

Prevalence of chronic non-communicable diseases in people living with HIV

Prevalência de doenças crônicas não transmissíveis em pessoas vivendo com HIV
Prevalencia de enfermedades crónicas no transmisibles en personas que viven con el VIH

Priscila Silva Pontes-Pereira¹  <https://orcid.org/0000-0002-1318-8431>


Marcela Antonini¹  <https://orcid.org/0000-0003-4711-4788>

Elizabete Melo Montanari Fedocci²  <https://orcid.org/0000-0002-7322-9370>

Christefany Régia Brás Costa¹  <https://orcid.org/0000-0001-6124-8243>

Abraham Isaac Esquivel-Rubio³  <https://orcid.org/0000-0001-6675-5439>

Eliã Pinheiro Botelho⁴  <https://orcid.org/0000-0002-9682-6530>

Elucir Gir¹  <https://orcid.org/0000-0002-3757-4900>

Renata Karina Reis¹  <https://orcid.org/0000-0002-0681-4721>

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Corresponding author

Priscila Silva Pontes-Pereira
E-mail: priscilapontes@usp.br

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Rafaela Gessner Lourenço
(<https://orcid.org/0000-0002-3855-0003>)
Universidade Federal do Paraná, Curitiba, PR, Brazil

Abstract

Objective: To identify the prevalence of chronic non-communicable diseases and associated factors in people living with HIV (PLHIV).

Methods: This is a retrospective cross-sectional study carried out through a secondary data analysis, collected between October 2014 and May 2018. The analyzed database included a sample of 550 people from five Specialized Care Services. Chi-square test, Odds Ratio (OR), Prevalence Ratio (PR) and their respective Confidence Intervals (CI) of 95%, Wald test of the estimate and p-value <0.05 were performed.

Results: The most prevalent chronic non-communicable diseases were hypertension (17.89%), diabetes mellitus (7.51%) and chronic kidney disease (4.83%). Having a chronic disease was associated with being female (PR=1.18, OR=1.3, p=0.022), age greater than 45 years (PR=2.15, OR=6.36, p=0.001), study time less than or equal to eight years (PR=1.23, OR=1.92, p=0.005), having dyslipidemia (PR=1.16, OR=2.01, p=0.001), detectable viral load (PR=2.32, OR=2.59, p=0.001) and TCD4+ cell count less than 350 cells/mm³ (PR=1.5, OR= 1.6, p=0.019). The pattern was repeated with the Prevalence Ratio.

Conclusion: A high prevalence of chronic non-communicable diseases was identified among people living with HIV and several associated factors, thus considering a multifactorial exposure. In this context, the important role of a multidisciplinary team in comorbidity prevention is emphasized.

Resumo

Objetivo: Identificar a prevalência de doenças crônicas não transmissíveis e fatores associados em pessoas vivendo com HIV (PVHIV).

Métodos: Trata-se de um estudo transversal retrospectivo realizado por meio de uma análise secundária dos dados coletados entre outubro de 2014 a maio de 2018. O banco analisado incluiu amostra de 550 pessoas, provenientes de cinco Serviços de Atendimento Especializado. Foi realizado teste qui-quadrado, *Odds Ratio (OR)*, Razão de Prevalência (RP) e seus respectivos Intervalos de Confiança (IC) de 95%, teste de Wald da estimativa e valor p<0,05.

Resultados: As doenças crônicas não transmissíveis mais prevalentes foram hipertensão arterial (17,89%), diabetes mellitus (7,51%) e Doença Renal Crônica (4,83%). Ter doença crônica foi associado ao sexo feminino (RP=1,18, OR=1,3, p=0,022), idade maior que 45 anos (RP=2,15, OR=6,36, p=0,001), tempo de estudo menor ou igual a oito anos (RP=1,23, OR=1,92, p=0,005), ter dislipidemia (RP=1,16, OR=2,01, p=0,001), carga viral detectável (RP=2,32, OR=2,59, p=0,001) e a contagem de células TCD4+ menor que 350 células/mm³ (RP=1,5, OR= 1,6, p=0,019), o padrão se repetiu com a razão de prevalência.

¹Department of Fundamental and Specialized Nursing, Universidade de São Paulo, Ribeirão Preto, SP, Brazil.

²Universidade Paulista de São José do Rio Preto, São José do Rio Preto, SP, Brazil.

