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Predictors of cardiovascular diseases among people living with HIV initiated on antiretroviral therapy in Khomas region, Namibia: A cross-sectional study

Roswitha Mahalie,[1] Penehafo Angula,[2] Kabwebwe Honoré Mitonga,[2] Olanrewaju Oladimeji[3]

[1]Olympia, Windhoek, Namibia; [2]School of Public Health: Oshakati Campus; Faculty of Health Sciences; University of Namibia, Namibia; [3]Department of Public Health, Faculty of Health Science, Walter Sisulu University, Eastern Cape, South Africa

Abstract

Cardiovascular diseases (CVDs) have been identified as the leading cause of morbidity and mortality among people living with human immunodeficiency virus (PLHIV). However, it is evident that there is a lack of effective surveillance and monitoring of CVDs. Salient side-effects of antiretroviral therapy (ART) exacerbate pre-existing co-morbidities, hence the need for CVDs and its predictors to be monitored closely to ensure life-long care. Personal health records play a crucial role in the field of health information extraction because of their factuality and reliability.

The current study assessed the predictors associated with CVDs among PLHIV initiated on ART in the Khomas health district in Namibia

A cross-sectional quantitative descriptive study was conducted to extract CVDs predictors from 529 patient care booklets (PCBs) between 2004 and 2018 at purposely selected health facilities in Khomas health district. Data was matched with the electronic Patient Monitoring System(ePMS) and statistical analyses were performed. The study found that prominent CVDs predictors were found to be greatly prevalent among PLHIV initiated on ART with an adjusted variation ($p<0.001$). The mean ± SD age of all participants was 38.10, ± range 64 and 55.1% of them were males and 44.9% were females. Data from this study suggest that high blood pressure, obesity, smoking, and alcohol use are greatly prevalent among PLHIV, particularly among males. Systems that provide accurate information, early screening with subsequent treatment for PLHIV, is recommended by this study.

Introduction

Cardiovascular diseases (CVDs), the leading cause of death globally (31%) and in Africa (11.3%), has recently been recognised as an important cause of morbidity and mortality among people living with human immunodeficiency virus (PLHIV).[1–5] The improved survival rate of PLHIV, and the changing HIV disease patterns, resulted in a growing burden of multi-morbidity.[6] Crucially, the changing landscape of HIV clinical care, as recent evidence suggests that HIV-associated inflammation and immune activation are important mediators of cardiovascular risks globally, contributing to at least 84% of PLHIV diagnosed with one non-communicable disease (NCD) by 2030.[7] HIV programmes, which are the first large-scale chronic disease initiatives in low-and-middle-income countries (LMICs), posit to be an ideal springboard to emulate and expand innovative tools and approaches to using data associated with CVDs risk factors that enhances the quality of life of PLHIV[8] through measurement of tangible health outcomes. Accurate and up-to-date epidemiological data,[9] are leveraged to positively identify gaps while influencing the future patterns, the burden and health outcomes of CVDs in the African region.[10]

A study conducted by Bogorodskaya, Chow and Triant established that there is a greater of risk of CVDs in the long term use of Antiretroviral therapy (ART).[11] The authors further signified a strong association between an aging HIV infected population with multiple comorbidities and its vulnerability to CVDs. The prevalence of NCDs among HIV-infected persons in LMICs, hypertension, hypercholesterolemia, and obesity were among the most prevalent risk factors.[6,11,12] The authors also found that although few NCD-HIV integrated programs with screening and management approaches exist in resource limited settings, efficacy of such integration is not well-established.[11,12] The introduction of prevention, screening, diagnosis, and treatment programmes in support with international recommendations are advocated for.

