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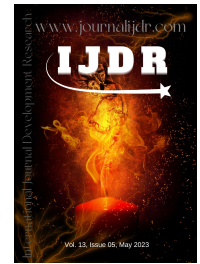
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PREVALENCE AND FACTORS ASSOCIATED WITH THE NEUROCOGNITIVE SYMPTOMS IN ADULTS AND ELDERS LIVING WITH HIV/AIDS IN AN ANTIVIRAL TREATMENT

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ABSTRACT

Introdução: Studies show that about 50% of people living with the Human Immunodeficiency Virus/ Acquired Immunodeficiency Syndrome (HIV/AIDS) will develop some HIV Associates Neurocognitive Disorder (HAND). **Objectives:** To describe the prevalence and factors associated with neurocognitive symptoms in adults living with HIV/AIDS undergoing antiretroviral treatment. **Method:** The cross-sectional study was carried out with adults (18 to 79 years old) living with HIV/AIDS on antiretroviral treatment in the municipality of Ponta Grossa- PR. The collection of primary data was carried out, between March and August 2021, with the instruments: International HIV Dementia Scale, Instrumental Scale for Activities of Daily Living (IADL), Depression, anxiety and stress scale (DASS- 21) and sociodemographic and behavioral data. Additionally, the extraction of secondary data (clinical and laboratory). Absolute(n) and relative (%) frequency measures and associations between HAND and sociodemographic, behavioral, clinical and laboratory variables were used using the chi-square test ($p < 0.05$). **Results:** A total of 118 users, aged 19 to 74, were included. The prevalence of probable HAND was 88.1%. About IADL, 78.0% proved to be independent for activities of daily living and none with total dependence. The evaluated participants had severe or very severe symptoms of anxiety (52.9%), and moderate and severe symptoms of depression (30.7%). The main factors likely associated with HAND were: lower education ($p = 0.013$), use of illicit drugs ($p = 0.03$), low CD4 nadir ($< 350 \text{ cell/mm}^3$) ($p = 0.047$), and low HDL ($< 40 \text{ mg/dl}$) ($p = 0.045$). **Conclusion:** There was a high prevalence of probable HAND associated with sociodemographic, behavioral, clinical and laboratory factors.

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INTRODUCTION

Since the first description of infection by Human Immunodeficiency Virus (HIV) in the decade 80, were registered more than 80million new cases, being 1,5million new infections only in 2020. (1). The advent of antiretroviral therapy (TARV) provided a significant increase in life expectancy of people living with HIV (PVHIV) (2,3) as well as the interference in the reduction in the prevalence of opportunistic diseases, including neurologic disorders (4). However, the process of the chronicity of the infection has resulted in new challenges, as high rates of comorbidities, amongst them, the neurological dysfunction (3), at different levels of involvement, known as HIV-Related Neurocognitive Disorders related to HIV (HAND) (5). The HAND commits about 35-50 % of almost 40 million people infected by HIV all around the world (6). It was defined in 2007 as three stages of cognitive impairment: asymptomatic neurocognitive impairment – ANI, mild or moderate cognitive impairment (*Mild Neurocognitive Disorder* – MND) and dementia associated with HIV (*HIV-Associated Dementia* - HAD) (2), based on neuropsychological assessment and the impact of the disease on activities of daily life (4). The neuroprotective effect resulting from Combination Antiretroviral Therapy (CART) is limited, despite its

systemic viral suppression (6,7). However, there was a reduction in HAND cases after the introduction of TARV, with a predominance of the ANI form, which currently corresponds to about half of the cases of HAND (8). The pathophysiology of HAND is complex and multifactorial, involving vascular neuroinflammatory processes, metabolic dysfunction and alteration of neural circuits. There is also a contribution of the comorbidities and co-infections in the development and progression of cognitive dysfunction, like sociodemographic factors (5). The HAND shows a broad clinical spectrum, with a mixed pattern of cortical and subcortical characteristics with more significant deficits in executive functioning and memory (9). The early stages commonly manifested as subacute impairment of working memory and attention, psychomotoricity, and mood disorders such as depression, apathy and anxiety. As the disease progresses, signs of dementia neuropathy, myelopathy, Parkinsonism, ataxia and seizures may be present (8). There is no consensus on how the diagnosis should be made, although a broad neuropsychological assessment is recommended, covering at least five neurocognitive domains, including language, working memory, executive functioning, learning, processing speed and motor skills. Alternatively, considering the limitations of access to specialized care in different locations worldwide, a presumptive clinical diagnosis can be based on symptomatology, physical examination and screening

