The prevalence of selected non-communicable disease risk factors among HIV patients on anti-retroviral therapy in Bushbuckridge Sub-district, Mpumalanga province

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Research article

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Abstract

Background: The rates of non-communicable diseases (NCD's) appear to be increasing in HIV infected people as compared to non-HIV infected people and this will have major implications for clinical care. The aim of the current study was to profile selected cardiovascular disease risk factors among HIV patients on ART in Bushbuckridge sub-district. Methodology: The current study followed a quantitative cross-sectional study design using a questionnaire which was adapted from World Health Organization stepwise approach to surveillance (WHO STEPS). Participants were HIV people on ART and data was entered into a computer software Microsoft excel, then imported to Stata 12 for analysis. Results: Seventy-two percent of the 332 participants were females and the overall age distribution among participants increased with increasing age. The overall prevalence of overweight at the initiation of ART amongst the participants was 18.1% and obesity was 11.5% as compared to the time of the study which was 21.4% overweight and 19.6% obese. The baseline and current body mass index at time of study for females had a significant difference (p-value 0.006). The overall prevalence of hypertension was found to be 34.6%, overweight was 21.4% obesity was 19.6%. The overall prevalence of abnormal waist circumference was 31.9% and females had a higher prevalence of 42.5% as compared to 4.4% of males. The overall prevalence of smoking 10.8% and alcohol consumption was 21.7%. Males were 22.5 times more likely to be smokers than females ($p<0.001$) and older people were found to be 0.3 times less likely to consume alcohol as compared to young people. The participant who were divorced were 6.2 times more likely to smoke than married participants ($p<0.05$). Males were 0.08 times less likely to be obese ($p<0.001$). Conclusion: The high levels of selected risk factors for NCDs among adults on ART in the current study area suggest an urgent need for health interventions to control risk factors in an era of HIV with an aim of reducing multiple morbidity of chronic diseases. occurrence of NCDs and their risk factors with an aim to achieve positive effects of the long-term anti-retroviral therapy (ART).

Introduction

Approximately more than 35 million deaths are caused by non-communicable diseases (NCDs) on an annual basis. Morbidity and mortality due to NCD's contribute significant threat globally on health and economy of individuals, societies and health systems [1; 2]. The four main NCDs which are been targeted for control globally are cardiovascular diseases, chronic respiratory diseases, cancers, and diabetes and the selected NCD risk factors also target for control are tobacco use, harmful alcohol use, salt intake, obesity, raised blood pressure, raised blood glucose and diabetes, and physical inactivity [2; 3; 4]. The development of health systems that are receptive, accessible and equipped to deal with the challenge of prevention and treatment of NCDs is a global priority. Achieving this type of health system will aid in the management of people with NCDs and reduce multiple morbidity [5].

The HIV and AIDS pandemic has significantly contributed to mortality rates in many countries over the past three decades [6; 7.]. there are substantial concerted efforts and actions which have been made to control the epidemic [6]. This include amongst others the introduction of effective antiretroviral therapy (ART) which has substantially reduced AIDS-related mortality [8; 9]. However, non-HIV-related mortality,

such as that attributable to CVD, has become increasingly important for the millions of people living with HIV (PLHIV) [6.] Due to the successful control of HIV viremia and HIV-induced AIDS through ART, CVD has emerged as a leading cause of death in those infected with HIV [10]. Cardiovascular diseases are a widely recognised as a complication of HIV infection. Most of the traditional risk factors of CVDs present in the general population are also present among the HIV-infected population [11]. Therefore, the use of antiretroviral therapy among HIV infected population has improved the quality and life expectancy [6; 12; 13] however, this exposes them to the effects of aging, including influence of environmental risk factors known to act in general population and contributing to the occurrence of obesity, diabetes mellitus and cardiovascular disease [11; 14, 15] and increased non-HIV related mortality estimated at 33.3 million [15].

Several studies in Africa cited a high burden of hypertension, obesity and hypercholesterolaemia among HIV patients on ART [16; 17]. HIV and Antiretroviral therapy (ART) seem to be causally linked with early CVD even after controlling for NCD's traditional risk factors and age [18]. An insight into the extent of the burden of NCD's risk factors amongst HIV positive people on ART is crucial for effective advocacy and action. It is vital to have surveillance for NCD risk factors amongst HIV positive population mainly for planning, implementation and evaluation of health programmes using good policies [19]. Therefore, the aim of this study was to determine the profiles of NCD risk factors among HIV positive people on ART in a rural area of Bushbuckridge in Mpumalanga Province of South Africa.

