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ORIGINAL ARTICLE

Predictors of poor health-related quality of life among people living with HIV aged ≥60 years in the PISCIS cohort: Findings from the Vive+ project

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Abstract

Introduction: Advancements in and accessibility to effective antiretroviral therapy has improved the life expectancy of people living with HIV, increasing the proportion of people living with HIV reaching older age (≥60 years), making this population's health-related quality of life (HRQoL) more relevant. Our aim was to identify the determinants of poor HRQoL in people living with HIV aged ≥60 years and compare them with those of their younger counterparts.

Methods: We used data from the 'Vive+' study, a cross-sectional survey conducted between October 2019 and March 2020, nested within the PISCIS cohort of people living with HIV in Catalonia and the Balearic Islands, Spain.

Predictors of poor health-related quality of life among people living with HIV aged ≥60 years in the PISCIS cohort: findings from the Vive+ project.

See Appendix A for PISCS study group details.

Prospective Health in Spain; International Cohort Consortium of Infectious Disease (RESPOND); HIV-CAUSAL; ART-CC; COHERE

We used the 12-item short-form survey (SF-12), divided into a physical component summary (PCS) and a mental component summary (MCS), to evaluate HRQoL. We used the least absolute shrinkage and selection operator for variable selection and used multivariable regression models to identify predictors.

Results: Of the 1060 people living with HIV (78.6% males) who participated in the study, 209 (19.7%) were aged ≥60 years. When comparing older people living with HIV (≥60 years) and their younger counterparts, older people exhibited a worse PCS (median 51.3 [interquartile range {IQR} 46.0–58.1] vs. 46.43 [IQR 42.5–52.7], $p < 0.001$) but a similar MCS (median 56.0 [IQR 49.34–64.7] vs. 57.0 [IQR 48.9–66.3], $p = 0.476$). In the multivariable analysis, cognitive function correlated with a PCS (β correlation factor *[β]* −0.18, $p = 0.014$), and depressive symptoms and satisfaction with social role correlated with an MCS (β 0.61 and β −0.97, respectively, $p < 0.001$) in people living with HIV aged ≥60 years.

Conclusion: Depressive symptoms, poor cognitive function, and lower satisfaction with social roles predict poorer HRQoL in older people living with HIV. These factors need to be considered when designing targeted interventions.

KEYWORDS

ageing, AIDS, cognitive function, depressive symptoms, health-related quality of life, HIV

INTRODUCTION

The introduction of combined antiretroviral therapy resulted in a steep decline in overall mortality rates in people living with HIV and a sustained decline over time [1]. This chronicity of HIV infection has led to a growing proportion of older people living with HIV. Globally, the proportion of people living with HIV aged >50 years has increased from 8% in 2000 to 16% in 2016, and was projected to reach 21% in 2020 [2]. As of 2019, over half (51%) of people living with HIV in the USA were aged ≥50 years, and nearly 22% were aged ≥60 years [3].

Within PISCIS, a population-based cohort of people living with HIV (covering >80% of people living with HIV in follow-up) in Catalonia and the Balearic Islands (Spain), the proportion of people living with HIV aged ≥60 years is estimated to be 11.8% [4]. These patients, under Spain's universal health system, are seen by the HIV clinic every 3 to 6 months and receive free combined antiretroviral therapy. Under the framework of a person-centred healthcare system, patients may also receive general and specialist medical coverage for other ailments. The prospect of long-term survival in people living with HIV has made it crucial to understand their health-related needs and to foster better health-related quality of life (HRQoL) in this population [5].

HRQoL is a comprehensive and multidimensional indicator that assesses the overall health status of individuals, capturing both physical and mental well-being, and the impact on their quality of life. It includes various aspects such as self-perceived health status, emotional and physical functioning, and social well-being. HRQoL takes into account the positive and negative aspects of health, making it a valuable tool for understanding the burden of preventable diseases, injuries, and disabilities [6]. For individuals with chronic medical conditions, HRQoL also considers how their disease and treatment affects their daily functioning and level of disability. HRQoL is highly subjective and unique to each individual. It is critical to understand the needs and values of patients, particularly those living with chronic illnesses [7].

Existing data report varying levels and different determinants of HRQoL in different settings [8]. People living with HIV face a variety of social problems, which can affect their HRQoL, both physically and mentally. Poorer HRQoL in people living with HIV has been consistently associated with several factors. These include stigma and low social support [9, 10], depression and stress, lower socioeconomic status, lower educational status, sexual dissatisfaction, lower self-esteem, being female, being heterosexual, having acquired HIV through intravenous drug use, and living longer with HIV [10–14].

The study of HRQoL is especially relevant in older people living with HIV, as older age has been associated with lower HRQoL in different studies [14–16], including in our setting [17]. The synergic effects of ageing and HIV result in premature senescence and immune decline,

potentially accelerating the ageing process [18] but this remains a subject of debate [19]. Although the exact nature of this relationship between HIV and ageing is still being investigated, it underscores the importance of comprehensive care for ageing people living with HIV. Understanding the HRQoL of people living with HIV is vital because improved quality of life is associated with better clinical outcomes.

Through the Vive+ project, extensive HRQoL data of people living with HIV were registered for the first time in Catalonia and the Balearic Islands. The objectives of this study were to compare the HRQoL of older people living with HIV (aged ≥60 years) with that of their younger counterparts and to identify the determinants of poor quality of life in these two groups of people living with HIV in Catalonia and the Balearic Islands, Spain.

METHODS

Study design, place of study, and period

The quality of life, habits, and lifestyles of people living with HIV in Catalonia and the Balearic Islands (Vive+) project is a cross-sectional study nested within the PISCIS cohort. This allowed other variables related to patients' clinical longitudinal follow-up, such as time living with HIV, CD4 count, and viral load at moment of HIV diagnosis could be included in the study. More detail on PISCIS can be obtained elsewhere [4]. Eligible participants were all people living with HIV aged ≥18 years who attended one of the units of the PISCIS cohort under clinical follow-up in one of the participating hospitals: 15 in Catalonia and two in the Balearic Islands. We excluded people who did not understand Spanish or had intellectual limitations that hindered their ability to comprehend the survey or sign the consent form. We conducted the study between October 2019 and March 2020.

