Original Article

Erectile dysfunction in men with human immunodeficiency virus: prevalence and associated factors

Suzane Skura[1]^, Anna Martha Vaitses Fontanari[2]^, Lia Beatriz Henke de Azevedo[1]^, Raquel Maiéli Bagatini[3]^, Valdir Spada Júnior[4]^, Dalila Moter Benvegnú[5]^, Paulo Cezar Nunes Fortes[4]^, Angelo Brandelli Costa[2,6]^, Guilherme Welter Wendt[1]^, Lirane Elize Defante Ferreto[3]^

[1]Postgraduate Program in Applied Health Sciences, Western Paraná State University, Francisco Beltrão, Brazil; [2]Department of Psychology, Pontifical Catholic University of Rio Grande do Sul, Porto Alegre, Brazil; [3]Postgraduate Program in Applied Health Sciences, Multidisciplinary Laboratory of Health Biosciences, Western Paraná State University, Francisco Beltrão, Brazil; [4]Undegraduate Course (Medicine), Health Sciences Center, Western Paraná State University, Francisco Beltrão, Brazil; [5]Federal University of Fronteira Sul and Multidisciplinary Laboratory of Health Biosciences, State University of Western Paraná, Realeza, Brazil; [6]Department of Psychological and Social Sciences, John Cabot University, Rome, Italy

Contributions: (I) Conception and design: S Skura, de Azevedo LBH, Costa AB, Júnior VS, Wendt GW, Ferreto LED, Fontanari AMV; (II) Administrative support: de Azevedo LBH, Bagatini RM, Júnior VS, Wendt GW, Ferreto LED; (III) Provision of study materials or patients: de Azevedo LBH, Ferreto LED, Fortes PCN, Júnior VS; (IV) Collection and assembly of data: S Skura, de Azevedo LBH, Júnior VS, Bagatini RM, Wendt GW, Ferreto LED; (V) Data analysis and interpretation: S Skura, Fontanari AMV, Bagatini RM, Júnior VS, Benvegnú DM, Fortes PCN, Costa AB, Wendt GW, Ferreto LED; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

Correspondence to: Guilherme Welter Wendt, PhD. Postgraduate Program in Applied Health Sciences, Western Paraná State University, Vitório Traiano HWY, KM2, Administrative Building, Room 9, Francisco Beltrão, PR 85.601-970, Brazil. Email: guilherme.wendt@unioeste.br.

Background: Male sexuality plays a crucial role in determining the overall quality of life, and it involves complex interactions between physical systems and psychosocial dimensions. Erectile dysfunction (ED) has a particularly notable impact on men's well-being, especially among those living with human immunodeficiency virus (HIV). This study's aim was to explore the prevalence of ED and its associated factors in men with HIV.

Methods: Cross-sectional research was conducted in a specialized care unit in Paraná, involving 120 adult men living with HIV. Data collection occurred from March 2021 to December 2023, and ED was assessed using the 6-item version of International Index of Erectile Function (IIEF-6) questionnaire. Psychological factors were assessed using the Depression, Anxiety and Stress Scales-21 (DASS-21). The primary outcome was ED.

Results: The prevalence of ED was 37.5% [95% confidence interval (CI): 28.8% to 46.2%]. A significant association was observed between advanced age and ED. Regarding the type of antiretroviral therapy (ART), the data revealed a significant association with ED, the differences were particularly notable when comparing the therapeutic regimens of nucleoside reverse transcriptase inhibitor (NRTI) + Integrase inhibitor (INI) *vs*. NRTI + protease inhibitor (PI) and NRTI + NRTI. Furthermore, mental health factors were analyzed, with anxiety demonstrating a significant association with ED [odds ratio (OR) =2.35; 95% CI: 1.02 to 5.43; P=0.046].

Conclusions: The findings highlight the urgent need for an integrated approach to clinical management that considers both medical and emotional aspects in men living with HIV. It has also a potential to subside further investigations, particularly those adopting a longitudinal design to capture casual mechanisms of ED in men with HIV.

Keywords: Erectile dysfunction (ED); anxiety; aging; human immunodeficiency virus (HIV)

^ ORCID: Suzane Skura, 0009-0003-8872-1274; Anna Martha Vaitses Fontanari, 0000-0002-1457-3884; Lia Beatriz Henke de Azevedo, 0000-0003-4874-727X; Raquel Maiéli Bagatini, 0009-0005-5801-6819; Valdir Spada Júnior, 0000-0002-6400-3329; Dalila Moter Benvegnú, 0000-0002-3419-9674; Paulo Cezar Nunes Fortes, 0000-0001-8331-2410; Angelo Brandelli Costa, 0000-0002-0742-8152; Guilherme Welter Wendt, 0000-0002-9014-6120; Lirane Elize Defante Ferreto, 0000-0002-0757-3659.

Submitted May 13, 2024. Accepted for publication Nov 03, 2024. Published online Nov 27, 2024.
doi: 10.21037/tau-24-234
View this article at: https://dx.doi.org/10.21037/tau-24-234

Introduction

Background

Male sexuality plays a central role in men's quality of life, involving a complex interaction between physical systems and psychosocial aspects (1). Sexual dysfunction manifests itself in the presence of changes in any of these components, ranging from motivation to erections and ejaculation (2,3). Erectile dysfunction (ED) is one of the components of sexual dysfunction, characterized by the inability to achieve or maintain a penile erection adequate for satisfactory sexual performance (3-5).