tools(8). The *International HIV Dementia Scale* (IHDS) is a widely evaluated instrument and a viable option for assessing neurocognitive changes in patients living with HIV as a screening method (10). Several factors have been associated with the development of HAND, such as those related to HIV infection (low nadir values of LT-CD4+ and current count being <350 cells/mm³ and high viral load) and comorbidities (hepatitis C virus co-infection, diabetes or insulin resistance, dyslipidemia) (11), in addition to the duration of infection, alcohol abuse, TARV-related toxicity, low cognitive reserve or education level and depressive symptoms (12). This study aimed to describe the prevalence and factors associated with neurocognitive symptoms in adults and elderly people with HIV/AIDS undergoing antiretroviral treatment.

METHODS

Cross-sectional study with primary and secondary data obtained through a convenience sample of users of the Specialized Care Service (SAE)/Testing and Counseling Center (CTA) from the city of Ponta Grossa, PR, Brazil, being carried out with adults and elderly people (18-74 years old) living with the Human Immunodeficiency Virus and Acquired Immunodeficiency Syndrome(HIV/AIDS), in outpatient care from March to August 2021, who agreed to participate in the research and met the eligibility criteria. Included PVHIV of both genders, aged 18, in outpatient care and a minimum follow-up of six months at the SAE/CTA in Ponta Grossa, in treatment, with antiretroviral drugs, who signed the Informed Consent Form. Participants aged over 80 or who were already being followed up by a neurologist due to opportunistic neurologic disease evidenced in the medical records or referred by the patient or those with the physical limitation that made it impossible to carry out the evaluation were excluded. The primary data were obtained during the waiting period for assistance at the SAE/CTA, between March and August 2021, through the application of the instruments: *International HIV Dementia Scale* (IHDS) and *Instrumental Scale for Activities of Daily Living* (AIVD), both instruments are validated in Brazil, contained and indicated in the Clinical Protocol and Therapeutic Guidelines (PCDT) for the management of HIV infection in adults made available by the Ministry of Health (4). To assess the prevalence and severity of symptoms of anxiety and depression in the studied population, the adapted and validated version for Brazilian Portuguese of the instrument used was the *Depression, anxiety and stress scale* (DASS) (13). During the collection, the users also answered about other data, the extraction of secondary data (sociodemographic, clinical and laboratory) from the medical records and the Notifiable Diseases Information System form (SINAN). It is noted that the current results of laboratory tests were considered to be laboratory data, collected six months previously or those requested in the appointment in which the evaluation took place. The current TARV variable was extracted from the drug dispensing list of the Medication Logistic Control System (SICLOM). Descriptive analysis was performed using absolute (n) and relative (%) frequencies and the use of association tests between the cognitive decline outcome through the result in the IHDS and sociodemographic, behavioral, clinical and laboratory independent variables, using the chi-square test ($p < 0,05$).

RESULTS

Among the 118 living with HIV in TARV evaluated, the prevalence of HAND probable (ANI, MND, HAD) was 88,1%. No patients showed total dependency for activities of daily life according to AIVD, but 22,0% with partial dependence and 78,0% showed independents. The sociodemographic characteristics of PVHIV are summarized in Table 1. Checks out the average age of 43,0 year (DP=12,1), ranging from 19 to 74 years. Among the participants, 59 (50,0%) are illiterate or completed only elementary school, 40 (33,9%) attend at least one year of high school. It turns out that the majority of PVHI reported not using cigarettes, alcohol or illicit drugs, whereas for the latter only 9 (7,6%) claiming to have used them at least once.

Table 1. Distribution of sociodemographic and behavioral characteristics of people living with HIV/AIDS on antiretroviral therapy assisted at the Specialized Assistance Service/ Testing and Counseling Center (n=118), Ponta Grossa-PR, 2021

Variable	n	%
Gender		
Female	58	49,2
Male	60	50,8
Age		
≤50	80	67,8
>50	38	32,2
Schooling		
Illiterate, incomplete or complete primary education	59	50,0
Incomplete or complete high school	40	33,9
Incomplete or complete higher education	19	16,1
Smoking		
Yes	47	39,8
No	71	60,2
Alcohol		
Yes	28	23,7
No	90	76,3
IllicitDrugs		
Yes	9	7,6
No	109	92,4

Source: The Authors, 2021.

