

# Poor Oral Health-Related Quality of Life and Frailty Among PLWHIV: A Cross-Sectional Study

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## ABSTRACT

**Aims:** This study aimed to explore the association between frailty and pre-frailty in people living with human immunodeficiency virus (PLWHIV), focusing on their oral health-related quality of life (OHRQoL) and health-related quality of life (HRQoL). **Materials and Methods:** A cross-sectional study was conducted with 184 PLWHIV. Frailty status was assessed using Fried's frailty criteria, categorizing participants as robust, pre-frail, or frail. The oral health profile was evaluated using the World Health Organization and European Association of Public Dental Health criteria. OHRQoL was assessed using the Oral Health Impact Profile-14 (OHIP-14), while HRQoL was measured using the 36-Item Short-Form Health Survey version 2 (SF-36v2). Descriptive statistics were calculated, and associations were analyzed using Spearman's correlation and one-way ANOVA, with significance set at  $P \leq 0.05$ . **Results:** The pre-frail and frail PLWHIV groups reported significantly lower HRQoL scores across all domains compared to the robust group. Additionally, robust PLWHIV exhibited better oral health outcomes, with higher mean OHIP-14 scores ( $P = 0.005$ ), attributed to fewer missing teeth ( $P = 0.019$ ) and a higher number of filled teeth ( $P = 0.031$ ). The total OHIP-14 score showed a moderate negative correlation with various SF-36v2 domains, particularly in the pre-frail and frail groups. Specifically, physical pain and physical disability subdomains of HRQoL were most affected by poorer OHRQoL. **Conclusions:** Frail and pre-frail PLWHIV demonstrated significantly poorer OHRQoL compared to robust PLWHIV, with a particular impact on physical pain and physical disability. A negative correlation between OHRQoL and HRQoL was evident, especially in the frail and pre-frail groups, highlighting the interrelationship between oral health and overall well-being in this population. Clinically, this suggests that improving OHRQoL could be an essential component of healthcare for frail and pre-frail PLWHIV, as enhancing oral health may positively influence their general health outcomes. Targeted interventions to manage frailty and improve oral health are needed to enhance both OHRQoL and HRQoL in this vulnerable group.

**KEYWORDS:** Cross-sectional studies, frailty, HIV infections, oral health, quality of life

Received : 09-May-2024  
Revised : 24-Nov-2024  
Accepted : 26-Nov-2024  
Published : 27-Dec-2024

## INTRODUCTION

Advancements in drug therapies and the implementation of antiretroviral therapy mean that the human immunodeficiency virus (HIV)

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**How to cite this article:** Santos-Lins LS, Santos MS, Amaral S, Alves CRB, Lins-Kusterer L. Poor oral health-related quality of life and frailty among PLWHIV: A cross-sectional study. J Int Soc Prevent Communit Dent 2024;14:515-22.

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**Website:** <https://journals.lww.com/jpcd>

**DOI:**  
10.4103/jispcd.jispcd\_65\_24

infection is now a chronic disease, with a longer life expectancy.<sup>[1]</sup> However, HIV infection may induce a generalized inflammatory state, due to the secretion of inflammatory cytokines (IL-1 $\beta$ , IL-6, and TNF $\alpha$ ), premature aging, and an increased risk of developing chronic noninfectious diseases (heart disease, systemic arterial hypertension, bone fractures, kidney failure, diabetes mellitus, dental caries, and periodontal disease) compared to the population without HIV infection. This may significantly impact their rates of morbidity, mortality, and health-related quality of life (HRQoL).<sup>[2-7]</sup>

The frailty phenotype (FP) was described by Fried *et al.*<sup>[8]</sup> in 2001. It is prevalent in older age groups and defined by the presence of three or more of the following criteria: unintentional weight loss, exhaustion, slow walking speed, weakness, and low levels of physical activity.<sup>[8]</sup> Studies indicate that FP occurs early in people living with HIV (PLWHIV), about 10 years prior to its incidence in people without HIV.<sup>[9-11]</sup> The presence of comorbidities, increased length of hospital stays, a history of acquired immunodeficiency syndrome (AIDS), socioeconomic characteristics (income, education, and occupation), and laboratory characteristics (low CD4 count and detectable viral load) have all been associated with frailty in PLWHIV.<sup>[5,10,11]</sup> Furthermore, some studies suggest that the inflammatory state caused by HIV infection can trigger the progression of frailty,<sup>[5,12]</sup> while frailty may lead to an increased inflammatory and coagulation markers and<sup>[13]</sup> cognitive decline and sarcopenia, which may have a significant impact on the HRQoL.<sup>[11,14,15]</sup>

