The Burden and Opportunities for Screening NCDs among People Living With HIV/AIDS Attending Care and Treatment Clinic at Temeke Regional Referral Hospital in Dar es Salaam

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Abstract

Introduction:

People living with HIV (PLHIV) in Tanzania now live longer and hence are at increased risk of developing non-communicable diseases (NCDs). Despite the substantial resources available for HIV care programs, the effective integration of NCD care into these programs remains inadequate. This study aimed to describe the risk factors for NCDs and evaluate the control rates of three-month NCD preventive efforts among PLHIV attending the Care and Treatment Clinic (CTC) at Temeke Regional Referral Hospital (RRH).

Materials and methods

This was a mixed methods study in which a cross-sectional approach was utilized to identify hypertension risk factors among PLHIV attending Temeke RRH in January 2020 and pre- and postintervention follow-ups were used to assess NCD control rates from February to April 2020. The survey included interviews, secondary data review, and blood pressure and glucose screening using the STEPwise approach of the World Health Organization (WHO) STEPS surveillance tool for NCDs. Data analysis was performed using the STATA tool, employing logistic regression to ascertain risk factors. Patients diagnosed with hypertension, increased blood glucose, or both were enrolled in an intervention program to receive NCD-related preventive health education. Blood pressure and blood glucose levels were re-evaluated at the end of the intervention. Control rates were assessed using paired t tests.

Results:

A total of 333 PLHIV were interviewed; 71 (21.32%) were diagnosed with hypertension, and 2.70% had high blood sugar levels. Among the total interviewees, 177 (53.15%) had never had their blood pressure (BP) measured before, and among them, 37 (20.90%) were diagnosed with hypertension. Within the cohort group of 76 patients, 71 had hypertension, 26 (36.6%) of whom were effectively controlled at the end of the intervention. Among the 9 PLHIV with high blood glucose levels, 5 (55.5%) achieved a normal blood sugar level.

Conclusion:

The burden of undiagnosed NCDs among PLHIV attending the care and treatment clinic at Temeke RRH is notably high. Interventions aimed at addressing these NCDs appear to be effective

Introduction

The burden of noncommunicable diseases (NCDs) worldwide remains unacceptably high (1). In 2016, NCDs accounted for 41 million (71%) of the world's 57 million deaths, with cardiovascular disease (CVD) contributing 44% and diabetes contributing 4%. (2). A total of 134,970 NCD-related deaths were recorded in Tanzania out of 409,000 total deaths in 2016 (5).

With the advancement of HIV/AIDS care and treatment programs, there has been a progressive decline in the number of AIDS-related deaths in the past decade. Overall, AIDS-related mortality has decreased by 49%, from 48,000 deaths in 2010 to 24,000 deaths in 2018 (6). In parallel, 30% of all PLHIV are older than 50 years; this trend will continue to increase and is expected to triple in the coming years. Most of them will have at least one NCD by 2040 (12).

Unlike that of HIV/AIDS, the burden of NCDs is increasing due to inadequate chronic disease management. Cardiovascular disease is the leading cause of non-AIDS-related morbidity and mortality among PLHIV (3, 4), and diabetes affects PLHIV almost twice as frequently as PLHIV without HIV (5–7). In addition to the increased risk due to aging, HIV disease itself and antiretroviral treatment (ART) use increase the risk of NCDs among PLHIV (8–10). Chronic immune activation due to the virus and medication side effects are key factors contributing to this increased risk (11).

Both HIV/AIDS and NCDs, such as diabetes and hypertension, necessitate lifelong adherence support. Comprehensive care is crucial due to the increasing burden of multiple comorbidities (15). The health system of LMICs needs to respond more effectively to the healthcare needs of people with NCDs to reduce morbidity, disability and death from NCDs and contribute to better overall health outcomes, especially for the forgotten population, such as PLHIV (15). The integration of care brings together the inputs, delivery, management and organization of particular service functions as a means of improving coverage, access, quality, acceptability and cost-effectiveness. The integration of care has been suggested in primary health care where resources are inadequate, as this integration increases system effectiveness and cost-effectiveness.

Patients with comorbidities (HIV, diabetes mellitus, or hypertension) can benefit from providing integrated care for all the diseases at a single point of care (16). Tanzania has strong and effective HIV/AIDS care and treatment programs. This provides a great opportunity to integrate the management of NCDs, including CVD and diabetes, into existing HIV/AIDS care and treatment programs in primary health facilities (11). If an appropriate multidisciplinary approach involving both preventive and curative interventions can be efficiently and effectively implemented, a decrease in NCDs can be achieved. This is evidenced in collaborative TB/HIV/AIDS activities, where TB deaths among people living with HIV declined by 23% between 2000 and 2016.

