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Prevalence and correlates of traditional risk factors for cardiovascular disease in a Nigerian ART-naive HIV population: a cross-sectional study

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ABSTRACT

Objectives HIV infection environment presents a classic example of the interplay between infectious diseases and non-communicable diseases (NCDs). Traditional cardiovascular disease (CVD) risk factors abound in the HIV population even before initiation of antiretrovirals (ARVs) and predispose them to the development of stroke and myocardial infarction. This work focuses on determining the prevalence of traditional CVD risk factors among ARV-naive HIV individuals in southern Nigeria.

Methods This was a cross-sectional study of ARV-naive patients initiating care at the University of Uyo Teaching Hospital HIV clinic cohort to determine the prevalence and correlates of hypertension, diabetes mellitus (DM), obesity and dyslipidaemia.

Results The sample consisted of 4925 assessed for hypertension, 5223 for obesity, 1818 for DM and 926 for dyslipidaemia. Hypertension prevalence was 26.7% (95% CI 25.5% to 28.0%) with a male preponderance (p=0.02). DM was found in 5.6% (95% CI 4.5% to 6.7%), obesity in 8.3% (95% CI 7.6% to 9.1%) and dyslipidaemia in 29.1% (95% CI 26.1% to 32.1%) with a high prevalence of low high-density lipoprotein-c (42.6%). Hypertension was independently associated with age (OR 1.04 (95% CI 1.03 to 1.05), p<0.001) and body mass index (BMI) (OR 1.06 (95% CI 1.03 to 1.08), p<0.001), obesity with age (OR 1.02 (95% CI 1.01 to 1.03), p<0.001), male gender (OR 0.38 (95% CI 0.29 to 0.49), p<0.001) and CD4 count (OR 2.63 (95% CI 1.96 to 3.53), p<0.001) while dyslipidaemia was associated with BMI (OR 1.05 (95% CI 1.01 to 1.10), p=0.03).

Conclusion The prevalence of traditional CVD risk factors is high in this ART-naive HIV population. An integrated approach of HIV and NCD screening/treatment may be relevant for centres in sub-Saharan Africa.

Strengths and limitations of this study

- This study documents the prevalence of hitherto neglected cardiovascular disease (CVD) risk factors—hypertension, diabetes mellitus, obesity and dyslipidaemia—in a large HIV population in sub-Saharan Africa.
- The findings from this work will help HIV caregivers and health policy makers develop long-term intervention plan for HIV patients with CVD risk factors.
- Missing data regarding some of the cardiovascular risk factors (including tobacco smoking) made it difficult to assess the degree of clustering of risk factors in this HIV population.

INTRODUCTION

HIV infection and the treatment thereof have been identified as being associated with increased frequencies of traditional cardiovascular disease (CVD) risk factors.[1 2] HIV infection environment presents a classic example of the interplay between infectious disease and non-communicable diseases (NCDs). While people with HIV infection now live longer, there may be an increased risk of stroke, myocardial infarction and chronic kidney disease because of the abundance of traditional CVD risk factors. Indeed, the use of antiretroviral (ARV) medications may in the long run increase prevalence of CVD risk factors like dyslipidaemia, hypertension and dysglycaemia.[3–5]

Modelling studies have indicated that 84% of HIV-infected patients will have at least one NCD by 2030 with about one-third of HIV patients having three or more NCDs.[6] We are already seeing a higher incidence of NCDs among HIV-infected patients than the general population[7] with its attendant economic and health system implications, especially in sub-Saharan Africa—the epicentre of HIV infection. It is therefore important to determine the burden of these risk factors among the HIV population before initiation of ARV for the purpose of healthcare delivery planning. We document in this study the prevalence of CVD risk factors and correlates in a large ARV-naive HIV population in Southern Nigeria.

METHODS

The University of Uyo Teaching Hospital (UUTH) HIV clinic is a US Agency for International Development-funded HIV care programme in Southern Nigeria that offers voluntary counselling and testing for HIV, provision of ARVs, identification and treatment of opportunistic infections and follow-up care for HIV patients. Patients enrolled into care at this facility have their sociodemographic characteristics collected; their weight, height, blood pressure are also measured according to the WHO STEPwise approach to surveillance (STEPS) protocol[8] and body mass index (BMI) calculated in kg/m^2 from the weight and height measurements. Blood samples are drawn for CD4 count, viral load, electrolytes, urea, alanine transaminase, hepatitis B surface antigen, antibody to hepatitis C virus and lipid profile at entry. This analysis was done using baseline characteristics not taking into cognisance changes occurring during follow-up of patients. We excluded paediatric patients (age less than 18 years) and individuals transferred in from other HIV treatment centres.