Oral problems, such as a cavitated teeth, periodontal treatment needs, gingival abscesses, and bad breath, may impact oral health-related quality of life (OHRQoL).<sup>[16,17]</sup> Periodontal disease is characterized by the host's immune response, involving the secretion of pro-inflammatory cytokines in response to pathogenic bacteria in the dental biofilm.<sup>[18]</sup> Dental caries is a chronic bacterial disease that can lead to toothache, cavities, and tooth loss.<sup>[19,20]</sup> Some studies reveal poor oral health status in PLWHIV, with a high prevalence of periodontal disease, and decayed and missing teeth, which impact on general health (GH), HRQoL, and OHRQoL.<sup>[6,7,17,21]</sup> However, other studies describe an association between frailty and poor oral health, emphasizing the low number of teeth and poor OHRQoL,<sup>[15,22]</sup> including the role of the oral health status in the progression of frailty.<sup>[22-24]</sup> To our knowledge, there are no OHRQoL data on frailty in PLWHIV. This study aims to describe the association between frailty and pre-frailty among PLWHIV and OHRQoL and HRQoL.

## MATERIALS AND METHODS

This cross-sectional study was carried out at the Professor Edgard Santos University Hospital Complex in Salvador, Bahia, Northeast Brazil, between March 2019 and June 2020. All the participants were from the Brazilian HIV-AIDS cohort (CoBRA) and were monitored by Infectious Diseases Outpatient Clinics. Inclusion criteria were HIV ribonucleic acid viral load below 50 copies/mL and age 18 years or above. To control bias, all the patients were assessed by the same team for the frailty parameters, OHRQoL, HRQoL, and oral health. Furthermore, since this is a university hospital within Brazil's Public Health System, which specializes in the care and specific needs of PLWHIV, the sample is representative of frailty among PLWHIV.

## ETHICS

This study received approval from the Ethics Committee of the School of Medicine at the Federal University of Bahia under protocol number 1.035.826. It adhered to the ethical guidelines outlined in Brazilian National Health Council Resolution 466/2012 and the 2013 Declaration of Helsinki. All participants provided written informed consent.

## FRAILTY

The FP was diagnosed using Fried's criteria.<sup>[8]</sup> Weight loss was defined as an unintentional weight loss of 5% body mass, comparing medical records and actual weight. Weakness was assessed by grip strength using an electronic hand dynamometer (CAMRY, EH101) to obtain the average of three measures from the dominant hand. Self-reported exhaustion was assessed through two questions from the Center for Epidemiological Studies Depression Scale.<sup>[25]</sup> Walking speed was measured by the patient walking 4.6 m, three times, at their normal speed. The Minnesota Leisure Time Activities Questionnaire assessed the level of physical activity.<sup>[26]</sup>

## ORAL HEALTH EVALUATION

The oral health profile was assessed using the criteria from the World Health Organization<sup>[24]</sup> and the European Association of Public Dental Health.<sup>[25]</sup> Periodontal screening and recording was used to assess periodontal diseases,<sup>[27]</sup> gingivitis was characterized as the presence of gingival bleeding and/or dental calculus, and periodontitis was characterized as alveolar bone loss using a World Health Organization periodontal probe. The number of decayed, missing, and filled teeth (DMF-T Index), stimulated salivary flow, and presence of oral lesions were also documented.

### ORAL HEALTH-RELATED QUALITY OF LIFE

The Oral Health Impact Profile 14 (OHIP-14) is a widely recognized instrument used to assess OHRQoL and provide evidence of how oral health can affect wellbeing. The questionnaire is composed of 14 questions, in a Likert-type scale coded as 0 = “never”; 1 = “hardly ever”; 2 = “occasionally”; 3 = “fairly often”; 4 = “very often.” The total score can range from 0 to 56, with higher scores reflecting poor OHRQoL.<sup>[28]</sup> The questions broadly address oral health issues, enabling patients to use the scale to describe the extent to which these problems interfere with their daily activities. The OHIP-14 can be divided into seven subscales: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap.<sup>[29]</sup> However, a one-dimensional scale hypothesis is accepted by some authors.<sup>[30,31]</sup>