Tanzania has a lack of evidence-based care models for scaling up integrated HIV/NCD care. This is due to inadequate or absent effective monitoring and evaluation systems (poor NCD surveillance), inadequate use of health information regarding NCDs, or weak chronic disease care health systems. In most parts, health care delivery is not patient-centered, resulting in ineffective control of chronic diseases (17). There are often inadequate multisectorial responses to diseases; inadequate resources (human, infrastructure, and funds); poor governance and leadership; and a low capacity for health service providers in terms of knowledge, skills, and numbers (18).

Therefore, our study aimed to determine the prevalence of hypertension among PLHIV receiving ART at the Temeke Regional Referral Hospital (Temeke RRH), a CTC in Dar es Salaam, Tanzania, to assess the risk factors for developing hypertension and to implement and evaluate hypertension and diabetes mellitus preventive efforts among these patients to provide recommendations for effective integration of NCDs care among PLHIV.

Materials and Methods

Study design and study setting

This study used mixed methods, including a cross-sectional study, a review of secondary data and a pre- and postevaluation study. The study was conducted in January 2020 to assess the incidence of hypertension and high blood sugar levels and to identify NCD risk factors among PLHIV attending CTC at Temeke Regional Referral Hospital (Temeke RRH). A pre- and postevaluation study was also conducted on PLHIV who were found to have HTN, increased blood sugar levels or both during the cross-sectional study. They were then enrolled in an educational intervention program and were followed for 3 months from February to April 2020. The present study was performed to assess the effect of a health education intervention on HTN and increased blood sugar levels.

Study settings:

The study was conducted at Temeke RRH, a publicly owned facility situated in the southern part of the Dar es Salaam region, the largest commercial city in the eastern part of Tanzania. The health facility is located in the Temeke district and serves a population of 1,368,881 people as per the 2012 Tanzania National Census, covering an area of 729 km². Temeke RRH provides care to patients from various parts of the Dar es Salaam and Pwani regions, ensuring geographical diversity and hence representativeness.

The hospital offers a wide range of services, including outpatient care; reproductive, maternal, newborn, and child health services; a diabetes clinic; cardiovascular and hypertension clinics; tuberculosis and leprosy care; a mental health unit; and an HIV care and treatment clinic. Specialized noncommunicable disease (NCD) clinics operate separately from HIV clinics. PLHIV diagnosed with hypertension (HTN) or diabetes are referred to the NCDs clinic, which is a distinct section within the hospital, as these services are not provided at a single point of care. The HIV Care and Treatment Clinic offers voluntary counseling and testing services, an ART clinic, and TB/HIV services. By the end of December 2019, nearly 4,209 adults had sought HIV/AIDS care and treatment at the clinic. Additionally, approximately 250 PLHIV receive ART at the clinic on a daily basis.

A: Quantitative/cross-sectional study

Study population:

The study population included adults aged 18 years and older who lived with HIV, who received HIV care and treatment at Temeke Hospital and who had been receiving antiretroviral therapy (ART) for more than one year.

Inclusion criteria:

All the PLHIV were aged 18 years and older, were currently receiving ART for more than 6 months, and had no history of CVD.

Exclusion criteria:

The study excluded pregnant women, acutely ill patients, patients whose medical records were not accessible and patients with mental diseases.

Sampling methods and sample size estimation

Sampling method:

A simple random sampling method was used to recruit study participants (PLHIV). The clinic arranges patients randomly, hence presenting diverse characteristics at each clinic attended, allowing diverse characteristics and representations to be obtained. Study participants were selected within 5 days to obtain an adequate sample and ensure randomization. Patients were selected randomly in a queue considering an interval of 5 to 10 PLHIV.

Sample size estimation:

The sample size was calculated based on a global prevalence of 34.7%, as obtained in a meta-analysis conducted in 2017 (14). The assumption was to use 4500 patients as the total study population of PLHIV who attended the health facility. A two-sided 95% confidence interval (95%

confidence interval (CI), design effect of 1, and power of the study set at 80 were entered into Open-Epi Version 3.01 for calculation. The resulting sample size was 324, and 11 patients were included to compensate for the nonresponse rate.

