



# Health-related quality of life assessment among people living with HIV in Rio de Janeiro, Brazil: a cross-sectional study

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## Abstract

**Purpose** To assess health-related quality of life (HRQoL) and its associated factors among people living with HIV/AIDS (PLWHA) in Rio de Janeiro, Brazil.

**Methods** A cross-sectional study including PLWHA receiving usual HIV-care at Instituto Nacional de Infectologia Evandro Chagas (INI/Fiocruz) was conducted between 2014 and 2016 in Rio de Janeiro, Brazil. The EQ-5D-3L assessed HRQoL; PHQ-2 and ASSIST were used for screening depression and substance use, respectively. Clinical variables were obtained from the INI/Fiocruz cohort database, and structured questions evaluated intimate partner violence, sexual abstinence and relationship status. Data were analysed using multivariable Tobit regression model.

**Results** A total of 1480 PLWHA were included: 64.7% were male at birth (38.4% men who have sex with men [MSM], 24.3% heterosexual men and 2% transgender women [TGW]); median age was 43.1 years, and 95.8% were receiving antiretroviral therapy. The median EQ-5D-3L utility score was 0.801. Results showed that the following factors: MSM and women; older age; lower educational level; no engagement in a relationship; depression screening positive; polysubstance use; and, detectable viral load were independently associated with worse HRQoL.

**Conclusions** PLWHA under care at INI/Fiocruz presented good HRQoL. Polysubstance use, depression and lower educational level were among the factors negatively associated with HRQoL. This was the first time that the EQ-5D-3L utility scores were calculated for a considerable number of PLWHA in Brazil, which is a fundamental piece of information for future cost-effectiveness analysis.

**Keywords** Quality of life · Gender · Age factors · Educational status · Depression · Substance abuse · Viral load, HIV

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## Introduction

HIV-related morbidity and mortality have changed over time and have transformed the way people face HIV infection, making its management similar to a chronic condition [1, 2]. The increase in survival [3], as well as the low morbidity found among people living with the HIV/AIDS (PLWHA) presenting high adherence to antiretroviral therapy (ART) [4], contributed to boost the interest on health-related quality of life (HRQoL). The evaluation of HRQoL, defined as the individual's perceived value associated with a given health state [5], allows broader and more personalized clinical decisions in HIV-care. The primary goal of HIV-treatment is reducing viral load to an undetectable level, which was shown to improve PLWHA's HRQoL [6, 7], although these specific effects of ART on HRQoL still remain inconsistent

[8, 9]. Some factors that may decrease the HRQoL of PLWHA [10] include older age [11], female gender [12, 13], substance use problems [14], current tobacco use [15] and depression [16]. Of these, depression appears to have a more adverse consequence on PLWHA [17, 18].

The assessment of HRQoL can be done using generic or disease-specific standardized questionnaires such as the EuroQol five dimensions questionnaire (EQ-5D) [19] or the WHOQOL-HIV BREF [20], respectively. The main advantage of a generic instrument is it allows comparisons across diseases. The EQ-5D, specifically, generates health utility scores used within the context of economic evaluations to establish whether a therapy or intervention is cost-effective. Thus, in addition to the individual benefits of measuring quality of life, it may be a valuable tool for public health evaluation [21]. In Brazil, studies have used WHOQOL-HIV BREF to evaluate HRQoL among PLWHA, but the EQ-5D's use is increasing due to the need of providing cost-effectiveness estimates in different areas such as HIV-treatment and prevention interventions. The present study aims to contribute to the literature by assessing HRQoL and its associated factors among PLWHA in Rio de Janeiro, Brazil.