### HEALTH-RELATED QUALITY OF LIFE

We used the 36-Item Short-Form Health Survey version 2 (SF-36v2) to assess the HRQoL. This is composed of eight domains: physical functioning (PF), role physical (RP), bodily pain (BP), GH, vitality (VT), social functioning (SF), role emotional (RE),

and mental health (MH). The physical component summary (PCS) is composed of the PF, RP, BP, GH, VT, and SF domains, while the mental component summary (MCS) includes the GH, VT, SF, RE, and MH domains. Domains were normalized to a mean of 50 with a standard deviation of 10 (OPTUM PRO CoRE v 1.4.7, license number QM053374).<sup>[32]</sup>

### VARIABLES AND STATISTICS

The dependent variable was the FP; the independent variables were OHRQoL, HRQoL, and oral health. Statistical analysis was performed using Statistical Package for the Social Sciences version 21 (IBM Corporation, Armonk, NY, USA). We used the chi-square test to compare proportions between groups and the prevalence ratio to evaluate the prevalence of the dependent variable for the other covariates. We applied the Mann–Whitney *U* test to compare the two groups' means. To correlate the OHIP-14 total score and the SF-36v2 domains and summaries, we used Spearman's correlation, while Cohen's classification was used to interpret these data.<sup>[33]</sup> We applied a significance level of 5% (0.05) and a confidence interval of 95% and based our power analysis on the OHIP-14 means, comparing

**Table 1: Sociodemographic data and habits of 184 patients living with human immunodeficiency virus, according to frailty criteria, Salvador, Bahia, Brazil, 2021**

	Pre-frailty/frailty N = 104	Robust N = 80	PR*	P value**
Age – N (%)				0.044
>50 years	71 (62.3)	43 (37.7)	1.32 (0.99–1.79)	
≤49 years	33 (47.1)	37 (52.9)	1	
Sex – N (%)				0.061
Female	48 (64.9)	26 (35.1)	1.27 (0.99–1.63)	
Male	56 (50.9)	54 (49.1)	1	
Race – N (%)				0.718
Black/Brown	94 (57)	71 (43)	1.08 (0.69–1.69)	
White	10 (52.6)	9 (47.4)	1	
Family income – N (%)†				0.049
Less or equal than BRL 1212	46 (65.7)	24 (34.3)	1.29 (1.01–1.65)	
More than BRL 1212	58 (50.9)	56 (49.1)	1	
Educational status – N (%)				0.345
Elementary	41 (63.1)	24 (36.9)	1.30 (0.87–1.94)	
High school	47 (54.7)	39 (45.3)	1.13 (0.75–1.68)	
College	16 (48.5)	17 (51.5)	1	
Marital status – N (%)				0.438
Stable relationship	30 (61.2)	19 (38.8)	1.18 (0.85–1.46)	
Single	74 (54.8)	61 (45.2)	1	
Tobacco use – N (%)				0.755
No	95 (56.9)	72 (43.1)	1.07 (0.67–1.71)	
Yes	9 (52.9)	8 (47.1)	1	
Alcohol consumption – N (%)				0.028
No	56 (65.1)	30 (34.9)	1.33 (1.03–1.71)	
Yes	48 (49)	50 (51)	1	

\*PR: prevalence ratio \*\*Chi-square Test †In Brazilian Reais BRL

the frailty groups<sup>[34]</sup> (G-Power, version 3.1.9.7). The total sample consisted of 108 patients, 54 in each group. Efforts were made to increase the sample size by increasing the case group by 30%.

**RESULTS**

The frequency of frailty/pre-frailty in PLWHIV aged 50 years and above was 32% higher than that observed in

the younger participants. PLWHIV with a family income less than or equal to one minimum wage (approximately United States Dollar 250.00) were 29% more likely to present as frail/pre-frail compared to the group with a higher family income (more than 1 minimum wage, as shown in Table 1). In addition, alcohol consumption was significantly lower in the frailty/pre-frailty group than in robust PLWHIV ( $P = 0.02$ ).

