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Prevalence and factors influencing the development of hypertension among people living with HIV and AIDS attending TASO at Mulago Hospital. A Cross-sectional study.

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ABSTRACT

Background:

Hypertension has devastated the lives of many people living with HIV/AIDS (PLWHIV) globally, yet its prevalence in Uganda is not known. This study aimed to determine the prevalence and factors influencing hypertension among PLWHIV and AIDS at TASO Mulago.

Methodology:

A cross-sectional design was employed with qualitative and quantitative approaches on 80 randomly sampled participants. Qualitative data was collected through interviews. Blood pressure measured by a sphygmomanometer, Height, and weight data by anthropometry were used to compute the body mass index (BMI). Descriptive statistics were run to report frequencies, means, and standard deviations for continuous variables, chi-square tests, and binary logistic regressions with adjusted odds ratios (AORs). Statistical significance was considered for p-values < 0.05. Ethical clearance obtained from Mild May Uganda Research Ethics Committee and study authorization from TASO.

Results:

In a sample of 80 PLWHIV attending TASO Mulago, the majority were females, 56(70.0%), while 50 (30%) were males. The majority 45.0% were married, 10(12.5%) single, 16(20.0%) divorced and 18(22.5%) widowed. The prevalence of hypertension was 37.5% (95% CI [27.5, 48.8]). In multivariable analysis, having secondary or higher education was independently associated with lower odds of hypertension (AOR = 0.27, 95% CI [0.08, 0.94], p = .040), whereas an undetectable viral load was associated with higher odds of hypertension (AOR = 2.83, 95% CI [1.00, 7.99], p = .049). Age ≥45 years, male sex, marital status, employment, socioeconomic status, ART regimen, and over-nutrition were not significantly associated with hypertension in the adjusted model.

Conclusion:

Hypertension is a prevalent comorbidity among PLWHIV at TASO Mulago, highlighting the dual burden of HIV and cardiovascular disease.

Recommendation:

Integration of HIV care through routine hypertension screening, nutritional counseling, adherence support, and targeted lifestyle interventions, to reduce cardiovascular complications and improve long-term health outcomes for PLWHIV in Uganda.

Keywords: *Prevalence, hypertension, People living with HIV and AIDS, The AIDS Support Organization, Mulago Hospital.*
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BACKGROUND

Hypertension, commonly referred to as the "silent killer," is a growing global public health concern, especially among people living with HIV/AIDS (PLWHIV) (Revoori et al., 2024). According to the World Health Organization (WHO, 2021), over 1.13 billion people worldwide have hypertension, many of whom also live with chronic conditions such as HIV. This dual burden significantly complicates health management and demands urgent attention from healthcare systems and policymakers.

In sub-Saharan Africa, where HIV prevalence remains high, hypertension among PLWHIV has reached alarming levels (Chiwandire et al., 2021). A systematic review reported prevalence rates as high as 40% among PLWHIV in East Africa (Kibret et al., 2021). Uganda, with approximately 1.4 million PLWHIV (UNAIDS, 2021), has also seen concerning rates: one study in Kampala found that 35% of PLWHIV were hypertensive, while another reported prevalence close to 50% in HIV care settings (Nabbuye et al., 2021; Okyere et al., 2022). These statistics are significantly higher than the national hypertension prevalence of around 30% (Uganda Ministry of Health, 2020), underscoring the need for targeted interventions.

Despite the growing burden, data specific to PLWHIV remains limited. Barriers such as HIV-related stigma, poor access to care, and limited integration of non-communicable disease (NCD) management within HIV services hinder comprehensive care. Demographic factors also influence hypertension risk. For example, older adults and women are more likely to develop hypertension, with females being reported to be 5.5 times more likely than males (Okyere et al., 2022).

Health-related factors also play a role. Long-term antiretroviral therapy (ART) has been associated with weight gain and metabolic changes that increase blood pressure (Fahme et al., 2018). Chronic immune activation, inflammation, and immune reconstitution due to HIV infection can affect vascular and renal function, further raising hypertension risk (Mbuthia et al., 2021). Comorbidities like diabetes and kidney disease exacerbate this burden.

Global and national efforts have aimed at integrating hypertension care into HIV services. The WHO advocates for the integration of NCD management within HIV programs and routine hypertension screening during HIV visits. In line with this, Uganda's Ministry of Health introduced NCD integration guidelines to facilitate the inclusion of hypertension screening and treatment in HIV care (Uganda Ministry of Health, 2022). A pilot project in selected clinics showed improved hypertension screening and management among PLWHIV (Mugisha et al., 2021).

TASO Uganda is a key provider of HIV care, particularly for marginalized populations such as men who have sex with men, sex workers, and people who use drugs, who are at heightened risk of hypertension due to poor diet, inactivity, substance use, and HIV-related mental health challenges like depression and anxiety (Tugume et al., 2021; Kigozi et al., 2021; Mbuthia et al., 2021). Long-term ART in these populations is further linked to hypertension risk (Fahme et al., 2018).

Despite these risks, hypertension management at TASO remains limited. Only 15% of PLWHIV receive routine hypertension screening (Mugisha et al., 2020), and just 1% of those diagnosed receive treatment (Kigozi et al., 2021). Challenges include inadequate provider training and weak integration of hypertension care into HIV services (Islam et al., 2023).