³Universidad Autónoma de Baja California at Mexicali, Baja California, Mexico.

⁴Universidade Federal do Pará, Belém, PA, Brazil.

Conflicts of interest: nothing to declare.

Conclusão: Identificou-se alta prevalência de doenças crônicas não transmissíveis entre pessoas vivendo com HIV e diversos fatores associados, considerando assim uma exposição multifatorial. Neste contexto, ressalta-se o importante papel da equipe multiprofissional na prevenção das comorbidades.

Resumen

Objetivo: Identificar la prevalencia de enfermedades crónicas no transmisibles y factores asociados en personas que viven con el VIH (PVIH).

Métodos: Se trata de un estudio transversal retrospectivo realizado mediante un análisis secundario de los datos recopilados entre octubre de 2014 y mayo de 2018. El banco analizado incluyó la muestra de 550 personas provenientes de cinco Servicios de Atención Especializada. Se realizó la prueba χ^2 de Pearson, *Odds Ratio* (OR), Razón de Prevalencia (RP) y sus respectivos Intervalos de Confianza (IC) del 95 %, prueba de Wald de la estimación y valor $p < 0,05$.

Resultados: Las enfermedades crónicas no transmisibles más prevalentes fueron la hipertensión arterial (17,89 %), diabetes mellitus (7,51 %) y enfermedad renal crónica (4,83 %). Padecer enfermedad crónica estuvo asociado al sexo femenino (RP=1,18, OR=1,3, $p=0,022$), edad superior a 45 años (RP=2,15, OR=6,36, $p=0,001$), tiempo de estudio inferior o igual a ocho años (RP=1,23, OR=1,92, $p=0,005$), padecer dislipidemia (RP=1,16, OR=2,01, $p=0,001$), carga viral detectable (RP=2,32, OR=2,59, $p=0,001$) y el recuento de células TCD4+ inferior a 350 células/mm³ (RP=1,5, OR= 1,6, $p=0,019$), el patrón se repitió con la razón de prevalencia.

Conclusión: Se identificó alta prevalencia de enfermedades crónicas no transmisibles en personas que viven con el VIH y distintos factores asociados, considerando, de esa forma, una exposición multifactorial. En este contexto, se destaca el importante papel del equipo multiprofesional para la prevención de las comorbidades.

Introduction

HIV infection is considered a chronic infectious disease. Chronicity enables greater survival and new perspectives for people living with HIV (PLHIV).⁽¹⁾ It is estimated that more than 70% of PLHIV in the world will be 50 years old or older by 2030.⁽²⁾ This fact culminates in an increase in the prevalence of chronic non-communicable diseases (NCDs), which may be associated with aging itself, time of exposure to HIV, the occurrence of adverse effects of drugs used in antiretroviral therapy (ART) or all these factors together.⁽¹⁾

NCDs are the highest morbidity and mortality burden in the world.⁽³⁾ According to current data from the World Health Organization (WHO), circulatory system diseases, diabetes, cancer and chronic respiratory diseases account for about 72% (41 million) of deaths each year.⁽³⁾ Evidence indicates that the increase in risk factors related to lifestyle, such as tobacco use, consumption of alcoholic beverages, physical inactivity and consumption of unhealthy foods, in addition to traditional and specific risk factors related to HIV infection, they progressively contribute to the emergence and/or worsening of these diseases among PLHIV.^(4,5)

In developing countries, in all socioeconomic strata, there is a high prevalence of multimorbidity and mortality from these diseases.⁽⁶⁾ On the other hand, individuals with greater vulnerability, including PLHIV, have an even more intense representativeness.⁽⁴⁾ PLHIV affected by NCDs are associated

with worse clinical outcomes greater use of health services, greater number of hospitalizations and consequently higher health expenditures.⁽⁷⁾ In addition, different combinations of diseases negatively affect the health of those affected and diverge in the care to be applied.⁽⁸⁾

Repercussions on economic levels in low- and middle-income countries associated with NCDs are worrisome. It is estimated that approximately US\$7 trillion will be spent between 2011 and 2025.⁽⁶⁾ The Global NCD Action Plan, approved by the World Health Assembly, established defined goals, such as reducing risk factors, prevalence and mortality from NCDs by 25% by 2025, improved access to medication, appropriate treatment and laboratory tests.⁽⁶⁾ These goals result in improvements in the care provided and higher quality of life of these people.⁽³⁾

Studies on this topic are necessary both for the scientific basis and planning of actions of a national nature and to strengthen and support action plans for health professionals who deal directly with PLHIV care, either in Basic Health Units (BHU) or in Specialized Care Services (SAE). Therefore, health promotion is essential for their quality of life. There is a tendency to continue to substantially grow the proportion of PLHIV with NCDs in the coming decades.⁽⁵⁾

Therefore, monitoring the prevalence of NCDs and associated factors among PLHIV are important to obtain essential indicators for the definition and implementation of health policies aimed at the prevention and control of these diseases.