Hypertension was defined as two or more recordings of blood pressure with systolic blood pressure (SBP) at least 140 mm Hg and/or diastolic blood pressure (DBP) of at least 90 mm Hg measured within 1 month of initiating care at the clinic or patient who is on antihypertensive medication. Individuals with hypertension were further classified into stage 1 and stage 2 hypertension as per the seventh report of the Joint National Committee on prevention, detection, evaluation and treatment of high blood pressure (JNC 7) classification.[9] Prehypertension was defined as SBP 120–139 mm Hg and/or DBP of 80–89 mm Hg;[9] isolated systolic hypertension (ISH) if SBP ≥140 mm Hg and DBP <90 mm Hg; isolated diastolic hypertension if SBP <140 mm Hg and DBP ≥90 mm Hg; mixed hypertension (MH) if SBP ≥140 mm Hg and DBP ≥90 mm Hg[10]. Mean arterial blood pressure was computed using the formula [DBP+(SBP–DBP)/3].

Diabetes mellitus (DM) was defined as fasting plasma glucose of at least 7.0 mmol/L and/or random/2-hour post meal plasma glucose of at least 11.1 mmol/L or individuals taking antidiabetic agents.[11] Obesity was defined as BMI of at least 30 kg/m^2 in a patient without peripheral oedema.[12] Unfortunately, waist circumference and related anthropometry were not collected routinely at baseline and therefore not included in this study. Dyslipidaemia was defined as deviation from reference values of the hospital chemical pathology laboratory (>6.5 mmol/L for total cholesterol; >3.5 mmol/L for low-density lipoprotein (LDL)-c,<0.9 mmol/L for high-density lipoprotein (HDL)-c and >2.0 mmol/L for serum triglyceride). Other dyslipidaemic characteristics including the Castelli Risk Index 1 (total cholesterol/HDL-c), Castelli Risk Index 2 (LDL-c/HDL-c) and atherogenic index of plasma (logarithm of triglyceride/HDL-c) were calculated where adequate data were available and considered to be elevated when greater than 4.4, 2.5 and 0.5, respectively.[13 14] Unfortunately, data on alcohol and tobacco use were not routinely collected and therefore not available. The proportion of the study population who were aware of their hypertension and diabetic status was also determined.

Due to programmatic constraints, data were not available for all the parameters measured. Blood pressure data were available for 4925 (40.5%); BMI (5223, 42.9%); DM (1818, 14.9%) and dyslipidaemia (926, 7.6%) of the study population. Analysis was therefore performed on a different subset of the HIV population for each of the risk factors. Data were extracted from patient's physical case records and transferred into STATA V.15 (StataCorp, Texas, USA) for analysis. Graphs were drawn using Microsoft Excel. The 15-year period was divided into five 3-year categories for the purpose of assessment of time trends. The Student's t-test (or its non-parametric equivalent, where necessary) was used to compare continuous variables while a χ^2 test was employed to compare categorical variables. The Cochran-Armitage trend test across ordered groups was performed to determine significant trends in prevalence of traditional risk factors during the period of the study and across different age groups. Four multivariable regression models were used to identify sociodemographic and clinical factors independently associated with each of the considered CVD risk factors (hypertension, DM, obesity and dyslipidaemia). The independent variables included in the models were important demographic factors like age (in 1-year increments), sex (with women being the reference category) and clinical factors like CD4 count and BMI at initiation of care. The years of study were included in the models to adjust for unmeasured confounders that can vary by year, and to explore if the trend across years is significant after adjustment for confounders. Collinearity was assessed using the condition number test. The goodness of fit of the models was assessed using the Hosmer-Lemeshow test while the predictive performance of the models was determined using receiver operating characteristic curves. P values less than 0.05 were deemed statistically significant. This cross-sectional study was reported using the Strengthening the Reporting of Observational Studies in Epidemiology guidelines[15] (see online supplementary 1).

Patient and public involvement

The patients in our HIV clinics have expressed concern about having concomitant high blood pressure/elevated blood glucose and HIV disease, especially because of their inability to procure hypertension and DM medications. However, the patients were not involved in the design, recruitment and conduct of this study. The results from this work will be disseminated to patients during the monthly clinic health talk.

RESULTS

Two thousand two hundred and seventy-five HIV-positive patients were seen between 2002 and 2004, 3725 in the 2005–2007 year category, 2628 for 2008–2010, 1962