Sample size

From the 14 190 people in follow-up in PISCIS during 2017, considering 5% statistical significance, 3% accuracy, and 30% participation turn downs, we estimated a required sample size of 1191 to predict at least a 30% prevalence of anxiety-depression (as a major surrogate for worse HRQoL) in our population [20]. We oversampled people aged ≥60 years to assure a significant proportion of this subpopulation. This sample size was distributed proportionally among the participating hospitals based on the number of individuals they had in follow-up.

Logistics and instruments of data collection

Eligible people living with HIV were invited to participate in the study by the attending clinician or by a study representative. Electronic tablets were given to participants so they could complete the self-administered online questionnaire. Paper questionnaires were also offered if the participant preferred this option or if internet connectivity was lost. The Vive+ monitor/representative was present to attend to participants' doubts or questions. Data were collected by a survey divided into six sections: sociodemographic, quality of life/well-being, relationships, lifestyle/drug use, stigma/discrimination, and use of the healthcare system.

The surveys were conducted in a separate room or space within the waiting room, and participants completed them in around 20 minutes. No economic incentives were given to the participants or to the recruiting agents.

Sociodemographic, relationship, and lifestyle variables collected were gender, education, employment status, monthly income, living companions, time spent taking care of a family member, time spent doing leisure activities, HIV mode of transmission and year of infection, sexual satisfaction, relationship status, nicotine dependency, recreational drug use, injected drugs, and sexualized drug use.

Participants who had full-time or part-time jobs, were self-employed, or were students were categorized as 'employed'.

Those who answered as being, in general, 'very satisfied' or 'satisfied' with their sex life were categorized as 'sexually satisfied', and those who answered 'unsatisfied' or 'very unsatisfied' were counted as 'not sexually satisfied'.

Participants spending at least 1 h a week taking care of a family member (minor or non-self-sufficient adults) were considered a 'caretaker of family member'.

Relationship status was categorized in four groups depending on their sexual partners: no sexual partners, stable partner, occasional partners, and stable and occasional partners. Steady partner was considered the person to whom the participant felt committed above anyone else. Occasional partner was any sexual partner who did not fulfil the 'steady partner' criteria.

Sexualized use of drugs was considered when a participant had consumed any of the listed drugs with the intention of having a long sex session (from hours to days), one on one, in a threesome or group, in a private house, or in a commercial venue where sex is practiced (saunas, sex clubs, club swinger).

We assessed HRQoL using the 12-item short-form survey (SF-12v1), a freely distributed questionnaire [21]. The SF-12 is arguably the most widespread for

assessment of general quality of life and has been used since the 1990s as it is devised to scale comparisons between specific groups and the general population. It consists of 12 items ranging between 3 to 5 points each, and measures HRQoL in two dimensions: the physical component score (PCS) and the mental component score (MCS) [22]. Total scores ranged from 0 to 100 and were calculated using the bidimensional response process model algorithm [23], based on item response theory [24]. Higher scores are indicative of poorer health.

We measured depressive symptoms in the previous 2 weeks using the Patient Health Questionnaire (PHQ-9), which consists of nine items that add up to 27 points. PHQ-9 can be used as a continuous marker for depressive symptoms and categorized in five levels (0–5 = no depression, 6–10 = mild, 11–15 = moderate, 16–20 = moderately severe, >20 = severe).

We assessed isolation using the Patient-Reported Outcomes Measurement Information System (PROMIS®) item bank version 2.0—Social Isolation 8a [25], which referenced perceptions of being avoided, excluded, or unknown by other people, without establishing a timeframe. In terms of scoring, each question has five response options, scored from 1 to 5. We obtained the total raw score by adding the values of the responses for each item and transforming them into T-scores, with a mean of 50 and a standard deviation (SD) of 10. We assessed satisfaction with participation in social roles and activities, cognitive function, and stigma using the specified Neuro-QOL item banks. Lower scores for social roles and cognitive function and higher scores for isolation and stigma were considered poorer.

Tobacco and nicotine dependence were measured using the Fagerström Test, consisting of six items that are summed to yield a total score of 0–10 (0–3 = low dependence, 4–6 = moderate dependence, 7–10 = high dependence). Alcohol consumption was measured using the AUDIT-C, a three-item questionnaire used to screen patients for hazardous (risky) and harmful alcohol consumption. Harmful consumption was considered as ≥4 points in women and ≥5 points in men. For transgender people, we used biological sex to determine harmful alcohol consumption thresholds.

We obtained HIV RNA viral load and CD4 cell count closest to the date of the survey within 12 months before or after the survey date and concomitant comorbidities at the time of the survey from the PISCIS cohort database. HIV undetectable viral load was defined as values <50 copies/ml, and CD4 count was split into two categories: ≤350 and >350 cells/mm^3. Patients' comorbidities at the time of the survey were grouped according to the categories established within the Swedish National study of Aging and Care in Kungsholmen [26].

Drug use was categorized into three clusters based on which recreational drugs (poppers, phosphodiesterase-5 blockers and other erectile dysfunction medication, natural or synthetic cannabinoids, amphetamines, methamphetamines, mephedrone or other synthetic stimulants, gamma hydroxybutyrate [GHB]/gamma butyrolactone [GBL], ketamine, lysergic acid diethylamide [LSD], and cocaine) the participant had used during the previous 12 months. We ran the model from 1 to 10 latent classes and eventually chose the optimal number after considering the following indicators: the lowest value of the adjusted Bayesian information criterion, the consistent Akaike information criterion, the entropy index (values close to 0.80), interpretability, and clinical criteria. Further details on the methodology and results of this latent class analysis can be found in Bayes-Marin et al. [17]. Cluster 1 mainly contained patients who did not consume drugs or mostly consumed common drugs (cannabis, cocaine, Viagra or poppers), with a 4% polyconsumption of two drugs at most. In cluster 2, there was a >50% prevalence of common drug consumption (cannabis, cocaine, or poppers), a low consumption of stimulants (3,4-methylenedioxymethamphetamine [MDMA], amphetamines, and methamphetamines), and polyconsumption between two and six drugs. Cluster 3 contained patients with a high consumption of common stimulants, sexualized drugs (GHB, mephedrone, Viagra), and ketamine and a higher polyconsumption: 4–13 drugs taken during the previous year.