Data collection procedures

The data were obtained via interviews and abstraction of secondary data. The interviews were performed using a semistructured questionnaire adopted from the STEPwise approach of the STEPS surveillance tool for NCDs, which is recommended by the WHO for accessing risk factors for NCDs (15). The interviews were conducted by research assistants and health facility staff (nurses and clinicians/physicians) who were trained on the data collection process. The demographic information (age, sex, and education level) and behavioral data (risk behaviors) were collected. These included history of alcohol use, history of tobacco use, physical activity and history of being diagnosed with NCDs.

For secondary data analysis, data were obtained from the patient electronic database and patient files. A standard checklist was prepared for all the variables required after reviewing different studies. The data extracted included duration since HIV diagnosis, WHO clinical HIV stage at diagnosis, CD4 count at diagnosis, duration of ART, current ART used, and viral load. Permission to extract the data from the patients' electronic databases was obtained from the health facility in charge.

Dependent variables (outcome variable)

The dependent variable was hypertension.

Independent (explanatory) variables:

Sociodemographic characteristics (age, sex, residence, and educational status), anthropometric data (body mass index (BMI) and waist-to-hip ratio), clinical data (blood glucose level), ART data (duration since HIV diagnosis, WHO HIV clinical stage at diagnosis, CD4 count at diagnosis, duration of ART, current ART use, and viral load), and substance use (alcohol drnking and cigarette smoking) were collected.

Blood pressure measurement

Client blood pressure was measured upon arrival at triage, after counseling and at the doctor's consultation; blood pressure was estimated to be thirty (30) minutes apart to aid in the diagnosis of hypertension. The readings were taken on the left upper arm using a cuff suitable for the upper arm width with the client in a seated position. Blood pressure (BP) was measured by health care workers using a standardized protocol and validated and regularly calibrated electronic sphygmomanometers (Omron HEM-7270). The average of three measurements was used to diagnose hypertension.

Measurement of blood glucose:

Blood glucose levels were measured using electronic sphygmomanometers, and blood sugar levels were measured using rapid methods such as the accu-chek method. Blood samples were taken while the patient was in a sitting position. An alcohol swab was used to clean the site, and the alcohol was allowed to dry before pricking using a lancet device.

Anthropometric measurements

Anthropometric measurements included body weight and height. The measurements were taken in a separate room and were recorded in the specially designed forms in the patients' files. The SECA was used to measure body weight (in kg) and was taken with the participant in light clothing and without shoes. Body height (in cm) was also measured using an SECA scale with participants wearing no shoes. Body weight and height were used to calculate body mass index (BMI) by taking weight in kilograms divided by the square of height in meters (kg/m2). Overweight was defined as a BMI between 25.0 and 29.9 kg/m2, and obesity was defined as a BMI ≥ 30 kg/m2.

Operational definitions

The following operational definitions were used:

- Overweight: BMI between 25.0 and 29.9 years
- Obese: BMI ≥ 30.0
- Hypertension (HTN): BP ≥ 140/90
- Isolated systolic HTN: systolic BP > 140, diastolic BP < 90
- Isolated Diastolic HTN: Diastolic BP > 90, systolic BP < 140
- Suppressed viral load: Viral load < 1000 copies/MLS
- High viral load: Viral load ≥ 1000 copies/MLS
- Physical activities: WHO recommendation-An equivalent combination of moderate- and vigorous-intensity physical activity for at least 600 MET-minutes;
- Increased blood glucose level: Fasting plasma glucose level ≥ 7.0 mmol/L

Pretesting of the questionnaire:

The data collection tool was pretested on 10 patients to assess its completeness, consistency, and accuracy before actual data collection.

Analysis of quantitative data

The data were entered and cleaned using Epi Info version 7, downloaded into an Excel spreadsheet and subsequently transferred to STATA version 15 for Windows (Stata Corp., College Station, TX, USA), where advanced analysis was conducted. Descriptive statistics such as medians (with interquartile ranges) and frequencies (with percentages) were used to compare the baseline characteristics of the participants between males and females with respect to the relevant variables. Missing data were excluded from the analysis. The chi-square test was used to compare categorical variables between male and female participants in relation to hypertension and diabetes diagnosis outcomes. Fisher's exact test was used where appropriate. The null hypothesis was that there was no difference in the distribution of characteristics between patients diagnosed with hypertension and those not diagnosed with hypertension. An alternative hypothesis was that at least one characteristic was related to patients diagnosed with hypertension and those not diagnosed with hypertension. Bivariate logistic regression was used to evaluate the associations between the independent and dependent variables. All independent variables with a P value ≤ 0.1 in the bivariate analyses were included in the final multivariable logistic model to identify the risk factors for developing hypertension and diabetes. All variables for which a p value < 0.05 was obtained were considered to be significantly different.