Lower socioeconomic status has been linked to limited access to care and increased stress, both of which contribute to hypertension among PLWHIV (Mazumder et al., 2023). Addressing these gaps will help guide targeted interventions to improve health outcomes in this vulnerable population. This study, therefore, aims to determine the prevalence of hypertension among PLWHIV at TASO Mulago and examine how socio-demographic factors such as age, sex, income, education, and occupation affect hypertension risk.

METHODOLOGY

Study Design

This study employed an analytical cross-sectional design utilizing quantitative methods. This design is appropriate for assessing the prevalence of hypertension among people living with HIV and AIDS (PLWHIV) attending TASO Mulago, and for determining the association between socio-demographic and health-related factors that influence the development of hypertension within this population.

Study Setting

The study was conducted at TASO Mulago in Kampala, a leading HIV care center serving people living with HIV/AIDS. The site is ideal due to its high client volume and integrated health services.

On average, 50 clients attend the clinic daily, with 80% (about 40 clients) undergoing routine blood pressure screening. The remaining 10% are typically absent for medication pickup and are represented. Among those

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screened, 10% (approximately 4 clients daily) are found to have either hypertension or pre-hypertension. This amounts to around 120 potential hypertensive or pre-hypertensive clients monthly.

Study Population

The study population comprised people living with HIV/AIDS (PLWHIV) who are receiving care at TASO Mulago in Kampala, Uganda. This includes adult clients aged 18 years and above who have been on anti-retroviral therapy (ART) for at least six months. Eligible participants will be those attending the clinic during the study period, who consent to participate, and who are available for clinical assessment, including blood pressure measurement.

This population is appropriate for the study as it allows access to individuals who may be at increased risk of developing hypertension due to factors related to HIV, ART use, and lifestyle. The setting also ensures that participants have ongoing interaction with healthcare services, facilitating reliable data collection and follow-up.

Sample Size Determination

The sample size for this study was determined using Yamane's (1967) formula, a widely recognized method for calculating representative samples from finite populations. This formula was employed because it accounts for the total population size while adjusting for the desired level of precision, making it suitable for this study's target group of 50 attendances at the clinic per week out of 8000 clients in total, 80% are screened for hypertension, and 10% are found with hypertension. A 95% confidence level with a 5% margin of error (e = 0.05) was applied to ensure a balance between accuracy and practicality.

The sample size (n) was calculated as follows:

N=N/1+N(e2)

Where:

n= sample size

N= population size

, e= margin of error

N=100

e=0.05

n= 100/1+100(0.052)

=100/1+100(0.0025)

= 100/1+0.25

= 100/1.25

n= 80

Based on this calculation, 80 clients were selected, representing 80% of the total population. This sample size ensured that the findings are statistically significant and can be generalized to the entire clinic population with minimal bias. The use of Yamane's formula is appropriate for this study as it provides a reliable and straightforward approach to determining sample sizes in educational research, particularly when dealing with small, well-defined groups.

Sampling Procedure

A simple random sampling method was employed to select participants for this study. The process involved obtaining a comprehensive list of all eligible HIV-positive clients attending TASO Mulago during the data collection period, who met the inclusion criteria (such as age 18 years and above, on ART for at least six months). Each eligible client was assigned a unique identification number. A computer-generated random number method or lottery system was then used to randomly select the required sample size of 80 participants from this list. This approach ensures that every eligible individual has an equal chance of being included, thereby minimizing bias and enhancing the representativeness of the sample.

Inclusion criteria

Adults aged 18 or older with a confirmed HIV diagnosis verified through medical records, attending TASO Mulago during data collection, which facilitates relevance and accessibility. Participants who understood and responded to the questionnaires, with translation support.

Exclusion criteria

This comprised individuals without documented HIV status, those with cognitive impairments or language barriers that cannot be addressed, and critically ill persons at the time of data collection. These measures protect data validity and participant safety.

Bias

Only informed, cooperative individuals were included, reducing bias and enhancing the applicability of results for targeted interventions, especially in resource-limited settings like Uganda.

Data collection

Questionnaire Survey

In this study, structured questionnaires were employed to collect quantitative data from participants to address the specific objectives. The questionnaire included sections on

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socio-demographic characteristics (such as age, gender, and socioeconomic status) to evaluate associated factors with hypertension among people living with HIV attending TASO Mulago. It also gathered medical history, including HIV-related clinical information, and lifestyle factors like physical activity and dietary habits, to explore their relationship with hypertension prevalence. This structured approach facilitated the collection of standardized data suitable for statistical analysis, enabling the identification of patterns and associations relevant to the prevalence and determinants of hypertension within this population.

Administration of instruments

Questionnaires were administered through face-to-face interviews with each participant. During the session, questions were read aloud and participants' responses recorded by ticking the appropriate options on the questionnaire form. This approach ensured clarity and allowed immediate clarification of any questions, thereby enhancing data accuracy. To maintain confidentiality and comfort, interviews were conducted privately within the clinic environment. Each questionnaire was reviewed to ensure completeness and consistency before proceeding to the next participant.

Data Analysis Procedure

This study adopted a cross-sectional analytical design, and data were collected exclusively through structured questionnaires administered to people living with HIV (PLWHIV) attending TASO Mulago. The questionnaire captured key socio-demographic variables such as age group, sex, marital status, education level, occupation, and socio-economic status, as well as participants' hypertension status. After data collection, responses were coded, cleaned, and entered into Statistical Package for the Social Sciences (SPSS) version 26 for analysis.

