Sociodemographic, behavioral, and geriatric characteristics in older adults with and without HIV

A case-control study

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Abstract

Older adults with human immunodeficiency virus (HIV) have higher risks for early manifestations of age-related disabilities. The objective of this study was to compare HIV-positive and HIV-negative adults aged ≥50 years in relation to sociodemographic, behavioral, and geriatric characteristics. A case-control study was conducted with a >90% estimated statistical power. A total of 52 individuals living with HIV were matched by age, sex, and neighborhood of residence with 104 community controls. Age-related disabilities were assessed throughout a comprehensive geriatric assessment. Review of medical records and interviews were used to obtain behavioral and clinical covariates. No statistical differences on clinically significant age-related disabilities were found. However, multivariate regression analyses, controlling for education and income, revealed that behavioral (use of condom [odds ratio (OR): 7.03; 95% confidence intervals (CI): 2.50–21.65] and number of medical visits [OR: 1.25; 95% CI: 1.09–1.43]), along with faster gait speed (OR: 17.68; 95% CI: 2.55–122.85) and lower body and muscle mass indexes were independently associated with HIV infection (OR: .88; 95% CI: .79–.98 and OR: .72; 95% CI: .54–.97, respectively). In summary, results on age-related disabilities between groups could mean that public policies on HIV might be contributing to patients’ positive outcomes regardless of the effects of aging, albeit gait speed, body and muscle mass indexes were independently associated with HIV. Screenings for age-related disabilities in specialized HIV services are recommended.

Abbreviations: ADL = Barthel Index for Activities of Daily Living, ART = antiretroviral treatment, BMI = body mass index, CGA = comprehensive geriatric assessment, CNID = chronic non-infectious diseases, GS = geriatric syndromes, HIV = human immunodeficiency virus, IADL = Lawton Scale for Instrumental Activities of Daily Living, MNA = Mini Nutritional Assessment, PLWHIV = people living with HIV, PNLWHIV = people not living with HIV, TCC = testing and counseling center.

Keywords: aging, developing nations, geriatric assessment, HIV

1. Introduction

Pharmacological and non-pharmacological developments have increased life expectancy in the elderly population and among individuals infected with the human immunodeficiency virus (HIV). However, considering the prevalence of chronic non-infectious diseases (CNID) and age-related disabilities, quality of life is not always present in these extra years lived. One might assume that age-related disabilities are exclusive – and should only be screened – to those over 60/65 years old. Nonetheless, clinical, social, and behavioral factors associated with HIV might accelerate biological aging, leading to conditions that compromise optimal health.[1–3]

Healthcare workers might be neglecting early predictors of negative outcomes in HIV-infected patients or missing essential variables that could augment the chances of infection. For example, alcohol abuse and risky sexual behavior predicted HIV infection among adults aged ≥50 years.[4] Similarly, a case-control study indicated that being male, having a low income, and reporting the previous diagnosis of sexually transmitted diseases were independently associated with HIV infection among those aged 50 years old or more.[5]
It makes sense that people living with HIV (PLWHIV) without antiretroviral treatment (ART) might be predisposed to early occurrence of age-related disabilities, multimorbidity, and geriatric syndromes (GS), conditions that affect individuals’ autonomy and independence. It is also sensible to infer that some more pronounced age-related disabilities, including dementia, might increase the odds of someone acquiring a sexually transmitted disease. However, even among PLWHIV in ART, cross-sectional evidence showed a high prevalence of age-related disabilities and GS, with falls and mobility issues affecting nearly one-third of the studied sample. In addition, frailty seems to occur prematurely in PLWHIV while polypharmacy appears higher among older adults living with HIV in comparison to community counterparts.

Research on age-related disabilities in PLWHIV has focused on biological (lower CD4+ values and multimorbidity) and socio-demographic (income and education) factors. However, it is essential to distinguish covariates that might be underpinning age-related disabilities in the context of HIV. Reasons for this include, but are not limited to, higher risk of drug interactions for PLWHIV in ART; premature cognitive impairment, malnutrition, emotional disorders, and combinations of multiple diseases. Thus, beyond the standard clinical care, there is the support that older adults living with HIV should receive geriatric supervision.