## Methods

A cross-sectional study was conducted between July 2014 and September 2016 and included a convenience sample of PLWHA receiving care at the National Institute of Infectious Diseases Evandro Chagas (INI/Fiocruz). The inclusion criteria were: adults (> 18-year-old), attending a HIV routine appointment at INI (irrespective of ART prescription), enrolled at the INI/IPEC HIV Clinical Cohort and accepting to participate in the study. The following exclusion criteria were adopted for the present analysis: incompleteness of EQ-5D-3L, individuals presenting HIV transmission mode as mother-to-child transmission, occupational exposure, injected drug users (IDU), blood transfusion and haemophilia; all these conditions were rare events in our cohort. Considering these exclusion criteria, 13 (0.8%) patients were excluded due to missing data in the EQ-5D-3L, 32 (2.1%) due to infrequent HIV transmission mode (mother-to-child [ $n=16$ ], occupational [ $n=1$ ], IDU [ $n=6$ ], blood transfusion [ $n=8$ ], haemophilia [ $n=1$ ]) and 1 (0.1%) because he was the unique transgender men. As there were no previous estimates on EQ-5D-3L in our population, the sample size has been determined considering to interview 50% of the total number of active patients in the cohort at the beginning of the study (approximately 3000 patients). This sample size is large enough to estimate a proportion of 0.5%, with 0.3% error at a 95% confidence interval, and anticipating refusals and losses at 17% [22]. Three trained nurses explained the study and obtained written informed consent from

individuals attending their routine clinical visits. Those who consented to participate were then interviewed, as described elsewhere [23]. We had nurses in the setting covering all the working hours and inviting patients indistinctively and consecutively to participate, however we did not have measures to control for any possible missed patients in the expected sequence. The local Institutional Review Board (CAAE #7844113.2.0000.5262) approved this research.

## Outcome

HRQoL was assessed using the EuroQoL 5 Dimensions 3 Levels (EQ-5D-3L), a generic standardized questionnaire that evaluates three levels of severity (no problems, some or moderate problems, extreme problems) of five dimensions (mobility, self-care, usual activities, pain/discomfort, anxiety/depression) within a 4-week recall period [19]. This instrument has been validated in Brazil [24] and includes the EuroQol visual analogue scale (EQ VAS), a tool used to record self-rated health on a vertical scale ranging between 0 and 100.

## Measures

Sex at birth, education level, relationship status, sexual abstinence and intimate partner violence (IPV) information were measured using structured questions and analysed as categorical variables. Gender identity was ascertained using HIV exposure data both from the questionnaire and the cohort database. TGW were previously identified from the cohort database. If an individual, male at birth, reported at least one episode of sex with men, he was considered MSM. The date of birth, self-reported colour/race, dates of HIV diagnosis, enrolment at HIV cohort, initiation of ART, viral loads (VL) and CD4<sup>+</sup> cell counts (CD4) were obtained from the INI/Fiocruz clinical cohort database [25].

Sexual compulsive behaviour (SCB) was measured using the 10-item Sexual Compulsivity Scale (SCS) in which participants are asked to state their sexual-related personal situations and/or views. Answers were recorded in 4-point scales [26].

Depression was screened using the Patient Health Questionnaire-2 (PHQ-2), a two-item questionnaire where answers were measured on a 4-point *Likert* scale and for a recall period of 2 weeks [27].

Substance use was assessed using the WHO Alcohol, Smoking and Substance Involvement Screening Test (ASSIST). ASSIST screens lifetime substance use and for those who report any lifetime use it evaluates substance use patterns using a 5-point *Likert* frequency scale and 3-month recall period [28]. Polysubstance in prior 3 months considered the report of more than one illicit substance (cannabis,

cocaine, amphetamine, inhalants, sedatives, hallucinogens, and/or opioids).

PHQ-2, ASSIST and SCS were previously validated in Brazil [29–31]. Further description for each independent variable is shown in Online Resource 1.