The data analysis commenced with descriptive statistics to summarize the background characteristics of study participants. For categorical variables such as age group, sex, marital status, education level, occupation, socio-economic status, and hypertension status, data were presented in terms of frequencies, percentages, and chi-squares. The distribution of these variables was displayed using pie charts and bar graphs to provide a visual overview of participant characteristics.

To examine the relationship between hypertension and selected socio-demographic factors, inferential statistical analysis was conducted. Specifically, chi-square tests of independence were used to assess associations between hypertension status and each of the following categorical variables: sex, age group, marital status, education level, occupation, and socio-economic status. Where expected cell counts are too low for the chi-square test to be valid.

To identify the independent predictors of hypertension, binary logistic regression analysis was performed. In this model, hypertension status (yes/no) was the dependent variable, while independent variables included age group, sex, marital status, education level, occupation, and socio-economic status. This multi-variable analysis allows for the control of potential confounders and provides a clearer understanding of which socio-demographic factors are significantly associated with hypertension among PLWHIV. Results were presented as Adjusted Odds Ratios (AORs) with corresponding 95% Confidence Intervals (CIs). A p-value of less than 0.05 was considered statistically significant.

All findings were reported in both narrative and tabular formats, with accompanying charts and graphs to aid interpretation. This approach ensures that the study objectives are addressed systematically and that the results are presented in a clear and comprehensible manner, in line with the quantitative and cross-sectional nature of the study.

Validity

To ensure the validity of the data collected, the questionnaire was pre-tested on a small group of participants who were similar to those in the main study but were not included in the final analysis. This pre-test helped identify questions that are unclear, ambiguous, or difficult to understand. Based on the feedback, any confusing or irrelevant questions were revised or removed to improve clarity and relevance. This process ensures that the questionnaire measures what it is intended to measure and is appropriate for the study population.

Reliability

To maintain the reliability of the data, standardized procedures were strictly followed during data collection. Before starting the main study, thorough training was conducted on how to administer the questionnaire correctly, including how to ask questions, record responses accurately, and handle ethical issues such as confidentiality and informed consent. This training will help reduce errors and variation in data collection. Additionally, by personally administering the questionnaires using the same approach for all participants, consistency was ensured. This helped

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Original Article

produce data that is stable and reproducible across all respondents.

Ethical Consideration

Ethical clearance was obtained from the Mild-may School of Health Sciences Research and Ethics Committee and TASO Mulago. Permission was also sought from the administration of the health facility where the data was collected. Participants were informed about the study's purpose, procedures, potential risks, and benefits before providing written informed consent. Participation was voluntary, with the right to withdraw at any time without consequence. Confidentiality was maintained through anonymized data using unique codes, and access was restricted to the research team. Measures were taken to minimize psychological or social harm, and participants were allowed to ask questions and receive feedback on study findings.

RESULTS

Characteristics of PLWHIV at TASO Mulago

The study assessed 80 respondents; the majority were females, 56(70.0%), while 50 (30%) were males. In addition, the majority, 45.0% of respondents were married, 10(12.5%) single, 16(20.0%) divorced, and 18(22.5%) widowed.

Table 1: Characteristics of PLWHIV at TASO Mulago

Variables	Frequency (N=80)	Percentage
Age category		
24 or below	6	7.5
25 to 34	24	30.0
35 to 44	20	25.0
45 and above	30	37.5
Marital status		
Single	10	12.5
Married	36	45.0
Divorced	16	20.0
Widowed	18	22.5
Education level		
None	4	5.0
Primary	30	37.5
Secondary	38	47.5
Tertiary	8	10.0
Occupation		
Unemployed	32	40.0
Self employed	40	50.0
Casual labourer	4	5.0
Salaried work	4	5.0
Socioeconomic status		
Low-income earner	64	80.0
Middle-income earner	16	20.0

Most respondents had lived with HIV for more than ten years, 41 (51.2%), while the rest had had HIV for five to ten years, 26 (32.5%), and less than 5 years, 13 (16.3%). Almost all 74 (92.5%) of the assessed PLWHIV were on the TDF/3TC/DTG combination, while only 6 (7.5%) were on other treatment regimens.

The viral load was not detected in most respondents 50, 62.5%), while 25 (31.3%) and 5 (6.3%) had a viral load of less than 100 copies and 100 or more copies, respectively.
The majority, 77(96.3%) of the assessed people living with HIV/AIDS did not suffer chronic illnesses, while 3 individuals reported experiencing chronic illnesses.

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The majority, 57(71.3%) of the respondents had opportunistic infections such as tuberculosis. In addition, only 21(26.3%) of the assessed PLWHIV had a normal nutritional status, while 6 (6.7%), 23 (28).

The majority, 59(73.8%) of the assessed PLWHIV reported that they experienced drug-related side effects, which did not greatly affect their drug adherence. The majority, 60 (75.0%) of respondents had never missed treatment, while 17 (21.3%) and 3 (3.8%) missed their treatment 1 to 2 times and 3 to 5 times, respectively.