Considering the above, this study aimed to identify the prevalence of non-communicable chronic diseases and associated factors in PLHIV.

Methods

This is a retrospective cross-sectional study carried out through a secondary data analysis, collected between October 2014 and May 2018.^{9,10} The union of the data analyzed was carried out between April and May 2021. The study population comprised PLHIV assisted by the SAE in a city in the countryside of São Paulo.

The database analyzed included a sample of 550 PLHIV from five SAEs. The investigated municipality is organized into five health districts and each district has an SAE, three are Reference Centers for Sexually Transmitted Diseases/AIDS and two are specialty outpatient clinics, all linked to the Unified Health System (SUS - *Sistema Único de Saúde*). In the studies, for the sample composition, calculations were adopted considering a prevalence of 50%, $\alpha=5\%$ and a relative error of 10%. The data represent the stratification of PLHIV, with a sample from each health district. In this investigation, 60% of respondents represent the central district, 7.6% the North, 9% the East, 14.2% the West and 9% the South.

In this study, we analyzed PVHIV data that met the eligibility criteria previously adopted by previous studies.^(9,10) We included people aged 18 years or older, both sexes, who had outpatient clinical follow-up in one of the SAEs, who were on regular ART use and who had clinical laboratory test results recorded in their medical records. We excluded pregnant women and individuals in confinement (inmates, institutionalized or residing in a support house). In previous studies, these were not considered as exclusion criteria.^(9,10)

The primary outcome was having a medical diagnosis of one or more chronic non-communicable diseases (arterial hypertension (AH), diabetes mellitus (DM) and chronic kidney disease (CKD)) recorded in the medical record. In the case of patients diagnosed with CKD, diagno-

sis was identified in the medical record and also from the calculation of the Glomerular Filtration Rate (eGFR) $<60\text{mL}/\text{min}/1.73\text{m}^2$, estimated by the Chronic Kidney Disease Epidemiology Collaboration Equation (CKD-EPI) of at least two eGFR measurements with an interval of 3 months, through information on serum creatinine, age, sex and race.⁽¹¹⁾ Two serum creatinine test results were collected at a 3-month interval between each.

The following independent variables were analyzed: sex (male/female); age (<45 years/ ≥ 45 years); education level (<8 years/ ≥ 8 years); skin color (yellow/white/black/brown/not declared); smoking (yes/no); dyslipidemia (yes/no); family history of NCDs (yes/no); ART dwell time (<3 years/ ≥ 3 years); diagnosis time (≤ 3 years, >3 years); viral load (≤ 40 copies/ml - undetectable/ > 40 copies/ml - detectable); TCD4+ lymphocyte count (<350 cells/ mm^3 / ≥ 350 cells/ mm^3). The values considered desirable for the lipidogram are: total cholesterol <190 mg/dl; high-density lipoprotein (HDL)- >40 mg/dL; low-density lipoprotein (LDL) >150 mg/dL; and triglycerides <150 mg/dL, as recommended by the update of the Brazilian Dyslipidemia and Atherosclerosis Prevention Guideline.⁽¹²⁾ Thus, individuals with at least one of these altered values were considered as dyslipidemic.

In the statistical analysis, relative and absolute frequencies were used for descriptive data for categorical variables: sex, age, skin color, education, smoking and dyslipidemia, DM, AH and CKD. For the numerical variables, age, education, ART dwell time, diagnosis time, TCD4+, mean, median, standard deviation, minimum and maximum.

For logistic regression, a chi-square test was performed, with $p<0.05$ being considered significant. The strength of such association was also assessed by determining the unadjusted and adjusted Odds Ratio (OR) and their respective 95% Confidence Intervals (CI). This analysis made it possible to determine the adjusted Odds Ratio, the precision (95% CI) and the significance (Wald test) of the estimate.