Studies indicate that people with human immunodeficiency virus (HIV) have a higher prevalence of sexual problems and sexual dysfunctions compared to those who are HIV negative, both in men and women. HIV infection has notable repercussions on sexual health, manifesting itself through a significant reduction in sexual activity, loss of libido, and the emergence of stigmas related to the transmission of the virus (6). Therefore, people living with HIV (PLHIV) face ongoing challenges related to intimacy and physical pleasure, due to several factors directly linked to HIV infection. However, it is common for sexual dysfunction and HIV-related sexuality-specific issues to be neglected in clinical practice.

ED acquires relevance in public health, considering that its impacts not only affect physical health, but also exert a considerable influence on the quality of life and emotional state of individuals infected with HIV (7). There is evidence that depression and anxiety are prevalent (from 11% to 64.97%) in people who have ED combined with HIV (7-11).

The prevalence of ED, at a global level, presents considerable variation, ranging from 3% to 76.5%, depending on the population studied, definition criteria and assessment methods (12-14). In the case of HIV, the prevalence of ED varies from 13% to 86% (4,6,11,15).

It is urgent to carry out more research about ED and sexual and reproductive health in PLHIV. This is due because ED is more prevalent in this population compared to those without HIV (4,10). Moreover, as explained by Chen *et al.*, chronic diseases and potential effects of drugs could help in understanding the etiological pathways of ED (5). Evidence from a meta-analysis showed that patients' experiences with ED increases the odds ratio (OR) for depression by 2.92 [95% confidence interval (CI): 2.37 to 3.60].

Moreover, not only depression, but other psychological factors have been neglected in studies focusing on ED in men. For instance, Akbas *et al.* stated the heterogeneity of findings in the ED literature might be explained by psychosocial aspects uniquely experienced by men with HIV, such as anxiety and quality of life (16).

ED has shown risk factors that are specific to HIV patients [i.e., antiretroviral therapy (ART)] as well as to the general population, including sociodemographic (i.e., age) and psychological aspects (i.e., anxiety and depression) (17,18). Indeed, the literature seems to point that a proper understanding of ED in men with HIV can be better obtained when mental health is accounted for (19).

Rationale and knowledge gap

Despite several studies investigating risk factors and ED in PLHIV (5,9,16-22), a gap exists when it comes to evidence

Highlight box

Key findings

- The results highlight the imperative need for an integrated approach to clinical management, considering both medical and emotional aspects in men living with human immunodeficiency virus (HIV).

What is known and what is new?

- Past studies have shown associations between older age, comorbidities, and erectile dysfunction (ED) in individuals with HIV.
- We found that the type of antiretroviral therapy (ART) had a significant association with ED, in which differences were particularly notable when comparing the therapeutic regimens involving nucleoside reverse transcriptase inhibitor (NRTI) *vs.* others. Also, anxiety [odds ratio (OR) =2.35; 95% confidence interval (CI): 1.02 to 5.43; P=0.046] and the use of ART consisting of NRTI + integrase inhibitor [OR =4.85; 95% CI: 1.48 to 15.86; P=0.009] were independently associated to the risk of ED.

What is the implication, and what should change now?

- The importance of an integrated clinical approach is highlighted, including not only medical aspects, such as specific therapeutic regimens of ART, but also emotional aspects, including the impact of anxiety on these patients' experiences.

Table 1 Sociodemographic characteristics of the sample (n=120)

Variables	N (%)
Age (years)	
<50	79 (65.83)
≥50	41 (34.17)
Ethnicity	
White	76 (63.33)
Other	44 (36.67)
Education (years)	
<8	35 (29.17)
≥8	85 (70.83)
Marital status	
Married or in a stable relationship	40 (33.33)
Single	80 (66.67)
Sexual orientation	
Heterosexual	75 (62.50)
Homosexual	29 (24.17)
Bisexual	16 (13.33)
Anal sex	
No	46 (38.33)
Yes	74 (61.67)
Oral sex	
Yes	94 (78.33)
No	26 (21.67)
Active sexual life	
Yes	97 (80.83)
No	23 (19.17)
Comorbidities	
Without	80 (66.67)
With	40 (33.33)
Time since HIV infection (years)	
<5	47 (39.17)
5–10	39 (32.50)
>10	34 (28.33)

HIV, human immunodeficiency virus.

involving heterosexual men, as well as about men who report engaging in sexual relations with other men (16). The precise magnitude of the relationship between HIV and ED in men is yet to be estimated. For instance, perhaps the first meta-analysis investigating the role of ED and depression has been published just a few years ago (i.e., 2018) and pointed out that effect sizes varied between studies which adopted standardized measure of ED, such as the 5- and 6-item versions of the International Index of Erectile Function (IIEF-5 and IIEF-6) (23) in comparison to other instruments (9). Other biases in the existing literature regards the lack of reporting of reliability indices of assessment tools (9) and little consideration of other psychological covariates, particularly stress (16,19).

Objective

Our objective was to estimate the prevalence and factors associated with ED in men with HIV, aged 18 years old or over. Participants were receiving healthcare at a specialized service located in Francisco Beltrão, Paraná, Brazil. Particularly, we sought to extend the knowledge about the factors associated with ED in men with HIV by adopting and reporting the psychometric properties of internationally recognized instruments (9) while considering recent claims for a broad assessment of psychological indicators of mental health (16). Moreover, we present this article in accordance with the STROBE reporting checklist (available at https://tau.amegroups.com/article/view/10.21037/tau-24-234/rc).