Materials And Methods

The current study followed a quantitative approach which the design was cross-sectional in nature [20], to describe non-communicable disease risk factors among HIV patients on ART in Bushbuckridge Sub-district of Mpumalanga Province. A total of 372 HIV people on ART at Rixile ART Clinic which is attached to Tintswalo Hospital were randomly selected to participate in the study. Therefore, a total of 332 people (240 females and 92 males) completed the adapted WHO STEPwise questionnaire. The reasons for not participating included amongst others refusals and others terminated the interview before completion.

The adapted WHO STEPwise approach to Surveillance (STEPS) for NCD risk factors [19; 21] was used to collect information on selected behavioural risk factors through face-to-face interviews and physical measurements were conducted following the recommended STEPwise protocols [19, 21; 22]. The OMRON M6 and M5-I Digital Automatic Blood Pressure Monitors were used to measure resting blood pressure. Blood pressure was measured three times and the average of the last two readings was used [19].Criteria for the diagnosis of hypertension were those proposed by World Health Organization (WHO)/International Society of Hypertension using the average systolic BP of 140mmHg or higher, or if the average diastolic BP was 90mmHg or higher, or if participants were on anti-hypertensive treatment [19, 23].

Height and weight were measured once using a stadiometer and digital balance. The readings were recorded to the nearest 0.5 centimetre and to the nearest 0.1 kg, respectively. Participants were measured without shoes and wearing only light clothing. Waist circumference was measured once using a constant

tension tape and recorded to the nearest 0.1 cm (High Waist Circumference >102 cm for men and >88 cm for women) [23].

Statistical methods

Data analysis was conducted through the use of STATA statistical software (STATA Corporation, College Station, Texas) version 12. Categorical variables were presented as percentages whilst continuous variable were expressed as mean ± SD. The coding of data was done in line with WHO guidelines [19]. Comparison of categorical variables was performed using Chi-Square and a level of 0.05 was considered significant. We report 95% confidence intervals (95% CIs) on all proportions. Univariate logistic regression was employed to determine predictors of selected cardiovascular disease risk factors [19].

Ethical consideration

The study was approved by the Turfloop Research Ethics Committee (TREC) with reference TREC/242/2017:PG under the University of Limpopo and the Department of Health Mpumalanga Province and all participants signed full informed consent.

Results

A total of 332 participants took part in the current study and majority (72%) of the participants were females as compared to males and there was a statistical significance difference (*p-value 0.001*) between the age groups. The overall age distribution among participants increased with increasing age from 4.2% in age group 18 – 24 years to 30.4% in age group 35 – 44 years then dropped to 26.5% and 17.5% in age groups 45 – 54 years and above 55 years respectively. Considering gender distribution, 7.6% of the participants of males were in age group 18 – 24 years; 31.6% in age group 45 – 54 years then dropped to 27%. In females a similar trend was witnessed, from 2.9% in age group 18 – 24 years to 33.8% in age group 25 – 44 years but then dropped to 24.6% and 13.8% in age groups 45 -54 years and above 55 years respectively as presented in table 1. Approximately 44.6% of males were unemployed as compared to 66.3% of females and approximately 36% of males were employed as compared to 26% of females. Majority of females were single at 45.8% whereas 51.1% of males were married. Lastly majority of the participants had a primary school level of education followed by no formal school as illustrated in table 1.

Baseline and current body mass index and blood pressure

Comparing the baseline and current body mass index at time of study, overweight at the initiation of ART amongst the participants was 18.1% and obesity was 11.5% as compared to at the time of the study which was 21.4% overweight and 19.6% obese. The current study findings revealed that there is no significant difference for males, however overweight percentage increased from 13% to 20.7%. The

baseline and current body mass index at time of study for females showed that there is a significant difference at p-value 0.006. Obesity increased from 14.6% to 25.8% in females. The blood pressure among males indicated a significant difference at p-value 0.026 and stage 2 hypertension category increased from 0% to 7.6%. The blood pressure among females also indicated a significant difference at p-value 0.038 and pre-hypertension increased from 17.1% to 22.5% whereas stage 2 hypertension dropped from 3.3% to 0.8% (Table 2).

Prevalence of selected risk factors

The overall prevalence of hypertension was found to be 34.6% and males had the highest prevalence at approximately 41% as compared to 32% of females. In breaking down hypertension into different stages, the overall prevalence of pre-hypertension was high at 23.2% and males had a prevalence of pre-hypertension of 25% as compared to 22.5% of females. Stage 1 hypertension had an overall prevalence of approximately 8.7% and both males and females had the same prevalence. Stage 2 hypertension had the lowest overall prevalence of 2.7% and males had a prevalence of 7.6 which is 6.8% higher than females (Table 3).