Table 1 Sociodemographic and clinical characteristics of HIV patients

	HIV population	Women	Men	P value
Age (years)	34.3±9.9	32.3±9.6	37.4±9.4	<0.001
SBP (mm Hg)	114.4±23.3	113.5±23.4	115.5±23.0	0.01
DBP (mm Hg)	76.5±17.7	75.7±17.2	77.4±18.3	0.001
MABP (mm Hg)	87.1±16.3	86.5±16.3	87.9±16.2	0.01
Hypertension (n=4925)	1315 (26.7% (95% CI 25.5% to 28.0%))	717 (25.4 (23.8–27.1))	598 (28.4 (26.5–30.4))	0.02
BMI (kg/m^2) (n=5223)	23.1±4.6	23.5±5.0	22.4±3.9	<0.001
Underweight	619 (11.9 (11.0–12.8))	407 (12.0 11.0–13.2))	212 (11.5 (10.1–13.0))	0.84
Normal BMI	3022 (57.9 (95% CI 56.5 to 59.2))	1827 (54.1 (52.4–55.8))	1195 (64.8 (62.6–67.0))	<0.001
Overweight	1147 (22.0 (95% CI 20.8 to 23.1))	790 (23.4 (21.9–24.8))	357 (19.4 (17.6–21.2))	0.13
Obese	435 (8.3% (95% CI 7.6% to 9.1%))	355 (10.5 (9.5–11.6))	80 (4.3 (3.5–5.4))	0.08
Haemoglobin (g/dL) (n=1510)	10.9±2.4	10.6±2.3	11.4±2.6	<0.001
Hepatitis C infection (n=3056)	68 (2.2% (95% CI 1.7% to 2.8%))	46 (2.5 (1.8–3.3))	22 (1.8 (1.1–2.7))	0.2
Hepatitis B infection (n=4909)	314 (6.4% (95% CI 5.7% to 7.1%))	140 (4.8 (4.0–5.6))	174 (8.8 (7.6–10.1))	<0.001
FPG (mmol/L)	4.6±2.1	4.5±1.8	4.8±2.4	0.02
Diabetes mellitus (n=1818)	101 (5.6% (95% CI 4.5% to 6.7%))	49 (4.7 (3.5–6.2))	52 (6.7 (5.1–8.7))	0.06
Serum albumin (g/L)	39.9±13.9	39.5±13.0	40.3±15.0	0.31
CD4 count (cells/µL) (n=8811)	197 (91–353)	209 (100–387)	180 (80–304)	<0.001
CD4 count (<200)	4435 (50.3% (95% CI 49.3% to 51.4%))	2557 (47.7 (46.3–49.0))	1878 (54.5 (52.8–56.1))	<0.001
CD4 count (<350)	6565 (74.5% (95% CI (73.6 to 75.4))	3810 (71.0 (69.8–72.2))	2755 (79.9 (78.5–81.3))	<0.001
Log viral load (n=741)	8.56 (5.97–10.61)	8.44 (6.00–10.41)	8.62 (5.82–10.91)	0.78
TC (mmol/L) (n=877)	4.1±1.3	4.3±1.3	3.9±1.2	<0.001
Triglyceride (mmol/L)	1.6±0.8	1.6±0.9	1.6±0.8	0.95
LDL-c (mmol/L)	2.1±0.9	2.0±0.9	2.1±0.8	0.74
HDL-c (mmol/L)	1.3±0.8	1.3±0.7	1.2±0.8	0.65
Dyslipidaemia (n=926)	269 (29.1% (95% CI 26.1% to 32.1%))	163 (29.2 (25.5–33.2))	106 (28.8 (24.2–33.7))	0.89
ALT n=5186 (median, IQR)	14 (7–28)	13 (7–27)	15 (8–30)	<0.001
AST n=3427 (median, IQR)	19 (12–34)	18 (11–32)	20 (12–36)	0.002

ALT, alanine transaminase; AST, aspartate transaminase; BMI, body mass index; DBP, diastolic blood pressure; FPG, fasting plasma glucose; HDL-c, high-density lipoprotein; LDL-c, low-density lipoprotein; MABP, mean arterial blood pressure; SBP, systolic blood pressure; TC, total cholesterol.

for 2011–2013 and 1577 for 2014–2016. Women constituted 60.3% of the total HIV population. The mean age of the study sample was 34.3±9.9 years (32.3±9.6 years for women versus 37.4±9.4 years for men; p<0.001). Only 247 (2.0%) participants were aged 60 years and above and 1099 (9.0%) aged 50 years and above. The median CD4 count was 197 cells/µL (25th–75th percentiles 91–353). Only 1.3% and 0.6% of the study population knew about their hypertension and diabetic status, respectively. Table 1 summarises the characteristics of the study population. Men were older (p<0.001), had higher blood pressure (SBP (p=0.01), DBP (p=0.001), mean arterial blood pressure (p=0.01)), haemoglobin (p<0.001), hepatitis B prevalence (p<0.001), fasting plasma glucose (p=0.02) and lower CD4 count at initiation of care (p<0.001), BMI (p<0.001) and total cholesterol (p<0.001) than the women. Figure 1A,B shows the time trend and age group trend for the CVD risk factors.

Hypertension

The overall prevalence of hypertension was 26.7% (95% CI 25.5% to 28.0%). Male patients were more likely to be hypertensive at initiation of care (31.8% vs 28.5%, p=0.01). There was progressive increase in frequency of hypertension as age and CD4 count increased for both men and women (table 2, figure 2). This was also true for stage 1 and 2 hypertension, ISH and MH. Individuals with hypertension were older and had higher levels of BMI, fasting blood sugar and CD4 count than the non-hypertensive patients (figure 3). The overall prevalence of prehypertension was 26.5% (95% CI 25.3% to 27.8%).

