Factors associated with sexual quality of life among HIV positive men

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Abstract

Introduction*:* There is a high prevalence of sexual difficulties among people living with HIV and AIDS (PLWHA), which makes it crucial to examine different dimensions of sexual quality of life (SQoL). We aimed to establish the prevalence of sexual difficulties and determine factors associated with SQoL among HIV-positive men.

Methods: Between December 2017 and December 2018, this cross-sectional study included 107 heterosexual men and 474 men who have sex with men (MSM). The participants were recruited from HIV centers or via the internet in five countries (Australia, Brazil, Canada, France, and the USA). The questions related to participants' physical and mental health status, as well as HIV parameters, were self-reported. We assessed the prevalence of three common sexual difficulties (erectile difficulty, ejaculation difficulty, low sexual desire) among the participants.

SQoL was assessed using the newly developed PROQOL-SexLife questionnaire, comprising six dimensions (score range: 0-100) for MSM and five dimensions for heterosexual men: positive sexual perception (POP), sexual difficulties (DIS), stigma/fear (STI), Sexual practices with partner (PAR), soft sexual practices (SOF), and drug consumption (DRG). A linear mixed model was used to explore the relationship between explanatory variables (sociodemographic variables, mental health-related variables, HIV biological-related factors) and scores measured by PROQOL-SexLife dimensions, by treating countries as random effects.

Results: A majority of the participants (54.6%) indicated experiencing low sexual desire, with MSM demonstrating a notably higher susceptibility compared to heterosexual men. Amongst MSM, SQoL in the POP dimension was associated with living with a partner and healthcare satisfaction, while the STI dimension was associated with frequent condom usage, cardiovascular complications, and being single. Viagra use, anti-cholesterol treatment, and living with a partner as a mode of life were significant in the DIS dimension. Amongst heterosexual men, employment status and African origin were found to be associated with SQoL scores in the POP dimension, and alcohol consumption in the STI. The mental health-related variables, such as clinical depression, depressive symptom, and preoccupation with the risk of HIV transmission during sexual practices, were negatively associated with a better outcome of SQoL in the three dimensions (POP, DIS, STI) among MSM and in two dimensions among heterosexual men (POP and DIS).

Conclusion: The significance of psychological and stress-related factors, alongside the lack of correlation between HIV-related biological parameters (CD4 count, viral load), and SQoL, highlights the necessity of taking non-clinical determinants into account when assessing SQoL outcomes. This includes factors like the perceived quality of healthcare and the confidence in understanding transmission risks, underscoring the necessity for tailored initiatives within the HIV context.

Introduction

Sexual health, an integral component of overall health related quality of life, encompasses the possibility of having pleasurable and safe sexual experiences or the enjoyment of sexual activity of one's choice, without causing or suffering physical or mental harm [1]. However, sexual health among people living with HIV (PLHIV) is confronted with challenges, which may contribute, among other things, to constrained intimacy but also sexual function difficulties [2]. Among men living with HIV, it has been reported a high prevalence of sexual function difficulties, especially erectile difficulties, which are more common (ranges from 9 to 74%) [3,4] and low sexual desire (ranges from 24 to 33%) [5,6]. These occurrences surpass not only those observed in individuals without HIV but also exceed rates found within cancer survivor groups [7]. The nature of the association between HIV and the presence of sexual difficulties, as well as the underlying reasons are subject to debate. Studies have identified multiple contributors of sexual function difficulties such as psychological (e.g. depression, psychological distress) [8] and relational factors [9] as well as HIV related stigma [10,11]. The role of antiretroviral therapy (ART) in the onset of sexual function difficulties remains controversial [12]. Troubles with sexual function have also been discovered to correlate with heightened engagement in sexual risk behaviors and reduced adherence to antiretroviral therapy (ART) [13]. These difficulties may influence sexual quality of life (SQoL).

In fact, SQoL refers to an individual's overall well-being and satisfaction in their sexual experiences and relationships [14]. It encompasses various aspects of a person's sexual health, including physical, emotional, and relational factors.

Taking a comprehensive approach to sexual health involves moving beyond a narrow focus on the more presence of sexual difficulties as the endpoint of studies. Instead, it emphasizes studying sexual health in relation to its impact on health-related quality of life among PLHIV. To do so it is important to assess a broad range of sexual dimensions specifically related to living with HIV, representing a measure of sexual quality of life and hence relevant to sexual health. It is also vital to examine contributors of sexual quality of life dimensions, which would be useful in clinical settings where individuals with poorer sexual quality of life are offered treatment. Assessing and addressing sexual quality of life is essential in healthcare and relationship counseling to enhance individuals' overall well-being and satisfaction in their sexual lives.