The overall prevalence of overweight was 21.4% and females had a slight higher prevalence than males at 21.7% and 20.7% respectively. Obesity had an overall prevalence of 19.6% and females had a higher prevalence than males with 22.5%. The overall prevalence of abnormal waist circumference was 31.9% and females had a higher prevalence of 42.5% as compared to 4.4% of males. The overall prevalence of smoking 10.8% and males had a higher prevalence at 32.6% as compared to 2.5% of females. Lastly, the overall prevalence of alcohol consumption was 21.7% and similarly to smoking, males had a high prevalence at 39.1% as compared to 15% in females (Table 3).

The prevalence of selected cardiovascular disease risk factors stratified by age groups in from the current study findings revealed that, the prevalence of overweight in females was found to be high in age groups 25 – 34 years and 35 – 44 years at 25% then decreased with age at age 45 – 54 years and above 55 years at 22% and 12.1% respectively. In males, the prevalence of overweight showed an increasing trend from 9.1% at age 25 – 34 years to 32% at age group above 55 years. At the age group 18 – 24 years' obesity was found to be high at 28.6% then decreased at age groups 25 – 34 years and 35 – 44 years to be at 26.7% and 17.3 respectively in females. An increasing trend of obesity was also recorded in females at age 45 – 54 years and above 55 years at 28.8% and 39.4% respectively. In males, the prevalence of obesity showed a decreasing trend from 9% at age group 25 – 34 years to 4% at age group above 55 years (Table 4).

Hypertension in the current study has shown a fluctuating trend in both females and males. It was highest in males at age 45 – 54 years at 60%, then 45.5%, 37.9% and 35% at age group 25 – 34 years, 45 – 54 years and 35 – 44 years respectively. Hypertension was highest in females 49.2% then dropped to 48.5% at age group above 55 years and at age group 18 – 24 years it was 28.6%, then 20% and 22.2% at age groups 25 – 34 years and 35 – 44 years respectively (Table 4).

The prevalence of abnormal waist circumference was found to high in females as compared to males. It has increased with age 32.1%, 44.1% and 66.7%, at age groups 35 – 44 years, 45 – 54 years and above 55 years respectively. Smoking was more prevalent in males than females but in females it was increasing with age whereas in males it had a fluctuating trend. In females there were only smokers from the age group 35 – 44 years at 1.2% then increased to 12.1% at age group above 55 years. The highest prevalence of smoking in males was 45.5% at age group 25 34 years followed by 41.4% age group 45 – 54 years and the lowest prevalence was 14.3% at age group 18 – 24 years. Alcohol consumption in both genders decreased with increasing age from 57.1% at age group 18 – 24 years to 3% age group above 55 years in females and 57.1% at age group 18 – 24 years to 20% at age group above 55 years in males (Table 4).

Table 5 presents the prevalence of selected cardiovascular disease risk factors by type of ART regimen. The prevalence overweight was found to be 73.1% in males who were on FDC as compared to 52.6% in females and these decreased in patients who were on other types of regimens. A similar trend was reported on obesity as males had a prevalence of 59.7% in males who were on FDC. The prevalence of hypertension was high on females who were on FDC as compared to males at 60.5% and 55.8% respectively. The prevalence of smoking and alcohol consumption was high in males as compared to females at 69.2%, 66.7% and 56.5%, 53.6% respectively. The prevalence of selected cardiovascular disease risk factors by duration on ART is presented in table 6. At less than 12 months, the prevalence of risk factors were low and increased with increase in duration on ART.

The predictors of selected cardiovascular disease risk factors

The findings of the current study show that older people and males were 1.6 and 1.4 times more likely to be hypertensive than young ones and females respectively however, these were not statistically significant. Older people were found to be 1.5 times more likely to be overweight, 0.7 times less likely to be obese and 0.97 times less likely to be having abnormal waist circumference as compared to younger people but this however, was not statistically significant. Males were found to be 0.9 times less likely to be overweight which was not statistically significant but with regard to obesity, males were statistical significant ($p<0.001$) 0.08 times less likely to be obese and 0.06 ($p<0.001$) to be having abnormal waist circumference as compared to females. Participants with low educational level were found to be 1.6 times more likely to be overweight than educated people(Table 7).