B: Pre- and postintervention:

Enrollment and Participants follow-up:

Pre- and postintervention enrollment were performed for 100 patients who were diagnosed with hypertension, increased blood sugar levels or both from the data obtained during an interview self-reported by clients attending the clinic.

Description of the intervention:

This study used a conceptual framework adopted from a study conducted in Zimbabwe based on community educational intervention (19). The model was modified to suit NCDs' care treatment and control (hypertension and type 2 diabetes mellitus) at Temeke Regional Referral Hospital. This framework was designed to improve care at both the individual and health facility levels considering patient, healthcare provider and health system needs.

The major input was educational intervention for individuals with hypertension and type 2 diabetes mellitus through a continuous process between the researchers and health delivery system implementers. All these factors aimed at increasing hypertension and type 2 diabetes mellitus control rates, improving adherence, and ultimately improving the well-being of individuals and the community.

Self-reported measurements were confirmed by measuring blood pressure at the clinic. A convenient sample was taken based on available resorurces. Enrollment in the intervention was conducted for one month, January 2020.

Conceptual framework

Refer to figure 1.

Delivery of intervention:

Patient follow-up included clinic visits on a monthly basis for three months from February to April 2023. At each clinic visit, patients with NCDs were put in a separate group and received health education that involved proper diet, importance of physical activities and exercises and adherence to medication.

Health education included awareness and NCDs, which included warning messages on NCDs and their risk factors, including tobacco use, excess alcohol use, unhealthy ubalanced diet, lack of physical exercise and added salt intake. Information education and communication materials were developed to assist in the provision of health education and included balanced diet pictures, brochures and large posters. The messages were translated into the easily understandable swahili language and pictures were used. Health care providers gave and clarified the messages to ensure that they were understood by the clients.

Intervention data collection:

Patients who were not seen during their clinical visit were followed up with phone calls and were encouraged to attend blood pressure and blood sugar checks. Patients were informed of lifestyle changes through physical exercise and food eating modifications focused on green vegetables and fruits. All measurements were entered into the surveillance tool for records.

The data collected included baseline (preintervention) and postintervention blood sugar and blood pressure levels and height and weight for the calculation of BMI. Blood pressure was taken once at each visit at least half an hour after arrival during the consultation. All the data collected were recorded with a surveillance tool that consitsute patient registry in an Excel spreadsheet developed following recommendations from the HEARTS technical package of the WHO and the Tanzania National Guideline. The patient registry consisted of the name of the patient, age, sex, residency, baseline blood pressure and blood glucose level, and weight measurements at each visit. The final measurement at three months of intervention was used for analysis.

Pre- and postintervention analysis

A paired t test was conducted on the measurements of participants (systolic and diastolic pressure, BMI, and fasting blood glucose levels) using STATA version 15 for Windows (Stata Corp., College Station, TX, USA) to determine whether the measurements at month three were different from those taken at baseline. An analysis was also conducted to ascertain the effectiveness of the intervention. Patients whose blood pressure and blood measurements were missing were excluded from the analysis.

Ethical consideration:

Ethical approval to conduct this study was obtained from the Muhimbili University of Health and Allied Sciences Institutional Review Board. Permission to conduct the study at Temeke Regional Referral Hospital was obtained from the Medical Officer Incharge. All participants provided informed consent to participate in the study after providing a thorough description of the study objectives and risks associated with participation. Separate rooms were used for interviews, blood pressure measurements and anthropometric measurements. A phlebotomy situated at the CTC was used to obtain blood samples for blood glucose measurements. Blood pressure and blood glucose measurements were considered routine measurements at the clinic, so there was no need for compensation. The data were handled and recorded in questionnaires, which were stored in a safe place before they were entered into a database on password-protected computers. Trained health care workers who provided care at the clinic on a daily basis were responsible for clinical data collection. Trained research assistants collected the data through interviews. The names and CTC numbers were removed before analysis to ensure privacy and confidentiality to all participants.

RESULTS

3.1. Sociodemographic Characteristics of the Study Participants.

A total of 335 PLHIV participated in the interview, and two (2) participants were removed from the analysis due to incomplete information.