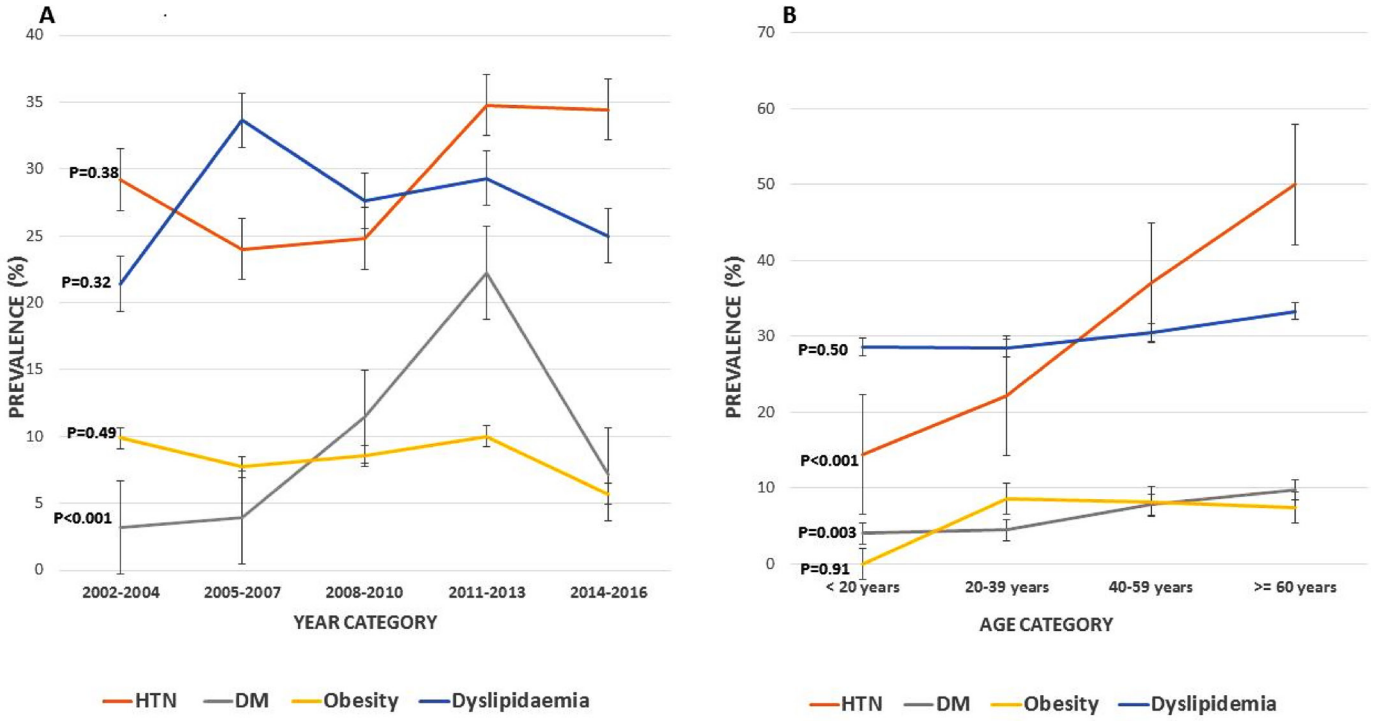

Figure 1 Trends of traditional cardiovascular disease risk factors prevalence (A) over the study period (B) across age categories. DM, diabetes mellitus; HTN, hypertension.

The prevalence of hypertension remained unchanged through the period of study (p=0.38) but increased with age (p<0.001) (figure 1A-B).

Diabetes mellitus

The prevalence of DM was 5.6% (95% CI 4.5% to 6.7%). There was no significant gender difference in prevalence (4.7% in women versus 6.7% in men, p=0.06). There was significant increase in DM prevalence across the years (p<0.001) and as patient age increased (figure 1A,B, table 2). The prevalence of DM increased with CD4 count increase (figure 2).

Obesity

Obesity was found in 8.3% (95% CI 7.6% to 9.1%) with a strong female predilection (10.5% vs 4.3%, p<0.001). There was also a female preponderance of overweight individuals (23.4% vs 19.4%, p<0.001). The total proportion of overweight individuals was 21.9%. Overall, 30.3% of the cohort was either overweight or obese and only 11.9% were underweight. Normal BMI was found in 57.9% of the cohort. There was no significant change in the prevalence of obesity across the years (p=0.49) or by age categories (p=0.91) (figure 1A,B) but increased with increase in CD4 count (figure 2).

Dyslipidaemia

Of the 926 individuals who had at least one component of the lipid profile done at baseline, dyslipidaemia occurred in 29.1% (95% CI 26.1% to 32.1%) with hypercholesterolaemia in 4.1% (95% CI 2.9% to 5.6%), elevated LDL-c in 7.8% (95% CI 3.8% to 14.0%), elevated triglyceride in 21.1% (95% CI 18.3% to 24.1%) and low HDL-c in 42.6% (95% CI 34.9% to 50.6%). There was increasing prevalence of high total cholesterol with increasing age (p=0.02), though this relationship was not evident with the other components of the cholesterol panel. There was also no gender difference in all the components of the lipid profile or their derivatives (p=0.16, 0.79, 0.80, 0.16 for total cholesterol, LDL-c, HDL-c and triglycerides, respectively). There was no significant change in the prevalence of dyslipidaemia across the years (p=0.32) or by age categories (p=0.50) (figure 1A,B).

Independent associations with CVD risk factors

Table 3 summarises the sociodemographic and clinical attributes independently associated with prevalent hypertension, DM, obesity and dyslipidaemia in our sample. Age (p<0.001), BMI (p<0.001) and year of the study were independently associated with hypertension. Age, gender, CD4 category and year category were associated with obesity while the risk of dyslipidaemia increased with increasing BMI (p=0.03).