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Table 2: Characteristics of PLWHIV at TASO Mulago

Variables	Frequency (N=80)	Percentage (%)
Years with HIV		
< 5 years	13	16.3
5 to 10 years	26	32.5
>10 years	41	51.2
ART regimen		
TDF/3TC/DTG	74	92.5
Others	6	7.5
Viral load		
Not detected	50	62.5
<100 copies	25	31.3
100+ copies	5	6.3
Chronic illness		
No	77	96.3
Yes	3	3.8
Opportunistic infections		
No	57	71.3
Yes	23	28.7
Nutritional status		
Underweight	6	7.5
Normal	21	26.3
Overweight	23	28.7
Obese	30	37.5
Drug side effects		
No	21	26.3
Yes	59	73.8
Drug adherence effect		
Not at all	59	73.8
Slightly	19	23.8
Moderately	2	2.5
Ever missed drugs		
Never	60	75.0

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1 to 2 times	17	21.3
3 to 5 times	3	3.8
ART changed		
No	64	80.0
Yes	16	20.0
Health anxiety		
Never	13	16.7
Sometimes	16	20.5
Often	19	24.4
Always	30	38.5
Support system		
No	28	35.0
Yes	52	65.0
Comfort discussed		
No	4	5.0
Yes	76	95.0
Mental referral		
No	71	88.8
Yes	9	11.2

Foods that were consumed occasionally among the majority of respondents include fruits and vegetables 40, 50.0%), whole grains 35, 43.8%), and lean protein 39, 48.8%). Foods that were eaten more than 3 to 5 times by the majority of respondents include legumes 35 (43.8%), dairy 31 (38.8%), saturated fats 29 (36.7%), sugary drinks 33 (41.3%), and red meat 36 (45.0%). The prevalence of hypertension was 30 (37.5%) among the respondents.

Table 3: Characteristics of PLWHIV at TASO Mulago

Variables	**Frequency (N=80)**	Percentage
Fruit and vegetables		
Rarely	11	13.8
Daily	5	6.3
Occasionally	40	50.0
3 to 5 times	24	30.0
Whole grains		
Rarely	6	7.5
Daily	6	7.5
Occasionally	35	43.8
3 to 5 times	33	41.3
Legumes		
Rarely	1	1.3
Daily	31	38.8
Occasionally	13	16.3
3 to 5 times	35	43.8
Dairy		
Rarely	2	2.5
Daily	24	30.0
Occasionally	23	28.7

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3 to 5 times	31	38.8
Saturated fats		
Rarely	3	3.8
Daily	19	24.1
Occasionally	28	35.4
3 to 5 times	29	36.7
High sodium		
Rarely	4	5.0
Daily	30	37.5
Occasionally	28	35.0
3 to 5 times	18	22.5
Sugary drinks		
Rarely	4	5.0
Daily	25	31.3
Occasionally	18	22.5
3 to 5 times	33	41.3
Red meat		
Daily	12	15.0
Occasionally	32	40.0
3 to 5 times	36	45.0
Lean protein		
Rarely	1	1.3
Daily	8	10.0
Occasionally	39	48.8
3 to 5 times	32	40.0

Prevalence of hypertension among PLWHIV attending TASO Mulago.

The first objective of the study was to determine the prevalence of hypertension among PLWHIV at TASO Mulago. The findings of this objective were gathered from questionnaires from respondents and their views on hypertension contraction.

Figure 1 shows the prevalence of hypertension among the assessed PLWHIV in Mulago. The findings show that 30(37.5%,95% CI [27.5%,48.8%]) had hypertension, while 50 (62.5%, 95% CI [51.2%,72.5%]) did not have hypertension.

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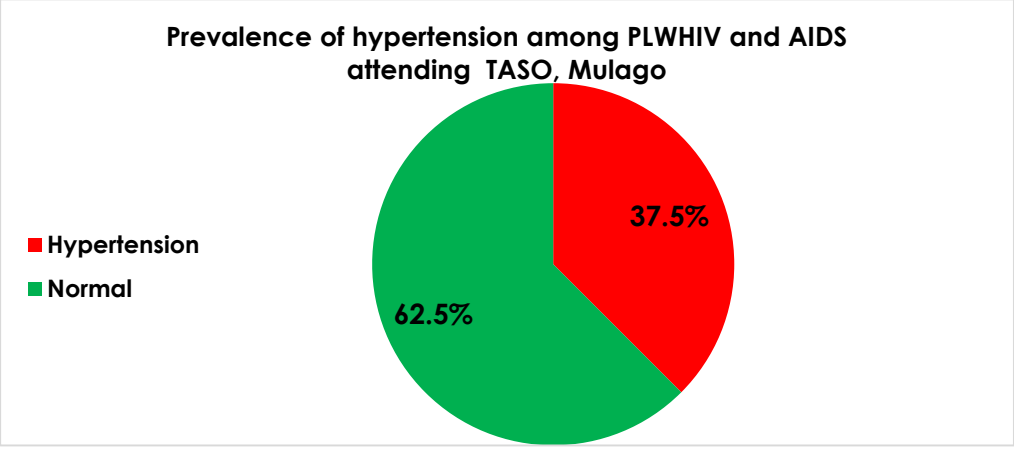

Figure 1: Prevalence of hypertension among PLWHIV at TASO, Mulago

These results were statistically significant. This finding can generally be used to conclude that hypertension may not be as prevalent among PLWHIV in Uganda. These findings do agree with research results by Magande et al. (2017) in Eastern Uganda, which reported significant rates of hypertension among PLWHIV and attributed it to a combination of urbanization, poor dietary habits, low physical activity, and ART exposure.

The present study established that 37.5% of PLWHIV attending TASO Mulago were hypertensive. This prevalence is considerably higher than both national and regional benchmarks. According to the Uganda Bureau of Statistics (UBOS) 2021 health survey report, the national prevalence of hypertension among PLWHIV was 26.4%, indicating that the burden of hypertension within this facility-based sample at TASO Mulago exceeds the national average by more than 10 percentage points. Comparatively, the Uganda STEPS survey (2023) reported a national adult hypertension prevalence of 22.2% in the general population (Bahendeka et al., 2023). Regionally, Chen et al. (2024) observed a prevalence of 21.9% among PLWHIV in Sub-Saharan Africa, while Tegegne et al. (2023) reported 19.5% in East Africa.