A total of 333 patients were included in the evaluation of hypertension and blood sugar levels. The demographic characteristics are shown in Table 1. The median age (IQR) for the study participants was 46 (39–52) years, with the majority 243 (72.97%) being females. Most of the study participants (n = 141; 42.34%) were aged between 40 and 49 years. Married or cohabiting participants represented many of the study participants (n = 118; 35.44%) compared to single, divorced or widowed participants. In addition, most of the study participants were from Temeke Municipal Council 277 (83.18%), while the majority were from other districts in Dar es Salaam, and the majority had a primary education level of 236 (70.87%). The majority were self-employed (n = 219; 65.77%) (Table 1).

Table 1
Sociodemographic characteristics of PLHIV attending the Care and Treatment Center in Dar es Salaam, Tanzania, in 2020 (n = 333)

Characteristics	Number (%)
Median age in years (SD)	46 (39–52)
Gender	
Female	243 (72.97)
Male	90 (27.03)
Age group in years	
18–39	84 (25.23)
40–49	141 (42.34)
50–70	108 (32.43)
Marital status	
Single	72 (21.62)
Married or cohabiting	118 (35.44)
Divorced/Separated	87 (26.13)
Widow	56 (16.82)
Residence	
Temeke Municipal Council	277 (83.18)
Other district within and outside Dar es Salaam	56 (16.82)
Education level, n (%)	
Not attended any school	37 (11.11)
Primary School	236 (70.87)
Secondary School	53 (15.92)
College/University	7 (2.10)
Employment status	
Not employed	59 (17.72)
Self employed	219 (65.77)
Employed in a private/government insitution	55 (16.52)

3.2. The prevalence of and risk factors for hypertension according to sex among PLHIV attending Temeke RRH in 2020.

Overall, of the 333 participants, 71/333 (21.32%) had hypertension, and 9/333 (2.70%) had diabetes. Four 4/333 (1.20%) participants were diagnosed with both hypertension and diabetes. Of the 71 patients with hypertension, 34/71 (47.89%) knew they had hypertension, and only 5 (7%) were already receiving treatment but had not achieved blood pressure control. Over half of the study participants (177/333; 53.15%) reported never having their blood pressure measured before, and among these, 37/177 (20.90%) were newly diagnosed with hypertension. Overall, of the 9 participants with diabetes, 4/9 (44.44%) knew they had diabetes and were receiving treatment, and 5/9 (66.67%) were diagnosed during the study (Table 2).

Table 2
The prevalence of and risk factors for hypertension according to sex among PLHIV attending Temeke RRH in 2020.

	Hypertension status		
Characteristics	**Yes (N = 71 (21.32%), n (%)**	**No (N = 262 (78.68%) n (%)**	**P value**
Sex			
Male	15 (16.67)	187 (76.95)	0.21
Female	56 (23.05)	75 (83.33)	
Age group in years			
18–39	11 (13.10)	73 (86.90)	0.05
40–49	30 (21.28)	111 (78.72)	
50–75	30 (27.78)	78 (72.22)	
Marital status			
Single	13 (18.06)	59 (81.94)	0.32
Married/Cohabiting	21 (17.80)	97 (82.20)	
Divorced/Separated	21 (24.14)	66 (75.86)	
Widow/Widower	16 (28.57)	40 (71.43)	
Education level			
Not educated	8 (21.62)	29 (78.38)	0.97
Primary School	52 (22.03)	184 (77.97)	
Secondary School	10 (18.87)	43 (81.13)	
College/University	1 (14.29)	6 (85.71)	
Employment status			
Not employed	18 (30.51)	41 (69.49)	0.07
Self employed	46 (21.00)	173 (79.00)	
Employed in a private/government insitution	7 (12.73)	48 (87.27)	
HIV Stage on diagnosis			
Stage 1 and 2	16 (27.59)	42 (72.41)	0.04
Stage 3 and 4	40 (24.69)	122 (75.31)	
Duration on ART			
≤ 5 years	9 (12.33)	64 (87.67)	0.04
> 5 years	62 (23.85)	198 (76.15)	
Viral load			
Suppressed	62 (21.45)	227 (78.55)	1.00
High viral load	2 (16.67)	10 (83.33)	
Tobacco use			
Not currently smoker	70 (22.15)	246 (77.85)	0.14
Current tobacco user	1 (5.88)	16 (94.12)	
Alcohol use			
Not using alcohol	65 (21.17)	242 (78.83)	0.82
Current alcohol users	6 (23.08)	20 (76.92)	
Body mass index (kg/m2)			