DISCUSSION

This study has shown a high prevalence of hypertension and dyslipidaemia in a large African ARV-naive HIV population with a relatively low prevalence of obesity. Hypertension was independently associated with increasing age and BMI, obesity with age and CD4 count, while dyslipidaemia was associated with increasing BMI.

The risk of CVD is at least 50% higher in people with HIV compared with the general population in some populations.[16] The prevalence of hypertension in this

Table 2 CVD risk factor prevalence across age groups and by gender

	Men					Women					All				
Age (years)	< 20	20-39	40-59	≥ 60	P value	<20	20-39	40-59	≥60	P value	<20	20-39	40-59	≥60	P value
Normal n (%)	5 (62.5)	622 (48.2)	294 (38.9)	16 (32.0)	0.08	52 (63.4)	1081 (51.5)	219 (37.5)	15 (26.8)	0.08	57 (63.3)	1703 (50.3)	513 (38.3)	31 (29.3)	<0.001
Pre-HTN n (%)	2 (25.0)	371 (28.8)	185 (24.5)	11 (22.0)	0.17	18 (21.9)	563 (26.8)	145 (24.8)	11 (19.6)	0.49	20 (22.2)	934 (27.6)	330 (24.6)	22 (20.8)	0.08
Stage 1 HTN n (%)	0 (0.0)	136 (10.5)	114 (15.1)	8 (16.0)	0.08	7 (8.5)	204 (9.7)	89 (15.2)	12 (21.4)	0.08	7 (7.8)	340 (10.0)	203 (15.2)	20 (18.8)	<0.001
Stage 2 HTN n (%)	1 (12.5)	161 (12.5)	163 (21.6)	15 (30.0)	0.1	5 (6.1)	251 (11.9)	131 (22.4)	18 (32.1)	0.08	6 (6.7)	412 (12.2)	294 (21.9)	33 (31.1)	<0.001
ISH n (%)	0 (0.0)	137 (2.9)	41 (5.4)	5 (10.0)	<0.001	0 (0.0)	46 (2.2)	28 (4.8)	10 (17.9)	<0.001	0 (0.0)	83 (2.5)	69 (5.2)	15 (14.2)	<0.001
IDH n (%)	0 (0.0)	73 (5.7)	64 (8.5)	3 (6.0)	0.08	6 (7.3)	103 (4.9)	39 (6.7)	3 (5.4)	0.32	6 (6.7)	176 (5.2)	103 (7.7)	6 (5.7)	0.01
Mixed HTN n (%)	1 (12.5)	187 (14.5)	172 (22.8)	15 (30.0)	<0.001	6 (7.3)	306 (14.6)	153 (26.2)	17 (30.4)	<0.001	7 (7.8)	493 (14.6)	325 (24.3)	32 (30.2)	<0.001
HTN n (%)	1 (12.5)	297 (23.0)	277 (36.6)	23 (46.0)	<0.001	12 (14.6)	455 (21.7)	220 (37.7)	30 (53.6)	<0.001	13 (14.4)	752 (22.2)	497 (37.1)	53 (50.0)	<0.001
DM	0 (0.0)	27 (6.1)	22 (7.1)	3 (13.6)	0.27	1 (4.2)	27 (3.5)	20 (8.8)	1 (5.3)	0.01	1 (4.0)	54 (4.4)	42 (7.8)	4 (9.8)	0.003
Underweight	1 (14.3)	129 (12.4)	80 (10.7)	2 (3.7)	0.06	15 (28.9)	288 (11.3)	89 (12.5)	15 (22.1)	0.39	16 (27.1)	417 (11.6)	169 (11.6)	17 (13.9)	0.54
Normal	5 (71.4)	702 (67.7)	452 (60.6)	36 (66.7)	0.03	33 (63.5)	1373 (53.9)	382 (53.7)	39 (57.4)	0.82	38 (64.4)	2075 (57.9)	834 (57.2)	75 (61.5)	0.81
Overweight	1 (14.3)	175 (16.9)	172 (23.1)	9 (16.7)	0.01	4 (7.7)	611 (24.0)	163 (22.9)	12 (17.7)	0.8	5 (8.47)	786 (21.9)	335 (23.0)	21 (17.2)	0.48
Obesity	0 (0.0)	31 (3.0)	42 (5.6)	7 (12.9)	0.001	0 (0.0)	275 (10.8)	78 (10.9)	2 (2.9)	0.86	0 (0.0)	306 (8.5)	120 (8.2)	9 (7.4)	0.91
High TC	0 (0.0)	2 (0.99)	7 (5.3)	1 (12.5)	0.005	0 (0.0)	18 (4.3)	8 (8.1)	0 (0.0)	0.17	0 (0.0)	20 (3.2)	15 (6.5)	1 (7.1)	0.02
High LDL-c	0 (0.0)	2 (5.9)	2 (10.0)	0 (0.0)	0.79	0 (0.0)	4 (7.1)	2 (15.4)	0 (0.0)	0.45	0 (0.0)	6 (6.7)	4 (12.1)	0 (0.0)	0.52
Low HDL-c	0 (0.0)	17 (40.5)	14 (66.7)	1 (50.0)	0.09	1 (50.0)	27 (37.0)	9 (42.9)	0 (0.0)	0.99	1 (50.0)	44 (38.3)	23 (54.8)	1 (33.3)	0.17
High CI 1	0 (0.0)	14 (37.8)	11 (68.8)	1 (50.0)	0.08	1 (50.0)	22 (34.9)	10 (52.6)	0 (0.0)	0.46	1 (50.0)	36 (36.0)	21 (60.0)	1 (33.3)	0.07
High CI 2	0 (0.0)	4 (11.8)	7 (36.8)	1 (50.0)	0.02	0 (0.0)	7(12.7)	5 (38.4)	0 (0.0)	0.08	0 (0.0)	11 (12.4)	12 (37.5)	1 (33.3)	0.003
High AIP	0 (0.0)	3 (8.8)	1 (5.6)	0 (0.0)	0.56	1 (50.0)	7 (11.3)	3 (17.6)	0 (0.0)	0.85	1 (50.0)	10 (10.4)	4 (11.4)	1 (33.3)	0.5
Dyslipidaemia	0 (0.0)	55 (25.5)	47 (33.1)	4 (44.4)	0.05	4 (30.8)	131 (30)	27 (26.7)	1 (16)	0.38	4 (28.6)	186 (28.4)	74 (30.4)	5 (33.3)	0.5