Eliminating shared risk factors such as tobacco use, unhealthy diet, physical inactivity and the abuse of alcohol could prevent up to 80% of heart diseases, type 2 diabetes and some cancers.[11] The enforcement of synergistic legislation which are good progress markers on reducing the prevalence of NCDs is suggested by several authors.[2,11–15]

Numerous studies have shown that the determining risk factors for CVDs at the initiation of ART, enhances integrated interventions subsequently.[7,16,17] Admittedly, local health systems are not adequately prepared to respond to the growing CVD burden by particularly identifying risk factors when clients are screened,[18] enrolled or initiated into long-term ART care. In the Namibian context, a literature search could not provide any epidemiological evidence on the risk and prevalence of multiple comorbidities with special emphasis on

Correspondence: Roswitha Mahalie, Namibia University of Science and Technology; Faculty of Health and Applied Sciences School; Private Bag 13301, Windhoek, Namibia.
Tel: +264 61 2072897; Fax: +264 61 2072897.
E-mail: rqmahalie@gmail.com; rmahalie@nust.na

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CVDs among PLHIV, thus the current study was conducted to assess the prevalence of risk factors associated with CVDs.

Materials and methods

This cross-sectional quantitative descriptive study excluded patients who were enrolled prior to January 2004 and after 2017 from the study. Health risk factors such as blood pressure, body mass index (BMI), tobacco and alcohol use were extracted from the Patient Care Booklets (PCBs) of 529 clients using a tailor-made data extraction tool.

Socio-demographic and programme data such as age,[19] sex, marital status, blood pressure,[20] overweight/obesity were matched with the electronic patient monitoring system (ePMS) as independent variables. The BMI, smoking and alcohol usage could not be used as the only standalone measure of risk factors for CVDs. Thus, a proven risk of developing CVDs were postulated accordingly:[20]

Combination of overweight, smoking, alcohol use and at least one elevated or stage 1 hypertension.

Combination of obesity, smoking, alcohol use and at least one elevated, stage 1 or stage 2 hypertension.

At least one elevated, stage 1 or stage 2 hypertension.

The case definition for hypertension was found to be the only well-defined predictor for CVDs at ART clinics. Hence, the reason why hypertension was used as the predominant variable to compare with other predictors and co-variates. The criteria for hypertension endorsed by the American College of Cardiology and American Heart Association (ACC/AHA) were used to classify hypertension as follows:

Elevated blood pressure: Systolic BP (SBP) 120-129 mmHg or diastolic BP (DBP) < 80 mmHg.

Stage 1 high blood pressure: SBP 130 to 139 mmHg or DBP 80 to 89 mmHg.

Stage 2 high blood pressure: SBP ≥140 mmHg or DBP ≥90 mmHg.[21]

The classification on accurate measurements and average of ≥2 readings on different occasions,[21] as recorded in the PCB.

Variables like weight and height were extracted to determine BMI and subsequently examine the impact of obesity among PLHIV. Overweight as denoted by a BMI of 25 or above whilst 30 or above was categorised as obese.

Data analysis

Client records were reviewed for risk factor data recorded in the PCB. The extracted data was entered into IBM (R) SPSS version 25 to perform statistical analyses. Data was described using frequencies and proportions and summarised in tables and figures. Bivariate and multivariate analyses was performed by constructing two by two tables for each potential risk factor outcome. Socio demographic characteristics were tabulated by age and sex.

Ethical considerations

The Institutional Research and Ethics Committee of University of Namibia in the faculty of Health Sciences and the Namibian Ministry of Health and Social Services approved the study under reference number 17/3/3RM. The clients' name, residential address, contact details, and any other variable that had the potential of breaching confidentiality were not included in the data extraction tool. The study conformed with the principles outlined in the World Medical Association Declaration of Helsinki.

Results

This study found that majority of the CVDs risk factors were greatly prevalent among PLHIV initiated on ART with an adjusted variation($p<0.001$) as depicted in Table 1. Of the 529 records extracted for PLHIV initiated on ART, 55.1% were male whilst 44.9% were female with a median ± SD age of 38.10 years.