Table 2. Distribution of clinical and laboratory characteristics of people living with HIV/AIDS on antiretroviral therapy treated at the Specialized Assistance Service/ Testing and Counseling Center, Ponta Grossa-PR, 2021

Variable	n	%
Time since diagnosis (full years) (n=103)		
0-5	47	45,6
6 a 15	33	32,0
>15	19	18,4
Current viral load (log ₁₀ copies/ml) (n=85)		
<minimumthresholdorundetected	68	80,0
Other	17	20,0
Highest viral load (log ₁₀ copies/ml) (n=97)		
<minimumthresholdorundetected	21	21,6
Other	76	78,4
CD4 Current cell/mm ³ (n=38)		
<350	12	31,6
≥350	26	68,4
Nadir if CD4 cell/mm ³ (n=98)		
<350	33	33,7
≥350	65	66,3
Hepatitis C co-infection (n=47)		
Yes	1	2,1
No	46	97,9
Syphilisco-infection (n=57)		
Yes	9	15,8
No	48	84,2
Body Mass Index (BMI) (n=58)		
Lowweight	3	5,3
Normal Weight	27	46,6
Overweightorobesity	28	48,3
BloodPressure (em mmHg) (n=100)		
Normal/great	69	69,0
Pre-hypertension/hypertension	31	31,0
Fastingbloodglucose(mg/dl) (n=65)		
Normoglycemia	36	55,4
Pre- diabetes	24	36,9
Established diabetes	5	7,7
Total cholesterol (mg/dl) (n=59)		
<190	33	55,9
≥190	26	44,1
Triglycerides(mg/dl) (n= 59)		
<150	32	54,2
≥150	27	45,8
High-Density Liproteins (HDL)(mg/dl) (n=59)		
>40	34	57,6
≤40	25	42,4

Source: The Authors, 2021.

It is observed that 45,6% of the participants had up to 5 years and 18,4% more than 15 years of diagnosis. Regarding laboratory data, 80,0% had a current viral load below the minimum limit or undetectable, while 31,6% and 33,7% presented current values of CD4 and nadir below 350 cell/mm³ respectively. The prevalence of hepatitis C and syphilis co-infections was 2.1% and 15.8%, respectively (Table 2). Table 2 also shows the metabolic parameters of PVHIV. It should be noted that 44,6% had blood glucose levels above 100 mg/dl, 44,1% had total cholesterol above 190 mg/dl and altered triglyceride levels in 45,8% of individuals. The results of the frequency of anxiety and depression can be seen in Table 3. It was found that 54 (52,9%) of PVHIV had severe or very severe symptoms of anxiety, and 31 (30,7%) had moderate or severe symptoms of depression. Although all participants reported using TARV, were considered for this study only those in which it was possible to obtain information from the Medication Logistic Control System (SICLOM), totalizing 105 PVHIV. Of these, 87,6% had at least one antiretroviral with cerebrospinal fluid penetration in their therapeutic scheme, while only 2,9% contained at least one antiretroviral drug with known clinical efficacy in short-term cognitive function (three to six months) or reduction in cerebrospinal fluid CV-HIV. However, the association between the therapeutic scheme and neurocognitive performance was not statistically significant ($p=0.583$ and $p=0.509$, respectively). Table 4 describes the main findings related to cognitive decline. It is verified that the probable presence of HAND was associated with lower education ($p=0,013$), illicit drug use ($p=0,038$), low nadir of CD4 (< 350 cell/mm²) ($p=0,047$), low HDL (<40 mg/dl) ($p=0,045$) and longer time of knowledge of diagnosis ($p>0,05$).

Table 3. Prevalence of anxiety, depression and impact of the disease on activities of daily living in people living with HIV/AIDS on antiretroviral therapy treated at the Specialized Assistance Service/ Testing and Counseling Center, Ponta Grossa, PR, 2021

Variable	n	%
Probable neurological disorder* (n=118)		
Yes	104	88,1
No	14	11,9
Activities of daily living ** (n=118)		
Total dependency	0	0,0
Partial dependency	26	22,0
Independent	92	78,0
Depression*** (n=101)		
Normal	70	69,3
Mild or moderate	27	26,7
Serious or very serious	4	4,0
Anxiety*** (n=102)		
Normal	32	31,4
Mild or moderate	16	15,7
Serious or very serious	54	52,9

*IHDS

**AIVD

*** DASS-21

Source: The Authors, 2021.