Methods

Design and participants

This is a quantitative, cross-sectional study. The research was carried out at the Specialized Care Service (SAE) in Francisco Beltrão-PR, which is the reference center for HIV/acquired immunodeficiency syndrome (AIDS) treatment for 27 municipalities in the region, serving a total population of approximately 400 thousand inhabitants. The research involved a sample of 120 men with HIV, aged ≥18 years old, and who were registered and receive treatment in the specialized service.

The mean age of participants was 46±16.12 years, ranging from 20 to 81 years old. The majority (65.83%) were under 50 years old. In addition, 63.33% were White, with 8 or more years of formal education (70.83%), singles (66.67%), and heterosexuals (62.50%; *Table 1*).

Data collection procedures

Data collection took place between March 2021 and

December 2023. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the Institutional Ethics Committee Board of Western Paraná State University/UNIOESTE (Nos. 4579204 and 3611523) after written permission from the SAE. Informed consent was taken from all the patients before taking part in the research. A convenience sample was chosen and data were collected at the SAE, in an environment specifically reserved for the research.

A structured questionnaire, applied through individual interviews and review of data present in patients' medical records, was used to collect general information and covariates, including: age, marital status, sexual activity, partner's HIV status, time from HIV diagnosis, type of ART, viral load (VL), CD4 count, possible coinfections, comorbidities, use and adherence to ART and long-term medications.

The assessment of ED was carried out using the adapted version of the IIEF to Brazilian Portuguese (24). The IIEF contains six questions regarding individuals' experiences and confidence regarding erectile function. Responses are given on a 5-point Likert scale ranging from 1 to 5, with higher scores indicating better erectile functioning. The severity of the ED was interpreted as recommended by the authors (23,24). A cut-off score of ≤25 indicates that the participant had clinically significant alteration in ED over the last 4 weeks. In the current sample, the IIEF exhibited excellent psychometric properties (α=0.90).

The measurement of psychological factors included depression, anxiety, and stress and was carried out using the Depression, Anxiety and Stress Scales-21 (DASS-21). This instrument captures a broad concept of psychological distress (25) and is composed by three, yet correlated factors. Each factor contains seven items. Responses apply to the previous week and are given on an agreement Likert scale ranging from 0 to 3. Higher scores indicate greater severity. Cut-off points were interpreted as recommended by the authors (26,27). Hence, clinically significant scores were as follows: ≥14 (depression), ≥10 (anxiety), and ≥19 (stress). Excellent psychometric properties were found (α=0.96).

Statistical analysis

Initially, the data were organized in an electronic spreadsheet using the Microsoft Excel® program. Statistical analyses were then conducted using the IMB Statistical Package for Social Sciences, version 23.0. No missing values were present.

Absolute and relative frequencies were calculated, as well as measures of central tendency (mean) and variability (standard deviation). The symmetry of continuous distributions was assessed using the Kolmogorov-Smirnov test. For the analysis of ED, outcomes were defined as presence and absence. Continuous variables were compared with age group and outcome using the Mann-Whitney *U* test (asymmetric distributions). For the comparison of categorical variables with ED (presence *vs.* absence), Fisher's exact test and Pearson's Chi-square test (χ^2) were used with Yates continuity whenever appropriated. P values less than 0.05 were considered significant (*Table 2*).

The investigation of the predictive capacity of the independent variables in relation to the outcome of ED was carried out using binary logistic regression (*Table 3*). The independent variables eligible to compose the model were those that presented raw OR with P values less than 0.05, as displayed in *Table 2*. The selection of representative variables occurred using the Backward Stepwise (Wald) method. To check the goodness of fit of the final logistic regression model, the Nagelkerk R^2 and Hosmer Lemeshow results were considered. In the final regression model, variables that presented P values less than 0.05 were maintained.

Results

Cross-tabulation comparisons between ED with the study's variables, as well as raw estimates of predictors of ED are displayed in *Table 2*. From the analysis of data presented in *Table 2*, a high prevalence of ED was identified in individuals over the age of 50 years old, evidenced by a raw OR of 2.40. This finding suggests a statistically significant association between advanced age and the incidence of ED. Additionally, an increasing trend in the prevalence of ED was observed in relation to the longer duration since HIV diagnosis, although this result did not reach statistical significance.

Regarding the presence of comorbidities, a significant association was found with ED (OR =2.20), indicating a possible association between the coexistence of other health conditions and ED. Regarding the type of ART for HIV, the data revealed a significant association with ED. The differences were particularly notable when comparing the therapeutic regimens of nucleoside reverse transcriptase inhibitor (NRTI) + integrase inhibitor (INI) *vs.* NRTI + protease inhibitor (PI) and NRTI + NRTI, suggesting that the specific antiretroviral treatment regimen may influence

Table 2 Binomial comparisons between ED according to the study's variables and raw ORs predicting the presence of ED (n=120)