The study sought to analyse the association between sex and high blood pressure. There was no evidence of a significant relationship between sex and high systolic blood pressure (Pearson Chi Square test 4.315, p-value of 0.365; Likelihood ratio test 4.271: p-value of 0.371) and high diastolic blood pressure (Pearson Chi Square test 1.824: p-value of 0.402; Likelihood ratio test 1.838: p-value of 0.399) among PLHIV.

The age of the patients was categorised between 1-10; 11-20; 21-30; 31-40; 41-50; 51-60; and 61+ years. There was no evidence of a significant relationship between age and high systolic blood pressure (Pearson Chi Square test at 29.385, p-value 0.260) and high diastolic blood pressure (Pearson Chi Square test at 11. 466, p-value 0.489) among PLHIV which indicate a p-value >0.05. However, age and BMI were found to be greatly significant with a p-value of 0.018.

In addition, the study found that a positive relationship exists between BMI and high systolic blood pressure (Pearson Chi Square test 164.911; Likelihood ratio test 162.295) and high diastolic blood pressure risk (Pearson Chi Square test 62.864; Likelihood ratio test 65.121) with a p-value 0.001 which is <0.05 threshold or 95% confidence level.

The findings of the study revealed that there is a significant association between alcohol consumption and risk of high systolic blood pressure. The Pearson Chi Square test (77.802) and the Likelihood ratio test (79.902) both shows a p-value of 0.001 which is <0.05 significant threshold.

Findings of the study proved that patient drop-out from ePMS was significantly associated with high blood pressure status (Pearson Chi Square test 16.737; Likelihood ratio test 17.087) which shows a p-value of 0.001 that is <0.05 significant threshold.

Furthermore, the study wanted to determine the association between a patient who is active in ePMS or those who are lost from the system either through death, transfer-out or lost-to-follow-up, and increased BMI. Both the Pearson Chi Square test (31.950) and Likelihood ratio test (31.708) shows a p-value of 0.001, respectively which is <0.05 significant threshold.

A significant relationship was found between the last ART status and alcohol consumption since the Pearson Chi Square test (6.713) shows a p-value of 0.035, and a Likelihood ratio(6.917) which presented with a p-value of 0.031. Both tests are above the threshold of <0.05 significance level.

Furthermore, it was found there is no significant association between sex and viral load, denoting that male and female viral load is random as the p-value of 0.767523 is greater than the threshold of <0.05 significance level. The Wald test result of a p-value of 0.5663 confirms that sex is not a good predictor of viral load (Table 2).

Lastly, age category, WHO clinical staging, blood pressure, alcohol consumption, smoking, body mass index, CD4 counts, ART regimens and duration on ART are significantly associated with viral load as the p-values are less than 0.05. The Wald test also confirm the significance of these predictors as shown in Tables 2 and 3.

Discussion

The study found that even though hospital-based information on morbidity and mortality of recent CVDs are readily available, similar data that is linked to individual PLHIV initiated on ART could not be found. All HIV uninfected individuals were excluded from the study and thus not used as controls.

High blood pressure, obesity, smoking, and alcohol use were found to be greatly prevalent among PLHIV initiated on ART in this study. These findings are in line with WHO, which suggests that NCDs are largely preventable by the reduction of their four main behavioural risk factors: tobacco use, harmful use of alcohol, unhealthy diet and physical inactivity.[12]

Gender is one of the important socioeconomic determinants of health.[20] Several studies have revealed that women are more vulnerable to the risk of obesity, heart diseases and stroke compared to men.[23,24] In addition, female gender (AOR 2.12; 95 % CI 1.45–3.11) was significantly associated with comorbidity risk by Magodoro, Esterhuizen and Chivese among adults living with HIV in Zimbabwe in 2016.[27] On the contrary, this study revealed that more males (56%) are at risk of elevated risk of high systolic blood pressure compared to females.[27] Notwithstanding, this finding is contrary to study findings conducted in South Africa and India where more females were found to be disproportionately affected by NCDs compared to males.[22] Interestingly, Anish *et al*.[25] also found that systolic blood pressure, fasting blood sugar, and low-density lipoprotein were found to be significantly lower in Indian women.