	Hypertension status		
Characteristics	**Yes (N = 71 (21.32%), n (%)**	**No (N = 262 (78.68%) n (%)**	**P value**
Sex			
Underweight	0 (0.00)	10 (100.00)	< 0.01
Normal	25 (15.63)	135 (84.38)	
Overweight	21 (22.83)	71 (77.17)	
Obese	25 (35.21)	46 (64.79)	
Waist-Hip ratio			
Recommended ratio	16 (14.55)	94 (85.45)	0.02
Abdominal obesity-1	27 (31.40)	59 (68.60)	
Abdominal obesity-2	28 (20.44)	109 (79.56)	
Physical activities (WHO)			
Met Standard	55 (22.27)	192 (77.73)	0.48
Did not meet the standard	16 (18.60)	70 (81.40)	
Diabetes mellitus			
Normal blood sugar	49 (19.60)	201 (80.40)	0.09
Diabetic	4 (44.44)	5 (55.56)	

The incidence of hypertension was significantly greater in patients older than 40 years (32/71 (42.11) and 50 years (33/71, 43.42%) than in their younger counterparts aged less than 39 years (11/71, 11.47%; P < 0.05) (Table 2).

Univariate and multivariate analyses

The univariate and multivariate analysis results are shown in Table 3. All variables with P values less than 0.2 in the bivariate analysis were subjected to multivariate analysis to control for confounders. According to our multivariate analysis, obese patients were 4 times more likely to have hypertension (AOR = 3.50; 95% CI = 1.60–7.68) than patients with a normal body weight were.

Table 3
Association between risk factors and elevated blood pressure or blood glucose among people living with HIV/AIDS attending the Care and Treatment Center in Dar es Salaam, Tanzania, in 2020

Characteristics	Crude OR	P value	95% CI	Adjusted OR	P value	95% CI
Sex						
Male	1			1		
Female	1.50	0.21	0.80–2.81	0.94	0.87	0.42–2.06
Age group in years						
18–39	1			1		
40–49	1.79	0.13	0.85–3.80	1.38	0.72	0.57–3.40
50–75	2.55	0.02	1.19–5.46	1.91	0.19	0.72–5.07
Marital status						
Single	1			1		
Married/Cohabiting	0.98	0.96	0.46–2.12	0.78	0.59	0.31–1.96
Divorced/Separated	1.44	0.35	0.66–3.14	0.69	0.48	0.25–1.90
Widow/Widower	1.82	0.16	0.79–4.18	1.35	0.58	0.47–3.92
Education level						
Primary School	1					
Not educated	0.98	0.96	0.43–2.26			
Secondary School	0.82	0.61	0.61–1.75			
College/University	0.59	0.63	0.07–5.01			
HIV Stage on diagnosis						
Stage 1 and 2	1					
Stage 3 and 4	1.07	0.81	0.60–1.72			
Duration on ART						
≤ 5 years	1					
> 5 years	1.02	0.95	0.64–1.86			
Viral load						
Suppressed	1					
High viral load	0.73	0.69	0.16–3.43			
Tobacco use						
Not using tobacco	1					
Current tobacco user	0.22	0.15	0.03–1.69	0.37	0.36	0.04–3.09
Alcohol use						
Not using alcohol	1					
Current alcohol users	1.12	0.82	0.43–3.05			
Body mass index (kg/m2)						
Underweight	Omitted			Omitted		
Normal	1			1		
Overweight	1.59	0.16	0.83–3.05	1.84	0.13	0.83–4.04
Obese	2.93	< 0.01	1.54–5.61	3.50	< 0.01	1.60–7.68
Physical activities (WHO)						

Characteristics	Crude OR	P value	95% CI	Adjusted OR	P value	95% CI
Sex						
Met Standard	1					
Did not meet the standard	1.25	0.48	0.67–2.33			
Diabetes mellitus						
Normal blood sugar	1			1		
Diabetic	3.28	0.09	0.85–12.68	3.01	0.14	0.70-12.93

Results from the intervention group:

Among the 100 PLHIV who were enrolled in the intervention group, 76 (76%) had complete data and were available for analysis at the end of the 3-month study.

After three months of intervention, the mean change in blood pressure for the study participants ranged from 164 to 159 mm/Hg for systolic blood pressure and 100 to 96 mm/Hg for diastolic blood pressure. Blood sugar levels ranged from 11.96 to 9.38 mmol/L in those who had increased blood sugar levels. Additionally, for BMI, the change ranged from 28.9 to 27.5 kg/m2. (Table 4)

The results of paired t tests showed a significant decrease in mean systolic blood pressure ($t = 3.07$ w/df = 81, $p < 0.01$, 95% CI (2.01, 9.45)) and mean diastolic blood pressure ($t = 2.91$ w/df = 81, $p < 0.01$, 95% CI (1.19, 6.33)). There was no statistically significant difference in the mean FBG level ($t = 0.03$ w/df = 81, $p = 0.82$, 95% CI (-0.45, 0.57)) or BMI ($t = 1.76$ w/df = 81, $p = 0.08$, 95% CI (-0.18, 3.03)).