## Statistical analysis

### EQ-5D-3L health utility calculation

The EQ-5D-3L derived utility score was the dependent variable, thus it was required that each participant had all the 5 dimensions of EQ-5D-3L fulfilled. If one or more dimensions were left blank, the patient was dropped from the analysis. A Stata command called `eq5d` was used for calculation of utility score [32]. The command was previously adapted using Brazilian value sets obtained from a representative sample of general population of Brazil [21]. The final EQ-5D-3L utility score for each individual is a number usually ranging between 0 (representing death) and 1 (full health), that can even be slightly negative in situations hypothetically considered worse than death.

Independent variables are described by their absolute and relative frequencies. EQ-5D-3L utility score is described using the median and interquartile range (IQR), overall and by each independent variable. Bivariate Tobit regression models were used to estimate the association between the factors and the dependent variable EQ-5D-3L utility scores (HRQoL). After bivariate analysis, variables with  $p$  values  $< 0.20$  were entered in the full multivariable Tobit regression model. The final Tobit regression model was reached through backward elimination of the variables with highest  $p$  values until every factor had at least one category with the  $p$  value of less than 0.10. The variable selection process avoided stepwise procedures.

Multivariable linear regression models with the same variables of the full and final models were run only to assess multicollinearity using variance inflation factor diagnostics (VIF). The level of significance adopted was 5% and the Stata software version 15 was used for statistical analysis [33].

## Results

Final analysis sample was comprised of 1480 participants: 64.7% were male at birth (38.4% MSM, 24.3% heterosexual men, and 2% TGW), median age was 43.1 years (IQR 34.9–50.8), 52.3% self-reported a black or mixed skin colour and 75.0% had  $\leq 12$  years of study. The most frequent relationship status was “not engaged” (63.2%), 18.4% reported sexual abstinence and 13.1% reported IPV lifetime. Most of the participants (95.8%) were on ART (69.7% for more

than 3 years), 57.7% with  $CD4 > 500$ , the median  $CD4$  nadir was 192 (IQR 74–320) and 69.3% presented  $VL < 50$ —as depicted in Table 1.

The overall median of the EQ-5D-3L utility score was 0.801 (IQR 0.7–1), and Table 2 shows dimension-detailed EQ-5D-3L results. The most affected dimension of the EQ-5D-3L was anxiety/depression, with 46.8% of participants reporting moderate to severe problems, followed by pain/discomfort with 34.5% and mobility with 15.3%. Considering only extreme problems, they were found in the anxiety/depression dimension of EQ-5D-3L for 10% of the participants, and in pain/discomfort dimension for 4.6%. All the other dimensions had less than 1% of extreme problems. Similarly to the utility scores summary results, EQ-5D-3L Visual Analogue Scale (EQ VAS) median was 80 (IQR 70–99).

Overall, 1.6% screened positive for SCB. The PHQ-2 results showed that 21.3% of the participants screened positive for depression. Regarding substance use, 34.3% reported alcohol use in the last 3 months, 21% tobacco use and 2.4% polysubstance use (Table 2).

Table 3 describes the summary statistics including median and IQR of EQ-5D-3L utility scores by characteristics of the participants. In the bivariate Tobit regression models (Table 3), the following variables were associated with EQ-5D-3L scores: sex at birth; gender identity; years of age; years of study; relationship status; sexual abstinence; intimate partner violence; depression screening; tobacco use; polysubstance use; years since HIV diagnosis; years on ART;  $CD4$  and  $VL$ . These variables were included in the initial multivariable model. Multicollinearity was present in the full model when “sex at birth” and “gender identity” were both included. “Sex at birth” was dropped and “gender identity” was kept in the full model because it was more informative.