Variables	ED, n (%)			Presence of ED		
	Yes (n=45)	No (n=75)	P value[†]	ORs	95% CI	P value[‡]
Age (years)			0.042*			0.027*
<50	24 (53.3)	55 (73.3)		1	–	
≥50	21 (46.7)	20 (26.7)		2.4	1.10 to 5.23	
Ethnicity			>0.99			0.85
White	29 (64.4)	47 (62.7)		1	–	
Other	16 (35.6)	28 (37.3)		0.84	0.92 to 1.99	
Education (years)			0.32			0.24
<8	16 (35.6)	19 (25.3)		1	–	
≥8	29 (64.4)	56 (74.7)		0.61	0.27 to 1.37	
Income			0.85			0.84
No income	5 (11.1)	9 (12.5)		1	–	
<2 minimum wages	16 (35.6)	30 (40.0)		0.96	0.27 to 3.35	
2–5 minimum wages	19 (42.2)	31 (41.3)		1.1	0.32 to 3.78	
6 minimum wages or more	5 (11.1)	5 (6.7)		1.8	0.34 to 9.39	
Time since HIV infection (years)			0.18			0.18
<5	13 (28.9)	34 (45.3)		1	–	
5–10	18 (40.0)	21 (28.0)		2.24	0.91 to 5.49	
>10	14 (31.1)	20 (26.7)		1.83	0.71 to 4.66	
Marital status			0.84			0.69
Single	31 (68.9)	49 (65.3)		1	–	
Married	14 (31.1)	26 (34.7)		0.65	0.36 to 1.87	
Sexual orientation			0.58			0.58
Heterosexual	24 (53.3)	47 (62.7)		1	–	
Homosexual	12 (26.7)	17 (22.7)		1.38	0.50 to 3.35	
Bisexual	9 (20.0)	11 (14.7)		1.6	0.58 to 4.39	
Anal sex			0.98			0.92
No	17 (37.8)	29 (38.7)		1	–	
Yes	28 (62.2)	46 (61.3)		1.03	0.46 to 2.22	
Oral sex			0.90			0.73
No	9 (20.0)	17 (22.7)		1	–	
Yes	36 (80.0)	58 (77.3)		1.17	0.47 to 2.90	
Active sexual life			0.67			0.73
No	10 (22.2)	13 (17.3)		1	–	
Yes	35 (77.8)	62 (82.7)		0.73	0.29 to 1.84	

Table 2 *(continued)*

Table 2 *(continued)*

Variables	ED, n (%)			Presence of ED		
	Yes (n=45)	No (n=75)	P value[†]	ORs	95% CI	P value[‡]
VL (copies/mL)			0.69			0.51
≥50	37 (82.2)	65 (86.7)		1	–	
<50	8 (17.8)	10 (13.3)		1.4	0.51 to 3.87	
Long-term medication (n=36)			0.41			0.31
No	29 (64.4)	55 (73.3)		1	–	
Yes	16 (35.6)	20 (26.7)		1.51	0.68 to 3.36	
Adherence to long-term medication (n=36)			>0.99			0.51
No	4 (25.0)	5 (25.0)		1	–	
Yes	12 (75.0)	15 (75.0)		0.74	0.31 to 1.76	
Comorbidities			0.072			0.047*
No	20 (44.4)	20 (26.7)		1	–	
Yes	25 (55.6)	55 (73.3)		2.2	1.01 to 4.79	
Adherence to ART			0.89			0.74
No	22 (48.9)	39 (52.0)		1	–	
Yes	23 (51.1)	36 (48.0)		0.88	0.42 to 1.85	
ART			0.002*			0.005*
NRTI + NRTI	4 (8.9)	22 (29.3)		1	–	
NRTI + PI	2 (4.4)	11 (14.7)		5.10	1.61 to 16.14	
NRTI + INI	39 (86.7)	42 (56.0)		0.99	0.15 to 6.33	
Depression			0.24			0.16
No	33 (73.3)	63 (84.0)		1	–	
Yes	12 (26.7)	12 (16.0)		1.9	0.77 to 4.71	
Stress			0.53			0.35
No	39 (86.7)	69 (92.0)		1	–	
Yes	6 (13.3)	6 (8.0)		1.76	0.53 to 5.86	
Anxiety			0.042*			0.027*
No	22 (48.9)	52 (69.3)		1	–	
Yes	23 (51.1)	23 (30.7)		2.36	1.10 to 5.07	

[†], results from cross-tabulation techniques; [‡], raw ORs predicting the presence of ED; *, P<0.05. ED, erectile dysfunction; OR, odds ratio; CI, confidence interval; HIV, human immunodeficiency virus; VL, viral load; ART, antiretroviral therapy; NRTI, nucleoside reverse transcriptase inhibitor; PI, protease inhibitor; INI, integrase inhibitor.

the incidence of ED.

Additionally, mental health factors such as depression, stress, and anxiety were analyzed, with anxiety demonstrating a significant association with ED (OR =2.35). This finding highlights the importance of considering mental health conditions in the context of ED in patients with HIV.