**Table 2: Oral health profile of 184 patients living with human immunodeficiency virus according to frailty criteria, Salvador, Bahia, Brazil, 2021**

	Pre-frailty/frailty N = 104	Robust N = 80	PR*	P value
Decayed, M ± SD	1.38 ± 2.34	1.30 ± 2.13	–	0.720*
Missed, M ± SD	12.76 ± 8.86	9.70 ± 7.94	–	0.019*
Filled, M ± SD	4.50 ± 4.50	6.00 ± 5.04	–	0.031*
Decayed, missing, and filled teeth index, M ± SD	18.64 ± 7.66	17.00 ± 8.18	–	0.181*
Periodontal disease, n (%)				0.125†
Gingivitis	22 (68.8)	10 (31.3)	1.27 (0.97–1.68)	
Periodontitis	82 (53.9)	70 (46.1)	1	
Low salivary flow, n (%)				0.986†
Yes	38 (55.9)	30 (44.1)	1.00 (0.77–1.31)	
No	63 (55.8)	50 (44.2)	1	
Presence of oral lesions, n (%)				0.492†
Yes	28 (60.9)	18 (39.1)	1.10 (0.84–1.45)	
No	76 (55.1)	62 (44.9)	1	

M = mean, SD = standard deviation

\*PR: prevalence ratio \*\*Mann–Whitney U test †Chi-square test

**Table 3: Oral health-related quality of life (OHIP-14) and health-related quality of life (SF-36 domains) of 184 patients living with human immunodeficiency virus, according to frailty criteria, Salvador, Bahia, Brazil, 2021**

	Cronbach α	Pre-frailty/frailty N = 104 M ± SD	Robust N = 80 M ± SD	P value*
Total OHIP-14	0.820	11.53 ± 8.98	7.91 ± 7.19	0.005
Functional limitation	–	0.74 ± 1.34	0.7 ± 1.38	0.760
Physical pain	–	2.78 ± 1.93	1.65 ± 1.88	<0.0001
Psychological discomfort	–	2.3 ± 2.5	1.84 ± 1.89	0.482
Physical disability	–	2.29 ± 2	1.5 ± 1.62	0.007
Psychological disability	–	1.81 ± 1.97	1.28 ± 1.64	0.087
Social disability	–	0.59 ± 1.16	0.44 ± 0.94	0.450
Handicap	–	1.03 ± 1.54	0.51 ± 1.04	0.025
Physical functioning	0.913	47.27 ± 10.45	53.74 ± 5.13	<0.0001
Role physical	0.941	48.33 ± 10.90	55.39 ± 3.86	<0.0001
Bodily pain	0.838	48.57 ± 11.48	54.31 ± 9.65	<0.0001
General health	0.782	49.80 ± 11.39	54.57 ± 7.89	0.011
Vitality	0.852	52.20 ± 11.22	58.21 ± 7.63	<0.0001
Social functioning	0.765	48.28 ± 10.38	52.51 ± 8.03	0.003
Role emotional	0.914	47.19 ± 11.19	51.21 ± 8.42	0.010
Mental health	0.823	47.79 ± 11.34	52.75 ± 8.88	0.002
Physical component summary	–	48.85 ± 10.78	55.36 ± 5.78	<0.0001
Mental component summary	–	48.74 ± 11.23	52.45 ± 8.58	0.044

M = mean, SD = standard deviation

\*Mann–Whitney U test



**Table 4: Spearman's correlation between oral health impact profile 14 (OHIP-14) total mean and 36-item short-form health survey version 2 (SF-36v2) domains and summaries of 184 patients living with human immunodeficiency virus, according to frailty criteria, Salvador, Bahia, Brazil, 2021**

SF-36 v2 domains and summaries	Pre-frailty/frailty (N=115)		Robust (N=84)	
	OHIP-14	p-value	OHIP-14	p-value
Physical functioning (PF)	-0,184*	0,049	-0,372**	<0,0001
Role physical (RP)	-0,174	0,063	-0,402**	<0,0001
Bodily pain (BP)	-0,184*	0,05	-0,170	0,123
General Health (GH)	-0,323**	<0,0001	-0,142	0,197
Vitality (VT)	-0,381**	<0,0001	-0,287**	0,008
Social functioning (SF)	-0,357**	<0,0001	-0,343**	0,001
Role emotional (RE)	-0,340**	<0,0001	-0,395**	<0,0001
Mental health (MH)	-0,279**	0,003	-0,122	0,271
Physical component summary (PCS)	-0,167	0,074	-0,246*	0,024
Mental component summary (MCS)	-0,382**	<0,0001	-0,253*	0,02

\*The correlation was significant at 0.05 level (2-tailed). \*\* The correlation was significant at 0.01 level (2-tailed).