Older people were 1.5 times more likely to be smokers than younger people but not statistically significant. However, males were 22.5 times more likely to be smokers than females ($p<0.001$). With regard to alcohol consumption, older people were found to be 0.3 times less likely to consume alcohol as compared to young people, however, males were 4 times more likely to consume alcohol as compared to females. The participant who were divorced were 6.2 times more likely to smoke than married participants ($p<0.05$) (Table 7).

Discussion

The methodology employed in the current study was retrospective quantitative cross-sectional in nature. The study used a questionnaire which was adapted from World Health Organization stepwise approach to surveillance (WHO STEPS) which has been validated and used in several studies globally [24]. Therefore, this signifies reliability of the current study findings.

The age distribution of participants in the current study increased with increasing age which concurs with a study conducted in Uganda (Kavishe et al 2015). As in other studies [25; 26], majority of the participants in the current study were females.

A cross sectional study conducted in Tanzania revealed that HIV and Non communicable diseases (NCDs) are major problem of public health importance in developing countries [27] which is similar to the current study findings as there is a increase in NCD risk factors amongst HIV positive people.

A number of studies have shown that there may be increased NCD risk factors in HIV-infected versus uninfected populations [28]. An increasing trend in the overall prevalence of overweight at the initiation of ART amongst the participants in the current study was noted which concurs with a study conducted by Tate et al (2012) in Birminghamin [25]. Remarkably, a greater proportion of females than males were overweight and obese at baseline and during the conduct of the study which is agreement with the findings from other studies [25; 29]. The highest prevalence of a higher waist circumference (abdominal obesity) (66.7%) is among females in the age category ≥55 years, surprisingly the age category 18 to 24 years among females have a prevalence of 42.9%. The latter, could be due to sedentary lifestyles and dietary patterns that young adults are in engaged in. The current results coincide with a study conducted by Alvarez et al (2010) in Latin America [30]. Although obesity might have a protective effect on HIV disease progression and AIDS-related deaths; it has harmful health consequences such as CVD [31]. These results show that epidemiologic transition may not only occur in developed countries but also in developing countries. This shows that HIV patients on HAART should not be encouraged to consume energy-dense foods higher than the general population as they are also prone to obesity as in the general population.

Hypertension, diabetes, and dyslipidaemia are also more common in HIV infected people [32]. In the current study the overall prevalence of hypertension was 34.6%, this is lower than that found in Cameroon of 38% among HIV patients on HAART [33]. In this study, Men had the highest prevalence of hypertension than women. The prevalence of hypertension among men and women in the current study was 41.3% and 32.1% respectively which concurs with a study conducted in Kenya were males had a higher hypertension prevalence of 11.2% as compared to 7.4% of females [34]. Our study findings again revealed that the highest prevalence of hypertension (60%) was among males in the age category ≥55 years which differs from a study by Bloomfield et al (2011) where they found younger men had a higher prevalence than older age [34]. The rationale could be that older men may not be able to control their blood pressure and stress levels better than their counterparts of the same age.

This study also found that the overall prehypertension prevalence is 23.2% which was found to be higher than the findings from a study done in three regions of Brazil where it was found that the prevalence of prehypertension was between 3% to 15% [35]. Prehypertension is independently associated with risk of CHD, which has been described in subjects not infected with HIV, more studies need to be done in order to find out if prehypertension and HIV are dependently associated with risk of CVD or not. In this study, the chances of having a high prevalence rate of hypertension were predicted by increasing BMI. Increasing BMI has been shown to be a predictor of hypertension in a study conducted in Nigeria [29].

Through observation most of the elderly men are staying alone no one look after men especially after they are diagnosed with HIV. Women also accept conditions or changes in their lifestyle better than men. To support the above statement, blood pressure taken when HAART was initiated and at time of study showed that stage 2 hypertension (≥160/100mmHg) increased from 0% to 7.6% for men and for women, however decreased from 3.3% to 0.83%. These findings concurred with that of two African studies which showed a higher prevalence of hypertension with HAART [29; 33], thus supporting the fact that HAART could possibly be linked to hypertension in these patients.

The overall smoking rate is 10.8% and according to South African National Health and Nutrition Examination Survey (SANHANES) report of 2013, the prevalence of smoking in South Africa is estimated to be 16%. The highest prevalence of smoking (45.5%) among males in the age category 25 to 34 years and in females highest (12%) in the age category ≥55 years. In our study, the overall alcohol consumption is 21.7% and it is highest (57%) in the age category 18 to 24 years in both males and females. In a study conducted in the United States of America, discovered that the prevalence of alcohol consumption in people living with HIV/AIDS was higher than the general population in the same region [36]. Many studies have found that people with HIV experience age-related comorbid disease, organ system functional decline, and frailty at an earlier age than demographically similar control subjects. This is likely to be accentuated among those consuming harmful amounts of alcohol [37]. Specifically, our study findings revealed that patterns of heavy consumption continue into middle and drops at older ages as compared to other studies [38; 39].