The final multivariable Tobit regression model results (coefficient;  $p$  value) showed that factors significantly associated with lower HRQoL were: MSM vs. heterosexual men ( $-0.051$ ;  $< 0.01$ ), women vs. heterosexual men ( $-0.087$ ;  $< 0.01$ ); age  $> 60$  years vs.  $< 30$  years ( $-0.083$ ;  $< 0.05$ ); no education vs.  $> 12$  years of formal education ( $-0.149$ ;  $< 0.01$ ),  $< 8$  vs.  $> 12$  years of formal education ( $-0.084$ ;  $< 0.01$ ), 9–12 vs.  $> 12$  years of formal education ( $-0.035$ ;  $p < 0.05$ ); no relationship vs. engaged in a relationship ( $-0.034$ ;  $< 0.05$ ); sexual abstinence vs. no ( $-0.042$ ;  $< 0.05$ ); positive depression screening vs. negative ( $-0.152$ ;  $< 0.01$ ); polysubstance use vs. no use ( $-0.110$ ;  $< 0.01$ ); years with HIV  $< 1$  vs. 1–10 ( $-0.110$ ;  $< 0.01$ ); years on ART 1–3 vs.  $< 1$  year ( $-0.092$ ;  $< 0.05$ ), years on ART  $> 3$  vs.  $< 1$  ( $-0.073$ ;  $< 0.05$ ); viral load  $\geq 50$  vs.  $< 50$  ( $-0.047$ ;  $< 0.01$ ) (Table 4). No multicollinearity was found for factors in the final model (mean VIF = 1.96, and highest VIF = 5.64 considering all levels of factors scored).

**Table 1** Characteristics of 1480 PLWHA in Rio de Janeiro, Brazil

Factor	Level	n (%)
Sex at birth	Male	958 (64.7%)
	Female	522 (35.3%)
Gender identity	MSM	569 (38.4%)
	Heterosexual men	359 (24.3%)
	Women	522 (35.3%)
	Transgender women	30 (2.0%)
Years of age	<30	187 (12.6%)
	30–39	395 (26.7%)
	40–59	777 (52.5%)
	>60	121 (8.2%)
Self-reported black or mixed skin colour	No	698 (47.2%)
	Yes	774 (52.3%)
	Missing	8 (0.5%)
Years of study	No study	25 (1.7%)
	<9	473 (32.0%)
	9–12	612 (41.4%)
	>12	351 (23.7%)
	Missing	19 (1.3%)
Relationship status	Engaged	540 (36.5%)
	Not engaged	935 (63.2%)
	Missing	5 (0.3%)
Sexual abstinence	No	1205 (81.4%)
	Yes	272 (18.4%)
	Missing	3 (0.2%)
Intimate partner violence	No	1277 (86.3%)
	Yes	194 (13.1%)
	Missing	9 (0.6%)
Years since HIV diagnosis	<1	66 (4.5%)
	1–10	827 (55.9%)
	>10	587 (39.7%)
Years enrolled in HIV cohort	<1	108 (7.3%)
	1–3	246 (16.6%)
	>3	1126 (76.1%)
Years on ART	Naive	62 (4.2%)
	<1	106 (7.2%)
	1–3	281 (19.0%)
	>3	1031 (69.7%)
CD4 nadir	<200	755 (51.0%)
	200–500	601 (40.6%)
	>500	124 (8.4%)
CD4	<200	118 (8.0%)
	200–500	403 (27.2%)
	>500	854 (57.7%)
	Missing	105 (7.1%)
	HIV viral load	<50
	≥50	384 (25.9%)
	Missing	71 (4.8%)
Overall		1480 (100.0%)

**Table 1** (continued)

Numeric variable	Median (IQR)
Age in years	43.1 (34.9–50.8)
CD4 nadir	192 (74–320)