Table 4
The effects of three months of preventive efforts in 76 HIV-positive patients with elevated blood pressure or blood glucose attending the Care and Treatment Center in Dar es Salaam, Tanzania, in 2020

Physical and biochemical measurements	Baseline measurements (mean ± SD)	Measurements at three months (mean ± SD)	P value
Diastolic pressure (mm/Hg)	99.52 ± 14.23)	95.76 (12.51)	< 0.01
Systolic pressure (mm/Hg)	164.28 ± 21.62	158 ± 21.23	0.01
Fasting blood level (mmol/L)	5.47 ± 2.85	5.41 ± 2.57	0.82
BMI (kg/m²)	28.89 ± 8.39	27.46 ± 5.60	0.08

DISCUSSION

In this study, we found that the risk of having hypertension among PLHIV was high among obese patients. We also found that there was a significant decrease in mean systolic and diastolic blood pressure at the end of the three-month intervention.

Our study revealed the incidence of HTN to be 21.32%, which is much lower than the estimated incidence of 26% in the general population in Tanzania (24). Similar findings were obtained in a study conducted in Senegal (25), similar to the findings of studies conducted in Mbeya and Ethiopia (13, 26). The incidence of hypertension observed in this study was greater than that in a study conducted in rural Tanzania, in which the prevalence of hypertension was 11.6% (9, 26). Hypertension is a major risk factor for heart disease; however, this risk factor is not well known among PLHIV (16, 21–23). This study highlighted the incidence of hypertension among PLHIV, although it created room for robust study with a much larger sample size.

In the present study, obesity was found to be an important risk factor for the development of hypertension. Similar findings were found in other studies conducted in Tanzania and other African countries (13, 25, 26). These findings could be explained by the growing evidence that increased visceral fat in the body is a pathological depot that leads to the accumulation of more visceral fat in tissues (27, 28). Visceral fat has been linked to increased inflammatory reactions in endothelial cells of blood vessels due to its sensitivity to lipolysis, which leads to endothelial dysfunction and arterial hypertension (27, 28). Additional evidence from different studies shows that increased prevalence of overweight and obesity has caused an increased burden of hypertension (29, 30). These findings add to the evidence that, as BMI is easily measured and widely accessible, it remains a simple and effective tool for screening for hypertension in public practice.

In our study, we found that many PLHIV diagnosed with hypertension were unaware of having hypertension, revealing missed opportunities to diagnose other comorbidities among PLHIV. Similar findings were obtained in Malawi and other parts of Africa (16–18). These findings are likely attributed to the HIV care settings, which do not mandate that clinicians screen for NCDs among PLHIV. As this has not been the practice, health care providers in CTC did not have up-to-date information regarding the provision of NCDs among PLHIV, similar to the findings from a study

performed in South Africa (20). The findings from our study call for the country to ensure that health care professionals provide NCD care among HIV-positive patients.

Furthermore, our study revealed a significant change in blood pressure after three months of intervention for both systolic and diastolic blood pressure. These findings were similar to those of a study conducted in Bangladesh, in which only physical and behavioral measurements were considered and not biochemical and blood pressure levels (33). Our study showed no significant change in BMI, while a study in Bangladesh showed a significant change in the level of physical activity, which might result in a change in BMI (33).

This study was conducted in an HIV setting where normal clinic visits occurred and did not result in disruption of care for PLHIV. Although risk factors were identified and added to the evidence, the information cannot be generalized elsewhere in Tanzania but can be used as a model for better research studies and program implementation. Another important limitation is that the study was implemented during the COVID-19 pandemic, which affected every part of the world. In our study, these limitations affected the scheduled patient follow-up clinic and measurements, as PLHIV were among the groups prone to infection; hence, they were given long clinic visits to avoid congestion at the clinic. Few HCWs were also scheduled for shifts to attend a clinic due to a lack of protective gear, further hindering consultative services for hypertensive patients. To overcome this, we used phone calls to follow up patients and extended the duration of clinical follow-up to guarantee that 76 out of 100 clients in the cohort underwent a second test for both blood pressure and blood glucose. This disruption might have affected the results of the intervention due to the decreased number of patients during follow-up.