A study conducted in Tanzania Kagaruki et al (2014) showed that older age (AOR = 3.42, 95% CI 2.06-5.70) was a risk factors that predicted the prevalence of hypertension among participants on ART [40] which contradicts to the current study findings as it was revealed that older age was not significantly the risk factors that predicted hypertension and overweight. Hypertension was not significantly associated with any of the socio-demographic factors as opposed to a study conducted in by in in Northwestern Tanzania and Southern Uganda [26] wherein there was a significant association between hypertension and gender, age, educational level, and participants' occupation or work status. Male gender has been found to be significantly associated with smoking (AOR = 22.5, 95% CI 7.8 – 64.7) and alcohol consumption (AOR = 4.0, 95% CI 2.1 – 7.7) in ART patients in the current study which is similar to other studies [38; 39].

Conclusion

HIV and Non communicable diseases (NCDs) are major problem of public health importance in developing countries. The current study revealed that there is a high level of selected risk factors for NCDs among adults on ART and this suggest an urgent need for health interventions to control risk factors in an era of HIV with an aim of reducing multiple morbidity of chronic diseases. The risk of developing chronic non-communicable diseases is increasingly recognized as a major public health problem in individuals infected with HIV. The profile of patients infected with HIV and on ART is changing and this will have major implications for clinical care in rural areas. The ageing HIV-infected population will put new demands on the health-care systems, which will have important implications for the health of HIV-infected patients in clinical care.

The findings from this study are important to inform health care and training, resource and research priorities and also to establish how non-communicable disease risk factors vary amongst HIV positive population. As Sub-Saharan Africa is facing intersecting epidemics of HIV and hypertension, it is essential to address the occurrence of NCDs and their risk factors with an aim to achieve positive effects of the long-term anti-retroviral therapy (ART). Together with the adverse effects that HIV and its treatment have on lipids, this may have serious implications for the South African health care system which is burdened by HIV epidemic. Therefore, monitoring of the interaction of HIV, ART use, and non-communicable diseases is needed at both individual and population levels.

Declarations

Competing interests

The principal investigator together with co-investigator did not have any actual or potential competing interests in taking part in the current research.

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Authors' contributions

The design of the study including the data management and writing of the article was done as a collaborative effort from all authors involved in the study. ME made substantial contributions to conception, design including analysis and interpretation of data while MR made substantial contribution in the acquisition of data, analysis, interpretation of data and drafting the manuscript.

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Tables

Table 1: Socio-demographic information

	Males (n=92)	Females (n=240)	P-value
	n (%)	n (%)	
18-24	7 (7.6)	7 (2.9)	
25-34	11 (12)	60 (25)	
35-44	20 (21.7)	81 (33.8)	0.001
45-54	29 (31.6)	59 (24.6)	
≥55	25 (27)	33 (13.8)	
mployment status	n (%)	n (%)	P-value
Employed	33 (35.9)	62 (25.8)	
Self- employed Unemployed	15 (16.3)	15 (6.3)	
Student	41 (44.6)	159 (66.3)	0.001
	3 (3.3)	4 (1.7)	
Iarital status	n (%)	n (%)	P-value
Single	13 (14.2)	110 (45.8)	
Married	47 (51.1)	42 (17.5)	
Co-habiting Divorced	19 (20.7)	29 (12.1)	
Separated	4 (4.4)	14 (5.8)	< 0.000
Widowed	5 (5.4)	15 (6.3)	
	4 (5.4)	30 (12.5)	
ducational status	n (%)	n (%)	P-value
No formal school	31 (33.7)	72 (30)	
Primary school Secondary school	41 (44.6)	104 (43.3)	
Tertiary	18 (19.6)	55 (23)	0.855
Post-graduate	2 (2.2)	8 (3.3)	
	0 (0.0)	1 (0.3)	

Table 2: Baseline and current body mass index and blood pressure for males and females separately