Pre-frail/frail PLWHIV had fewer filled teeth and more missing teeth than robust PLWHIV. All the participants had some periodontal disease, as well as gingivitis and/or periodontitis. The following oral lesions were detected: candidiasis ( $n = 19$ ), leukoplakia ( $n = 5$ ), oral frictional keratosis ( $n = 5$ ), periapical fistula ( $n = 4$ ), oral traumatic ulcer ( $n = 3$ ), actinic cheilitis ( $n = 2$ ), pyogenic granuloma ( $n = 2$ ), oral nodule ( $n = 2$ ), erythematous lesions ( $n = 2$ ), melanocytic lesion ( $n = 1$ ), oral lymphoepithelial cyst ( $n = 1$ ), oroantral communication ( $n = 1$ ), and hairy leukoplakia ( $n = 1$ ). Table 2 summarizes these oral health findings.

Pre-frail/frail PLWHIV had lower mean HRQOL scores in all the domains and summaries. Robust PLWHIV had higher OHIP-14 mean scores, which correlated with low scores for decayed, missing, total DMF-T, and a high number of filled teeth [Table 3].

The OHIP-14 total mean score showed a moderate negative correlation between certain SF-36v2 domains and summaries (GH, VT, SF, RE, and MCS) in the pre-frailty/frailty group [Table 4]. In the robust group, the domains PF, RP, SF, and RE also demonstrated a moderate negative correlation with the OHIP-14 total score [Table 4].

## DISCUSSION

Frailty is a syndrome observed in older adults and is most prevalent in people aged 65 years or above.<sup>[8]</sup> In our study, most of the frail PLWHIV were aged 50 years or above. This difference can be explained by the fact that PLWHIV may present with accelerated biological aging due to the HIV infection, leading to earlier onset of the FP.<sup>[35]</sup> Frailty affects more PLWHIV than those who are not HIV-infected, particularly women.<sup>[14,36]</sup> Lower income is considered a risk factor for frailty,<sup>[8,37]</sup>

as is poor oral health and less access to healthcare services.<sup>[38]</sup> In this work, PLWHIV with a family income less than or equal to 1 minimum wage exhibited more frailty/pre-frailty than robust PLWHIV.

A previous cross-sectional study in Brazil<sup>[32]</sup> described an association between the absence of functional dentition and frailty in PLWHIV, characterizing it as a risk factor for frailty in women.<sup>[24]</sup> In addition, the frailty and pre-frailty groups used more prostheses than the robust PLWHIV, which may indicate previous experience of dental caries and/or periodontitis. A systematic review<sup>[22]</sup> defined oral frailty as a decrease in the oral function with a decline in cognitive and physical functions. In our sample, the pre-frailty/frailty group had more missing teeth and fewer filled teeth compared to the robust PLWHIV, indicating poor oral function (speaking, chewing, and self-esteem) in this group.

In the OHIP categories, physical pain is any experience of oral pain or discomfort when eating. The physical disability OHIP refers to the impacts of teeth, mouth, and a prosthesis on meals.<sup>[28]</sup> In our study, the pre-frailty/frailty group had poor OHRQoL, particularly with regards to physical pain and physical disability. This can be explained by the fact that the causes of orofacial pain include dental caries, oral lesions, periodontal disease, muscle pain, temporomandibular joint pain, and facial neuropathy.<sup>[16,39]</sup> The physical disability associated with the poor OHRQoL in the pre-frailty/frailty group can be explained by the fact that they had more missing teeth and fewer filled teeth.

Compared to the robust PLWHIV, we observed a poor HRQoL in the pre-frailty/frailty group. PLWHIV had worse HRQoL than patients not infected with HIV in both the mental and physical domains.<sup>[14]</sup> Furthermore,

poor/fair quality of life was associated with frailty, three or more comorbidities, and one geriatric syndrome. The negative impact of frailty on quality of life is higher than that observed in geriatric syndrome and comorbidities in older PLWHIV.<sup>[36]</sup> The poor HRQoL in the pre-frailty/frailty group can be explained by the main findings used to diagnose frailty<sup>[8]</sup>: sarcopenia, weakness, and exhaustion. Moreover, in PLWHIV, low HRQoL is associated with depressive symptoms.<sup>[35]</sup>

The OHIP was developed to measure the individual perception of the social impact of oral disorders on wellbeing<sup>[28]</sup> in relation to perceived GH. A preliminary study by our research group demonstrated an association between poor HRQoL, comorbidities, and poor oral health in PLWHIV.<sup>[6]</sup> Moreover, the poor MCS was associated with a high DMF-T index summary in PLWHIV with depression.<sup>[6]</sup> The OHRQoL can sometimes have a greater impact on the physical and mental components of HRQoL than clinical oral features.<sup>[40]</sup>