The prevalence of ED among men living with HIV was observed to be 37.5% (95% CI: 28.8% to 46.2%). We

Table 3 Variables independently associated with ED in men with HIV, Francisco Beltrão, Paraná, 2023 (n=120)

Variables	B	Standard error	χ^2	P	ORs	95% CI
Covariates						
Age (years)	0.02	0.01	2.67	0.10	1.02	1.00 to 1.05
Comorbidities (number)	–0.002	0.12	0.00	0.98	0.99	0.80 to 1.25
Factors						
ART: NRTI + NRTI	1	–	–	–	–	–
ART: NRTI + INI	1.58	0.60	6.81	0.009	4.85	1.48 to 15.86
ART: NRTI + PI	0.03	0.96	0.00	0.97	1.03	0.16 to 6.76
Anxiety (yes)	0.85	0.43	3.98	0.046	2.35	1.02 to 5.43

$\chi^2(5)=18.721$; P=0.002; Nagelkerke $R^2=0.20$. ED, erectile dysfunction; HIV, human immunodeficiency virus; OR, odds ratio; CI, confidence interval; ART, antiretroviral therapy; NRTI, nucleoside reverse transcriptase inhibitor; INI, integrase inhibitor; PI, protease inhibitor.

Table 4 Comparisons between the mean scores for depression, stress, and anxiety between ED presence and absence groups (n=120)

Variables	ED		P
	Presence (n=45)	Absence (n=75)	
Depression	5.73±4.93	4.17±5.64	0.01
Stress	6.49±5.59	3.64±5.31	<0.001
Anxiety	8.47±6.31	5.64±6.19	0.007

Data are presented as mean ± standard deviation. ED, erectile dysfunction.

observed in *Table 3* that men stratified for anxiety were 2.35 times more likely to develop ED. The use ART with NRTI + INI increased the risk of ED (OR =4.85; 95% CI: 1.48 to 15.86).

Finally, higher scores for depression, anxiety, and stress were found among men with ED in comparison to those without ED (*Table 4*). Means and standard deviations for these comparisons are provided in *Table 4*.

Discussion

Key findings

The results indicated to a prevalence of ED of 37.5% (95% CI: 28.8% to 46.2%) in the sample studied. In other words, more than a third of men living with HIV in the sample reported ED. Our study also expanded previous investigations that considered the role of mental health in influencing the experiences of ED in men with HIV, revealing that anxiety significantly increases the risk for ED.

Strengths and limitations

This study stands out for its use of internal HIV registries, allowing high-quality verification of clinical details. Moreover, as no missing data were present, the study did not rely on imputation techniques. Also, data were collected at a mandatory reference center for HIV/AIDS treatment, which serves 27 municipalities in the Southwest region of Paraná. With a sample of 120 participants, we reached a satisfactory power of approximately 80%. Therefore, the results can be quite informative to the health region covered by this research. Quite likely is the utility of the findings for application and possible comparisons across the country, especially with regard to health care for the male population with HIV.

Among the limitations of the study, the use of self-administered questionnaires (IIEF-6 and DASS-21) to assess the presence of ED and symptoms of anxiety, depression, and stress stands out. While these tools are valuable for collecting data in a standardized format and are preferable in comparison to other tools (9), it is important to note that they are subject to bias. One of the bias is the self-report bias, which can result in underreporting or overreporting, especially given the stigmas associated with sexuality and mental health. Furthermore, it is important to mention that the use of the IIEF-6 does not allow identifying whether the respondent has passively penetrative sex, particularly in men who have sex with men, which can lead to inaccurate answers. We therefore suggest that future studies consider the

development of an instrument specifically aimed at this group in order to better address their experiences and nuances.

Comparison with similar researches

The prevalence found in this study appears to be in line with other reports in the literature, which indicate that ED affects between 30% to 60% of men with HIV worldwide (6,16,20,21,28-30). A cross-sectional study carried out in 2020, involving 65 men with HIV in Iran, obtained a prevalence of 27.7% of ED (31). Another cross-sectional study published in 2023, involving 107 men with HIV who attended a hospital in Turkey, using the IIEF, obtained a prevalence of ED of 73.8% (32). Furthermore, a study carried out in Germany with men aged between 30 and 80 years old, identified that ED prevalence was 19.2%, with a sharp age-related increase from 2.3% to 53.4% (33). Brazilian studies achieved similar results, with prevalences ranging from 21.6% to 54.5% (4,15,34,35). The frequency of ED in heterosexual men was double that identified among homosexual men, unlike the study involving men from São Paulo (36).

Among PLHIV using ART, there are reports of prevalence of ED varying between 9% and 74%, depending on the method, design, sample, and comorbidities considered in each study (29). In our study, the use of ART (NRTI + INI) was one of the main risk factors associated with the presence of ED (OR =4.85).

Explanations of findings

According to the literature, prolonged exposure to ART is strongly associated with ED (34,35,37-40). A study carried out in Brazil between 2013 and October 2016, involving 234 adults living with HIV, revealed a prevalence of ED of 49.7% and the median time on ART was 192 months among men (4). Older studies indicate the prevalence of ED in 53.2% in a population with a median ART use of 119 months (34) and 54.5% in a population with a median ART use of 109 months (35). In this study, although an increasing trend was observed in the prevalence of ED with the longest time since HIV diagnosis and ART use, there was no statistical significance, which can be attributed to the sample size. Considering that previous studies (4,34,35,37-39) suggest that HIV infection and its treatment can negatively influence erectile function, it is suggested that longitudinal research be carried out to confirm these associations.

The data revealed a significant association between ED and ART therapeutic regimens. Most studies carried out so far have stated that protease inhibitors (PIs) as the ART agents that have the greatest association with ED (11,17,18,41). One study suggests that a decrease in sexual interest and ED are found in individuals who are on ART especially if their regimens contain PI (42).