	Males (n=92)		P-value	Females (n=240)		P-value
	Initial	Current		Initial	Current	
BMI	n (%)	n (%)		n (%)	n (%)	
Underweight	11 (12)	10 (7.5)		31 (12.9)	18 (7.5)	
Normal	66 (71.7)	60 (65)		126 (52.5)	108 (45)	
Overweight	12 (13)	19 (20.7)	0.590	48 (20)	52 (21.7)	
Obesity	3 (3.3)	3 (3.3)		35 (14.6)	62 (25.8)	0.006
Blood pressure	n (%)	n (%)	P-value	n (%)	n (%)	P-value
Hypotension	2 (2.2)	0 (0.0)		9 (3.8)	4 (1.67)	
Normal	66 (71.7)	54 (58.7)		170 (70.8)	159 (66.2)	
Pre-hypertension	18 (19.6)	23 (25)	0.026	41 (17.1)	54 (22.5)	
Stage 1 hypertension	6 (6.5)	8 (8.7)		12 (5.0)	21 (8.7)	
Stage 2 hypertension	0 (0.0)	7 (7.6)		8 (3.3)	2 (0.83)	0.038

Table 3: Overall prevalence of selected risk factors stratified by gender

Risk factor	Overall %(95%CI)	Males % % (95%CI)	Females %(95%CI)
Hypertension (BP>140/90mmHg)	34.6 (29.5 – 39.8)	41.3 (31.2 – 51.5)	32.1 (26.1 – 38.0)
Pre-hypertension	23.2 (18.6 – 27.8)	25.0 (16.1 – 33.9)	22.5 (17.2 – 27.8)
Stage 1 hypertension	8.7 (5.7 – 11.8)	8.7 (2.9 – 14.5)	8.8 (5.2 – 27.8)
Stage 2 hypertension	2.7 (0.9 – 4.5)	7.6 (2.1 – 13.0)	0.8 (-0.03 – 2.0)
Overweight (BMI kgm^2 ≥25 to ≤29.9)	21.4 (17.0 – 25.8)	20.7 (12.3 – 29.0)	21.7 (16.4 – 26.9)
Obesity (BMI kgm^2 ≥30)	19.6 (15.3 – 23.9)	3.3 (-0.04 – 6.9)	25.8 (20.3 – 31.4)
Waist circumference	31.9 (26.9 – 37.0)	4.4 (0.1 – 8.6)	42.5 (36.2 – 48.8)
Smoking	10.8 (7.5 – 14.2)	32.6 (22.9 – 42.3)	2.5 (0.5 – 4.5)
Alcohol	21.7 (17.2 – 26.1)	39.1 (29.1 – 49.2)	15.0 (10.5 – 19.5)

Table 4: Prevalence of selected cardiovascular disease risk factors stratified by age group

		Age in years				
		18-24 % (95% CI)	25-34 % (95% CI)	35-44 % (95%CI)	45-54 % (95% CI)	≥ 55 % (95% CI)
Risk factors						
Overweight	Male	-	9.1 (-8.9 – 27.1)	20.0 (1.8 – 38.2)	20.7 (5.5 – 35.9)	32.0 (13.1 – 50.9)
	Female	-	25.0 (13.9 – 36.1)	25.0 (15.2 – 34.2)	22.0 (11.3 – 32.8)	12.1 (0.8 – 23.5)
Obesity	Male	-	9.0 (-8.9 – 27.1)	5.0 (-4.9 – 14.9)	-	4.0 (-3.9 – 11.9)
	Female	28.6 (-7.8 – 64.9)	26.7 (15.3 – 38.0)	17.3 (8.9 – 25.6)	28.8 (17.1 – 40.5)	39.4 (22.4 – 56.4)
Hypertension	Male	-	45.5 (14.2 – 76.7)	35.0 (13.3 – 56.7)	37.9 (19.7 – 56.1)	60.0 (40.1 – 79.9)
	Female	28.6 (-7.8 – 64.9)	20.0 (9.7 – 30.3)	22.2 (13.1 – 31.4)	49.2 (36.2 – 62.1)	48.5 (31.1 – 65.9)
Waist circumference	Male	-	9.1 (-0.9 – 27.1)	-	-	12.0 (-1.2 – 25.2)
	Female	42.9 (3.1 – 82.7)	41.7 (29.0 – 54.3)	32.1 (21.8 – 42.4)	44.1 (31.2 – 56.9)	66.7 (50.3 – 83.1)
Smoking	Male	14.3 (-14.1 – 42.7)	45.5 (14.2 – 76.7)	30.0 (9.1 – 50.9)	41.4 (22.9 – 59.9)	24.0 (6.7 – 41.3)
	Female	_	_	1.2 (0.1 – 3.7)	1.6 (0.2 – 5.0)	12.1 (0.1 – 23.5)
Alcohol consumption	Male	57.1 (17.0 – 97.3)	54.5 (23.3 – 85.8)	45.0 (22.3 – 67.7)	41.4 (22.9 – 59.9)	20.0 (3.8 – 36.2)
	Female	57.1 (17.3 – 96.9)	25.0 (13.9 – 36.1)	12.3 (5.1 – 19.6)	10.2 (2.4 – 17.9)	3.0 (-2.9 – 8.9)