Statistical analyses

We used multiple imputation algorithms to deal with missing data for all potential confounding and exposure variables among all participants. In total, 20 imputed datasets were generated and can be consulted at Bayes-Marin et al. [17]. We performed a descriptive analysis of all patients aged <60 and ≥60 years. The number of transgender male and female participants was low, so we combined these into one group to give greater statistical power. We expressed categorical variables as counts and percentages, and we used measures of central tendency and dispersion for quantitative variables (median and interquartile range [IQR] or mean and SDs). Proportions for categorical variables were compared using χ^2, and continuous variables were compared using the *t*-test.

To assess any differences in HRQoL within each categorical variable, we described median values of PCS and MCS and compared them using the Mann–Whitney *U* or Kruskal–Wallis test, where appropriate. We also looked at correlations between quality of life and other

continuous variables using Spearman's rank correlation coefficient.

We used multivariable linear regression models to identify risk factors associated with poor quality of life, providing unadjusted and adjusted odds ratios with 95% confidence intervals (CIs), stratified by age groups (<60 and ≥60 years). To avoid over-fitting and to determine which variables to adjust for, we used the least absolute shrinkage and selection operator (LASSO) regressions as a variable selection model.

In the LASSO regressions, we also fixed gender and country of birth as potential confounding variables in all models. In patients aged <60 years, we adjusted the PCS and MCS models by gender, country of birth, education level, occupation, monthly income, mode of transmission, sexual orientation, overall satisfaction with sex life, disclosure of serostatus, CD4 cell count at survey, number of comorbidities, nicotine dependence, sexual risk behaviour in the previous 6 months, alcohol consumption, drug consumption patterns, injection drug use, depressive symptoms score, satisfaction with social role, stigma and discrimination, cognitive function, and social isolation. In patients aged ≥60 years, we adjusted the models by mode of transmission, overall satisfaction with sex life, CD4 cell count at survey, number of comorbidities, nicotine dependence, injection drug use, depressive symptoms score, satisfaction with social role, and cognitive function.

Statistical significance was set at a *P*-value of <0.05 (two-sided) and a *P*-value of <0.01 (two-sided) for Spearman's correlation. We performed all analyses using R statistical software, version 4.1.0.

Ethical considerations

All participants provided written informed consent prior to participation. The study was approved by the Germans Trias i Pujol University Hospital ethics committee (ref. num: PI-19-172) and by the ethics committees of all participating hospitals.

Further details are described in the Vive+ final report [27].

RESULTS

A total of 1092 patients were approached to participate in the study, and 1060 accepted (2.9% refusal rate). Of these, 851 (80.3%) were aged <60 years and 209 (19.7%) were aged ≥60 years (Figure 1). Participants were predominantly male (78.6% [$n = 833$]); 18.1% ($n = 192$) were female and 3.3% ($n = 35$) were transgender. Participants' education level varied: 51.3% ($n = 544$) had completed a degree of higher education, 26.8% had completed secondary school ($n = 284$), and 21.9% had not completed

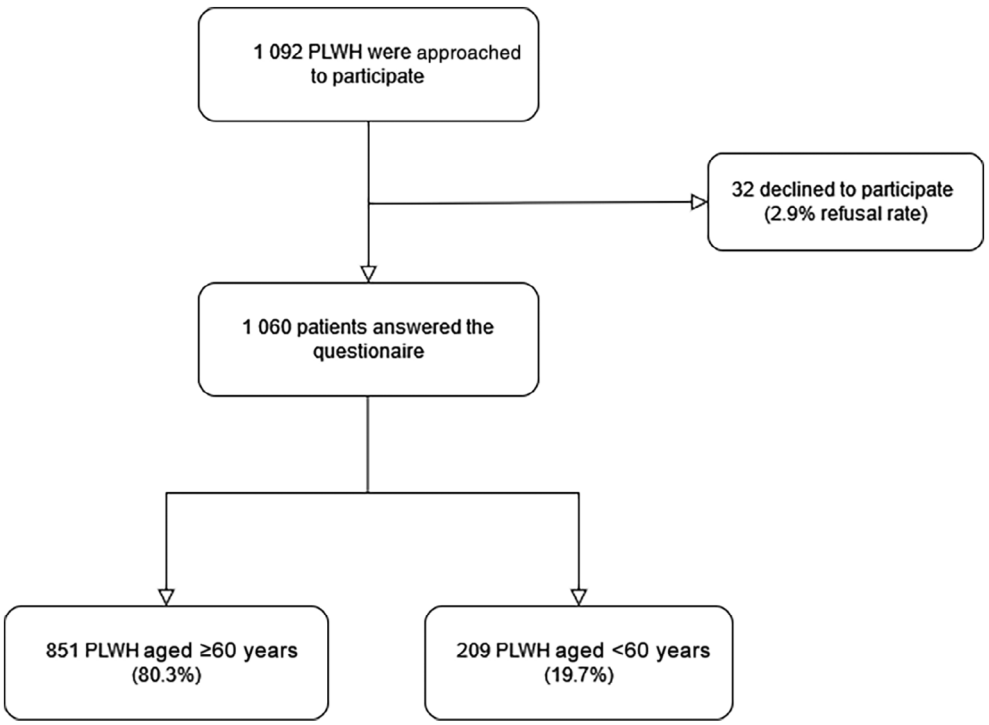

FIGURE 1 Number of patients included in the Vive+ study. PLWH = people living with HIV.

TABLE 1 Comparison of sociodemographic, behavioural, and clinical characteristics of participants between patients aged <60 and ≥60 years.