Notwithstanding that Brazil was a pioneer among developing countries in offering free HIV treatment to its population, the lack of research has led to scarce information in terms of specific needs for young and older HIV patients. Although diagnosing age-related disabilities is useful in facilitating healthcare planning and resource management, the latest national HIV protocol does not differentiate strategies for assisting young and older Brazilian and resource management, the latest national HIV protocol does not differentiate strategies for assisting young and older Brazilian and age-related disabilities is useful in facilitating healthcare planning.

The independent variables were age-related disabilities. Measurements were obtained by the CGA, which comprises: polypharmacy, functionality (measured using the Barthel Index for Activities of Daily Living [ADL] and the Lawton Scale for Instrumental Activities of Daily Living [IADL]); nutritional status (assessed via Mini Nutritional Assessment [MNA] and body mass index [BMI]); occurrence of falls in the past 12 months; affect and cognition (Mini-mental State Examination and the Geriatric Depression Scale); gait speed, frailty syndrome, and physical activity; sarcopenia; medications in use; and adherence to treatment. Details on these assessments are provided next.

2. Materials and methods

2.1. Participants, procedures, and design

This is a case-control study that involved a total of 156 older PLWHIV (n=52) and 104 PNLWHIV. For each PLWHIV, 2 controls were recruited. Positive HIV status, age (≥50), and being a registered patient in continuous treatment at a specialized HIV testing and counseling center (TCC) were the inclusion criteria for PLWHIV. Out of the 60 PLWHIV registered at the TCC, 52 accepted the invitation. Community controls were enlisted from primary health units according to the matching criteria, which were sex, age, and neighborhood of residence. Out of 200 community controls invited, 104 accepted and had negative HIV status confirmed by 2 consecutive blood rapid tests. The study was conducted in 2019 in the city of Francisco Beltrão, PR, Brazil.

2.2. Variables

2.2.1. Outcome. The outcome variable was HIV status (n=52 PLWHIV and 104 PNLWHIV).

2.2.2. Independent variables. The independent variables were age-related disabilities. Measurements were obtained by the CGA, which comprises: polypharmacy, functionality (measured using the Barthel Index for Activities of Daily Living [ADL] and the Lawton Scale for Instrumental Activities of Daily Living [IADL]); nutritional status (assessed via Mini Nutritional Assessment [MNA] and body mass index [BMI]); occurrence of falls in the past 12 months; affect and cognition (Mini-mental State Examination and the Geriatric Depression Scale); gait speed, frailty syndrome, and physical activity; sarcopenia; medications in use; and adherence to treatment. Details on these assessments are provided next.

2.3. Polypharmacy

Polypharmacy was considered if ≥5 medications were in use; drugs were counted by the number of active ingredients. For patients undergoing HIV/AIDS treatment, ART medication was not counted for diagnosing polypharmacy.

2.4. Functionality

Functionality was evaluated considering ADL and IADL. For ADL, we used the Barthel Index, a questionnaire with a score ranging from 0 to 100. A score from 91 to 100 denotes complete independence in all activities. Scores between 60 and 90 indicate some dependence; values less than 60 indicate severe dependence; and values less than 20 indicate total dependence. In this research, IADL was computed as follows: independent individuals (>27 points); partially dependent (26–18 points); and total dependency (<17 points).

2.5. Nutritional status

The evaluation of nutritional status was performed via the MNA. The MNA assesses changes in food intake, weight loss in recent months, mobility, psychological stressors or acute illness in the last trimester, neuropsychological problems, and BMI. If the score is ≤11, there is a risk for malnutrition; then, a second part of the evaluation should be performed: the global evaluation. The global examination explores lifestyle habits, the occurrence of skin lesions or skin ulcers, medications in use, a dietary investigation (number of meals, intake of food and liquids, ability to feed), self-assessment regarding health, and anthropometric measurements. Results from the MNA were interpreted as follows: normal scores range from 24 to 30 points; 17 to 23.5 points indicate nutritional risk; and values <17 points denote malnourished patients. BMI analyses were interpreted...
2.9. Sarcopenia