*n* number of observations, *IQR* interquartile range

**Table 2** Description of EQ-5D-3L, SCS, PHQ-2 and ASSIST results among 1480 PLWHA in Rio de Janeiro, Brazil

EQ-5D-3L dimension	Level	<i>n</i> (%)
Mobility	No problems	1254 (84.7%)
	Some problems	219 (14.8%)
	Extreme problems	7 (0.5%)
Self-care	No problems	1415 (95.6%)
	Some problems	58 (3.9%)
	Extreme problems	7 (0.5%)
Usual activities	No problems	1364 (92.2%)
	Some problems	105 (7.1%)
	Extreme problems	11 (0.7%)
Pain/discomfort	No problems	969 (65.5%)
	Some problems	443 (29.9%)
	Extreme problems	68 (4.6%)
Anxiety/depression	No problems	788 (53.2%)
	Some problems	544 (36.8%)
	Extreme problems	148 (10.0%)
Overall		1480 (100%)
EQ-5D-3L visual analogue scale		Median (IQR)
EQ VAS		80 (70–99)
Sexual compulsivity (SCS)	Level	<i>n</i> (%)
Sexual compulsivity	No	1438 (97.2%)
	Yes	24 (1.6%)
	Missing	18 (1.2%)
Depression screening (PHQ-2)	Level	<i>n</i> (%)
Depression	Negative	1159 (78.3%)
	Positive	315 (21.3%)
	Missing	6 (0.4%)
ASSIST	Level	<i>n</i> (%)
Alcohol use in the last 3 months	No	971 (65.6%)
	Yes	508 (34.3%)
	Missing	1 (0.1%)
Tobacco use in the last 3 months	No	1169 (79.0%)
	Yes	311 (21.0%)
Polysubstance use in the last 3 months	No	1443 (97.5%)
	Yes	35 (2.4%)
	Missing	2 (0.1%)

*n* number of observations, *IQR* interquartile range

Although intimate partner violence did not remain in the final model it has affected a considerable proportion of the individuals (13.1%), and was significantly higher among

MSM (11.4%), TGW (26.7%) and women (18%) than in heterosexual men (7.5%) ( $p < 0.001$ ). Additionally, there were gender differences for relationship status, sexual abstinence,

**Table 3** Summary statistics of EQ-5D-3L utility scores by all categorical variables among 1480 PLWHA in Rio de Janeiro, Brazil

Factor	Level	Median	p25	p75	p value
Sex at birth	Male	0.801	0.737	1.000	Reference
	Female	0.787	0.692	1.000	<0.01
Gender identity	Msm	0.801	0.737	1.000	0.082
	Heterosexual men	1.000	0.737	1.000	Reference
	Women	0.787	0.692	1.000	<0.01
	Transgender women	0.794	0.737	1.000	0.165
Years of age	<30	0.801	0.737	1.000	Reference
	30–39	0.801	0.737	1.000	0.955
	40–59	0.801	0.737	1.000	<0.01
	>60	0.737	0.633	1.000	<0.01
Self-reported black or mixed skin colour	No	0.801	0.737	1.000	Reference
	Yes	0.801	0.737	1.000	0.216
	Missing	0.715	0.603	1.000	
Years of study	No study	0.737	0.513	0.801	<0.01
	<9	0.787	0.681	1.000	<0.01
	9–12	0.801	0.737	1.000	<0.05
	>12	0.801	0.756	1.000	Reference
	Missing	0.801	0.756	1.000	
Relationship status	Engaged	0.801	0.737	1.000	Reference
	Not engaged	0.801	0.731	1.000	<0.01
	Missing	1.000	0.801	1.000	
Sexual abstinence	No	0.801	0.737	1.000	Reference
	Yes	0.787	0.667	1.000	<0.01
	Missing	0.787	0.756	0.801	
Sexual compulsivity (SCS)	No	0.801	0.737	1.000	Reference
	Yes	0.801	0.715	1.000	0.442
	Missing	0.794	0.690	1.000	
Intimate partner violence	No	0.801	0.737	1.000	Reference
	Yes	0.787	0.692	1.000	<0.01
	Missing	0.801	0.737	1.000	
Depression screening (PHQ-2)	Negative	0.801	0.737	1.000	Reference
	Positive	0.737	0.633	0.801	<0.01
	Missing	0.894	0.737	1.000	
Alcohol use in the last 3 months	No	0.801	0.737	1.000	Reference
	Yes	0.801	0.737	1.000	0.832
	Missing	0.737	0.737	0.737	
Tobacco use in the last 3 months	No	0.801	0.737	1.000	Reference
	Yes	0.801	0.737	1.000	<0.01
Polysubstance use in the last 3 months	No	0.801	0.737	1.000	Reference
	Yes	0.737	0.617	0.801	<0.01
	Missing	0.796	0.592	1.000	
Years since HIV diagnosis	<1	0.801	0.731	1.000	0.068
	1–10	0.801	0.737	1.000	Reference
	>10	0.801	0.692	1.000	<0.01
Years enrolled in HIV cohort	<1	0.801	0.737	1.000	Reference
	1–3	0.801	0.737	1.000	0.232
	>3	0.801	0.737	1.000	0.585
Years on ART	Naive	0.801	0.754	1.000	0.360
	<1	0.801	0.737	1.000	Reference
	1–3	0.801	0.737	1.000	0.657
	>3	0.801	0.737	1.000	0.156