One study<sup>[41]</sup> proposed models to analyze the correlation between the OHRQoL and HRQoL. In all these models, the OHRQoL was strongly correlated with the mental and physical health dimensions of HRQoL. In our study, poor OHRQoL was correlated with certain domains linked to the MCS (GH, VT, SF, and RE) and the MCS in the pre-frailty/frailty group. The negative impact of OHRQoL on HRQoL is clear, particularly on the mental component. In addition, in the robust PLWHIV, poor OHRQoL was correlated with the PF, RP, and SF domains related to the PCS. Oral aspects and OHRQoL can, therefore, affect HRQoL in both the mental and physical dimensions.

This study has certain limitations, such as its small sample size and the inherent limitations of observational studies. Future prospective studies are, therefore, required to explore how OHRQoL affects overall HRQoL and frailty among HIV patients and how targeted dental care interventions could reduce frailty or improve OHRQoL in frail PLWHIV. This vulnerable population requires public policies to maximize their access to dental care in order to improve their OHRQoL.

## CONCLUSION

Frail/pre-frail PLWHIV presented with poor OHRQoL compared to the robust PLWHIV, particularly in relation to physical pain and physical disability. Low OHRQoL was correlated with poor HRQoL in the pre-frailty/frailty group.

## ACKNOWLEDGEMENT

Not applicable.

## FINANCIAL SUPPORT AND SPONSORSHIP

This study was financed in part by the Coordenacao de Aperfeicoamento de Pessoal de Nivel Superior – Brasil (CAPES) – Finance Code 001. CNPQ Research Fellowship - QUALIDADE DE VIDA RELACIONADA À SAÚDE E DESENVOLVIMENTO DE INSTRUMENTOS (Processo CNPq: 303398/2021-3). 01.

## CONFLICTS OF INTEREST

There are no conflict of interest.

## AUTHORS CONTRIBUTIONS

Authors make substantial contributions to conception and design, and/or acquisition of data, and/or analysis and interpretation of data: LSSL and LLK. Authors participate in interpretation of data: MSS, SVBANA, and CRBA. Authors participate in drafting the article: LSSL and LLK. Authors participate revising the article critically for important intellectual content: MSS, SVBANA, and CRBA. Authors give final approval of the version to be submitted and any revised version: LSSL, MSS, SVBANA, CRBA, and LLK.

## ETHICAL POLICY AND INSTITUTIONAL REVIEW BOARD STATEMENT

This study was approved by Ethic Committee of School of Medicine, Federal University of Bahia, by protocol number (1.035.826), following the Ethical guidelines of Brazilian National Health Council Resolution 466/2012 and the 2013 Declaration of Helsinki.

## PATIENT DECLARATION OF CONSENT

All patients signed a consent form.

## DATA AVAILABILITY STATEMENT

Not applicable.

## Abbreviations

PLWHIV People living with HIV  
 OHRQoL Oral health-related quality of life  
 HRQoL Health-related quality of life  
 OHIP-14 Oral Health Impact Profile 14  
 SF-36v2 36-Item Short-Form Health Survey version 2  
 ART Antiretroviral therapy  
 HIV Human immunodeficiency virus  
 FP Frailty phenotype  
 AIDS Acquired immunodeficiency syndrome  
 PD Periodontal disease  
 RNA Ribonucleic acid  
 CES-D Center for Epidemiological Studies Depression  
 PSR Periodontal screening and recording  
 DMF-T Index Decayed, missing, and filled teeth  
 PF Physical functioning  
 RP Role physical

BP Bodily pain  
 GH General health  
 VT Vitality  
 SF Social functioning  
 RE Role emotional  
 MH Mental health  
 PCS Physical component summary  
 MCS Mental component summary  
 USD United States Dollar