This study contributes significantly to the evidence base by providing facility-specific data for TASO Mulago, filling a notable gap where recent local prevalence figures were lacking. The implication is clear: nearly four in ten clients may be hypertensive, often unknowingly posing an urgent challenge to HIV care models. Immediate programmatic adjustments are necessary, particularly strengthening hypertension screening, patient education, and risk-reduction strategies as standard components of HIV care at TASO and similar facilities.

These findings show the intersection of social and health inequities, emphasizing the need for differentiated care approaches that address these demographic risk factors in hypertension prevention among PLWHIV.

Association between socio-demographic factors and hypertension among PLWHIV at TASO Mulago.

The second objective of the study was to determine associations between socio-demographic factors and the development of hypertension among PLWHIV at TASO Mulago. The findings of this objective were gathered from questionnaires and interviews with respondents.

Logistic regression analysis revealed that hypertension was positively associated with age, gender, marital status, and employment status. Specifically, the odds of being hypertensive were 1 times higher among people aged 45 or more years (AOR=1.05, 95% CI [0.33, 3.35], p= 0.936) compared to their counterparts who were aged below 45 years. Males, married and employed PLWHIV, were twice as likely to be hypertensive as their counterparts who were females, not married and unemployed. On the other hand, the odds of hypertension were significantly lower among respondents who had attained secondary/higher education (AOR=0.27, 95% CI [0.08, 0.94], p=0.040) compared to those without secondary school education. In addition, the odds of being hypertensive were lower among middle-income earners compared to their counterparts who were

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low-income earners (AOR=0.74, 95% CI [0.18, 3.08], p= 0.684).

Table 4: Socio-demographic factors and hypertension among PLWHIV

Variables	Hypertension n (%)			
	No	Yes	AOR (95%CI)	P value
Age category				
<45	33 (66.0%)	17 (56.7)	1	
45 and above	17 (34.0)	13 (43.3)	1.05 (0.33-3.35)	0.936
Gender				
Female	36 (72.0)	20 (66.7)	1	
Male	14 (28.0)	10 (33.3)	1.55 (0.50-4.77)	0.444
Marital status				
Not married	29 (58.0)	15 (50.0)	1	
Married	21 (42.0)	15 (50.0)	1.80 (0.59-5.47)	0.298
Education				
Primary	17 (34.0)	17 (56.7)	1	
Secondary	33 (66.0)	13 (43.3)	0.27 (0.08-0.94)	0.040*
Employment				
Unemployed	21 (42.0)	11 (36.7)	1	
Employed	29 (58.0)	19 (63.3)	1.97 (0.65-6.02)	0.232
Socioeconomic status				
Low income	39 (78.0)	25 (83.3)	1	
Middle	11 (22.0)	5 (16.7)	0.74 (0.18-3.08)	0.684

p<0.05 and statistically significant at 95% confidence interval

The study revealed that older age (≥45 years) was strongly associated with hypertension, confirming evidence from Kanyike et al. (2024) and Okyere et al. (2022) who found that aging PLWHIV are at higher risk due to vascular deterioration and cumulative exposure to ART. As HIV transitions from a fatal to a chronic condition, older clients now face long-term complications like hypertension. Male participants had a higher prevalence (41.7%) compared to females (35.7%), echoing findings from Mbuthia et al. (2021) and Magande et al. (2017) who attributed this to men's lower health-seeking behavior and higher exposure to risk factors like alcohol and smoking. However, Okyere et al. (2022) reported higher hypertension in post-menopausal females in South Africa, suggesting gender effects may be influenced by hormonal and regional variations.

Marital status was also significant, with married participants more likely to be hypertensive, a trend also noted by Stephen et al. (2023) in Northeast Nigeria. This may be linked to life stress, financial responsibilities, or dietary patterns in family settings. Educational attainment showed a protective effect. Respondents with secondary or higher education had significantly lower odds of hypertension, supporting findings by Mivumbi & Gbadamosi (2025) in Kigali, Rwanda. Education likely enhances health literacy and empowers individuals to adopt preventive behaviors and seek timely care.

Association between health-related factors and hypertension among PLWHIV at TASO Mulago

The third objective of the study was to determine the association between Health-related factors that influence the development of hypertension among PLWHIV at TASO Mulago. Table 4 below shows the results generated from the regression analysis that positive predictors of hypertension (HTN) were years lived with HIV, ART regimen, viral load,

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Original Article

overnutrition, alcohol use, having ART side effects, and missing treatment. Specifically, the odds of HTN were twice as high among respondents who had lived with HIV for more than five years, were on other ART regimens, over over-nourished, and experienced ART-related side effects. In addition, those who sometimes missed ART were 4 times (AOR=3.53, 95% CI [0.83,14.97], p=0.087) more likely to be hypertensive than those who never missed treatment. Having a non-detected viral load was a significant predictor of HTN (AOR=2.83, 95% CI [1.00, 7.99], p=0.049). The likelihood of HTN was reduced among people with opportunistic infections (AOR=0.63, 95% CI [0.20,1.96], p=0.427) and those whose ART regimens were changed (AOR=0.61, 95% CI [0.14, 2.59], p=0.500).