The frequencies of PLHIV with at least one NCD were compared with those who did not have NCDs, according to age, sex, skin color, educa-

tion level, smoking, dyslipidemia, family history of NCDs, ART dwell time, HIV diagnosis time, viral load and TCD4+ and number of NCDs (1, 2, 3 or more).

Unadjusted and adjusted prevalence and Prevalence Ratios (PR) and their respective 95% CI were calculated. The significance level considered was $\alpha=0.05$. Data were processed and analyzed using the Statistical Package for Social Science (SPSS), version 25.0.

The study was authorized by the Research Ethics Committee of the *Escola de Enfermagem de Ribeirão Preto, Universidade de São Paulo*, under Opinion 4,667,593 and met all the recommendations of Resolution 466/2012 of the Brazilian National Health Council (CNS).

Results

In this study, a sample of 550 PLHIV was included. Participants were, on average, 44.7 years old ($SD=12.11$), with the minimum and maximum age between 18 and 75 years old. The mean HIV diagnosis time was 10 years ($SD=7.12$), minimum and maximum (0-29.3 years) and ART dwell time was 8.0 years ($SD=6.46$), minimum and maximum (0-27 years). The most prevalent diseases among PLHIV were AH, 17.89% ($n=100$), followed by DM 7.51% ($n=42$) and CKD 4.83% ($n=27$). It was identified that being 45 years of age or older, having a low level of education, not being a smoker and having dyslipidemia are variables that are present in most participants who presented any of these NCDs, in addition to those who had an undetectable viral load and TCD4+ cells ≥ 350 cells/mm³. In the comparison between sex, DM was more frequent among women, and in contrast, AH and CKD among men, as shown in Table 1.

Logistic regression analysis showed that having NCD was associated with being female (PR=1.18, OR=1.3, $p=0.022$), age greater than 45 years (PR=2.15, OR=6.36, $p=0.001$), when studying less than or equal to 8 years (PR=1.23, OR=1.92, $p=0.005$), having dyslipidemia (PR=1.16, OR=2.01, $p=0.001$), detectable viral load (PR=2.32,

OR=2.59, $p=0.001$) and CD4+ T cell count less than 350 cells/mm³ (PR=1.5, OR= 1.6, $p=0.019$). The pattern repeats with PR, when comparing the same indicators between the population with and without NCDs. Such data are shown in Table 2.

Table 3 shows that those participants with less than eight years of education, yellow skin color, dyslipidemia, detectable viral load and TCD4+ count less than 350 cells/mm³ had higher PR (1.28; 2.05; 1.24; 2.05; 1.59) to have an NCD when compared to participants who did not have any NCDs. As for multimorbidity, we found that 10.9% ($n=59$) had a diagnosis of two chronic diseases and 3.3% ($n=18$) had three or more. The PR for having two NCDs was higher among PLHIV who were older than 45 years and were female (1.59; 1.14), respectively.

Discussion

The results of this study indicate a high prevalence of NCDs among PLHIV. Those aged over 45 years, female, less educated, who had dyslipidemia, detectable viral load and TCD4+ lymphocyte count less than 350 cells/mm³ were associated with a higher occurrence of NCDs.

In our findings, PLHIV aged over 45 years were more likely to have two NCDs compared to younger ones. This fact corroborates the literature, in which it is already well established that multimorbidity increases with advancing age, and confirms that such diseases present earlier when compared to those who do not live with the virus.⁽¹³⁾ An observational study carried out in Japan showed that, when comparing PLHIV and those without HIV, the former had a higher burden of comorbidities and co-medication as they were older than the others.⁽¹³⁾ Thus, more efforts are needed to maximize the potential for healthy aging among PLHIV on ART.⁽¹⁴⁾

The progression of HIV in the body directly affects the immune system and is more pronounced in the elderly, as they have fewer functional cytotoxic T cells, which are directly responsible for the inhibition of viral replication and the consequent decrease in CD4+ T lymphocytes. In addition to this reason, the physiological changes resulting from the

Table 1. Distribution of the prevalence of chronic non-communicable diseases among people living with HIV according to sociodemographic, behavioral and clinical variables (n=550)