Variables	All patients, $N = 1060$, 100%	Patients aged <60 years, $N = 851$, 80.28%	Patients aged ≥60 years, $N = 209$, 19.72%	*p*-value[a]
Sociodemographic variables				
Age, years				<0.001
<39	236 (22.26)	236 (27.73)	0 (0)	
40–59	615 (58.02)	615 (72.27)	0 (0)	
≥60	209 (19.72)	0 (0)	209 (100)	
Gender				0.152
Male	833 (78.58)	679 (79.79)	154 (73.68)	
Female	192 (18.11)	146 (17.16)	46 (22.01)	
Transgender	35 (3.3)	26 (3.06)	9 (4.31)	
Born abroad				<0.001
No	706 (66.6)	531 (62.4)	175 (83.73)	
Yes	354 (33.4)	320 (37.6)	34 (16.27)	
Education level				<0.001
Higher education	544 (51.32)	468 (54.99)	76 (36.36)	
Secondary school	284 (26.79)	222 (26.09)	62 (29.67)	
Without or primary school	232 (21.89)	161 (18.92)	71 (33.97)	
Occupation				<0.001
Employed/student	599 (56.51)	560 (65.8)	39 (18.66)	
Unemployed	171 (16.13)	160 (18.8)	11 (5.26)	
Retired	161 (15.19)	33 (3.88)	128 (61.24)	
Home caretaker	25 (2.36)	21 (2.47)	4 (1.91)	
On leave	104 (9.81)	77 (9.05)	27 (12.92)	
Monthly income, €				<0.001
No income	97 (9.15)	92 (10.81)	5 (2.39)	
<1000	392 (36.98)	289 (33.96)	103 (49.28)	
1001–2000	420 (39.62)	346 (40.66)	74 (35.41)	
>2001	151 (14.25)	124 (14.57)	27 (12.92)	
Sexual orientation				<0.001
Heterosexual	417 (39.34)	295 (34.67)	122 (58.37)	
Homosexual	531 (50.09)	478 (56.17)	53 (25.36)	
Bisexual	112 (10.57)	78 (9.17)	34 (16.27)	
HIV infection-related variables				
Mode of transmission				<0.001
MSM	619 (58.4)	531 (62.4)	88 (42.11)	
PWID	191 (18.02)	142 (16.69)	49 (23.44)	
MHTX	103 (9.72)	64 (7.52)	39 (18.66)	
WHTX	147 (13.87)	114 (13.4)	33 (15.79)	
Viral load at survey				0.305
Undetectable	990 (93.4)	791 (92.95)	199 (95.22)	
Detectable	70 (6.6)	60 (7.05)	10 (4.78)	

TABLE 1 (Continued)

Variables	All patients, $N = 1060$, 100%	Patients aged <60 years, $N = 851$, 80.28%	Patients aged ≥60 years, $N = 209$, 19.72%	*p*-value[a]
CD4 cell count at survey				0.027
>350 cells/mm^3	805 (75.94)	659 (77.44)	146 (69.86)	
≤350 cells/mm^3	255 (24.06)	192 (22.56)	63 (30.14)	
Years living with HIV	15.89 ± 10.57	14.25 ± 10.13	22.54 ± 9.71	<0.001
Comorbidities				
Number of comorbidities				<0.001
0	126 (11.89)	125 (14.69)	1 (0.48)	
1–3	416 (39.25)	377 (44.3)	39 (18.66)	
≥4	518 (48.87)	349 (41.01)	169 (80.86)	
Number of comorbidities	3.00 (1.00–6.00)	3.00 (1.00–5.00)	6.00 (4.00–9.00)	<0.001
Mental component score	56.73 (48.90–65.94)	57.02 (48.88–66.25)	56.00 (49.35–64.65)	0.476
Physical component score	47.47 (43.07–54.44)	46.43 (42.52–52.68)	51.26 (46.02–58.13)	<0.001
Depressive symptoms score	4.00 (1.00–9.00)	3.00 (1.00–8.00)	4.00 (1.00–9.00)	0.912
Cognitive function	50.50 (44.60–56.80)	50.20 (44.20–57.10)	51.80 (45.60–56.45)	0.13
Health-related behaviours				
Nicotine dependence				<0.001
Non-smoker	610 (57.55)	459 (53.94)	151 (72.25)	
Low/moderate	386 (36.42)	336 (39.48)	50 (23.92)	
High	64 (6.04)	56 (6.58)	8 (3.83)	
Alcohol consumption				0.002
Non-drinker	278 (26.23)	205 (24.09)	73 (34.93)	
Low-risk drinker	591 (55.75)	481 (56.52)	110 (52.63)	
High-risk drinker	191 (18.02)	165 (19.39)	26 (12.44)	
Drug consumption pattern				<0.001
Cluster 1	829 (78.21)	626 (73.56)	203 (97.13)	
Cluster 2	140 (13.21)	136 (15.98)	4 (1.91)	
Cluster 3	91 (8.58)	89 (10.46)	2 (0.96)	
Intravenous drug use during lifetime				0.036
No	899 (84.81)	732 (86.02)	167 (79.9)	
Yes	161 (15.19)	119 (13.98)	42 (20.1)	
Sexualized use of drugs during the last year				<0.001
No	813 (76.7)	623 (73.21)	190 (90.91)	
Yes	247 (23.3)	228 (26.79)	19 (9.09)	
Sexual partners during the last 6 months				<0.001
None	202 (19.06)	128 (15.04)	74 (35.41)	
Steady and occasional partners	171 (16.13)	155 (18.21)	16 (7.66)	
Only steady partner	417 (39.34)	332 (39.01)	85 (40.67)	
Only occasional partner	270 (25.47)	236 (27.73)	34 (16.27)	
Social environment				
Disclosure of serostatus				0.728
More than one-half	198 (18.68)	155 (18.21)	43 (20.57)	
Less than one-half	694 (65.47)	561 (65.92)	133 (63.64)	

(Continues)

TABLE 1 (Continued)

Variables	All patients, $N = 1060$, 100%	Patients aged <60 years, $N = 851$, 80.28%	Patients aged ≥60 years, $N = 209$, 19.72%	p-value[a]
No-one	168 (15.85)	135 (15.86)	33 (15.79)	
Lives alone				<0.001
No	723 (68.21)	601 (70.62)	122 (58.37)	
Yes	337 (31.79)	250 (29.38)	87 (41.63)	
Overall satisfaction with sex life				0.002
Yes	870 (82.08)	714 (83.9)	156 (74.64)	
No	190 (17.92)	137 (16.1)	53 (25.36)	
Hours spent caring for others	6.49 ± 16.73	6.28 ± 16.74	7.37 ± 16.71	0.395
Satisfaction with social role	47.20 (43.90–49.20)	47.10 (43.80–49.20)	47.40 (44.35–49.20)	0.589
Social isolation	43.25 (34.00–50.90)	44.50 (34.00–51.40)	41.30 (34.00–48.60)	0.003
Stigma and discrimination	10.00 (8.00–14.00)	10.00 (8.00–14.00)	9.00 (8.00–12.00)	0.002
Hours dedicated to leisure	14.87 ± 15.50	13.45 ± 14.06	20.65 ± 19.35	<0.001

Abbreviations: MHTX, men infected through heterosexual contact; MSM, men who have sex with men; PWID, people who inject drugs; WHTX, were women infected through sexual contact.