Table 5: Health-related factors and hypertension among PLWHIV

Variables	Hypertension n (%)			
	No	Yes	AOR (95%CI)	P value
Years with HIV				
5 or fewer	12 (24.0)	7 (23.3)	1	
> 5 years	38 (76.0)	23 (76.7)	1.55 (0.42-5.73)	0.513
ART regimen				
TDF/3TC/DTG	46 (92.0)	28 (93.3)	1	
Others	4 (8.0)	2 (6.7)	1.85 (0.21-16.17)	0.578
Viral load				
Detected	15 (30.0)	15 (50.0)	1	
Not detected	35 (70.0)	15 (50.0)	2.83 (1.00-7.99)	0.049*
Opportunistic infections				
No	37 (74.0)	20 (66.7)	1	
Yes	13 (26.0)	10 (33.3)	0.63 (0.20-1.96)	0.427
Over nutrition				
No	14 (28.0)	13 (43.3)	1	
Yes	36 (72.0)	17 (56.7)	2.19 (0.74-6.49)	0.159
Alcohol use				
No	31 (62.0)	23 (76.7)	1	
Yes	19 (38.0)	7 (23.3)	1.68 (0.48-5.82)	0.416
ART side effects				
No	10 (20.0)	11 (36.7)	1	
Yes	40 (90.0)	19 (63.3)	1.72 (0.48-6.15)	0.407
ART missed				
No	34 (68.0)	26 (86.7)	1	
Yes	16 (32.0)	4 (13.3)	3.53 (0.83-14.97)	0.087
ART changed				
No	40 (80.0)	24 (280.0)	1	
Yes	10 (20.0)	6 (20.0)	0.61 (0.14-2.59)	0.500

p<0.05 and statistically significant at 95% confidence interval

The above findings, like those for PLWHIV who had lived with HIV for more than five years, were twice as likely to be hypertensive. This confirms studies by Hagabimana et al. (2024), who attributed the risk to long-term ART use and chronic immune activation. Being overweight was a significant predictor, echoing findings from Dechasa et al. (2023) in Ethiopia and Ngcobo et al. (2022) in South Africa, who documented higher hypertension prevalence among overweight PLWHIV. Urban diets, lack of exercise, and ART-related fat redistribution may explain this trend.

Notably, clients with non-detectable viral loads were more likely to be hypertensive. This contradicts Carter (2018) but aligns with Okello et al. (2023), who proposed that long-term viral suppression might be linked with metabolic side

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Original Article

effects due to ART toxicity. These findings highlight that virologic success does not equate to overall health, and NCD risks must be monitored even in stable patients.

The respondents with opportunistic infections were less likely to have hypertension, possibly due to weight loss or increased clinical visits that enable earlier BP detection and intervention. Also, clients who had missed ART doses showed a higher likelihood of hypertension, consistent with Ngcobo et al. (2022), who reported that poor adherence undermines immune recovery and may worsen cardiovascular outcomes.

These health-related risk factors highlight the need for integrated monitoring of viral suppression, adherence, and metabolic parameters within ART programs.

DISCUSSION

Prevalence of hypertension among PLWHIV attending TASO Mulago

The study found that 37.5% of people living with HIV at TASO Mulago had hypertension, a prevalence notably higher than both the national estimate of 26.4% among PLWHIV (Ministry of Health, 2020) and the 22.2% observed in the general adult population in Uganda (Bahendeka et al., 2023). This elevated burden highlights that nearly four in ten HIV clients at this facility may face increased cardiovascular risk, underscoring the intersection of communicable and non-communicable diseases within HIV care. The relatively higher prevalence in this sample could reflect both biological and contextual factors, including the effects of long-term ART, lifestyle changes, and the unique demographic profile of TASO clients, many of whom may reside in urban Kampala, where dietary transitions and sedentary behaviors are more pronounced.

These findings align with previous Ugandan research. Lubega et al. (2021) reported a prevalence of 29% among ART clients, while Magande et al. (2017) documented significant rates in Eastern Uganda linked to urbanization and poor dietary practices. The prevalence observed at TASO Mulago, however, surpasses these earlier reports, suggesting a possible facility-specific or temporal increase in disease burden. Similar patterns have been described across Africa and beyond: Mbuthia, Magutah, and McGarvey (2021) reported hypertension in 25.3% of male and 16.9% of female HIV patients in Kenya, while Antonello et al. (2015) observed 22.5% in southern Brazil. The consistently elevated prevalence across diverse settings reinforces the global nature of this challenge among PLWHIV, though the higher figures in Uganda may point to contextual vulnerabilities.

One limitation of this facility-based analysis is the possibility of selection bias, since TASO Mulago clients may not fully represent the broader population of PLWHIV in Uganda. The reliance on self-reported lifestyle behaviors also restricts deeper interpretation of contributing factors. Nevertheless, the large confidence interval around the prevalence estimate and the magnitude of difference from national benchmarks suggest that the finding is robust and clinically important.

The implications are immediate and profound. Integrating hypertension screening, risk reduction, and patient education into HIV care at TASO Mulago is essential to prevent downstream cardiovascular complications. Beyond the facility, these results call for policy-level strategies to embed chronic disease management into HIV programs across Uganda, ensuring that gains from ART are not undermined by rising non-communicable disease burdens.

The study reveals a higher-than-expected prevalence of hypertension among PLWHIV at TASO Mulago, exceeding both national and regional estimates. This finding emphasizes the urgency of strengthening integrated care approaches and illustrates the shifting health needs of an aging HIV-positive population.