Conclusion and recommendation:

Overall, our study revealed a high incidence of hypertension among PLHIV and missed opportunities to diagnose NCDs, hence putting these patients at risk. Our study showed that most HIV-positive patients are not screened for hypertension or other NCDs. In addition, we found that health education and close follow-up are important for monitoring patients. We recommend strengthening health education and screening for NCDs among people with HIV. We also recommend more robust methodological studies on missed opportunities to diagnose hypertension among PLHIV.

Declarations

Ethics approval and consent to participate

Ethical approval to conduct this study was obtained from the Muhimbili University of Health and Allied Sciences Institutional Review Board. Permission to conduct the study at Temeke Regional Referral Hospital was obtained from the Medical Officer Incharge. All participants provided informed consent to participate in the study after providing a thorough description of the study objectives and risks associated with participation.

Consent for publication

Consent for publication was obtained from all the authors.

Availability of data and materials

The corresponding author had full access to all the data in the study. The data will be shared upon request at the address provided.

Competing interests

The authors declare no competing interests.

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Formal analysis: AM, GM, EM.

Funding acquisition: AM.

Investigation: AM.

Methodology: AM, GM, EM

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Figures

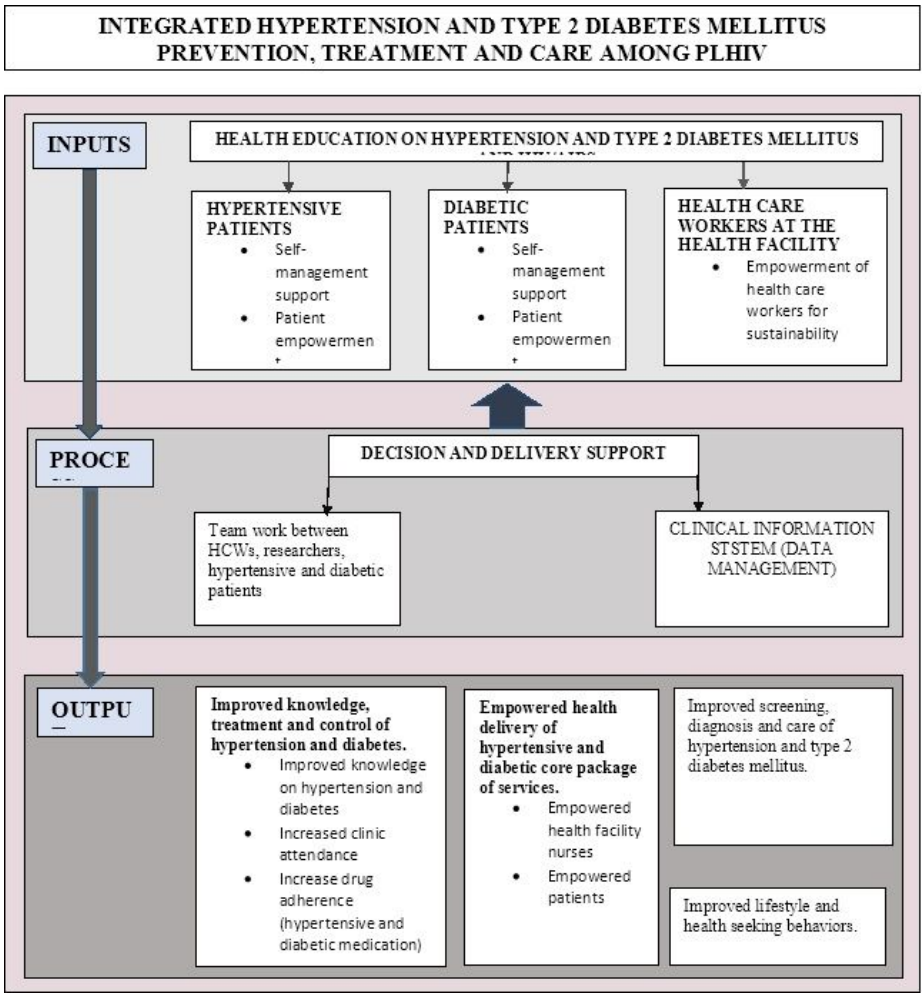

Figure 1

The conceptual framework for the study implemenented to acess the Burden and Opportunities for Screening NCDs among People Living With HIV/AIDS Attending Care and Treatment Clinic at Temeke Regional Referral Hospital in Dar es Salaam in 2020