However, two recent studies (38,43) conducted on the African continent indicate that decreased libido and ED are common in men following an antiretroviral regimen based on dolutegravir (DTG), classified as an INI, which is very similar to what we have found. Consequently, given the scarcity of in-depth research on regimens using INIs, and considering the observation of a substantial reduction in the risk of ED with the non-use of ART with NRTI + INI, the need for to carefully evaluate the benefits and risks of different therapeutic regimens, opting for treatments that combine therapeutic efficacy and VL suppression with the quality of life and sexual health of people with HIV.

Several emotional factors and psychological aspects are peculiar to PLHIV and can affect sexuality, such as stigma, body self-perception, fear of transmission, mandatory use of condoms, sexual behavior (16,44). Changes in mental health are also frequently comorbid in people with ED (30), with the greatest evidence being found for disorders related to depression and anxiety and in some cases, including dysfunctional affective states resulting from a stressor or specific life crisis (30,45). When we associate ED with HIV, there are findings in the literature that relate depression and anxiety as associated psychosocial factors (10,11,43). A significant association (OR =2.35) between anxiety and ED was found, pointing to it as a risk factor and corroborating studies that indicate that the this is, perhaps, the emotional state that contributes more to ED (10,43).

When comparing the means and statistical differences between groups with and without ED, for the variables depression, stress, and anxiety, the results indicated that individuals with ED had higher means for depression (5.73±4.93 *vs.* 4.17±5.64, P=0.01), stress (6.49±5.59 *vs.* 3.64±5.31, P<0.001) and anxiety (8.47±6.31 *vs.* 5.64±6.19, P=0.007) compared to men without ED. These results indicate a significant association between the presence of ED and symptoms of changes in the emotional state of the population under study, as well as the findings in the literature. Regarding age, the comparison between the groups revealed no significant difference, suggesting age homogeneity (P=0.32).

Moreover, the association between the presence of comorbidities and ED highlights the importance of

considering other aspects of patients' global health. Conditions such as diabetes and hypertension, common in PLHIV, are also correlated with ED (46). An integrated approach to these conditions is essential for managing erectile function in this population.

Implications and actions needed

The high prevalence of ED justifies early and routine screening for ED in men with HIV, particularly after reaching their fifth decade of life. The use of structured questionnaires can help to identify the presence of ED early, thus guiding the clinical approach for men with HIV. In general, erectile function is influenced by the natural aging process (47-49). In this study, we identified a significant association between advanced age (over 50 years old) and the occurrence of ED. Aging, along with associated physiological changes, can impair erectile capacity, emphasizing the importance of age as a relevant factor in the prevalence of ED (10,14,44,47-50). However, in multivariate analyses, the effect of age did not reach statistical significance.

These findings have important implications because the need for specific interventions for men, especially older men, have been widely documented since they continue to maintain an active sexual life due to increased life expectancy. Consequently, the relevance of including psychological support in the management of patients with HIV stands out. Screening instruments can be easily incorporated into healthcare facilities. In addition, data-driven practices can then offer both individual and group psychological interventions to prevent and treat anxiety, hence adding improvements for ED risk. The World Health Organization, for instance, provides guidance on the use of interpersonal therapy and describes the approach in a simplified manual for use by facilitators (51).

Moreover, albeit only anxiety was independently associated with ED in this sample, differences in the means of depression and stress were also noted. In this respect, readers must consider that the instrument used (DASS-21) posits that symptoms of anxiety, depression, and stress might overlap (52). Caution should be taken as screening measures are not diagnostic tools. Nonetheless, the importance of self-reported measures for optimizing HIV healthcare can not be understated.

Conclusions

In summary, the results of this research offer a valuable contribution to understanding the prevalence and factors associated with ED in men living with HIV. Highlighting the importance of an integrated clinical approach, the findings highlight the need to consider not only the medical aspects, such as specific therapeutic regimens of ART, but also the emotional elements, including the impact of anxiety on these patients' experiences. We reinforce the importance of future longitudinal research and the development of specific instruments for assessing ED, aiming to further improve the understanding and effective management of ED in this specific population. The need for large clinical trials, cohort studies and other forms of investigations that can shed light on casual pathways linking individual differences, HIV status, and ED is imperative.

Acknowledgments

We would like to thank the SAE team in Francisco Beltrão/PR for their collaboration and provision of space to carry out the research and the multi-user Health Biosciences Laboratory.

Funding: None.

Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://tau.amegroups.com/article/view/10.21037/tau-24-234/rc

Data Sharing Statement: Available at https://tau.amegroups.com/article/view/10.21037/tau-24-234/dss

Peer Review File: Available at https://tau.amegroups.com/article/view/10.21037/tau-24-234/prf

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://tau.amegroups.com/article/view/10.21037/tau-24-234/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the Institutional Ethics Committee Board of Western Paraná State University/UNIOESTE (Nos. 4579204 and 3611523)

after written permission from the SAE. Informed consent was taken from all the patients before taking part in the research.