Variables	Chronic non-communicable diseases (n=550)					
	DM 549(100)		AH 548(100)		CKD 548(100)	
	Yes n(%) 42(7.6)	No n(%) 507(92.4)	Yes n(%) 100(18.2)	No n(%) 448 (81.8)	Yes n(%) 27(4.9)	No n(%) 521(95.1)
Sex						
Male	17 (5.1)	319(94.9)	54(16.1)	281(83.9)	16(4.7)	321(95.3)
Female	25(11.7)	188(88.3)	46(21.6)	167(78.7)	11(5.2)	200(94.8)
Age						
<45 years	04(1.5)	257(98.5)	11(4.2)	248 (95.8)	04(1.5)	257(98.5)
≥45 years	38(13.2)	250(86.8)	89 (30.8)	200(69.2)	23(8.0)	264(92.0)
Education level						
≤8 years	32(8.5)	345(91.5)	73(19.7)	298(80.3)	22(5.9)	349(94.1)
> 8 years	10(5.6)	168(94.4)	27(15.3)	150(84.7)	05(2.8)	172(97.2)
Skin color						
Yellow	1(7.1)	13(92.9)	01(7.1)	13(92.9)	01(7.1)	13(92.9)
White	11(4.5)	233(95.5)	41(16.9)	202(83.1)	12(4.9)	231(95.1)
Brown	15(8.5)	162(91.5)	23(13.0)	154(87.0)	07(3.9)	171(96.1)
Black	7(11.7)	53(88.3)	15(25.0)	45(75.0)	02(3.4)	57(96.6)
Not declared	8(14.8)	46(85.2)	20(37.0)	34(63.0)	05(9.3)	49(90.7)
Smoking						
Yes	06(3.6)	160(96.4)	25(15.2)	140(84.8)	08(4.8)	158(95.2)
No	35(9.2)	344(90.8)	74(19.5)	305(80.5)	18(4.8)	360(95.2)
Dyslipidemia						
Yes	37(8.7)	386(91.3)	84(19.9)	339(80.1)	22(5.2)	400(94.8)
No	5(4.0)	119(96.0)	16(13.0)	107(87.0)	05(4.0)	119(96.0)
Viral load						
Detectable	4(5.6)	68(94.4)	08(11.1)	64(88.9)	05(7.0)	66(93.0)
Undetectable	38(8.0)	437(92.0)	92(19.4)	382(80.6)	22(4.6)	453(95.4)
TCD4+ (cells/mm ³)						
<350	5(6.0)	78(94.0)	10(12.0)	73(88.0)	05(6.0)	78(94.0)
≥350	37(8.0)	424(92.0)	90(19.6)	370(80.4)	22(4.8)	438(95.2)
Total	42(7.5)	507(92.5)	100(17.9)	456(81.8)	27(4.8)	521(94.8)

The difference between the total presented in the table within each NCD and the study sample represents the missing data

senility process contribute to the emergence of multimorbidity.⁽¹⁵⁾

In the present study, when measuring participants' educational level, it was identified, specifically, that the lower levels of education are related to the higher prevalence of NCD, among which cardiovascular diseases (CVD), DM and AH stand out, as well as in the literature.^(16,17) It is already well established that there is a close relationship between social, economic, cultural, ethnic-racial, psychological and behavioral factors that influence the occurrence of health problems and risk factors in the population.⁽¹⁸⁾ It is this relationship that underlies the discussions on determinants of health.^(16,17,18)

In this context, it is noteworthy that the lower level of education, in most cases, may be related to a lower understanding of information related to health.⁽¹⁹⁾ Moreover, it can imply lower income,

more unstable work situations, sedentary lifestyle and unhealthy diet, and consequently, the combination of these factors can lead to an increased risk for the development of NCDs.^(19,20)

In lipid disorder assessment, this study showed that PLHIV with dyslipidemia are more likely to have NCD. Among the various pathophysiological mechanisms related to the lipid profile to be considered, diseases such as DM, AH and CKD usually present biochemical and physiological changes that cause this imbalance.⁽²¹⁾ Corroborating this idea, a study showed that about 50% of PLHIV had some lipid alteration, whether due to hypertriglyceridemia, hypercholesterolemia, increased LDL-c or decreased HDL-c. These changes may be associated with the HIV infection itself and/or continuous ART use, and consequently, may favor the develop-

Table 2. Prevalence, unadjusted and adjusted Prevalence Ratio and analysis of associated factors of chronic non-communicable diseases in people living with HIV according to sociodemographic, behavioral and clinical variables (n=550)