The current study found that 40.5% of the patients between the ages of 41-50 years enrolled in the ART programme are at risk of stage 2 systolic blood pressure. On the other hand, 39.4% and 32. 3% of the patients between the age group 41-50 years have been classified as high risk and optimal risk for raised diastolic blood pressure, respectively. Findings of the study such as increased prevalence of high blood pressure, obesity, smoking and alcohol use among PLHIV initiated on ART concur with Bogorodskaya *et al*., who postulated that an increase in age is a critical determinant of traditional risk factors and the role it plays in relation to CVD events.[11] Several studies revealed similar trends in Africa and globally.[23,25]

The study also established a significant association (p-value of 0.001) between BMI and raised blood pressure. These results concur with Anspro *et al*.[26] who found that obesity (BMI>30 kg/m2) was the only risk factor that increased the odds of having an uncontrolled BP in hypertensive patients (p=0.02) after adjusting for age, gender, smoking status, alcohol use and HIV status. Critical lifestyle modification is required to reduce the prevalence of CVDs among PLHIV initiated on ART who are smoking tobacco products.

Twenty percent (20%) of those patients who are active in ePMS, showed a great statistical significance(p-value of 0.001) between alcohol use and smoking of tobacco products which requires strict enforcement of regulations on tobacco smoking and the mushrooming of illegal shebeens in Namibia.[20] The results of this study are contrary to several other studies which indicated that alcohol use and smoking did not increase the risk of uncontrolled BP.[26]

Incidentally, peer reviewed studies focussing on blood pressure estimates in PLHIV initiated on ART and untreated HIV negative controls revealed that HIV infection was associated with lower SBP, while treatment was associated with higher lipid levels in Sub-Saharan Africa.[29,30] However, this study could not establish the prevalence of hypotension as a major risk factor leading to CVDs among PLHIV initiated on ART, suggesting that future studies measure the association of biomarkers of metabolic risks in the prediction of CVDs at health facility level.

Furthermore, the study revealed that patients who were enrolled in the ART programme and sampled for this study, had a mean follow-up day of 75.52% with a relatively low number of visits per annum which is reflected at 3.45%. Similar studies conducted in Eswatini (42%) and Cameroon (22.7%) demonstrated a slightly higher rate of follow-up days with a 16.3% loss to follow-up rate of per annum.[26]

There is overwhelming evidence from the study findings that sex is not associated with viral load and CVDs. It was also found that all the other predictors such as age category, WHO clinical staging, blood pressure, alcohol consumption, smoking, body mass index, CD4 count, ART regimens and duration on ART have a significant influence on the viral load and consequently leading to CVDs. The current findings are contrary to a study conducted by Niwaha *et al.,* who could not find notable differences in the odds of hypertension by CD4 count, viral load, or ART among HIV positive individuals in this sample.[30] At the time of data collection, the majority of the patients (53.67%) were on ART therapy for more than 2 years, specifically on first-line regimens such as TDF+3TC+NVP (38.19%), TDF/FTC/EFV(1F) (14.12%) and TDF/FTC/EFV (8.8%) respectively. However, with the advent of 'Test and Treat' in 2019, early diagnosis and targeted management of CVDs among PLHIV initiated on ART were optimised.. This may address challenges identified in protease inhibitors (PI) containing regimens while changing to Dolutegravir (DTG) which is more tolerable and effective for PLHIV initiated on ART.[28]

Table 1. Summary of association between CVDs risk factors (n=529).