Note: Data are presented as n (%), mean ± standard deviation, or median (interquartile range) unless otherwise indicated.

[a]Comparing people living with HIV aged <60 and ≥60 years, using $\chi 2$ for categorical variables and Mann–Whitney U test for continuous variables.

secondary school ($n = 232$). A third of participants (33.4%) were born outside of Spain. Regarding the mode of transmission, most participants were men who were infected by having sex with other men (MSM) ($n = 619$ [58.4%]), 191 (18.0%) were infected through intravenous drug use (people who inject drugs [PWID]), 147 (13.9%) were women infected through sexual contact (WHTX), and 103 (9.7%) were men infected through heterosexual contact (MHTX).

When comparing the two age groups (patients aged ≥60 vs. < 60 years),older patients were more likely to be born in Spain (83.7% vs. 62.4%, $p < 0.001$) as well as tobe within the PWID (23.4% vs. 16.7%, $p < 0.001$) and MHTX (18.7%vs. 7.5%, $p < 0.001$) mode of transmission groups. Older people living with HIV were more likely to be living alone (41.6% vs. 29.4%, $p < 0.001$), while less likely to have finished higher education (36.4% vs. 55.0%, $p < 0.001$), and to engaged in sexualized drug use during the previous year (9.1% vs. 26.8%, $p < 0.001$). They also presented more often CD4 cell counts ≤350 cells/mm^3 (30.1% vs. 22.6%, $p < 0.001$).

Older patients had a worse PCS than younger people living with HIV (median score 51.3 [IQR 46.0–58.1] vs. 46.4 [IQR 42.5–52.7], $p < 0.001$) and a similar MCS (median score 56.0 [IQR 49.4–64.7] vs. 57.0 [IQR 48.9–66.3], $p = 0.476$). These patients had also spent more years living with HIV (mean 22.5 ± SD 9.7 vs. 14.3 ± SD 10.1). The sociodemographic information and comparison between the two groups is shown in Table 1.

In the bivariable analysis, transgender people, PWID, and those with CD4 cell count <350 cells/mm^3, high nicotine dependence, or no sexual partners during the previous 6 months presented poorer PCS and MCS in both age groups. Table 2 shows PCS and MCS in both age groups.

The variables used for each of the LASSO regression models are listed in Table 3. In people living with HIV aged ≥60 years, the multivariable analysis showed that a worse cognitive function correlated with a lower PCS (β correlation factor [β] −0.18, $p = 0.014$) and that a higher prevalence of depressive symptoms and lower satisfaction with social role correlated with a worse MCS (β 0.61 and β −0.97, respectively, $p < 0.001$). No other sociodemographic or clinical variables were associated with poor HRQoL.

Conversely, although cognitive function, presence of depressive symptoms, satisfaction with social role, and social isolation were also related to changes in HRQoL in people living with HIV aged <60 years, we found associations with other factors. For this younger group, factors correlated with a low PCS in the multivariable analysis were being female (β 1.37, $p = 0.022$) or transgender (β 5.38, $p < 0.001$), uncompleted secondary education (β 1.17, $p = 0.048$), being on leave from work (β 3.25, $p < 0.001$), having no monthly income (β 2.99, p=0.001), low use of drugs (cluster 1) versus high use of drugs (cluster 3) (β 3, $p < 0.001$), more than four comorbidities (β 2.49, $p < 0.001$), a higher prevalence of depressive symptoms (β 0.20, $p < 0.001$), a lower satisfaction with social

TABLE 2 Median values of physical and mental component score of quality of life (SF-12 survey) among patients aged <60 and ≥60 years.

	Patients aged <60 years				Patients aged ≥60 years			
	Physical component score		Mental component score		Physical component score		Mental component score	
	Median (IQR)	*p*-value[a]	Median (IQR)	*p*-value[a]	Median (IQR)	*p*-value[a]	Median (IQR)	*p*-value[a]
Sociodemographic variables								
Gender		0.000		0.012		0.302		0.490
Male	46.0 (42.5–50.5)		56.0 (48.4–65.8)		50.9 (45.4–58.2)		55.3 (49.1–63.6)	
Female	51.7 (44.8–57.7)		59.1 (51.1–67.5)		53.4 (48.2–58.1)		56.3 (50.3–67.8)	
Transgender	56.6 (49.5–61.2)		61.2 (52.2–66.9)		55.1 (46.6–59.9)		58.1 (46.6–65.7)	
Born abroad		0.002		0.207		0.410		0.327
No	47.4 (42.9–53.6)		56.6 (48.7–65.7)		51.4 (46.6–58.1)		56.3 (49.8–65.2)	
Yes	45.5 (42.5–51.2)		57.9 (49.2–66.8)		49.5 (43.6–60.1)		54.8 (46.9–63.4)	
Education level		0.000		0.011		0.321		0.850
Without or primary school	50.7 (46.2–58.5)		60.2 (49.3–67.8)		52.2 (47.0–59.8)		56.3 (50.4–63.6)	
Secondary school	47.4 (43.0–53.2)		57.5 (46.8–66.4)		51.8 (45.3–58.5)		56.4 (49.6–65.4)	
Higher education	45.5 (42.2–50.3)		55.4 (49.0–65.1)		49.6 (45.7–56.9)		54.6 (48.9–65.4)	
Occupation		0.000		0.000		0.160		0.070
Employed	45.4 (42.0–49.9)		54.8 (47.2–63.8)		47.7 (44.7–55.7)		55.1 (48.8–63.6)	
Unemployed	48.2 (44.1–55.5)		62.4 (50.0–68.2)		49.5 (47.7–61.9)		64.4 (49.2–67.8)	
Home caretaker	53.1 (46.6–57.9)		60.2 (54.9–68.6)		55.2 (44.2–65.7)		53.1 (49.4–56.9)	
Retired	52.5 (47.7–57.1)		61.6 (55.7–67.0)		51.7 (46.5–58.3)		54.4 (48.8–63.6)	
On leave	55.8 (47.0–61.7)		63.4 (54.4–68.2)		53.0 (48.1–59.5)		62.4 (53.0–67.6)	
Monthly income, €		0.000		0.000		0.469		0.088
No income	49.3 (45.2–56.4)		60.5 (49.5–69.0)		57.6 (47.9–63.1)		48.6 (38.8–56.7)	
<1000	50.1 (44.6–57.1)		60.7 (49.2–67.8)		52.8 (46.3–58.7)		57.8 (51.8–65.5)	
1001–2000	44.8 (41.6–49.1)		55.7 (48.9–64.0)		49.6 (45.5–57.2)		54.6 (48.5–64.2)	
>2001	44.7 (42.1–48.0)		51.7 (46.8–60.2)		49.1 (45.7–57.7)		52.1 (48.4–62.8)	
Sexual orientation		0.000		0.023		0.144		0.721
Heterosexual	50.0 (44.6–57.0)		58.8 (49.2–66.7)		52.5 (47.4–58.4)		55.9 (49.3–65.3)	
Homosexual	45.5 (42.2–49.5)		55.2 (48.0–65.8)		50.2 (45.1–58.0)		54.6 (49.0–63.0)	
Bisexual	47.0 (42.5–53.1)		58.1 (49.1–67.4)		48.6 (45.2–57.4)		56.6 (49.7–65.6)	
HIV infection-related variables								
Mode of transmission		0.000		0.000		0.057		0.019
MSM	45.5 (42.2–50.1)		55.3 (48.0–65.2)		49.0 (45.1–57.7)		56.4 (49.3–63.8)	
PWID	50.2 (45.4–58.3)		61.4 (51.8–68.2)		54.8 (49.3–58.7)		58.1 (52.3–67.2)	
MHTX	46.3 (42.5–52.2)		54.2 (45.4–64.3)		50.8 (44.7–58.5)		51.8 (44.9–63.6)	
WHTX	51.3 (44.1–56.9)		59.0 (49.8–67.4)		53.9 (48.1–57.7)		56.0 (46.4–68.0)	
Viral load at survey		0.424		0.054		0.422		0.832
Undetectable	46.4 (42.5–52.9)		56.3 (48.6–66.2)		51.3 (45.8–58.0)		56.0 (49.4–64.0)	
Detectable	47.2 (44.0–51.5)		60.5 (51.5–66.7)		51.5 (47.1–64.2)		58.2 (48.1–67.2)	