**Table 3** (continued)

Factor	Level	Median	p25	p75	<i>p</i> value
CD4 nadir	< 200	0.801	0.737	1.000	Reference
	200–500	0.801	0.737	1.000	0.688
	> 500	0.801	0.737	1.000	0.991
CD4	< 200	0.787	0.667	1.000	< 0.05
	200–500	0.801	0.737	1.000	0.422
	> 500	0.801	0.737	1.000	Reference
	Missing	0.801	0.737	1.000	0.847
HIV viral load	< 50	0.801	0.737	1.000	Reference
	≥ 50	0.787	0.692	1.000	< 0.01
	Missing	0.801	0.737	1.000	0.878
Overall		0.801	0.737	1.000	

p25 and p75, percentile 25 and 75%, respectively, lower and upper bounds of interquartile range; *p* value estimated by bivariate Tobit regression models using EQ-5D-3L index and each factor

sexual compulsivity, depression screening, substance use and other variables (Online Resource 2).

## Discussion

### Key study findings

Our study was able to estimate EQ-5D-3L health utilities among a considerable number of PLWHA in Rio de Janeiro, showing distinctive HRQoL results for this population. Moreover, the multivariate model identified that lower utility scores were independently associated with several factors, as following: MSM or women gender identities, older age, less years of study, no engagement in relationship, sexual abstinence, depression, polysubstance use, recent HIV diagnosis, years on ART and detectable viral load.

The EQ-5D utility scores in our study suggest that most participants have good HRQoL, although mean scores were lower than found among general population (0.821 vs. 0.889 obtained among 4001 participants from Brazilian Amazon) [34]. To our knowledge, there were no previous studies using EQ-5D to evaluate HRQoL among PLWHA in Brazil or Latin America, and the scores may be useful for future cost-effectiveness studies in the region. A study conducted in the United Kingdom (UK) showed that PLWHA had a mean EQ-5D-3L utility score of 0.74 which was also lower than general population score (0.82) [35]. Scores in Brazil for PLWHA were higher reflecting better quality of life, but most of the previous studies have used other instruments like the WHOQOL-HIV BREF [17, 36]. Our results show that specific subgroups could benefit from tailored interventions with the aim to improve their HRQoL. Lower HRQoL was found among those presenting lower educational level, positive depression screening and polysubstance use. These findings suggest that HRQoL could be improved, with gain

of 0.14 of utility score (14% of a full health score), through implementation of interventions to eradicate non-literacy, for example.