AIP, atherogenic index of plasma; CI 1, Castelli Risk Index 1; CI 2, Castelli Risk Index 2; CVD, cardiovascular disease; DM, diabetes mellitus; HDL-c, high- density lipoprotein; HTN, hypertension; IDH, isolated diastolic hypertension; ISH, isolated systolic hypertension; LDL-c, low-density lipoprotein; TC, total cholesterol.

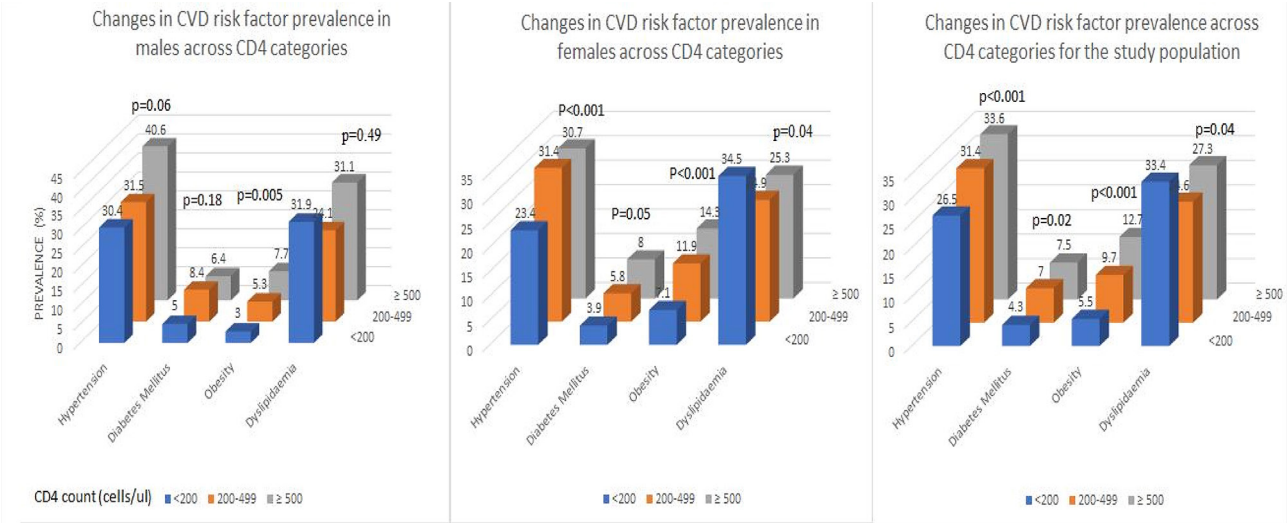

Figure 2 Changes in cardiovascular disease (CVD) risk factor prevalence across CD4 categories.

relatively young HIV population is high but this may be a reflection of the hypertension prevalence in the general population in this region which ranged from 24.5% to 44.3% in recent community-based studies.[17–19] The similarity in prevalence of hypertension in the HIV population compared with the general population has been observed in other studies.[20–23] HIV infection, however, has been shown to be associated with low-grade inflammation and elevated levels of inflammatory markers despite virological control.[24] This may lead to accelerated atherosclerosis and ultimately hypertension earlier in life. Indeed, this has been shown to be the case in other climes where hypertension prevalence is significantly higher in the HIV population compared with the general population.[20] However, in sub-Saharan Africa, a lower prevalence of hypertension has been documented among HIV patients than those non-infected,[25 26] despite having a relatively higher age than that recorded in this study. We did not attempt a head-to-head comparison of hypertension prevalence between age-matched HIV positive and negative individuals in this study. The prevalence of prehypertension of 26.5% suggests a likelihood of even higher hypertension prevalence as these patients live longer with the infection. An important point to note is that most of the HIV patients in low-income countries are either unaware of their hypertension status (as documented in this study) or unable to afford blood pressure medications in the long term because of out-of-pocket payment for medications. This may contribute to increased occurrence of target organ damage leading to stroke, heart disease