References

1. Nolsøe AB, Durukan E, Jensen CFS, et al. Diagnosis of Male Sexual Dysfunction. In: Sarikaya S, Russo GI, Ralph D. Andrology and Sexual Medicine. Cham: Springer International Publishing; 2022:19-28.
2. Rochira V, Carani C, Granata ARM. Management of Sexual Dysfunction. In: Wass J, Arlt W, Semple R. Oxford Textbook of Endocrinology and Diabetes 3e. Oxford University PressOxford; 2022:1605-18.
3. Sarikaya S. Erectile Dysfunction: From Diagnosis to Treatment. In: Sarikaya S, Russo GI, Ralph D. Andrology and Sexual Medicine. Cham: Springer International Publishing; 2022:29-39.
4. Scanavino MT, Mori E, Nisida VV, et al. Sexual Dysfunctions Among People Living With HIV With Long-Term Treatment With Antiretroviral Therapy. Sex Med 2022;10:100542.
5. Chen L, Shi GR, Huang DD, et al. Male sexual dysfunction: A review of literature on its pathological mechanisms, potential risk factors, and herbal drug intervention. Biomed Pharmacother 2019;112:108585.
6. Luo L, Deng T, Zhao S, et al. Association Between HIV Infection and Prevalence of Erectile Dysfunction: A Systematic Review and Meta-Analysis. J Sex Med 2017;14:1125-32.
7. Xiao Y, Xie T, Peng J, et al. Factors associated with anxiety and depression in patients with erectile dysfunction: a cross-sectional study. BMC Psychol 2023;11:36.
8. Ma K, Song P, Liu Z, et al. Genetic evidence suggests that depression increases the risk of erectile dysfunction: A Mendelian randomization study. Front Genet 2022;13:1026227.
9. Liu Q, Zhang Y, Wang J, et al. Erectile Dysfunction and Depression: A Systematic Review and Meta-Analysis. J Sex Med 2018;15:1073-82.
10. Fumaz CR, Ayestaran A, Perez-Alvarez N, et al. Clinical and Emotional Factors Related to Erectile Dysfunction in HIV-Infected Men. Am J Mens Health 2017;11:647-53.
11. Huntingdon B, Muscat DM, de Wit J, et al. Factors associated with erectile dysfunction among men living with HIV: a systematic review. AIDS Care 2020;32:275-85.
12. Goldstein I, Goren A, Li VW, et al. Epidemiology Update of Erectile Dysfunction in Eight Countries with High Burden. Sex Med Rev 2020;8:48-58.
13. Quilter M, Hodges L, von Hurst P, et al. Male Sexual Function in New Zealand: A Population-Based Cross-Sectional Survey of the Prevalence of Erectile Dysfunction in Men Aged 40-70 Years. J Sex Med 2017;14:928-36.
14. Nkafu TS, Gaetan SWA, Divine EEE, et al. Prevalence of sexual dysfunction, factors, and psychological effects on adult males in the Buea Health District, Cameroon. J Public Health Epidemiol 2023;15:304-19.
15. Gomes TV, Brites C. Prevalence and risk factors for erectile dysfunction in HIV-infected patients in Salvador, Brazil. Braz J Infect Dis 2019;23:464-7.
16. Akbas S, Alcéna-Stiner DC, McMahon JM. Psychosocial risk factors of erectile dysfunction among heterosexual men living with HIV. AIDS Care 2023;35:253-60.
17. Jansen N, Daniels C, Sunil T, et al. Factors associated with erectile dysfunction diagnosis in men with HIV infection: a case-control study. HIV Med 2021;22:617-22.
18. Moreno-Pérez O, Escoín C, Serna-Candel C, et al. Risk factors for sexual and erectile dysfunction in HIV-infected men: the role of protease inhibitors. AIDS 2010;24:255-64.
19. Scofield D, Frisch M, Andersson M, et al. Psychosocial and sexual health among men with and without HIV who have sex with men: A cross-sectional nationwide study in Denmark. HIV Med 2024;25:1203-17.
20. Chirca N, Streinu-Cercel A, Stefan M, et al. A Novel Risk Calculator to Predict Erectile Dysfunction in HIV-Positive Men. J Pers Med 2023;13:679.
21. De Vincentis S, Tartaro G, Rochira V, et al. HIV and Sexual Dysfunction in Men. J Clin Med 2021;10:1088.
22. Phillips AN, Venter F, Havlir D, et al. Risks and benefits of dolutegravir-based antiretroviral drug regimens in sub-Saharan Africa: a modelling study. Lancet HIV 2019;6:e116-27.
23. Rosen RC, Cappelleri JC, Smith MD, et al. Development and evaluation of an abridged, 5-item version of the International Index of Erectile Function (IIEF-5) as a diagnostic tool for erectile dysfunction. Int J Impot Res