Associated factors	NCD		Unadjusted PR (95% CI)	Adjusted PR (95% CI)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	p-value
	Present 331(100)	Absent 219(100)					
Age							0.001
< 45 years (ref)	122(46.7)	139(53.3)	1.74 (1.5-1.96)	2.15 (1.84-2.38)	3.05 (2.11-4.4)	6.36 (3.54-11.43)	
≥ 45 years	209(72.3)	80(27.7)					
Sex							0.022
Male (ref)	190(56.4)	147(43.6)	1.25 (0.99-1.53)	1.18 (0.84-1.57)	1.43 (0.99-2.07)	1.3 (0.78-2.18)	
Female	141(66.2)	72(33.8)					
Education level							0.005
<8 years	239(64.2)	133(35.8)	1.17 (1.04-1.29)	1.23 (1.05-1.37)	1.61 (1.1-2.33)	1.92 (1.13-3.25)	
> 8 years (ref)	92(51.7)	86(48.3)					
Skin color							0.028
Yellow	11(78.6)	3(21.4)	2.59 (0.72-8.69)	3.12 (0.62-13.61)	2.65 (0.72-9.75)	3.22 (0.62-16.58)	
White (ref)	139(57.0)	105(43.0)	1	1	1	1	
Brown	114(64.0)	64(36.0)	1.22 (0.92-1.55)	1.28 (0.87-1.74)	1.34 (0.89-2.01)	1.44 (0.83-2.5)	
Black	42(70.0)	18(30.0)	1.68 (0.96-2.79)	1.21 (0.58-2.37)	1.79 (0.96-3.32)	1.23 (0.56-2.7)	
Not declared	25(46.3)	29(53.7)	0.54 (0.29-0.97)	0.66 (0.28-1.46)	0.5 (0.26-0.96)	0.63 (0.25-1.57)	
Smoking							0.958
Yes	100(60.2)	66(39.8)	1.04 (0.8-1.33)	0.76 (0.50-1.11)	1.06 (0.73-1.56)	0.69 (0.41-1.17)	
No (ref)	228(60.0)	152(40.0)					
Dyslipidemia							0.001
Yes	268(63.2)	156(36.8)	1.13 (1.03-1.2)	1.16 (1.04-1.25)	1.67 (1.1-2.52)	2.01 (1.16-3.49)	
No (ref)	63(50.8)	61(49.2)					
ART dwell time							0.179
<3 years (ref)	85(55.6)	68(44.4)	1.08 (0.97-1.18)	1.13 (0.89-1.28)	1.33 (0.91-1.96)	1.57 (0.71-3.44)	
≥3 years	243(61.8)	150(38.2)					
HIV diagnosis time							0.373
<3 years (ref)	58(56.3)	45(43.7)	1.04 (0.95-1.11)	0.91 (0.64-1.09)	1.23 (0.79-1.9)	0.67 (0.27-1.64)	
≥3 years	273(61.1)	174(38.9)					
Viral load (copies/ml)							0.001
Undetectable (ref)	275(57.8)	201(42.2)	2.55 (1.51-4.06)	2.32 (1.11-4.38)	2.91 (1.57-5.38)	2.59 (1.12-6.0)	
Detectable	56(77.8)	16(22.2)					
TCD4+ (cells/mm ³)							0.019
<350	60(72.3)	23(27.7)	1.67 (1.06-2.51)	1.5 (0.78-2.69)	1.81 (1.07-3.07)	1.6 (0.76-3.37)	
≥350 (ref)	271(58.7)	191(41.3)					

ref-Reference value

ment of chronic diseases, such as the emergence of atherosclerosis and other CVDs.⁽²²⁾

In the pathophysiology that surrounds the development of AH and DM, there is dysfunction in the endothelium, with increased peripheral vascular resistance, plus inflammatory processes and oxidative stress, which is closely related to dyslipidemias.⁽²³⁾ In CKD, lipid alterations may be associated with decreased hepatic lipase and lipoprotein lipase activity. Finally, these changes are capable of damaging mesangial and endothelial cells, favoring the progression of kidney injury.⁽²⁴⁾

The mean HIV diagnosis time identified was 10 years. According to a study conducted by the International Network for Strategic Initiatives in Global HIV Trials, people who have lived with HIV

for a longer period of time are more likely to develop some comorbidity when compared to those with a shorter period.⁽¹⁵⁾ This exposure of RNA viral load for a long period causes a persistent systemic inflammatory process, which is one of the permanent risk factors for the development of NCDs.⁽²⁵⁾