DISCUSSION

The prevalence of HAND in the present study, of 88.1%, was considerably higher than the world average of approximately 50%(9). There are many difficulties when analyzing the prevalence of HAND, starting with the different methodologies in the form of collection used in studies to determine cognitive decline. Until now, there is no consensus regarding the best diagnostic approach for HAND (6). Even in studies that use the same collection instrument, there is variability regarding the cutoff point. In comparison, a study conducted in Ethiopia in 2015 (14) that adopted the value $\leq 9,5$, on the same scale, the risk of HAND was estimated at 36.4%. In Brazil, some works have already evaluated the prevalence of HAND through the IHDS, with the majority adopting a value of ≤ 10 as a cut-off point, obtaining the following results: 38,0%(15), 71,2% (16), 54,0% (17) 53,2%(18) and 54,0%(19). Marins-Webb *et al.* (20) a study carried out in Berlin with 480 PVHIV, describes that 50,0% of the participants obtained ≤ 11 points, a score below that found in this study.

Therefore, the high prevalence found in the present study may derive from the high cut-off point of ≤ 11 adopted to determine probable HAND. However, it is justified that studies have evaluated the sensitivity and specificity of the instrument IHDS, according to different cutoff points. Although when the value of 11 points was adopted, both sensitivity and specificity results were 80.0%, however, when considering the value of 10, sensitivity dropped to almost half (48.0%), at the expense of an increase in specificity to 98.0%(20). In a systematic review with a 2021 meta-analysis, the accuracy of 13 studies that also used the IHDS was evaluated, and the cutoff points ranged from 6 to 12, with 10 being the most adopted value. The authors concluded that the best accuracy value is 9.72 (21). Despite these results, the present study followed the cut-off line of ≤ 11 by the recommendations of the Clinical Protocol of the Ministry of Health of our country (4). Elbirt *et al.* (2015) (22) point to the need for further studies to determine appropriate cutoff values for different populations, in addition to the impact of depression on the results of the IHDS. It should be noted that cognitive impairment is clinically significant when it causes limitations in daily activities (23). In this research, 22% of PVHIV, pointed to the need complete a neuropsychological evaluation, with an assessment of at least five neurological domains (22).

A low nadir of CD4 was associated with poor cognitive performance in the present study. The count depletion of CD4 is a factor for cognitive decline and is described in the literature (6). It should be a parameter that the clinician should pay attention to in the care of PVHIV, the same in ART. Studies show that PVHIV has a high prevalence of cardiovascular risk factors (such as diabetes mellitus, systemic arterial hypertension, obesity, dyslipidemia, atherosclerosis and coronary artery disease)(24). The mechanisms by which such comorbidities act in the development of HAND are still uncertain, and it is difficult to determine whether cognitive dysfunction is related only to HIV infection or is influenced by such comorbidities in its pathogenesis (6). Therefore, it is not clear if these factors actually contribute to the development of HAND or if they just have a higher prevalence in this group. It is worth mentioning that the only cardiometabolic factor that showed a significant association with HAND in the present research was a low value of HDL. Previous studies have already demonstrated an association between higher levels of HDL-C with a lower risk for dementia, even in the general population (25). In the present study, a significant association between better cognitive performance and the use of therapeutic schemes with good liquor penetration was not indicated. There are currently no well-established guidelines for the treatment of HAND (11). The ARVs differ in their ability to cross the blood-brain barrier to reach liquor therapeutic levels. Drugs with better penetration into the central nervous system seem to have more effect on controlling viral replication, however, the clinical implications on cognition are still unknown (26).