Guidelines from the European Working Group on Sarcopenia in Older People were adopted. Participants were classified as follows: reduction only in muscle mass is marked as pre-sarcopenia and reduction of muscle mass associated with loss of muscle strength, or when associated with altered physical performance, is marked as sarcopenia. Finally, loss of muscle mass associated with decreased strength and poor physical performance is considered severe sarcopenia.[23]

2.10. Medications and adherence to treatment

Medications in use and adherence were asked by the geriatrician (3 questions). Possible answers were “yes/no.” If at least 1 answer was “yes,” then we considered that patients did not have sufficient adherence to treatment.

2.10.1. Covariates. Sex, age, skin color, education, marital status, occupation, income, smoking and alcohol consumption, history of blood transfusion, active/not active sexual life, use of the condom, and the number of medical consultations at both the TCC and in other health units were the covariates assessed by individual interview. Moreover, medications in use and the quantity of diagnosed CNID were obtained from medical records by trained research assistants. These covariates were previously found to play a significant clinical and behavioral role with HIV in those aged ≥50.[5,8,9,24]

2.11. Data collection

Data collection took place from April to November 2019 and commenced after the approval from the Western Paraná State University Research Ethics Committee (Approval number 07934919.4.0000.0107). Following the signature of informed consent, a geriatrician performed the interviews and the CGA. PLWHIV participated at the specialized TCC; controls took part in primary health units. In general, each assessment was completed in less than 50 minutes and there were no obvious signs of fatigue or tiredness that could have interfered in the CGA, even among senior participants. The ratio of participants who accepted to take part in the research was higher for PLWHIV probably because they were recruited immediately after their follow-up appointment with the infectious diseases doctor, while PNLWHIV were invited to take part in the research based on the matching criteria. Consequently, PNLWHIV were invited to visit the primary health unit solely with the purpose of contributing to this research.

2.12. Analyses

Frequencies, means, and standard deviations were used to describe the sample. Since all variables were not normally distributed (Kolmogorov–Smirnov test statistically significant), differences in categorical variables were investigated using the Chi-square test with Yates continuity correction. Comparisons between continuous variables were carried out using the Mann–Whitney test. Binary logistic regression with bootstrapping procedure (10,000 resamples) was performed to calculate odds ratios (OR) and 95% bias-corrected and accelerated confidence intervals. Bootstrapping was adopted to reduce bias regarding inflated OR in regression analyses with moderate sample sizes.[25]

Aside from the matching criteria described earlier, crude and
adjusted models were tested to verify confounders in the variables associated with HIV. Precisely, multivariate models accounted for income and education, since low income has been linked with higher vulnerability for HIV infection, an early manifestation of age-related disabilities, and less education.\cite{8,24} These analyses were performed in Statistical Package for the Social Sciences 25 with significance set at \( P \leq .05 \). Considering that all eligible PLWHIV throughout the study period were included, statistical power was computed on a post hoc basis using G\textsuperscript* Power v. 3.1.9. By entering data from our multiple regression analyses (ie, \( OR = .88 \)), the achieved power was over 90\% (two-tailed; \( \alpha = .05 \)). No missing data were present in the database.

3. Results

3.1. Descriptive results

Participants’ average age was 60 ± 7.8 years (PLWHIV: 60.5 ± 7.9; community controls: 60.8 ± 7.8, \( p = .818 \)). Among PLWHIV, the mean age of HIV diagnosis was 51.2 ± 10.6 years. The majority (44.2\%) of them were diagnosed before the age of 50, 38.5\% between 50 and 60 years, and 17.3\% after 60 years. The time since HIV diagnosis was 9.2 ± 7.7 years, and the meantime when viral load was undetectable was 5.6 ± 5.3 years. When the research was conducted, all PLWHIV were using ART, following the Brazilian treatment protocol. Adhesion to ART was reported by 86.5\% of PLWHIV, while 84.6\% had a VL of less than 40 copies/mL. CD4+ T lymphocyte counts of 0 to 199, 200 to 349, and ≥350 were observed in 11.5\%, 15.4\%, and 73.1\% of PLWHIV, respectively. There were few significant differences between descriptive variables (Table 1).