HIV viral load management through ART compliance allows the immunological restoration of PLHIV, resulting in an improvement in their time and quality of life. However, viral load control goes beyond concern with immunological aspects.⁽²⁶⁾

In our findings, the prevalence of NCD was higher among those who had a detectable viral load. The presence of HIV alone generates constant immune activation and inflammatory response, with increased levels of monocytes, cytokines, Tumor Necrosis Factor

Table 3. Sample distribution with and without chronic non-communicable diseases (number of comorbidities) and their respective Prevalence Ratio according to sociodemographic, behavioral and clinical variables (n=542)

Variables	Sample without NCD n(%) 219(100)	Sample with NCD (number of comorbidities)			Prevalence Ratio			p-value
		1	2	3	1/0	2/0	3/0	
Sex								0.022
Male (ref)	147(44.4)	146(44.1)	32(9.4)	7(2.1)	1.19(0.97-1.48)	1.14(1.0-1.33)	1.09(1.01-1.22)	
Female	72(34.1)	100(47.4)	28(13.3)	11(5.2)				
Age								0.001
<45 years (ref)	139(53.9)	110(42.6)	6(2.3)	3(1.2)	1.50(1.23-1.85)	1.59(1.39-1.89)	1.13(1.05-1.26)	
≥45 years	80(28.2)	136(47.9)	53(18.7)	15(5.3)				
Education level								0.005
≤8 years	133(36.3)	176(48.1)	44(12.0)	13(3.6)	1.28(1.05-1.54)	1.13(1.0-1.27)	1.04(0.96-1.11)	
>8 years (ref)	86(48.9)	70(39.8)	15(8.5)	5(2.9)				
Skin color								0.028
Yellow	3(21.4)	9(64.3)	1(7.1)	1(7.1)	2.05(0.87-3.20)	1.38(0.72-1.61)	1.00(0.99-1.00)	
White (ref)	105(43.6)	106(44.0)	22(9.1)	8(3.3)	Ref	Ref	Ref	
Brown	64(36.4)	91(51.7)	17(9.7)	4(2.2)	1.18(0.95-1.42)	0.99(0.83-1.09)	1.01(0.91-1.04)	
Black	18(30.5)	25(42.4)	13(22.0)	3(5.1)	1.15(0.80-1.50)	1.40(1.15-1.55)	1.10(0.97-1.13)	
Not declared	29(55.8)	15(28.8)	6(11.5)	2(3.8)	0.76(0.53-0.99)	0.97(0.75-1.08)	0.99(0.84-1.02)	
Smoking								0.958
Yes	66(40.2)	78(47.6)	18(11.0)	2(1.2)	1.03(0.84-1.29)	1.0(0.89-1.16)	0.94(0.88-1.02)	
No (ref)	152(40.4)	168(44.7)	40(10.6)	16(4.2)				
Dyslipidemia								0.001
Yes	173(40.0)	198(45.8)	49(11.3)	12(2.8)	1.24(0.99-1.50)	1.17(1.02-1.30)	1.03(0.93-1.10)	
No (ref)	61(50.0)	50(41.0)	8(6.6)	3(2.5)				
Viral load (copies/ml)								0.001
Undetectable (ref)	201(42.9)	197(42.0)	58(12.4)	13(3.3)	2.05(1.37-3.23)	0.82(0.74-1.06)	1.17(1.01-161)	
Detectable	16(22.5)	49(69.0)	1(1.4)	5(7.0)				
TCD4+ (cells/mm ³)								0.019
≥350 (ref)	191(42.0)	195(42.9)	54(11.9)	15(3.3)	1.59(1.14-2.31)	0.94(0.82-1.21)	1.05(0.96-1.32)	
<350	23(28.0)	51(62.2)	5(6.1)	3(3.7)				
Total	219(40.4)	246(45.4)	59(10.9)	18(3.3)				

The difference between the total number of participants n=550 and the one presented in the table n=542 represents the missing data

Alpha (TNF- α) and C-reactive protein (CRP) that contribute to the development of metabolic alterations such as DM and other NCDs, especially those of a cardiovascular nature such as AH and CKD.⁽²⁶⁾

Although ART decreases this inflammatory response, PLHIV, even in long-term viral suppression, maintains these chemokines in high amounts when compared to people who do not live with HIV, showing HIV infection as a risk factor for the development of other diseases.^(26,27)

Considering the above, it is important to incorporate this problem in the care for PLHIV in primary care systems to facilitate the monitoring of comorbidities, in order to cover the new needs, resulting in an improvement in the quality of life of this population.