Table 5: Prevalence of selected cardiovascular disease risk factors stratified by type of ART regimen

		ART Regimen type					
		FDC % (95% CI)	Dumiva and efavirenz % (95% CI)	Dumiva and alluvia % (95%CI)	Efavirenz and lamividine % (95% CI)	Tenamine and neverapine % (95% CI)	Alluvia and tenefovir
Risk factors		Females (n=240)					
Overweight	Male	73.1 (59.3 – 83.5)	9.6 (4.0 – 21.3)	7.7 (2.9 – 19.0)	1.9 (0.2 – 12.7)	5.8 (1.8 – 16.7)	1.9 (0.2 – 12.7)
	Female	52.6 (30.3 – 73.9)	26.3 (11.0 – 50.8)	15.8 (4.9 – 40.4)	_	_	5.3 (0.7 – 31.1)
Obesity	Male	59.7 (47.0 – 71.2)	24.2 (15.0 – 36.5)	6.5 (2.4 – 16.1)	_	8.1 (3.3 – 18.1)	1.6 (0.2 – 10.8)
	Female	_	_	_	_	_	_
Hypertension	Male	55.8 (44.5 – 66.6)	22.1 (14.1 – 32.8)	13.0 (7.1 – 22.6)	_	9.1 (4.4 – 18.0)	_
	Female	60.5 (44.0 – 74.9)	23.7 (12.6 – 40.1)	13.2 (5.5 – 28.5)	_	2.6 (0.4 – 17.2)	_
Waist circumference	Male	59.8 (49.9 – 69.0)	22.5 (15.4 – 31.8)	6.9 (3.3 – 13.8)	9.8 (0.1 – 6.8)	7.8 (3.9 – 15.0)	2.0 (0.4 – 7.6)
	Female	_	_	_	_	_	_
Smoking	Male	69.2 (63.0 – 74.8)	14.1 (10.2 – 19.20	8.1 (5.2 – 12.4)	0.8 (0.2 – 3.4)	6.4 (3.9 – 10.4)	1.3 (0.4 – 3.9)
	Female	56.5 (43.7 – 68.4)	27.4 (17.6 – 40.1)	8.1 (3.3 – 18.2)	_	4.8 (1.5 – 14.3)	3.2 (0.8 – 12.3)
Alcohol consumption	Male	66.7 (59 – 72.8)	16.2 (11.7 – 21.9)	7.8 (4.8 – 12.5)	0.9 (0.2 – 3.9)	7.4 (4.5 – 11.9)	0.9 (0.2 – 3.9)
	Female	53.6 (40.3 – 66.4)	32.1 (21.1 – 45.7)	8.9 (3.7 – 20.1)	_	3.6 (0.9 – 13.6)	1.8 (0.2 – 12.1)

Table 6: Prevalence of selected cardiovascular disease risk factors stratified by type of duration on ART

		Duration on ART in years				
		< 12 months % (95% CI)	1 – 2 years % (95% CI)	3 – 4 years % (95%CI)	5 – 6 years % (95% CI)	≥7 years
Risk factors						
Overweight	Male	12.5 (1.5 – 58.0)	35.0 (17.2 – 58.3)	11.1 (2.6 – 36.7)	38.5 (16.1 – 67.0)	12.1 (4.5 – 28.8)
	Female	31.3 (13.2 – 57.7)	29.2 (17.9 – 43.7)	15.6 (7.5 – 29.5)	20.6 (10.0 – 37.7)	19.6 (12.8 – 28.8)
Obesity	Male	_	5.0 (0.6 – 29.9)	5.6 (0.7 – 32.5)	_	3.0 (0.4 – 19.5)
	Female	31.3 (13.2 – 57.7)	18.8 (10.0 – 32.5)	23.6 (22.9 – 50.6)	23.5 (12.1 – 40.8)	24.7 (17.1 – 34.4)
Hypertension	Male	25.0 (5.6 – 65.4)	30.0 (13.7 – 53.7)	61.1 (36.9 – 80.8)	23.1 (7.1 – 53.9)	48.5 (31.7 – 65.5)
	Female	25.0 (9.3 – 51.9)	22.9 (13.0 – 37.1)	40.0 (26.7 – 55.0)	35.3 (21.0 – 52.8)	33.0 (24.3 – 43.0)
Smoking	Male	25.0 (5.6 – 65.4)	45.0 (24.7 – 67.2)	27.8 (11.6 – 53.0)	38.5 (16.1 – 67.0)	27.3 (14.6 – 42.2)
	Female	_	_	2.2 (0.3 – 14.6)	2.9 (0.3 – 18.7)	4.1 (1.5 – 10.6)
Alcohol consumption	Male	25.0 (5.6 – 65.4)	60.0 (37.2 – 79.2)	33.3 (15.2 – 58.1)	38.5 (16.1 – 67.0)	33.3 (19.2 – 51.3)
	Female	25.0 (9.3 – 51.9)	14.6 (7.0 – 27.8)	8.9 (3.3 – 21.7)	17.6 (8.0 – 34.5)	15.5 (9.5 – 24.2)