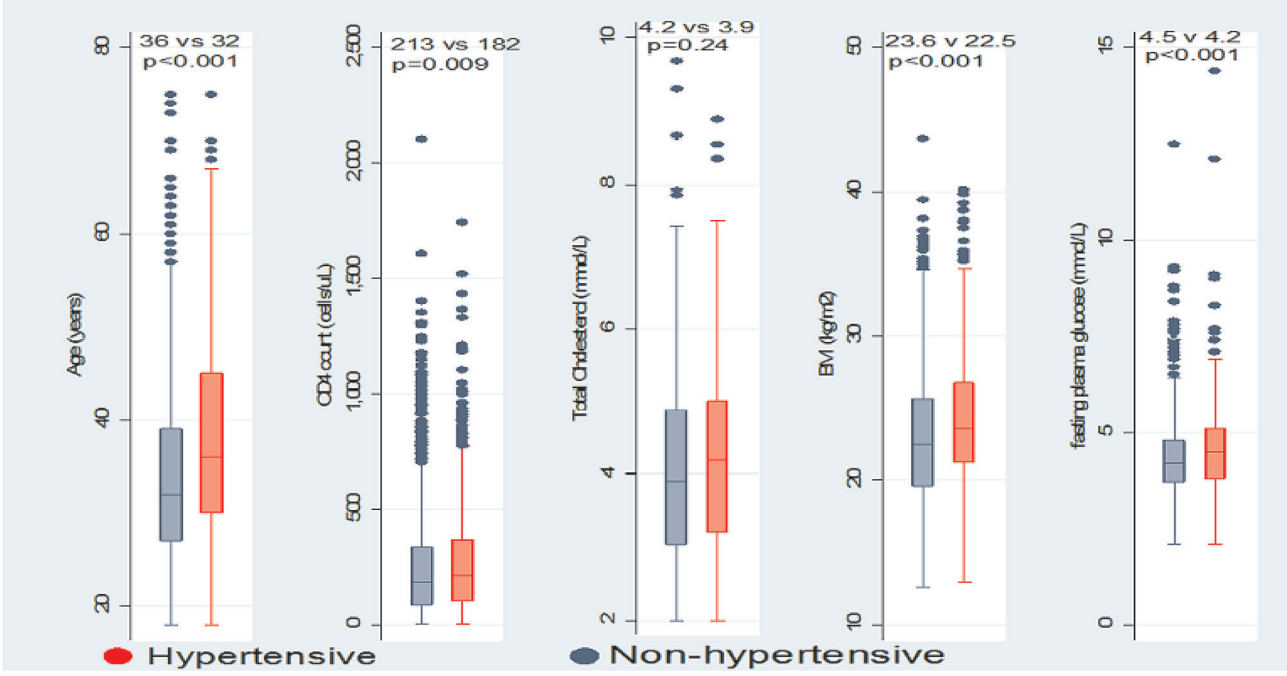

Figure 3 Relationship of other cardiovascular disease risk factors with hypertension among HIV patients.

Table 3 Multivariable logistic regression models showing independent associations with CVD risk factors

	Hypertension (n=1729)	Obesity (n=4946)	Diabetes mellitus (n=587)	Dyslipidaemia (n=478)
	OR (95% CI) P value	OR (95% CI) P value	OR (95% CI) P value	OR (95% CI) P value
Age (years)	1.04 (1.03 to 1.05)<0.001	1.02 (1.01 to 1.03)<0.001	1.03 (0.99 to 1.06) 0.13	1.01 (0.99 to 1.03) 0.51
Sex				
Women	1	1	1	1
Men	1.21 (0.97 to 1.50) 0.09	0.38 (0.29 to 0.49)<0.001	1.74 (0.80 to 3.79) 0.16	1.24 (0.81 to 1.89) 0.33
BMI (kg/m^2)	1.06 (1.03 to 1.08)<0.001	–	1.07 (0.99 to 1.15) 0.10	1.05 (1.01 to 1.10) 0.03
CD4 category				
<200	1	1	1	1
200–499	1.17 (0.94 to 1.47) 0.16	1.90 (1.50 to 2.42)<0.001	1.94 (0.87 to 4.32) 0.10	0.85 (0.55 to 1.32) 0.47
≥500	1.13 (0.83 to 1.54) 0.44	2.63 (1.96 to 3.53)<0.001	3.07 (0.97–9.65) 0.06	0.80 (0.43 to 1.49) 0.48
Year category				
2002–2004	1	1	1	1
2005–2007	0.65 (0.47 to 0.91) 0.01	0.59 (0.41 to 0.85) 0.005	1.22 (0.64 to 2.35) 0.54	1.86 (0.50 to 6.87) 0.35
2008–2010	0.65 (0.46 to 0.93) 0.02	0.59 (0.42 to 0.84) 0.004	3.91 (1.96 to 7.82)<0.001	1.40 (0.39 to 5.08) 0.61
2011–2013	0.63 (0.44 to 0.90) 0.01	0.76 (0.55 to 1.06) 0.11	8.60 (3.76 to 19.64)<0.001	1.52 (0.38 to 6.14) 0.56
2014–2016	0.57 (0.39 to 0.85) 0.006	0.38 (0.26 to 0.56)<0.001	2.31 (0.72 to 7.44) 0.16	1.22 (0.16 to 9.47) 0.85
AUROC	0.64	0.68	0.69	0.59