1999;11:319-26.
24. Gonzáles AI, Sties SW, Wittkopf PG, et al. Validation of the International Index of Erectile Function (IIFE) for use in Brazil. Arq Bras Cardiol 2013;101:176-82.
25. Lovibond PF, Lovibond SH. The structure of negative emotional states: comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. Behav Res Ther 1995;33:335-43.
26. Apóstolo JL, Mendes AC, Azeredo ZA. Adaptation to Portuguese of the Depression, Anxiety and Stress Scales (DASS). Rev Lat Am Enfermagem 2006;14:863-71.
27. Vignola RC, Tucci AM. Adaptation and validation of the depression, anxiety and stress scale (DASS) to Brazilian Portuguese. J Affect Disord 2014;155:104-9.
28. Bernal E, Torres M, Alcaraz A, et al. Association Between Erectile Dysfunction and Carotid Subclinical Atherosclerosis in HIV-Infected Patients. J Acquir Immune Defic Syndr 2019;80:429-35.
29. Santi D, Brigante G, Zona S, et al. Male sexual dysfunction and HIV--a clinical perspective. Nat Rev Urol 2014;11:99-109.
30. Li K, Liang S, Shi Y, et al. The Relationships of Dehydroepiandrosterone Sulfate, Erectile Function and General Psychological Health. Sex Med 2021;9:100386.
31. Manshadi SD, Pirdehi AK, Shahmohamadi E, et al. Prevalence of Erectile Dysfunction (ED) among People Living with HIV in Tehran, Iran. Curr HIV Res 2023;21:361-6.
32. Atalay S, Ucak HA, Caglayan D, et al. Erectile dysfunction prevalence and associated factors in men living with HIV from Western Turkey: A cross-sectional study. Int J STD AIDS 2023;34:914-20.
33. Braun M, Wassmer G, Klotz T, et al. Epidemiology of erectile dysfunction: results of the 'Cologne Male Survey'. Int J Impot Res 2000;12:305-11.
34. Guaraldi G, Luzi K, Murri R, et al. Sexual dysfunction in HIV-infected men: role of antiretroviral therapy, hypogonadism and lipodystrophy. Antivir Ther 2007;12:1059-65.
35. Zona S, Guaraldi G, Luzi K, et al. Erectile dysfunction is more common in young to middle-aged HIV-infected men than in HIV-uninfected men. J Sex Med 2012;9:1923-30.
36. Mauro GP, da Conceição Vasconcelos KGM, Carvalho HA. Quality of Life and Sexual Function of Men Who Have Sex With Men Treated for Anal Cancer: A Prospective Trial of a Neglected Population. J Sex Med 2021;18:1461-6.
37. Asboe D, Catalan J, Mandalia S, et al. Sexual dysfunction in HIV-positive men is multi-factorial: a study of prevalence and associated factors. AIDS Care 2007;19:955-65.
38. Zakumumpa H, Kiguba R, Ndagije HB, et al. Patient experiences of sexual dysfunction after transition to dolutegravir-based HIV treatment in mid-Western Uganda: a qualitative study. BMC Infect Dis 2022;22:692.
39. Ismail AMA. Is there a role for exercise in men suffering from HIV-induced erectile dysfunction. Aging Male 2023;26:2174512.
40. Enoma A, Ching SM, Hoo FK, et al. Prevalence and factors associated with erectile dysfunction in male patients with human immunodeficiency virus in a teaching hospital in West Malaysia. Med J Malaysia 2017;72:186-9.
41. Mellgren Å, Eriksson LE, Reinius M, et al. Longitudinal trends and determinants of patient-reported side effects on ART-a Swedish national registry study. PLoS One 2020;15:e0242710.
42. Schrooten W, Colebunders R, Youle M, et al. Sexual dysfunction associated with protease inhibitor containing highly active antiretroviral treatment. AIDS 2001;15:1019-23.
43. Íncera-Fernández D, Román FJ, Gámez-Guadix M. Risky Sexual Practices, Sexually Transmitted Infections, Motivations, and Mental Health among Heterosexual Women and Men Who Practice Sexualized Drug Use in Spain. Int J Environ Res Public Health 2022;19:6387.
44. De Vincentis S, Decaroli MC, Milic J, et al. Determinants of sexual function in men living with HIV younger than 50 years old: Focus on organic, relational, and psychological issues. Andrology 2023;11:954-69.
45. Salonia A, Bettocchi C, Boeri L, et al. European Association of Urology Guidelines on Sexual and Reproductive Health-2021 Update: Male Sexual Dysfunction. Eur Urol 2021;80:333-57.
46. OMS. Scoping consultation on noncommunicable diseases and mental health conditions in people living with HIV. 2021. Available online: https://www.who.int/publications-detail-redirect/9789240022393
47. Erens B, Mitchell KR, Gibson L, et al. Health status, sexual activity and satisfaction among older people in Britain: A mixed methods study. PLoS One 2019;14:e0213835.
48. Saramies J, Koiranen M, Auvinen J, et al. A Natural History of Erectile Dysfunction in Elderly Men: A Population-Based, Twelve-Year Prospective Study. J Clin Med 2022;11:2146.
49. Yafi FA, Huynh LM, Ahlering T, et al. What Is a

"Validated Questionnaire"? A Critical Review of Erectile Function Assessment. J Sex Med 2020;17:849-60.
50. Parent MC, Wille L. Heterosexual Self-Presentation, Identity Management, and Sexual Functioning Among Men Who Have Sex with Men. Arch Sex Behav 2021;50:3155-62.
51. World Health Organization. mhGAP intervention guide for mental, neurological and substance use disorders in non-specialized health settings: mental health Gap Action Programme (mhGAP). version 2.0. Geneva: World Health Organization; 2016.
52. Campbell TS, Johnson JA, Zernicke KA. General Adaptation Syndrome. In: Gellman MD. Encyclopedia of Behavioral Medicine. Cham: Springer International Publishing; 2020:926-9.

Cite this article as: Skura S, Fontanari AMV, de Azevedo LBH, Bagatini RM, Júnior VS, Benvegnú DM, Fortes PCN, Costa AB, Wendt GW, Ferreto LED. Erectile dysfunction in men with human immunodeficiency virus: prevalence and associated factors. Transl Androl Urol 2024;13(11):2396-2407. doi: 10.21037/tau-24-234