Table 7**:** Univariate logistic regression to determine predictors of selected cardiovascular disease risk factors

Variables	Smoking	Alcohol consumption	Hypertension	Overweight	Obesity	Waist Circumference
Age						
18 – 34 years	Reference (1)	Reference (1)	Reference (1)	Reference (1)	Reference (1)	Reference (1)
≥35 years	1.5 (0.5 – 4.8) [a]	0.3 (0.2 – 0.6)**	1.6 (0.9 – 3.0) [a]	1.5 (0.8 – 3.1) [a]	0.7 (0.4 – 1.4) [a]	0.97 (0.53 – 1.78) [a]
Gender						
Female	Reference (1)	Reference (1)	Reference (1)	Reference (1)	Reference (1)	Reference (1)
Male	22.5 (7.8 – 64.7)***	4.0 (2.1 – 7.7)***	1.4 (0.9 – 2.4) [a]	0.9 (0.5 – 1.9) [a]	0.08 (0.02 – 0.3)***	0.06 (0.02 – 0.2)***
Educational status						
High	Reference (1)	Reference (1)	Reference (1)	Reference (1)	Reference (1)	Reference (1)
Low	0.9 (0.6 – 1.5) [a]	0.7 (0.5 – 1.1) [a]	0.8 (0.6 – 1.1) [a]	1.6 (1.2 – 2.3)**	0.7 (0.5 – 1.0) [a]	1.1 (0.8 – 1.6) [a]
Marital status						
Married	Reference (1)	Reference (1)	Reference (1)	Reference (1)	Reference (1)	Reference (1)
Single	1.5 (0.4 – 5.4) [a]	0.9 (0.4 – 1.9) [a]	0.8 (0.4 – 1.5) [a]	0.8 (0.4 – 1.7) [a]	0.7 (0.3 – 1.5) [a]	0.8 (0.4 – 1.6) [a]
Cohabiting	1.8 (0.6 – 5.6) [a]	0.9 (0.4 – 2.1) [a]	o.8 (0.3 – 1.7) [a]	0.3 (0.1 – 1.0)*	0.7 (0.2 – 1.9) [a]	0.7 (0.3 – 1.9) [a]
Divorced	6.2 (1.2 – 31.8)*	0.7 (0.2 – 3.1) [a]	1.5 (0.5 – 4.2) [a]	0.2 (0.02 – 1.2) [a]	3.1 (0.9 – 10.4) [a]	1.6 (0.5 – 5.1) [a]
Separated	1.3 (0.2 – 7.9) [a]	0.2 (0.02 – 1.4) [a]	1.5 (0.5 – 4.0) [a]	0.8 (0.2 – 2.6) [a]	0.6 (0.2 – 2.6) [a]	1.1 (0.4 – 3.7) [a]
Widowed	1.1 (0.2 – 6.6) [a]	0.4 (0.1 – 1.6) [a]	1.8 (0.8 – 4.3) [a]	1.0 (0.4 – 2.6) [a]	1.0 (0.3 – 2.9) [a]	1.6 (0.6 – 4.1) [a]
Work status						
Working	Reference (1)	Reference (1)	Reference (1)	Reference (1)	Reference (1)	Reference (1)
Not working	–	2.8 (0.7 – 10.8) [a]	-	0.08 (0.02 – 0.3) [a]	1.2 (0.3 – 5.1) [a]	0.8 (2.1 – 2.9) [a]

Values are reported as odds ratios (95%CI); *significant *at p<0.05; ***significant *at p<0.005; ****significant *at p<0.001*, [a]Not significant