However, the PCDT from the Brazilian Ministry of Health (4) suggests that potentially neuroactive drugs should be included for patients with symptomatic forms of HAND. In addition to drug therapy, management of concomitant comorbidities is recommended, such as mood disorders and factors related to lifestyle that contribute to cognitive decline (27). It is noteworthy that, despite the high prevalence of neurological disorders found in the studies, most guidelines for HIV treatment in the world do not make recommendations about screening for cognitive impairment (28). Therefore, services should be increasingly reinforced to be attentive to the diagnosis and monitoring of HAND. In Brazil, according to the PCDT, it is recommended to screen for cognitive changes at the time of diagnosis of HIV infection, before the onset of TARV and then annually. If it is impossible to carry out a comprehensive neuropsychological together with an assessment of the impact on activities of daily living (4), a simple and easy-to-apply instrument was used in the present study. The following limitations in the study should be considered, such as, for example, the sample size, which may not have been sufficient, as it did not work with sample calculation, and the difficulty in recruiting for a survey carried out during the COVID-19 pandemic. Additionally, the study included

secondary data; therefore, the absence of some information considerably reduced the number of responses for many variables studied. Furthermore, the application of the DASS-21 scale occurred during the COVID-19 pandemic, which may have influenced a higher prevalence of anxiety and depression symptoms. In addition, prescribing and dispensing TARV does not guarantee correct adherence to treatment. Finally, the possible influence of adverse effects of other medications on cognitive performance is presented in the evaluation. However, it is emphasized that the study provides additional information for the studied phenomenon, mainly data from a reference municipality in the interior of Paraná, which may reflect the reality of other municipalities. Successful cognitive aging in PLHIV translates into several benefits for this population, such as a smaller decline in activities of daily living, medication adherence and appointments, and mental health and quality of life as a whole. (2)