Independent variable (chi squares)	High Systolic Blood pressure		Overweight /Obesity		Alcohol		Smoking		Poor data recording		True retention	
	Pearson Chi square	P-value	Pearson Chi square	P-value	Pearson Chi square	P-value	Pearson Chi square	P-value	Pearson Chi square	P-value	Pearson Chi square	P-value
Sex	(.504)	0.478	(.513)	0. 474	(.752)	0.386	(2.810)	0.094	(1.227)	0.268	(1.232)	0.267
Age	(.727)	0.394	(5.557)	0.018	(.382)	0.536	(1.000)	0.317	(6.676)	0.010	(4.673)	0.031
Marital status	(15.606)	0.048	(.318)	0. 573	(.014)	0.907	(.731)	0.392	(.008)	0.927	(.029)	0.865
Blood pressure	n/a	n/a	(32.042)	0.001	(1.686)	0.194	(2.241)	0.134	(80.830	0.001	(16.737)	0.001
Overweight/obesity	(164.911)	0.001	n/a	n/a	(1.467)	0.226	(.573)	0.449	(53.014)	0.001	(31.950)	0.001
Alcohol	(77.802)	0.001	(1.467)	0.001	n/a	n/a	(.096)	0.757	(2.372)	0.124	(2.585)	0.108
Smoking	(76.888)	0.001	(.573)	0.449	(.096)	0.757	n/a	n/a	(3.853)	0.050	(.648)	0.421
Poor data recording	(80.830)	0.001	(53.014)	0.001	(2.372)	0. 124	(3.853)	0. 050	n/a	n/a	(13.303)	0.001
Follow-up days	1.428)	0.490	(1.665)	0.435	(2.559)	0. 278	(6.227)	0. 044	(46.191)	0.001	(19.489)	0.001
True retention	(16.737)	0.001	(31.950)	0.001	(2.585)	0.108	(.648)	0. 421	(13.303)	0.001	n/a	n/a
Last ART status	4.333)	0.115	(1.849)	0.397	(6.713)	0.035	(1.706)	0.426	(105.885)	0.001	(87.754)	0.001

*P-value Pearson chi-square test statistically significant at 0.05.

Table 2. Summary of association between CVDs risk factors and viral load.