### Association of sociodemographic factors with HRQoL

Concerning the role of sociodemographic factors, older age and lower education levels were negatively associated with HRQoL, similar to found in an Italian study [11]. It is possible that higher education levels leads to better capacity to cope with HIV, contributing to improve subjective well-being [37], self-rated health [22] and HRQoL. Controversies related to age and HRQoL have been reported. In a study with 308 HIV-positive Brazilians it was found that younger age (< 35 years) was associated with worse HRQoL measured with WHOQOL-HIV [36]. Younger age and worse HRQoL was also observed in another research with 227 patients from the Northeast of Brazil [38]. However, many studies have similar findings to our study, reporting that older age is a factor negatively associated to HRQoL [8, 9, 39, 40]. Memory difficulties, anxiety and depression, gender, ethnicity, financial factors and relationship status were reported as contributors to less quality of life in people with HIV over the age of 50 [41]. Research on ageing with HIV needs attention given improvement of survival, and quality of life should be taken in account together with the co-morbidities and frailty discussion [42].

In contrast to research that did not find difference related to gender in HRQoL [11], in our study and also in others [43, 44], being a woman was independently associated with lower HRQoL. These results suggest that gender is a determinant of HRQoL, and that quality of life differences between genders need to be tackled. Other important contribution to this debate is a study that used the WHOQOL-HIV BREF and found that three predominant psychosocial

**Table 4** Tobit regression model with HRQoL (EQ-5D-3L utility scores) as dependent variable for PLWHA in Rio de Janeiro, Brazil

	Coef.	SE	95% CI lower bound	95% CI upper bound	p value
<b>Gender identity</b>					
MSM vs. hetero. men	−0.051	0.019	−0.088	−0.013	<0.01
Women vs. hetero. men	−0.087	0.018	−0.122	−0.052	<0.01
Transgender women vs. hetero. men	−0.020	0.048	−0.115	0.075	0.68
<b>Years of age</b>					
30–39 vs. <30	−0.002	0.024	−0.048	0.044	0.94
40–59 vs. <30	−0.032	0.024	−0.079	0.015	0.18
>60 vs. <30	−0.083	0.034	−0.149	−0.016	<0.05
<b>Years of study</b>					
No study vs. >12	−0.149	0.053	−0.252	−0.046	<0.01
<8 vs. >12	−0.084	0.019	−0.122	−0.046	<0.01
9–12 vs. >12	−0.035	0.017	−0.069	0.000	<0.05
<b>Relationship status</b>					
Not engaged vs. engaged	−0.034	0.015	−0.063	−0.006	<0.05
<b>Sexual abstinence</b>					
Yes vs. no	−0.042	0.018	−0.078	−0.005	<0.05
<b>Depression screening</b>					
Positive vs. negative	−0.152	0.016	−0.183	−0.121	<0.01
<b>Polysubstance use</b>					
Yes vs. no	−0.110	0.042	−0.193	−0.028	<0.01
<b>Years since HIV diagnosis</b>					
<1 vs. 1–10	−0.110	0.041	−0.191	−0.028	<0.01
>10 vs. 1–10	−0.030	0.016	−0.062	0.001	0.06
<b>Years on ART</b>					
ART naive vs. <1	−0.049	0.043	−0.132	0.035	0.25
1–3 vs. <1	−0.092	0.036	−0.163	−0.022	<0.05
>3 vs. <1	−0.073	0.035	−0.141	−0.005	<0.05
<b>HIV viral load</b>					
≥50 vs. <50 copies/ml	−0.047	0.016	−0.078	−0.016	<0.01
Missing	−0.004	0.032	−0.066	0.058	0.90
Constant	1.166	0.043	1.082	1.251	<0.01

32 individuals were excluded due to missing values in one or more of these factors: years of study, relationship status, sexual abstinence, depression screening, and polysubstance use; missing indicator method was used for HIV viral load