3.2. Frequency of age-related disabilities and geriatric syndromes

Figure 1 displays the percentages of PLWHIV and community controls who had age-related disabilities and the co-occurrence of 2 or more GS. The most common alteration among those with HIV was related to physical inactivity, while community-controls reported a higher occurrence of obesity and overweight. Differences between these frequencies were only significant for obesity and overweight, with PLWHIV having a lower proportion in

| Table 1 |
| Sociodemographic characteristics of the sample (n = 156). |

| Variable                        | Cases (n = 52) | Controls (n = 104) | \( P \) value |
|---------------------------------|---------------|--------------------|---------------|
| **Sex**                         |               |                    |               |
| Male                            | 20 (38.5)     | 40 (38.5)          | 1.00          |
| Female                          | 32 (61.5)     | 64 (61.5)          |               |
| **Age**                         |               |                    |               |
| Up to 60 yrs                    | 33 (63.5)     | 60 (57.7)          | .60           |
| More than 60 yrs                | 19 (36.5)     | 44 (42.3)          |               |
| **Skin color**                  |               |                    |               |
| White                           | 27 (51.9)     | 78 (75.0)          | .01\*         |
| Brown                           | 20 (38.5)     | 23 (22.1)          |               |
| Black                           | 5 (9.6)       | 3 (2.9)            |               |
| **Education**                   |               |                    |               |
| Up to 7 yrs                     | 29 (55.8)     | 62 (59.6)          | .77           |
| More than 7 yrs                 | 23 (44.2)     | 42 (40.4)          |               |
| **Marital status**              |               |                    |               |
| Single                          | 13 (25.0)     | 16 (15.4)          | .005\*        |
| Married                         | 15 (28.8)     | 57 (54.8)          |               |
| Divorced                        | 16 (30.8)     | 13 (12.5)          |               |
| Widowed                         | 8 (15.4)      | 18 (17.3)          |               |
| **Income**                      |               |                    |               |
| Up to R$ 99,800                 | 26 (50.0)     | 47 (45.2)          | .69           |
| More than R$ 99,800             | 26 (50.0)     | 57 (54.8)          |               |
| **Smoking**                     |               |                    |               |
| No                              | 30 (57.7)     | 61 (58.7)          | 1.00          |
| Current or previous             | 20 (42.3)     | 43 (41.3)          |               |
| **Alcohol consumption**         |               |                    |               |
| No                              | 39 (75.0)     | 68 (65.4)          | .30           |
| Current or previous             | 13 (25.0)     | 36 (34.6)          |               |
| **Blood transfusion**           |               |                    |               |
| No                              | 41 (78.8)     | 89 (85.6)          | .40           |
| Yes                             | 11 (21.2)     | 15 (14.4)          |               |
| **Sexual life**                 |               |                    |               |
| Not active                      | 19 (36.5)     | 30 (29.1)          | .45           |
| Active                          | 33 (63.5)     | 73 (70.9)          |               |
| **Use of condom**               |               |                    |               |
| No                              | 20 (38.5)     | 81 (79.4)          | <.001\*       |
| Yes                             | 32 (61.5)     | 21 (20.6)          |               |

\* Denotes statistical significance.
comparison to community controls (30.6% vs 62.5%, \(P < .001\)). When the Brazilian criteria for the geriatric syndrome were adopted (co-occurrence of 2 or age-related disabilities), we found no statistically significant differences between PLWHIV and community controls (38.5% and 42.3%, respectively); importantly, these comparisons did not change when controlling the analyses for education and income.