Association between socio-demographic factors and hypertension among PLWHIV at TASO Mulago

The study showed that hypertension among PLWHIV at TASO Mulago was associated with several socio-demographic factors, particularly age, gender, marital status, education, and employment status. Clients aged 45 years or more had higher odds of being hypertensive, echoing the well-documented link between aging and elevated blood pressure (Sarfo et al., 2019; Kanyike et al., 2024). Although the odds ratio in this study was modest and statistically nonsignificant, the trend underscores the cumulative effects of vascular deterioration and long-term ART exposure as PLWHIV live longer (Deeks et al., 2013; Okyere et al., 2022).

Male participants exhibited a greater prevalence of hypertension than females, a finding consistent with Ugandan and regional studies. Magande et al. (2017) and Mbuthia et al. (2021) attributed this disparity to lower health-seeking behavior and higher exposure to alcohol and smoking among men. At the same time, contrasting evidence from Okyere et al. (2022) highlights that post-

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Original Article

menopausal women may experience elevated risks, pointing to a complex interaction between biology, hormones, and social determinants.

Married clients were nearly twice as likely to be hypertensive compared to unmarried counterparts, mirroring findings from Stephen et al. (2023) in Nigeria. While marriage often provides social support and better ART adherence, it may also introduce financial and psychosocial stressors that contribute to hypertension. Dietary practices within family settings, such as higher salt consumption, could further explain this association (Maher et al., 2011).

Education emerged as a protective factor. Clients with secondary or higher education had significantly lower odds of developing hypertension compared to those with only primary education, supporting evidence from Mivumbi and Gbadamosi (2025) and Rutaremwa and Kabagenyi (2016). Higher education improves health literacy, enabling individuals to recognize symptoms, adhere to medication, and engage in preventive behaviors. This finding affirms the need to integrate targeted health education into HIV care at TASO Mulago, especially for clients with limited formal schooling.

Employment was positively associated with hypertension, although not statistically significant in this study. Similar patterns have been noted elsewhere, with employed individuals experiencing occupational stress, sedentary behaviors, and lifestyle changes that elevate cardiovascular risk (Banerjee et al., 2017; Magande et al., 2017). Conversely, unemployment introduces barriers such as poor diet and delayed care-seeking, showing that both extremes of occupational status can undermine blood pressure control depending on the context.

A limitation of these findings lies in their cross-sectional design, which prevents causal inference. Additionally, some associations lacked statistical significance, possibly due to the modest sample size. Self-reported data on socioeconomic factors may also have introduced recall or reporting bias. Nonetheless, the observed associations align with broader literature, suggesting they reflect genuine vulnerabilities among PLWHIV.

These findings carry important implications for HIV care integration. Hypertension prevention at TASO Mulago cannot adopt a one-size-fits-all approach but must stratify interventions by socio-demographic profiles. Age- and gender-sensitive screening, health education tailored to low-literacy clients, and stress-management interventions for employed or married individuals are practical strategies. Such approaches not only address hypertension but also reinforce the long-term sustainability of ART outcomes.

The associations between socio-demographic factors and hypertension observed in this study mirror trends across Uganda and sub-Saharan Africa, underscoring the need for differentiated care models. By integrating targeted hypertension management into HIV services, TASO Mulago can address the complex social realities that shape cardiovascular risk among PLWHIV.

Association between health-related factors and hypertension among PLWHIV at TASO Mulago

The study found that several health-related factors were associated with hypertension among PLWHIV at TASO Mulago, including duration of HIV infection, viral load, overnutrition, alcohol use, ART side effects, and ART adherence. Clients who had lived with HIV for more than five years had nearly twice the odds of being hypertensive compared to those diagnosed within five years. Although not statistically significant, this pattern aligns with findings from Hagabimana et al. (2024), who attributed long-term HIV infection and ART exposure to chronic immune activation and endothelial dysfunction, both of which accelerate hypertension risk.

Overnutrition also emerged as an important predictor, with overweight and obese clients facing more than double the odds of hypertension compared to those with a healthy BMI. This result supports evidence from Ethiopia and South Africa, where Dechasa et al. (2023) demonstrated that adipose amplifies hypertension risk among PLWHIV. The metabolic activity of excess fat tissue, combined with ART-induced fat redistribution and sedentary urban lifestyles, likely explains this elevated risk.

A striking finding was the association between viral suppression and hypertension. Clients with undetectable viral loads had significantly higher odds of hypertension than those with detectable viral loads. This contradicts earlier findings by Carter (2018), who reported no such relationship, but aligns with Okello et al. (2023), who suggested that long-term viral suppression may expose clients to metabolic side effects of ART, including weight gain and dyslipidemia. This emphasizes that achieving virologic success does not eliminate NCD risks, highlighting the dual burden of HIV and hypertension.

The analysis also indicated that clients who missed ART doses were more likely to be hypertensive. Although the association did not reach statistical significance, it mirrors

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Original Article

observations by Ngcobo et al. (2022), who showed that poor adherence undermines immune recovery and increases susceptibility to cardiovascular complications. On the other hand, opportunistic infections appeared inversely associated with hypertension, with affected clients being less likely to have elevated blood pressure. A plausible explanation is that opportunistic infections often result in weight loss and frequent clinical monitoring, both of which may reduce the likelihood of hypertension detection in this subgroup.

A limitation of these findings lies in the small sample size, which may have reduced the power to detect significant associations for some variables, such as ART side effects and adherence. Additionally, cross-sectional data cannot disentangle whether hypertension developed before or after ART non-adherence or viral suppression. Self-reported measures of alcohol use and ART adherence may also be vulnerable to under-reporting, limiting the precision of associations.