## REFERENCES

- Porter K, Babiker A, Bhaskaran K, Darbyshire J, Pezzotti P, Porter K, *et al*; CASCADE Collaboration. Determinants of survival following HIV-1 seroconversion after the introduction of HAART. *Lancet* 2003;362:1267-74.
- Guaraldi G, Orlando G, Zona S, Menozzi M, Carli F, Garlassi E, *et al*. Premature age-related comorbidities among HIV-infected persons compared with the general population. *Clin Infect Dis* 2011;53:1120-6.
- Silva JVF, Silva EC, Rodrigues APRA, Miyazawa AP. A relação entre o envelhecimento populacional e as doenças crônicas não transmissíveis: Serio desafio de saúde pública. *Ciências Biológicas e da Saúde* 2015;2:91-100.
- Deeks SG. HIV infection, inflammation, immunosenescence, and aging. *Annu Rev Med* 2011;62:141-55.
- Piggott DA, Muzaale AD, Mehta SH, Brown TT, Patel KV, Leng SX, *et al*. Frailty, HIV infection, and mortality in an aging cohort of injection drug users. *PLoS One* 2013;8:e54910.
- da Costa Vieira V, Lins L, Sarmiento VA, Netto EM, Brites C. Oral health and health-related quality of life in HIV patients. *BMC Oral Health* 2018;18:1-7.
- Liberali SA, Coates EA, Freeman AD, Logan RM, Jamieson L, Mejia G. Oral conditions and their social impact among HIV dental patients, 18 years on. *Aust Dent J* 2013;58:18-25.
- Fried LP, Tangen CM, Walston J, Newman AB, Hirsch C, Gottdiener J, *et al*. Frailty in older adults: Evidence for a phenotype. *J Gerontol A Biol Sci Med Sci* 2001;56:M146-57.
- Desquilbet L, Jacobson LP, Fried LP, Phair JP, Jamieson BD, Holloway M, *et al*; Multicenter AIDS Cohort Study. HIV-1 infection is associated with an earlier occurrence of a phenotype related to frailty. *J Gerontol A Biol Sci Med Sci* 2007;62:1279-86.
- Önen NF, Agbebi A, Shacham E, Stamm KE, Önen AR, Overton ET. Frailty among HIV-infected persons in an urban outpatient care setting. *J Infect* 2009;59:346-52.
- Zeballos D, Lins L, Brites C. Frailty and its association with health related quality of life in older HIV patients, in Salvador, Brazil. *AIDS Res Hum Retroviruses* 2019;35:1074-81.
- Fukui SM, Piggott DA, Erlandson KM. Inflammation strikes again: Frailty and HIV. *Curr HIV/AIDS Rep* 2018;15:20-9.
- Walston J, McBurnie MA, Newman A, Tracy RP, Kop WJ, Hirsch CH, *et al*; Cardiovascular Health Study. Frailty and activation of the inflammation and coagulation systems with and without clinical comorbidities: Results from the Cardiovascular Health Study. *Arch Intern Med* 2002;162:2333-41.
- Rubtsova AA, Sabbag S, Sundermann E, Nguyen AL, Ellis RJ, Moore DJ, *et al*. Frailty and neurocognitive impairment: Impacts on quality of life in HIV. *J Assoc Nurses AIDS Care* 2020;31:290-300.
- Hakeem FF, Bernabé E, Sabbah W. Association between oral health and frailty among American older adults. *J Am Med Dir Assoc* 2020;22:1-7.
- Sánchez GA, D'Eramo LR, Lecumberri R, Squassi AF. Impact of oral health care needs on health-related quality of life in adult HIV+ patients. *Acta Odontol Latinoam* 2011;24:92-7.
- Mohamed N, Saddki N, Yusoff A, Mat Jelani A. Association among oral symptoms, oral health-related quality of life, and health-related quality of life in a sample of adults living with HIV/AIDS in Malaysia. *BMC Oral Health* 2017;17:1-11.
- Lindhe J, Karring T, Lang NP. *Tratado de Periodontia Clínica e Implantologia Oral*. 4th ed. Rio de Janeiro: Guanabara Koogan; 2005.
- MacEntee MI. Missing links in oral health care for frail elderly people. *J Can Dent Assoc* 2006;72:421-5.
- Gao L, Xu T, Huang G, Jiang S, Gu Y, Chen F. Oral microbiomes: More and more importance in oral cavity and whole body. *Protein Cell* 2018;9:488-500.
- de Quadros Coelho M, Cordeiro JM, Vargas AMD, de Barros Lima Martins AME, de Almeida Santa Rosa TT, Senna MIB, *et al*. Functional and psychosocial impact of oral disorders and quality of life of people living with HIV/AIDS. *Qual Life Res* 2015;24:503-11.
- Dibello V, Zupo R, Sardone R, Lozupone M, Castellana F, Dibello A, *et al*. Oral frailty and its determinants in older age: A systematic review. *Lancet Healthy Longev* 2021;2:e507-20.
- Kimble R, Papacosta AO, Lennon LT, Whincup PH, Weyant RJ, Mathers JC, *et al*. The relationship of oral health with progression of physical frailty among older adults: A longitudinal study composed of two cohorts of older adults from the United Kingdom and United States. *J Am Med Dir Assoc* 2023;24:468-74.e3.
- Wiechmann SL, Tejo AM, Inácio MVS, Mesas AE, Martínez-Vizcaino V, Cabrera MAS. Frailty in people 50 years or older living with HIV: A sex perspective. *HIV Med* 2023;24:1222-32.
- Radloff LS. The CES-D scale: A self-report depression scale for research in the general population. *Appl Psychol Meas* 1977;1:385-401.
- Lustosa LP, Pereira DS, Dias RC, Britto RR, Parentoni AN, Má LS, *et al*. Tradução e adaptação transcultural do Minnesota Leisure Time Activities Questionnaire em idosos. *Geriatr Gerontol Aging* 2011;5:57-65.
- Landry RG, Jean M. Periodontal screening and recording (PSR) index: Precursors, utility and limitations in a clinical setting. *Int Dent J* 2002;52:35-40.
- Slade GD. Derivation and validation of a short-form oral health impact profile. *Community Dent Oral Epidemiol* 1997;25:284-90.
- Cohen-Carneiro F, Rebelo MAB, Souza-Santos R, Ambrosano GMB, Salino AV, Pontes DG. Psychometric properties of the OHIP-14 and prevalence and severity of oral health impacts in a rural riverine population in Amazonas State, Brazil. *Cad Saude Publica* 2010;26:1122-30.
- dos Santos CM, de Oliveira BH, Nadanovsky P, Hilgert JB, Celeste RK, Hugo FN. The oral health impact profile-14: A unidimensional scale? *Cad Saude Publica* 2013;29:749-57.
- Santos-Lins LS, Aguiar ILS, Codes L, Evangelista MA, de Oliveira Castro A, Bittencourt P L, *et al*. Poor oral health-related quality of life in pre- and post-liver transplantation patients. *Open Dent J* 2021;15:196-203.
- Lins-Kusterer L, Valdelamar J, Aguiar CVN, Menezes MS, Netto EM, Brites C. Validity and reliability of the 36-item short form health survey questionnaire version 2 among people living with HIV in Brazil. *Braz J Infect Dis* 2019;23:313-21.