Beyond the examination of categorical differences between groups (Figure 1), Table 2 explores differences in continuous indicators of clinical and behavioral data. Among PLWHIV,

| Variable                          | Cases (n = 52) | Controls (n = 104) | \(P\) value |
|-----------------------------------|----------------|--------------------|-------------|
| Number of medications            | 2.0 ± 2.2      | 2.9 ± 2.5          | .019*       |
| Number of chronic non-infectious diseases | 1.9 ± 1.7      | 2.1 ± 1.5          | .25         |
| Number of medical consultations  | 5.3 ± 3.0      | 3.5 ± 3.3          | <.001*      |
| Activities of daily living       | 96.3 ± 15.6    | 99.8 ± 1.3         | .28         |
| Instrumental activities of daily living | 26.0 ± 4.0    | 26.8 ± 1.0         | .77         |
| Mini-mental state examination    | 25.0 ± 3.6     | 24.9 ± 3.6         | .91         |
| Geriatric depression scale       | 4.1 ± 4.0      | 3.9 ± 3.6          | .98         |
| Waist circumference              | 91.5 ± 12.3    | 100.5 ± 11.5       | <.001*      |
| Arm circumference                | 30.2 ± 4.5     | 33.0 ± 3.8         | <.001*      |
| Calf circumference               | 35.2 ± 4.1     | 38.2 ± 4.3         | <.001*      |
| Body mass index                  | 25.5 ± 4.3     | 29.0 ± 5.5         | <.001*      |
| Mini nutritional assessment      | 25.24 ± 4.3    | 25.83 ± 3.2        | .66         |
| Number of falls                  | 0.29 ± 0.57    | 0.28 ± 0.70        | .41         |
| Gait speed                       | 0.95 ± 0.27    | 0.87 ± 0.23        | .017        |
| Palmar grip strength             | 29.5 ± 11.5    | 29.1 ± 10.2        | .95         |
| Muscle mass index                | 7.80 ± 1.76    | 9.20 ± 1.77        | <.001*      |
| Frailty syndrome                 | 1.04 ± 1.30    | 1.17 ± 1.14        | .26         |

* Denotes statistical significance.

**Table 2**
Comparison of measures of age-related disabilities in PLWHIV and community controls from Francisco Beltrão, Paraná, Brazil (n = 156).
there was less use of medications. They also had a higher number of medical visits, smaller circumferences in body measurements (calf, arm, and waist), lower BMI, lower muscle mass index, and higher gait speed. Table 3 presents multilevel correlates of HIV in the studied sample. Models were built based on both statistical (variables with \( P \leq .20 \) from Tables 1 and 2) and theoretical reasoning (ie, controlling for education and income).\(^{[22,23]}\) It was observed that associations identified in crude analyses (model 1) were maintained after controlling for education and income (model 2). In the final model, the use of condoms, number of medical consultations, low/normal weight, higher gait speed, and lower muscle mass index were independently associated with HIV. A \( P \) value ≤.05 was set for statistical significance, and analyses were carried out using the Statistical Package for the Social Sciences (v. 23).

### 4. Discussion

The goals of this study were to investigate the frequency of age-related disabilities in older PLWHIV and PNLWHIV and to examine the role of clinical and behavioral factors associated with HIV. The case of geriatric syndromes playing a role when investigating HIV outcomes is certainly puzzling for most of our society. However, according to some experts, there is a clear necessity in drawing attention to factors that are usually not explored among adults living with HIV.\(^{[5,6,9,26]}\) Our main hypothesis that age-related disabilities would be higher among PLWHIV was not fully supported by the data, thus contradicting previous reports.\(^{[7,9,10]}\) Comparisons with past studies on geriatric syndromes and HIV are rather limited since we could not locate investigations adopting the co-occurrence of 1 or more age-related disabilities to diagnose GS.\(^{[16]}\)