$R^2 = 0.22$ ;  $N = 1448$ ; Coef., coefficient; SE, standard error; CI, confidence interval

pathways for HRQoL were not significant for women [13], reinforcing the existence of complex gender differences in the determination of quality of life. Of note, MSM also presented lower HRQoL compared to heterosexual men. It is possible that factors such as stigma, discrimination and barriers to reach holistic health care [45, 46] can be also affecting disproportionately their quality of life. In addition, these individuals may be more prone to other vulnerabilities such as IPV. Overall IPV prevalence was 13.1%, but was significantly higher among MSM, TGW and women (7.5% among hetero men, 11.4% MSM, 26.7% TGW and 18.0% among women). This frequency is higher (13.1% vs. 7%) than found among HIV negative MSM/TGW looking for PrEP [47] and additional studies should investigate reasons

for such discrepancy in order to motivate public policies directed to prevent and manage IPV, especially in populations disproportionately affected by HIV [48, 49].

Our results showed that not being engaged in a relationship was independently associated with lower HRQoL. This was reported before [40] and might reflect the effect of loneliness. Similarly, sexual abstinence after HIV diagnosis is a frequent problem that affects negatively the HRQoL of individuals independently of sex/gender [50]. Previous research showed that HIV-care, ART and health improvement were associated with an increase in sexual activity [51]. Though we have no means of assessing how sexual activity has changed over time in our population (most of them were on ART), we did find that sexual abstinence was high (18.4%

overall, 13.9% among hetero men, 13.0% MSM, 1.0% TGW and 28.2% among women).

### Mental health and substance use and HRQoL

There is well-established evidence on the association of substance use, depression and HRQoL [17, 52–54], that we corroborate with the present as well as in a recent study focusing on SRH [22]. Considering that non-specialists could manage most depression cases [55], training staff to systematic screen and treat individuals in care should be considered a next step to achieve better HRQoL. We also found that recent (< 1 year) HIV infection was associated with lower HRQoL, compared with those who were living with HIV for 1–10 years. A decline in HRQoL shortly after HIV infection was previously reported [9]. Future studies should investigate if, in the period from 1 to 10 years with HIV, individuals could cope more with the HIV and with its treatment and still do not have the long-term consequences of the disease, ageing and co-morbidities associated [14]. In a similar way, being on ART for a time period between 1 and 3 years, or for more than 3 years were associated with lower HRQoL in comparison with less than 1 year of ART. A decrease in the physical health dimension of HRQoL with time under ART was previously reported [9]. This might occur because the early benefits of the ART cannot be noticed anymore, and the need of taking daily medications, attending medical care and possible side effects might weight more in the balance [56].

### HRQoL association with HIV clinical outcomes and study limitations

Although we did not find association between HRQoL and CD4<sup>+</sup> cell counts, a detectable viral load was significantly associated with a lower HRQoL. It is possible that HRQoL may be improved by achieving HIV viral suppression, the final goal of HIV-care. On the other hand, a good quality of life can influence patients' adherence, and consequently the achievement of viral suppression [57, 58]. As our study design was cross-sectional, this possible reverse-causality bias may not be excluded, and findings need to be confirmed by longitudinal studies. In addition, data must be generalized with caution, considering the non-probabilistic sample that may not represent the entire population of PLWHA in the country. Considering data were collected by interviewers, it is not possible to rule out social desirability bias and associated overestimation of HRQoL, but studies using EQ-5D-3L have also used this method [59, 60].

Research evidence showed that HIV sexual transmission did not occur even after unprotected sex with a HIV-positive individuals with undetectable viral load [61], supporting an Undetectable = Untransmittable (U = U)

statement and worldwide campaign [62]. This knowledge might improve PLWHA's HRQoL and particularly can reduce the proportion of non-engagement in relationship that was still considerable high in our study.

### Conclusions

This was the first time that the EQ-5D-3L utility scores were calculated for a considerable number of PLWHA in Brazil, which is a fundamental piece of information for future cost-effectiveness analysis. Overall, EQ-5D-3L utility scores were high, indicating good HRQoL, and several factors were associated with lower HRQoL in similarity to studies using other instruments in the country.

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### Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethical approval** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Informed consent** Informed consent was obtained from all individual participants included in the study.

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