Another relevant result refers to the presence of multimorbidity. The coexistence of two or more chronic conditions was identified in 14.2%

(n=77) of PLHIV. Such a finding is of concern, as the clinical management of individuals with multiple comorbidities is generally more challenging. Clustered comorbidities may indicate shared causes or common risk factors, and identifying the most common patterns of comorbidities is a priority for the population living with HIV in order to improve targeted health care delivery.⁽²⁸⁾

The prevalence of AH (17.8%) and DM (7.51%) in our findings is similar to that observed in other studies conducted in Brazil.^(6,29) Nevertheless, the prevalence of 4.83% of people with CKD in our sample reinforces the requirement of periodic monitoring of renal function in these individuals. The prevalence of CKD is known to be higher among PLHIV than in the general population, and HIV-positive individuals develop CKD more often and with a faster rate of progression compared to HIV-negative people.⁽³⁰⁾

This study makes an important contribution to understanding the various chronic diseases that affect PLHIV's health. The results contribute to comprehensive care for this population, as it expands the look at chronic care, leaving the emphasis solely on using ART and viral suppression that currently configures the predominant mode of production of care for PLHIV.

Our findings point to the need for a comprehensive and complete patient assessment by the multidisciplinary team so that modifiable and non-modifiable risk factors are previously identified. This assessment includes monitoring cardiovascular and renal health through laboratory tests, measurement of risk factors, counseling on the management of modifiable risk factors, in addition to an individualized care plan with relevant strategies focused on the quality of life of these people, in order to improve the care provided.

Thus, it is important to act jointly between government bodies and hierarchical levels of the health system on the main risk factors that affect this population in an efficient, economic and sustainable way, in order to rethink public policies and action plans at primary, secondary and tertiary health levels involved in the care for this population.⁽³¹⁾

For prevention and control of these diseases, the assistance provided to PLHIV should include ART use and regular check-ups by health professionals as an opportunity for early diagnosis of comorbidities, as well as the implementation of educational strategies that favor changes in lifestyle habits that are important to reduce the risk of NCDs.

The findings of this study must be interpreted in light of the limitations resulting from a cross-sectional study, in which the relationship between cause and effect of the variables could not be detected. In addition to this, it is noteworthy that there was no specific analysis on which types of antiretroviral drugs were most associated with NCDs.

Despite this limitation, the sample size is sufficient for a robust analysis and data were collected from more than one care clinic to ensure that the type of service would not incur bias. However, the lack of some data from medical records constitutes a limitation of this study. As this is a survey with

secondary data, it was not possible to recover this lost information. On the other hand, it is worth reflecting on the failure of certain information in medical records that can configure lack of attention to other pathologies and risk factors, in addition to just focusing on ART use and viral suppression as the focus of the goal of coming to the health service. In this way, many records are weakened on the variables related to NCDs. This limitation even reinforces the importance of this study, which shows that NCDs should be included in periodic care for PLHIV.

Conclusion

In the present study, a high prevalence of NCD was identified among PLHIV. Individuals over 45 years of age, female, less educated, dyslipidemia, detectable viral load and TCD4+ lymphocyte count less than 350 cells/mm³ were associated with the prevalence of chronic diseases in this population. In this context, the important role of a multidisciplinary team in the context of comorbidity prevention in PLHIV stands out, especially nurses, which can use interventions aimed at promoting the health of this population, which include educational strategies that favor changes in lifestyle, focusing on the adoption of healthy habits. Knowledge about the prevalence of NCDs, including multimorbidity among PLHIV, can help to provide relevant data to implement health promotion, prevention, early diagnosis and treatment strategies aimed at PLHIV, providing individualized plans for comprehensive patient care. In addition to conducting future research on different strategies to be adopted by health teams as a way of preventing and early coping with NCDs in PLHIV.

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Collaborations

Pontes-Pereira PS, Antonini M, Fedocci EMM, Costa CRB, Esquivel-Rubio AI, Botelho EP, Gir E and Reis RK collaborated with the study design, data analysis and interpretation, article writing, relevant critical review of the intellectual content and approval of the final version to be published.

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