(Continues)

TABLE 2 (Continued)

	Patients aged <60 years				Patients aged ≥60 years			
	Physical component score		Mental component score		Physical component score		Mental component score	
	Median (IQR)	*p*-value[a]	Median (IQR)	*p*-value[a]	Median (IQR)	*p*-value[a]	Median (IQR)	*p*-value[a]
CD4 cell count at survey		0.001		0.132		0.040		0.002
≤350 cells/mm^3	48.3 (43.6–55.0)		58.4 (48.1–67.1)		54.3 (47.3–59.5)		58.8 (51.8–67.2)	
> 350 cells/mm^3	46.1 (42.5–51.7)		56.7 (48.9–65.8)		50.2 (45.1–57.6)		54.2 (48.8–63.3)	
Comorbidities								
Number of comorbidities		0.000		0.000		0.021		0.228
0	44.6 (42.0–49.3)		54.0 (45.3–64.3)		42.5 (42.5–42.5)		49.2 (49.2–49.2)	
1–3	44.9 (41.9–48.6)		53.8 (46.8–63.3)		47.7 (43.6–55.4)		53.7 (46.5–61.9)	
≥4	50.9 (45.2–57.1)		61.3 (53.9–67.8)		52.8 (46.7–58.4)		56.4 (50.4–65.3)	
Health-related behaviours								
Nicotine dependence		0.000		0.001		0.118		0.002
Nonsmoker	45.9 (42.2–51.9)		55.5 (47.9–65.5)		50.3 (45.7–57.7)		54.5 (48.4–63.1)	
Low/moderate	46.6 (42.7–52.1)		58.1 (49.0–66.6)		51.4 (47.7–60.1)		59.6 (52.4–66.9)	
High	51.6 (47.9–58.9)		61.4 (55.2–68.5)		55.5 (52.2–60.4)		66.9 (56.1–67.6)	
Alcohol consumption		0.000		0.000		0.750		0.537
Non-drinker	48.3 (43.7–57.0)		61.4 (49.3–67.3)		50.9 (45.1–59.2)		57.1 (50.4–65.0)	
Low-risk drinker	46.0 (42.5–51.5)		54.9 (47.4–65.0)		51.2 (45.8–57.7)		55.2 (49.1–63.7)	
High-risk drinker	46.5 (42.6–51.9)		58.3 (49.6–66.0)		53.6 (47.4–58.1)		53.8 (49.2–65.6)	
Drug consumption pattern		0.000		0.012		0.912		0.573
Cluster 1	46.9 (43.0–54.5)		56.2 (48.6–65.7)		51.3 (46.2–58.0)		55.8 (49.3–64.4)	
Cluster 2	46.3 (42.3–51.3)		57.8 (47.9–66.5)		53.2 (42.1–65.9)		62.2 (51.1–69.2)	
Cluster 3	44.1 (41.3–48.1)		63.1 (51.1–67.6)		54.6 (46.6–0.0)		55.7 (52.6–0.0)	
Intravenous drug use during lifetime		0.000		0.000		0.026		0.019
No	46.0 (42.5–51.6)		56.0 (48.1–65.7)		49.8 (45.4–57.8)		55.1 (48.4–64.0)	
Sexual risk behaviour in the last 6 months		0.000		0.001		0.195		0.063
None	51.5 (46.1–58.5)		62.2 (53.1–68.3)		53.9 (47.2–59.4)		58.1 (49.6–66.0)	
Only steady partner	46.4 (42.5–53.6)		55.9 (47.5–65.1)		49.5 (45.7–57.6)		55.8 (50.7–63.2)	
Only occasional partner	46.2 (42.5–50.6)		57.1 (48.9–66.6)		51.5 (45.3–58.4)		53.4 (50.1–65.6)	
Steady and occasional partners	44.7 (41.7–48.8)		54.8 (49.2–63.8)		48.9 (41.0–56.3)		48.9 (43.2–57.6)	
Yes	50.7 (46.1–58.8)		61.4 (53.8–68.2)		55.1 (49.4–58.9)		58.2 (52.8–67.1)	
Social environment								
Disclosure of serostatus		0.134		0.001		0.475		0.095
No-one	45.5 (42.2–51.1)		51.8 (45.1–61.6)		50.2 (42.4–57.5)		54.5 (48.2–61.9)	
Less than one-half	46.6 (42.8–52.7)		58.0 (49.5–66.5)		50.5 (46.3–58.2)		55.2 (49.2–64.1)	
More than one-half	47.9 (42.5–54.4)		56.8 (47.8–67.1)		54.8 (45.7–59.5)		58.6 (50.8–67.3)	
Lives alone		0.873		0.413		0.222		0.218
No	46.4 (42.5–52.9)		56.8 (49.2–65.4)		52.1 (47.0–58.3)		55.3 (48.4–63.3)	
Yes	46.7 (42.8–52.2)		58.2 (48.0–67.1)		49.6 (45.1–57.8)		57.8 (50.8–65.5)	