AUROC, area under the Receiver operating characteristic curve; BMI, body mass index.

and kidney failure among HIV patients in the developing world. Patient education regarding these NCDs may help bridge the gap between high prevalence of hypertension and knowledge of hypertension status but not necessarily lead to control because of the relatively high cost of blood pressure medications.

DM prevalence in this study was not different from that of the general population (2.2%–7.0%).[27–30] This is not unexpected as this cohort was yet to commence ARVs. This seems to be corroborated by a meta-analysis of several studies from sub–Saharan Africa showing no relationship between HIV and glycated haemoglobin levels.[26] DM incidence among HIV patients have been shown to increase with long-term use of ARVs, especially protease inhibitors[31 32] presumably from increased insulin resistance associated with their use. Lower prevalence (1.8%–2.9%) from other African HIV cohorts have been documented.[33 34]

People with HIV in our setting tend to present late for treatment (as indicated by the low median CD4 count at initiation of care) when HIV wasting syndrome may have been established as seen in the pre-ARV era.[35] This may account for the relatively low prevalence of obesity and high frequency of underweight individuals in our newly presenting patients and the increased likelihood of being obese with increasing CD4 count seen with the multivariable analysis. Indeed, it has been documented that there is increasing tendency of HIV patients being obese/overweight in the ARV era approaching proportions seen in the general population.[36] Cachexia in untreated HIV patients is believed to be mediated by cytokines like interleukin 1 and 6.[37] Despite the low frequency of obesity, there was a high prevalence of lipid abnormalities, especially low HDL-c and high serum triglyceride. Low HDL–c was seen in 42.6% of the sample which was comparable to the 51.3% observed in the ARV-naive patients in Kenya.[38] High serum triglycerides in HIV patients may be initiated and perpetuated by the elaboration of cytokines, especially tumour necrosis factor (TNF) and interferon alpha, which are known to be elevated in infections including HIV infection.[39 40] It is believed that TNF rapidly increases very low density lipoprotein (VLDL) production and mobilises fatty acids from the peripheral tissues leading to elevated serum triglycerides.[39] This high frequency of dyslipidaemia may increase the risk of cardiovascular events as life expectancy increases among HIV patients in sub-Saharan Africa.

An integrated approach to care of HIV patients with CVD risk factors has been recommended.[41 42] Integration may involve one of these models—introduction of NCD care into existing HIV care clinics, integration of HIV care into primary healthcare programmes already caring for NCD patients and simultaneous integration of NCD and HIV care programmes.[43] In our clime, donor-funded HIV programmes have become well established in longitudinal care, promotion of healthy lifestyle and routine monitoring, therefore providing an opportunity for long-term care of HIV patients with cardiovascular risk factors. Unfortunately, this integration is yet to be implemented except for cervical cancer screening[44 45] because of shortage of manpower, unavailability of medications for treatment of hypertension, diabetes and dyslipidaemia

unlike ARVs, lack of facilities for diagnosis and monitoring of cardiovascular risk factors and funding constraints. Integrated care of patients with HIV and NCDs has shown promise in reduction of blood pressures and improvement in CD4 count in South Africa,[46] similar blood pressure control in HIV patients compared with HIV-negative controls in Kenya[47] and maximised healthcare delivery efficiency in a resource-limited community in Malawi.[48] Proper management of an integrated programme is expected to yield benefits in the prevention of the occurrence of CVD risk factors, increase detection rates of these NCDs and ensure good treatment outcomes. The timely and adequate prevention and treatment of these conditions may help to reduce the burden of target organ damage in HIV patients. An integrated approach may also reduce cost and increase efficiency in sub-Saharan Africa where financial and manpower resources are scarce.[49]

Strengths and limitations

The current study used routinely collected data in the process of providing care to people with HIV, and therefore has some limitations. Some key CVD risk factors of interest not routinely collected (including tobacco smoking) were missing in the database, and therefore limited our capacity to explore all major CVD risk factors singly and in combination in this sample. The unavailability of complete CVD risk factor data has highlighted the low premium placed on the importance of these factors by HIV caregivers in our centre and provided an avenue for improvement of the current programme. Again, the relatively large patient number may help address this problem in part. We also believe these findings are important, coming from a high HIV prevalence area with small number of published data on CVD risk factors in the HIV population.

CONCLUSION

The high prevalence of traditional CVD risk factors makes it imperative to ensure detailed screening for cardiovascular risk factors in HIV patients at initiation of care and at regular intervals during follow-up. An integrated approach to NCD/HIV care may be the answer to this double burden of disease.

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