Initially, 80.8% of PLWHIV and 74.0% of community controls had at least 1 domain affected as measured by the CGA. However, clinically significant results would imply deficits in ≥2 domains. Thus, 41% had at least 2 GS,\(^{[16]}\) with no group differences. The most frequent age-related disabilities found were cognitive impairment (48.1% in PLWHIV vs 51.9%), depression (30.8% in PLWHIV vs 24.0%), and obesity (30.6% in PLWHIV vs 62.5%). Mild depression and depression can be easily confused in elderly patients, thus denoting the importance of critical judgment by the clinician. In the current study, depression and cognitive impairment were the most frequent GS for the PLWHIV group, albeit no statistically significant differences with community controls were found. Ávila-Funes et al (2016) reported an incidence of depression of 15.9% in PLWHIV,\(^{[27]}\) whereas our data estimated 30.8%. Furthermore, evidence for cognitive impairment was present in 48.1% of PLWHIV and in 51.9% of community controls, which is well above the 21.3% found by Melo et al.\(^{[28]}\) Remarkably, factors commonly associated with cognitive impairment – such as low education, tobacco use, obesity, and low levels of physical activity – were present in our study in the same proportions between groups, which could have influenced the high frequency of cognitive impairment\(^{[29]}\) when compared to past reports. As for BMI, we found statistically significant differences in proportions of overweight and obesity (62.5% in controls vs 30.6%). Cumulative evidence suggests a tendency of increased BMI in PLWHIV, which seems abrupt in the first year of ART\(^{[30]}\) and more apparent in patients using protease inhibitors.\(^{[31]}\) Nonetheless, the proportion of obesity in PLWHIV was comparable to what has been reported previously (ie, about one-third of PLWHIV).\(^{[10,31]}\)

Inferential statistics had divergent findings in comparison with past investigations. For example, contrary to our results, Schrack et al found a faster decline in gait speed in PLWHIV aged ≥50 years when compared to those PNLWHIV (\( P < .001 \)).\(^{[32]}\) Albeit direct comparisons are not possible due to distinct study designs, we found that PLWHIV had a faster gait speed in comparison to...
community controls (P = .017). These differences could be better explained when data on malnutrition and obesity are considered. It is known that both extremes (ie, very low and very high weight) are associated with slower gait speed.[33]

Frailty syndrome was present in 11.5% of PLWHIV and in 14.4% of community controls. These results deserve proper attention since the literature indicates that frailty is related to higher mortality and higher incidence of comorbidities, regardless of the presence of HIV.[26] In previous studies, the prevalence ranged from 7.5% to 19.4%, being higher as the individuals get older.[6,26,34] In this respect, ART might have protective effects by reducing the prevalence of frailty.[12,35] For instance, data from an 11-year follow-up cohort investigation revealed that HIV treatment was associated with a reduction in frailty syndrome in people aged ≥50 years but increased in people aged 75.[35]

Evidence linking polypharmacy to HIV—especially in the elderly population[6,9]—was not supported by the data. Results indicated that 13.5% of PLWHIV met the criteria for polypharmacy, which is smaller when compared to what Levett and Wright reported (≥30%) in a study with older adults living with HIV in the United Kingdom.[6] The importance of this specific GS is paramount. As the number of medications increases, greater are the risks of drug interactions, adverse events, clinical complications, and risk of falls. Indeed, the addition of 1 medication might increase the risk of falls by 1.4 times.[36] Likewise, the frequency of falls varies widely between studies from 11% to 37.2%,[9,36,37] and risks are higher for women, Caucasians, and smokers[36] in our study, 25% of PLWHIV reported not using condoms which increases the susceptibility to contamination by HIV and other sexually transmitted infections and HIV superinfection.[42] Also, unprotected sex increases the risk of contamination by other sexually transmitted infections and HIV superinfection.[42] Nevertheless, most studies on age-related disabilities and GS in populations not living with HIV have been carried out either with people aged 65 years old or more, or examined specific indicators alone (ie, only frailty, only polypharmacy, cognitive impairment, etc).[12] Moreover, national guidelines on geriatric assessment in Brazil require attention in at least 2 domains to diagnose an individual with GS.[16] These factors could explain distinct frequencies of GS than we encountered.[11]

With demographic transitions occurring in many parts of the world, combined with improved treatment and early diagnosis, health services must be better prepared to deal with HIV patients. Nonetheless, there are some limitations of this research. First, our sample impedes the generalization of the results to other regions. Moreover, giving the nature of the study design and the methods used to perform the CGA, some results could have been influenced by participant’s recall bias. Although attempts to minimize selection bias were made by matching the sample by age, sex, and neighborhood of residence, other pairing criteria could be considered in future studies, such as educational level and socioeconomic status. Likewise, research involving more health centers, with larger samples are very necessary.

Author contributions

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