TABLE 2 (Continued)

	Patients aged <60 years				Patients aged ≥60 years			
	Physical component score		Mental component score		Physical component score		Mental component score	
	Median (IQR)	*p*-value[a]	Median (IQR)	*p*-value[a]	Median (IQR)	*p*-value[a]	Median (IQR)	*p*-value[a]
Overall satisfaction with sex life		0.000		0.000		0.626		0.001
No	51.3 (46.4–57.6)		65.1 (55.1–69.6)		52.4 (47.0–57.8)		63.1 (52.8–67.0)	
Yes	46.0 (42.3–51.4)		55.4 (47.5–65.2)		50.9 (45.6–58.2)		54.3 (49.0–62.8)	

[a]Mann–Whitney *U* test or Kruskal–Wallis.

role (β −0.42, $p < 0.001$), and a poor cognitive function (β −0.08, $p = 0.01$). Factors correlated with worse MCS were being born abroad (β 1.48, $p = 0.005$), overall sexual dissatisfaction (β 1.47, $p = 0.038$), having disclosed HIV status to less than half of their close friends and relatives (β 1.31, $p = 0.047$), high use of drugs (cluster 3) (β 1.99, p = 0.018), intravenous drug use (β 1.48, $p = 0.005$), a higher prevalence of depressive symptoms (β 0.77, $p < 0.001$), a lower satisfaction with social role (β −0.41, $p < 0.001$), poor cognitive function (β −0.16, $p < 0.001$), and greater social isolation (β 0.08, $p = 0.041$).

DISCUSSION

To our knowledge, this is the first study that has analysed the determinants of HRQoL separately between older people living with HIV (aged ≥60 years) and their younger counterparts. The older population did present worse physical HRQoL than the younger population, but – interestingly – although differences were not statistically significant, mental HRQoL was slightly better in the older population, contrary to what would be expected given that it typically decreases with age among the general population [28]. These differences were consistent with the regional general population but not the country-wide Spanish general population, where MCS decreased with age [22, 28].

Although other studies have shown greater stigma and less social support in older people living with HIV, our study revealed less stigma, discrimination, and social isolation within the group aged >60 years, concurrent with newer findings [29]. This could explain the slightly better than expected MCS in older participants, as other studies have shown the protective nature of social support [30] and the direct effects of isolation and stigma on depression and a worse HRQoL [29, 31].

It is worth noting that, although the PCS scores in our population with HIV were slightly better than in the general Catalan population [22], the MCS score was 6 points lower overall. In the older population, despite the difference in the defined age groups (≥60 years in people living with HIV and ≥55 years in the general population), we interpret a clearly poorer mental HRQoL in people living with HIV than in the general population, whereas the physical HRQoL was relatively similar. This is significant, as a worse HRQoL has been associated with higher rates of hospitalization and mortality in people living with HIV [32, 33].

Our results also clearly demonstrate that, although some socioeconomic factors influence HRQoL in younger people living with HIV, only deficits in cognitive function showed correlation with a lower PCS, and dissatisfaction with social role and depressive symptoms correlated with a worse MCS in older people living with HIV. Notably, although the older group presented less stigma and social isolation than the younger group, these were not determinants of better HRQoL within the group. In the case of depression, although it is strongly correlated with the psychological domains of HRQoL, there is evidence that it also impacts the physical domains [34-36]. Lang et al. showed similar results in older people living with HIV, correlating depression and mild cognitive impairment with poor PCS and MCS [37]. Unfortunately, our results did not show that higher levels of depressive symptoms correlated with a worse PCS or that decreased cognitive function correlated with MCS in people living with HIV aged ≥60 years.

It is also surprising that we found no correlation between comorbidities and HRQoL in the older group, as these have been strongly linked to a worse HRQoL and are often more prevalent in older people living with HIV [30, 38]. This could be due to the homogeneity of this older group, as over 80% of the older group presented four or more comorbidities. This is equally true for other

TABLE 3 Multivariable analysis of factors associated with physical and mental quality of life among patients aged <60 and ≥60 years.

	Physical component score				Mental component score			
	Patients aged <60 years		Patients aged ≥60 years		Patients aged <60 years		Patients aged ≥60 years	
	β^a	*p*-value	β^a	*p*-value	β^a	*p*-value	β^a	*p*-value
(Intercept)	71 088	<0.001	70.519	<0.001	72.572	<0.001	102.192	<0.001
Gender: ref. to male								
Female	1.369	**0.022**	1.407	0.271	0.036	0.958	−0.224	0.867
Transgender	5.377	**<0.001**	1.425	0.574	0.028	0.985	−0.646	0.808
Born abroad: ref. to no								
Yes	−0.472	0.287	−0.035	0.981	1.484	**0.005**	−1.723	0.238
Education level: ref. to higher education								
Secondary school	−0.088	0.859						
Without or primary school	1.171	**0.048**						
Occupation: ref. to employed/student								
Unemployed	0.123	0.855						
Retired	1.886	0.082						
Home caretaker	−0.709	0.62						
On leave	3.248	**<0.001**						
Monthly income: ref. to no income (€)								
<1000	−0.965	0.216						
1001–2000	−2.994	**0.001**						
>2001	−2.413	**0.017**						
Overall satisfaction with sex life: ref. to yes								
No	0.737	0.206			1.474	**0.038**		
Sexual partners during the last 6 months: ref. to none								
Steady and occasional partners	−1.347	0.079						
Only steady partner	−0.637	0.311						
Only occasional partner	−0.746	0.28						
Disclosure of serostatus: ref. to more than one-half								
Less than one-half					1.313	**0.047**		
No-one					−1.333	0.127		
Drug consumption pattern: ref. to cluster 1								
Cluster 2	−1.039	0.07			−0.547	0.431		
Cluster 3	−2.995	**<0.001**			1.991	**0.018**		
Intravenous drug use during lifetime: ref. to no								
Yes	−0.472	0.287	−0.035	0.981	1.484	**0.005**	−1.723	0.238
Number of comorbidities: ref. to 0								
1–3	0.252	0.671	4.223	0.574	0.264	0.724		
≥4	2.491	**<0.001**	6.965	0.352	1.646	0.036		
Depressive symptoms score	0.196	**<0.001**	0.238	0.06	0.769	**<0.001**	0.613	**<0.001**
Satisfaction with social role	−0.424	**<0.001**	−0.37	0.083	−0.405	**<0.001**	−0.968	**<0.001**
Stigma and discrimination	0.036	0.384			0.039	0.463		
Cognitive function	−0.079	**0.01**	−0.181	**0.014**	−0.157	**<0.001**	−0.086	0.259
Social isolation					0.077	**0.041**		