REFERENCES

- Almeida Rodrigues R, Lisboa Oliveira R, Grinsztejn B, Silva MTT. Validade da Escala Internacional de Demência pelo HIV no Brasil. *Arquivos de Neuro-Psiquiatria*. 2013;71(6):376–9.
- Almeida SM de. Cognitive impairment and major depressive disorder in HIV infection and cerebrospinal fluid biomarkers TT - Alteração cognitiva e desordem depressiva maior na infecção do HIV e biomarcadores no líquido cefalorraquidiano. *Arquivos de Neuro-Psiquiatria* [Internet]. 2013; 71(9B):689–92. Available from: http://www.scielo.br/scielo.php?script=sci_arttext & pid=S0004-282X2013001000689&lang=pt
- Baldez RAR. Estudo da prevalência das alterações cognitivas ligadas ao HIV em pacientes portadores da infecção pelo HIV/AIDS TT - A prevalence study of HIV associated neurocognitive disorders in HIV / AIDS patients [Internet]. 2011. p. xiii,68-xiii,68. Available from: http://157.86.8.8/reports/mestrado_bibcb/roiza_baldez_ipec_mest_2011.pdf
- Brasil M da Saúde S de V em Saúde. Protocolo Clínico e Diretrizes Terapêuticas para Manejo da Infecção pelo HIV em Adultos / Ministério da Saúde, Secretaria de Vigilância em Saúde, Departamento de Vigilância, Prevenção e Controle das Infecções Sexualmente Transmissíveis, do HIV/Aids e das. Ministério Da Saúde. Secretaria De Vigilância Em Saúde. Departamento De Vigilância Prevenção E Controle Das Infecções Sexualmente Transmissíveis Do Hiv/Aids E Das Hepatites Virais. 2018. 410 p.
- Christo PP. Alterações cognitivas na infecção pelo HIV e Aids. *Revista da Associação Médica Brasileira*. 2010;56(2):242–7.
- de Souza EM, Buoniconti CS, Valim FC, Moura AS. Risk factors for neurocognitive impairment in HIV-infected patients and comparison of different screening tools. *Dement Neuropsychol*. 2016;10(1):42–6.
- Elbirt D, Mahlab-Guri K, Bezalel-Rosenberg S, Gill Bhsc H, Attali M, Asher I. Hiv-associated neurocognitive disorders (Hand). Vol. 17. 2015.
- Gaskill PJ, Fields JA, Langford DT, Stauch KL, Williams DW. Editorial: Advances in Understanding NeuroHIV Associated Changes in Neuroimmune Communication in the Combined Antiretroviral Therapy (cART) Era. Vol. 12, *Frontiers in Neurology*. Frontiers Media S.A.; 2021.
- Kimani RW. Assessment and Diagnosis of HIV-Associated Dementia [Internet]. Available from: www.npjjournal.org
- Kimani RW. Assessment and Diagnosis of HIV-Associated Dementia. *Journal for Nurse Practitioners*. 2018 Mar 1;14(3):190–5.
- Marin-Webb V, Jessen H, Kopp U, AB J, Hahn K. Validation of the International HIV Dementia Scale as a Screening Tool for HIV-Associated Neurocognitive Disorders in a German-Speaking HIV Outpatient Clinic. *PLoS One* [Internet]. 2016;11(12):e0168225. Available from: <https://pubmed.ncbi.nlm.nih.gov/27992497/>
- Meucci O. Introduction to the special issue “NeuroHIV in the current era: mechanisms and comorbidities contributing to cognitive impairment”. Vol. 1730, *Brain research*. Netherlands; 2020. p. 146620.
- Muller EV, Gimeno SGA. Risk factors for cardiovascular disease in HIV/AIDS patients treated with highly active antiretroviral therapy (Haart) in the central-southern region of the state of Paraná – Brazil. *Ciencia e Saude Coletiva*. 2019 May 1;24(5):1903–14.
- Pinheiro CAT, Souza LDM, Motta JVS, Kelbert EF, Souza MS, Martins CSR, et al. Depression and diagnosis of neurocognitive impairment in HIV-positive patients. *Brazilian Journal of Medical and Biological Research*. 2016;49(10).
- Rosca EC, Tadger P, Cornea A, Tudor R, Oancea C, Simu M. International hiv dementia scale for hiv-associated neurocognitive disorders: A systematic review and meta-analysis. Vol. 11, *Diagnostics*. MDPI; 2021.
- Rosenthal J, Tyor W. Aging, comorbidities, and the importance of finding biomarkers for HIV-associated neurocognitive disorders. *Journal of NeuroVirology*. 2019 Oct 1; 25(5):673–85.
- Rumbaugh JA, Tyor W. HIV-associated neurocognitive disorders: Five new things. *Neurol Clin Pract*. 2015 Jun;5(3):224–31.
- Sacktor N. Changing clinical phenotypes of HIV-associated neurocognitive disorders. Vol. 24, *Journal of Neuro Virology*. Springer; 2018. p. 141–5.
- Saloner R, Cysique LA. HIV-Associated neurocognitive disorders: A global perspective. Vol. 23, *Journal of the International Neuropsychological Society*. Cambridge University Press; 2017. p. 860–9.
- Smail RC, Brew BJ. HIV-associated neurocognitive disorder. In: *Handbook of Clinical Neurology*. Elsevier B.V.; 2018. p. 75–97.
- Svensson T, Sawada N, Mimura M, Nozaki S, Shikimoto R, Tsugane S. The association between midlife serum high-density lipoprotein and mild cognitive impairment and dementia after 19 years of follow-up. *Translational Psychiatry*. 2019 Jan 1;9(1).
- Tozzi V. Cognitive function in treated HIV patients. *Neurobehavioral HIV Medicine*. 2010 Nov;95.
- Troncoso, Flávio Trentin CL de O. {Prevalence of neurocognitive disorders and depression in a Brazilian HIV population}. {Revista da Sociedade Brasileira de Medicina Tropical} [Internet]. 2015;48:390–8. Available from: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0037-86822015000400390&lang=pt
- Tsegaw M, Andargie G, Alem G, Tareke M. Screening HIV-associated neurocognitive disorders (HAND) among HIV positive patients attending antiretroviral therapy in South Wollo, Ethiopia. *J Psychiatr Res*. 2017 Feb;85:37–41.
- Underwood J, Winston A. Guidelines for Evaluation and Management of Cognitive Disorders in HIV-Positive Individuals. Vol. 13, *Current HIV/AIDS Reports*. Current Medicine Group LLC 1; 2016. p. 235–40.
- Vignola RCB, Tucci AM. Adaptation and validation of the depression, anxiety and stress scale (DASS) to Brazilian Portuguese. *Journal of Affective Disorders*. 2014 Feb;155(1):104–9.
- Wing EJ. HIV and aging. Vol. 53, *International Journal of Infectious Diseases*. Elsevier B.V.; 2016. p. 61–8.
- Winston A, Spudich S. Review Cognitive disorders in people living with HIV [Internet]. Vol. 7. 2020. Available from: www.thelancet.com/hiv