Despite these limitations, the results carry strong clinical implications. They highlight the need for routine integration of NCD screening into HIV care, particularly monitoring BMI, adherence, and metabolic complications among virally suppressed clients. ART programs should not only focus on virologic outcomes but also track cardiovascular risks, offering tailored dietary and lifestyle counseling alongside pharmacological management where necessary.

The study shows that health-related factors such as duration of HIV infection, overnutrition, viral suppression, and ART adherence strongly influence hypertension risk among PLWHIV. These findings affirm the importance of holistic HIV care that addresses both infectious and non-communicable diseases, ensuring that long-term survival with HIV does not translate into heightened vulnerability to cardiovascular complications.

The study assessed 80 PLWHIV attending TASO Mulago, of whom 56 (70%) were female and 24 (30%) male. The majority were married (45%) and aged 45 years and above (37.5%). Most participants had secondary education (47.5%), were employed (50%), and belonged to the low-income category (80%). Over half (51.2%) had lived with HIV for more than ten years, and 92.5% were on the TDF/3TC/DTG ART regimen. Viral load was not detected in 62.5% of respondents, and 96.3% reported no chronic illness. Opportunistic infections were reported in 28.7% of participants, while overnutrition (overweight or obese) was observed in 66.2% of respondents. Most participants (73.8%) reported experiencing ART-related side effects, though these did not substantially affect adherence, with 75% having never missed a treatment dose.

The prevalence of hypertension among the participants was 37.5% (95% CI [27.5%-48.8%]), indicating a higher burden than national averages for PLWHIV (26.4%) and the general adult population (22.2%). Logistic regression analysis showed that older age (≥45 years), male gender, marital status (married), employment, and overnutrition were positively associated with hypertension. Educational attainment was protective, with secondary or higher education significantly reducing the odds of hypertension (AOR=0.27, 95% CI [0.08-0.94], p=0.040). Health-related factors significantly associated with hypertension included longer duration of HIV (>5 years), non-detectable viral load (AOR=2.83, 95% CI [1.00-7.99], p=0.049), and missing ART doses (AOR=3.53, 95% CI [0.83-14.97], p=0.087). Participants with opportunistic infections or ART regimen changes were less likely to be hypertensive. Dietary patterns showed low consumption of fruits, vegetables, whole grains, and lean protein, with higher intake of red meat, saturated fats, and sugary drinks, which may contribute to the observed hypertension prevalence.

CONCLUSION

Hypertension is a prevalent comorbidity among PLWHIV at TASO Mulago, affecting over one-third of clients. Older age, male gender, marital status, overnutrition, non-detectable viral load, and inconsistent ART adherence were significant predictors of hypertension, while higher education offered a protective effect. These findings underscore the need for integrated HIV care that incorporates routine hypertension screening, nutritional counseling, adherence support, and targeted lifestyle interventions. Addressing these risk factors is essential to reducing cardiovascular complications and improving long-term health outcomes for PLWHIV in Uganda.

RECOMMENDATION

Given the high prevalence of hypertension (37.5%) among PLWHIV, ART clinics should include routine blood pressure checks during every clinic visit to ensure early detection and timely management.

Older clients, males, married individuals, and those with overnutrition or non-detectable viral loads should receive priority in screening, counseling, and lifestyle modification programs to reduce cardiovascular risk.

Since overnutrition was a significant predictor of hypertension, HIV programs should integrate structured

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Original Article

dietary guidance, weight management support, and promotion of physical activity into routine care.

Inconsistent ART adherence was associated with increased hypertension risk; therefore, clinics should strengthen adherence counseling while linking it to cardiovascular health promotion, emphasizing medication compliance and healthy lifestyle practices.

Socio-demographic factors such as education, employment, and marital status influenced hypertension risk. ART clinics should use this information to identify high-risk clients and tailor counseling and monitoring accordingly.

The dual burden of HIV and hypertension underscores the need for comprehensive national care guidelines that integrate prevention, screening, and management of both conditions. This integration would enhance patient outcomes and optimize health system efficiency.

Future Research

Future studies should adopt longitudinal designs and multi-site sampling to improve generalizability and establish causality. In addition, continuous monitoring of facility-specific trends is recommended to guide targeted interventions effectively.

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LIST OF ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
AOR	Adjusted Odds Ratio
ART	Antiretroviral Therapy
CD4	Cluster of Differentiation 4
CI	Confidence Interval
CVD	cardiovascular diseases
HCFs	Health Care Facilities
HCW	Health care workers
HIV	Human Immunodeficiency Virus
HTN	Hypertension
MoH	Ministry of Health
NCDs	Non-Communicable Diseases
PLWHIV	People Living With HIV
TASO	The Aids Support Organization
SDOH	Social Determinants of Health
SPSS	Statistical Package for Social Sciences
SSA	Sub-Saharan Africa
UNAIDS	United Nations Program on HIV/AIDS
WHO	World Health Organization

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CONFLICT OF INTEREST

The author declares no conflict of interest.

AUTHOR CONTRIBUTIONS

ZA -Principal investigator
GK -Supervised study
JFN -Analyzed data
EO -Pretested research tools

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Original Article

EA -Participated in data collection and analysis

DATA AVAILABILITY

Data is available upon request.

INFORMED CONSENT

There was full disclosure; full comprehension, and respondents voluntarily consented to participate in the study.

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