Note: Bold formating indicates statistically significant results.

[a]Beta coefficient in multivariable logistic regression models.

sociodemographic aspects that were correlated with worse HRQoL in the younger group, such as gender, immigration, education level, occupation, monthly income, overall satisfaction with sex life, disclosure of HIV serostatus, and drug consumptions patterns, but surprisingly did not affect HRQoL in the older population. This highlights the need for separate interventions depending on the age of the person living with HIV. Although younger populations could benefit from socioeconomic and clinical interventions, our results showed that the HRQoL of older people living with HIV only correlated with depression, social role, and cognitive function. Therefore, it might be more important to offer social and mental health support to these people as these are the main factors related to their overall wellbeing [37].

Overall, our study indicates that psychological factors are associated with HRQoL in people living with HIV. In younger people, although certain sociodemographic factors were linked to HRQoL, depressive symptoms, social role, cognitive function, and social isolation also played an important role. The fact that HIV clinicians show greater concern for HIV treatment and its adverse effects than social, psychological, and HIV-related stigma [39, 40] is of concern, given they are important in determining HRQoL, specially in older people living with HIV. These results emphasize the importance of addressing HRQoL and associated factors in both younger and older people living with HIV. They also highlight the need for targeted interventions to improve the well-being of older people living with HIV [41].

Strengths and limitations

Our study had several limitations. Initially, we used a convenience sample that included a limited number of older participants. Although the sample was not randomized, we mitigated this limitation by recruiting a sample representative of the local HIV population by gender, age, and hospital of recruitment. Additionally, we oversampled people aged ≥60 years to obtain a greater number of participants from this subset, which is often underrepresented in HIV-related studies. Second, we collected questionnaire data using an electronic tablet. This could have presented some difficulty for those unfamiliar with newer technologies, such as older people. Conversely, the use of an electronic tablet greatly improved participant uptake and overall efficiency of the study, and we believe the inclusion of a study monitor who could guide and answer any of the participants' questions helped to minimize any difficulties. Lastly, Vive+ was a cross-sectional study, so causality could not be inferred. Many of the correlations found could depend on a bidirectional relationship between them and HRQoL, especially mental health. We hope to address this in follow-up studies or even a longitudinal study to determine the changes in the factors associated with HRQoL and ageing and to explore their effects.

One of the main strengths of our present work is that we exhaustively assessed a varied sample of measures that could be related to HRQoL and ageing, such as comorbidities, health-related behaviours, and social environment-related variables, which we believe provided a good approximation of the factors affecting the ageing process. Furthermore, the instruments used have been previously validated in people living with HIV, providing greater rigour to our research. For example, the SF-12 has been used in people living with HIV and in the general population of reference, which permitted us to compare the two. This and the fact we included a representative sample with enough people living with HIV to identify the variables under study, lends confidence to our results.

CONCLUSION

This study revealed that older people living with HIV have a lower physical component of HRQoL than their younger counterparts, whereas their mental component is similar. However, clinical and socioeconomic factors were associated with poor HRQoL among younger people living with HIV, whereas depressive symptoms, poor cognitive function, and lower satisfaction with social roles were identified as predictors of poor HRQoL in older people living with HIV. The increasing proportion of older people living with HIV necessitates work to ensure they receive appropriate and effective care. The findings of this study provide valuable insights into the factors that contribute to poor HRQoL in older people living with HIV and can inform the development of targeted interventions to enhance their quality of life.

AUTHOR CONTRIBUTIONS

JRU, JC, and AB conceived and designed the study. AB, JRU, and LEC had full access to all the study data, verified the data, and take responsibility for the integrity of the data and the accuracy of the data analysis. LEC, AB, and JRU performed the analyses. AB and LEC wrote the first draft of the paper and incorporated revisions. All authors contributed to the interpretation of results. All authors critically revised and approved the final manuscript.

FUNDING INFORMATION

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CONFLICT OF INTEREST STATEMENT

JMM has received consulting honoraria and/or research grants from AbbVie, Angelini, Contrafect, Cubist, Genentech, Gilead Sciences, Jansen, Lysovant, Medtronic, MSD, Novartis, Pfizer, and ViiV Healthcare, outside the submitted work. There are no further conflict of interest to be declared.

DATA AVAILABILITY STATEMENT

The protocol, data, and code for this study are available at the Centre for Epidemiological Studies of Sexually Transmitted Diseases and HIV/AIDS in Catalonia (CEEISCAT), the coordinating centre of the PISCIS cohort, and from each of the collaborating hospitals upon request via https://pisciscohort.org/contacte/.

NON-FINANCIAL INTERESTS

The authors declare they have no non-financial interests.

ETHICS APPROVAL

This study was performed in line with the principles of the Declaration of Helsinki. The study was approved by the Germans Trias i Pujol University Hospital ethics committee (N°: PI-19-172), and later approved by all participating hospitals' ethics committees.

CONSENT TO PARTICIPATE AND FOR PUBLICATION

Written informed consent was obtained from all participants in the study, including consent for publication.

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APPENDIX A

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