Characteristic	Total	Viral Load: Low Level Viremia		P-value*
		No	Yes	
Sex				
Female	313	136 (60.9%)	177 (57.8%)	0.767523
Male	216	87(39.1%)	129(42.2%)	
Total	529	223	306	
Age Category				
0-17 years	4	2 (0.7%)	2 (0.8%)	0.000
18-25 years	13	6 (2.2%)	7 (2.9%)	
56-45 years	122	66 (24.2%)	56 (23.0%)	
66-35 years	146	54 (19.8%)	92 (37.9%)	
>45 years	231	145 (53.1%)	86 (35.4%)	
Total	516	273	243	
WHO Clinical Staging				
1	238	113 (80.7%)	125 (83.9%)	0.02216
2	23	10 (7.1%)	13 (8.7%)	
3	24	16 (11.4%)	8 (5.4%)	
4	4	1 (0.7%)	3 (2.0%)	
Total	289	140	149	
CVDs Predictors				
Blood Pressure				
Elevated (>120-129 or >80mmHg(d)	35	21 (7.3%)	14 (6.2%)	0.00
Hypertension risk stage 1(130-139 or 89-90mmHg(d))	55	48 (16.6%)	7 (3.1%)	
Hypertension risk stage 2 (>140-170 and ≥90 mmHg (d)	77	42 (14.5%)	35 (15.4%)	
Hypertension crises (>180 mmHg(s) or ≥90-110 mmHg (d)	4	4 (1.4%)	0 (0.0%)	
Low BP (<90 (s) and ≥60(d)	14	13 (4.5%)	1 (0.4%)	
No BP Recorded in PCB	167	56 (19.4%)	111 (48.9%)	
Normal BP (<120 and <80mmHg(d))	164	105 (36.3%)	59 (26.0%)	
Alcohol				
No don't drink alcohol	138	104 (32.0%)	34 (21.7%)	0.020292
Not Recorded in PCB	226	139 (42.8%)	87 (55.4%)	
Yes, drink alcohol	118	82 (25.2%)	36 (22.9%)	
Total	482	325	157	
Smoking				
No don't smoke any tobacco products	254	161 (61.2%)	93 (36.8%)	0.00
Not Recorded in PCB	228	90 (34.2%)	138 (54.5%)	
Yes, smoke tobacco products	34	12 (4.6%)	22 (8.7%)	
Total	516	263	253	
Body Mass Index				
No height recorded in PCB	140	39 (14.3%)	101 (41.6%)	0.00
Normal weight (18.0-24.9)	241	149 (54.6%)	92 (37.9%)	
Not scaled	3	1 (0.4%)	2 (0.8%)	
Obese (>30)	23	17 (6.2%)	6 (2.5%)	
Overweight (25.0-29.9)	67	36 (13.2%)	31 (12.8%)	
Underweight (<18)	42	31 (11.4%)	11 (4.5%)	
CD4 Count				
<200 cells/mm^3	21	21 (7.7%)	0 (0.0%)	0.00
200-350 cells/ mm^3	18	18 (6.6%)	0 (0.0%)	
350-500 cells/ mm^3	11	11 (4.0%)	0 (0.0%)	
>500 cells/ mm^3	466	223 (81.7%)	243 (100.0%)	
Total	516	273	243	
ART regimens				
ABC+3TC+DTG	2	2 (0.7%)	0 (0.0%)	0.00
ABC/3TC/EFV (99 / 00)	4	4 (1.4%)	3 (1.2%)	
ABC/3TC/LPV-r (99 / 00)	4	4 (1.4%)	0 (0.0%)	
AZT+3TC+NVP	1	1 (0.4%)	0 (0.0%)	
AZT/3TC/EFV	1	1 (0.4%)	1 (0.4%)	
AZT/3TC/EFV (1b / 4d)	8	8 (2.9%)	8 (3.3%)	
AZT/3TC/LPV-r (99 / 4e)	1	1 (0.4%)	0 (0.0%)	
AZT/3TC/NVP (1a / 4b)	16	16 (5.8%)	14 (5.8%)	
AZT/TDF/3TC/ATV-r	3	3 (1.1%)	2 (0.8%)	
D4T/3TC/EFV (1d / 4c)	2	2 (0.7%)	1 (0.4%)	
D4T/3TC/NVP (1c / 4a)	3	3 (1.1%)	1 (0.4%)	
TDF+3TC+DTG	44	44 (15.8%)	41 (16.9%)	
TDF+3TC+DTG100	1	1 (0.4%)	1 (0.4%)	
TDF+3TC+EFV	10	10 (3.6%)	9 (3.7%)	
TDF+3TC+EFV400	19	19 (6.8%)	19 (7.8%)	
TDF+3TC+NVP	199	199 (71.6%)	3 (1.2%)	
TDF+FTC+EFV	3	3 (1.1%)	3 (1.2%)	
TDF/3TC/ATV-r	6	6 (2.2%)	0 (0.0%)	
TDF/3TC/EFV (1f)	30	30 (10.8%)	29 (11.9%)	
TDF/3TC/LPV-r	1	1 (0.4%)	1 (0.4%)	
TDF/3TC/NVP (1e)	16	16 (5.8%)	14 (5.8%)	
TDF/AZT/3TC/LPV-r (2a)	1	1 (0.4%)	1 (0.4%)	
TDF/FTC/ATV-R(99/00)	2	2 (0.7%)	2 (0.8%)	
TDF/FTC/EFV	46	46 (16.5%)	44 (18.1%)	
TDF/FTC/EFV (99 / 00)	1	1 (0.4%)	1 (0.4%)	
TDF/FTC/EFV (99)	10	10 (3.6%)	10 (4.1%)	
TDF/FTC/EFV (99/00)	13	13 (4.7%)	11 (4.5%)	
TDF/FTC/EFV(1F)	74	74 (26.6%)	59 (24.3%)	
Total	521	278	243	
Duration on ART (years)				
<2 years	146	88 (32.35)	58	0.00
> 2 years	126	90 (33.08)	36	
Total	272	178	94	

*P-value Pearson chi-square test statistically significant at 0.05.

