08-0.47)	3.48(1.35-8.92)
Adherence									
Poor (<85%)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fair (85-95%)	2.14(0.62-7.39)	1.97(0.40-9.73)	1.04(0.22-4.80)	0.61(0.13-2.88)	1.04(0.75-1.38)	2.55(0.68-9.51)	0.54(0.14-2.06)	1.66(0.44-6.26)	3.13(0.77-12.7)
Good (>95%)	1.46(0.50-4.24)	0.68(0.15-2.97)	1.41(0.37-5.37)	1.06(0.26-4.27)	0.43(0.11-1.64)	1.78(0.55-5.60)	1.08(0.33-3.52)	1.60(0.49-5.17)	1.27(0.36-1.54)
TB (12 months)									
TB coinfection	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
No symptoms	1.07(0.51-2.24)	0.95(0.45-2.03)	2.64(1.05-6.59)	0.59(0.27-1.27)	0.49(0.23-1.06)	0.56(0.26-1.20)	1.53(0.71-3.27)	0.82(0.38-1.78)	0.72(0.34-1.58)
Note: 1-Reference category, Adjusted Odds Ratio [aRR], (95% Confidence interval); * P<0.05; ** P<0.01; *** p<0.001									