33. Cohen J. Statistical power analysis for the behavioral sciences. *Biometrics* 1970;26:588.
34. da Mata C, Allen PF, McKenna GJ, Hayes M, Kashan A. The relationship between oral-health-related quality of life and general health in an elderly population: A cross-sectional study. *Gerodontology* 2019;36:71-7.
35. Pathai S, Lawn SD, Gilbert CE, McGuinness D, McGlynn L, Weiss HA, *et al.* Accelerated biological ageing in HIV-infected individuals in South Africa: A case-control study. *AIDS* 2013;27:2375-84.
36. Brañas F, Torralba M, Antela A, Vergas J, Ramírez M, Ryan P, *et al.*; FUNCFRAIL study group. Effects of frailty, geriatric syndromes, and comorbidity on mortality and quality of life in older adults with HIV. *BMC Geriatr* 2023;23:1-10. .
37. Bandeen-Roche K, Seplaki CL, Huang J, Buta B, Kalyani RR, Varadhan R, *et al.* Frailty in older adults: A nationally representative profile in the United States. *J Gerontol A Biol Sci Med Sci* 2015;70:1427-34.
38. de Lucena EHG, da Silva RO, Barbosa ML, de Araújo ECF, Pereira AC, Cavalcanti YW. Influence of socioeconomic status on oral disease burden: A population-based study. *BMC Oral Health* 2021;21:4-11.
39. Mendez M, Melchior Angst PD, Stadler AF, Oppermann RV, Gomes S. Impacts of supragingival and subgingival periodontal treatments on oral health-related quality of life. *Int J Dent Hyg* 2017;15:135-41.
40. Lee IC, Shieh TY, Yang YH, Tsai CC, Wang KH. Individuals' perception of oral health and its impact on the health-related quality of life. *J Oral Rehabil* 2007;34:79-87.
41. Sekulić S, John MT, Davey C, Rener-Sitar K. Association between oral health-related and health-related quality of life. *Zdr Varst* 2020;59:65-74.