Table 3. Summary of the significance of CVDs risk factors in predicting viral load.

Characteristic	Coefficient	Wald Chi-Square	OR 95 C.I lower	OR 95 C.I upper	P-value*
(Intercept)	-0.198776	0.3875017	-0.84366	0.446109	0.53362
Sex					
Female (Ref)					
Male	0.271975	21.51447	0.153557	0.390394	0.5663
Smoking					
Yes, smoke tobacco products	-0.232779	0.6822987	-0.80191	0.336351	0.00880
No don't smoke any tobacco products	-0.280431	1.03203	-0.83792	0.277056	0.00968
Not Recorded in PCB	-0.355939	1.422928	-0.95855	0.246675	0.03292
Blood Pressure					
Hypertension risk stage 1(130-139 or 89-90mmHg(d))	0.78867	30.19451	0.498812	1.078529	0.00000
Hypertension risk stage 2 (>140-170 and ≥90 mmHg (d)	0.768154	34.59375	0.504397	1.031911	0.00000
Elevated (>120-129 or >80mmHg(d)	0.291774	5.525152	0.041088	0.54246	0.01874
Normal BP (<120 and <80mmHg(d))	0.763519	30.79211	0.485641	1.041398	0.00000
Hypertension crises (>180 mmHg(s) or ≥90-110 mmHg (d)	0.274983	1.452056	-0.18588	0.735842	0.02820
No BP Recorded in PCB	0.458446	16.54767	0.230845	0.686047	0.00005
Alcohol					
No don't drink alcohol	0.055181	1.32156	-0.04176	0.152122	0.00531
Not Recorded in PCB	0.122916	0.9543502	-0.13119	0.37702	0.02861
Age category					
0-17 years	-0.172322	0.7527848	-0.57343	0.228785	0.00560
18-25 years	0.01585	0.01886101	-0.21722	0.248921	0.00077
26-35 years	-0.092117	3.007174	-0.1994	0.015162	0.00290
35-45 years	0.017912	0.1339827	-0.08092	0.116742	0.001434
Body Mass Index (BMI)					
Normal weight (18.0-24.9)	0.052254	0.621706	-0.08158	0.186093	0.03041
Overweight (25.0-29.9)	0.071948	0.8382374	-0.08676	0.230652	0.00990
Obese (>30)	-0.04357	0.1819073	-0.24988	0.162739	0.01974
No height recorded in PCB	0.134243	3.06677	-0.02057	0.289056	0.04991
Not scaled	0.029812	0.01618541	-0.44344	0.503061	0.03876
CD4 Count					
< 200 cells/ mm^3	-0.012215	0.007050633	-0.30599	0.281563	0.00308
> 500 cells/ mm^3	0.325156	6.983351	0.076663	0.573648	0.00823
200-350 cells/ mm^3	-0.008193	0.002862852	-0.31744	0.301055	0.01733

*P-value Pearson chi-square test statistically significant at 0.05.

Limitations

The challenge of getting the right datasets for CVDs risk factor prediction is very important. The study findings revealed that missing and incomplete CVDs risk factor data from the PCBs and ePMS compromised the quality of care provided to PLHIV initiated on ART. Therefore, an integrated approach to ensure sound data management practices for better health outcomes was recommended to the Ministry of Health and Social Services.

Conclusions

The study highlights the high prevalence of CVD risk, lack of information of CVDs and its risk factors among PLHIV initiated on ART. Although statistical evidence posits that major predictor risk factors are significantly associated with viral load, more research is needed to gain understanding of the immune activation and inflammation markers to estimate the link between the predictor risk factors in PLHIV initiated on ART and CVDs. With the current epidemiological transition of HIV and CVDs, there is a need to advocate for systems that provide accurate information and early screening of CVDs for PLHIV[31] initiated on ART.

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