In this study, our aim was to establish the prevalence of sexual difficulties and identify the factors associated with Sexual Quality of Life (SQoL) among HIV-positive men.The assessment of sexual quality of life dimensions was conducted using the PROQOL-Sexlife questionnaire [14]. The questionnaire provides a 6-factor structure with 22 items for self-identified men who have sex with men (MSM) and a 5-factor structure with 23 items for self-identified heterosexual men, as per the factor structures.

The PROQOL-Sexlife self-report questionnaire measures the following sexual quality of life dimensions: Positive sexual perception (POP), Sexual difficulties (DIS), Stigma and fear (STI), Sexual practices with partner (PAR), Soft sexual practices, refer to intimate activities including sexual dreams and masturbation, (SOF) and Drug consumption (DRG). While the drug consumption (DRG) are addressed separately among MSM, for heterosexual men, they are compiled in one unique dimension (SOF/DRG).

Methods

Study participants, recruitment, and procedures:

This cross sectional was carried out across multiple centers and countries among PLWHA from December 2017 to December 2018. The study spanned France, Australia, Brazil, the USA, and Canada. These countries were selected to account for differences in the health care systems, cultures and languages, treatment availability and to augment study feasibility. A convenience sample was performed among male patients attending the HIV clinic. Patients who visited the HIV clinics were invited participate to this study in Canada and Brazil, while in USA, invitation was exclusively by e-mail. In France and Australia the potential participants were invited both at the HIV clinics and by e-mail. Eligibility criteria included (1) male patient living with HIV followed-up in one of the study HIV clinics, and (2) being fluent in the official language (English, French or Portuguese). Non-inclusion criteria were (1) hospitalization and (2) having an acute infectious disease at the time of the study. Written informed consent was obtained prior to inclusion to the study. Participants' personal data were anonymized, and a 4-digit number was assigned to each participant in the clinical report form, this number was later used for gathering the missing data.

Sexual quality of life (SQoL)

SQoL was measured using the PRQOL-Sexlife self-report questionnaire that assesses the six and five SQoL dimensions respectively for MSM and heterosexual men using a 5-point Likert

scale from “never” to “all the times”. Some items in the POP dimension used a 5-point intensity scale (“very good” to “very bad”). Dimension scores transformed linearly, according to a standardized algorithm ranging from a score of 0 to 100. In the POP, DRG, STI and DIS dimensions, lower scores indicate better SQoL and higher scores are equal to poorer SQoL. Table 1 presents one question for each dimension of the PROQOL-SexLife questionnaire, with the purpose of fostering comprehension of the questionnaire.

Sexual function difficulties

The prevalence of sexual function was evaluated through questions about the occurrence of specific difficulties such as erectile problems, ejaculatory issues, and low sexual desire over the previous four weeks. The responses were recorded on a 3-point Likert scale (not frequently, sometimes, and frequently).

Explanatory factors questionnaire

Based on previous HIV-related research and discussion with experts at the medical centers, explanatory factors of interest were grouped into sociodemographic, clinical HIV-related, comorbidities, mental health, and health-related behaviors domains. The questionnaire was filled out at the same time as the PROQOL-Sexlife questionnaire.

The sociodemographic domain encompassed factors such as age, education, ethnicity, employment, marital status, living mode and sexual orientation.

The clinical HIV-related domain: it included the duration of HIV treatment (year), HIV treatment regimen (only for three country: Brazil, France and Canada), biological markers (CD4 count, viral load). The HIV-related parameters were reported by the patients and in clinic settings the participants were helped by a research assistant providing them the data from medical records.

Comorbidities domain: The participants were inquired about the presence of certain comorbidities, responding with “yes/no”, these comorbidities included the coinfection with viral hepatitis (HCV or HBV), diabetes, and cardiovascular complications.

Mental health domain: it was assessed by questions about, psychiatric disorders, clinical depression, presence of depressive symptoms, using anti-depressant/psychiatric treatment during the last four weeks, responding with “yes/no”. Depressive symptoms were measured by two variables: frequently feeling sad/hopeless, and lack of interest for life. Besides, participants were asked the extent of concern regarding HIV transmission during sexual

activities, using a 3-point Likert scale that ranged from "not preoccupied" to "very preoccupied."

Health-related behaviors domain: To comprehend the risky behaviors, we incorporated the variables of psychoactive substance use, responding with “yes/no”, such as alcohol (defined as consumption of more than 2 glasses of alcoholic drinks per day or not), tobacco (defined as smoking at least one cigarette per day or not), Cocaine and Cialis/Viagra .

In the same theme, we were also interested in assessing the level of awareness regarding the risk of HIV transmission and the practice of condom use using a 3-point Likert scale (not frequently, sometimes, frequently). For this, we used two questions of SRQ-12 (questionnaire of understanding the risk of HIV transmission) to measure the knowledge of the risk of transmission of HIV among people living with HIV. In which, participants were asked to indicate the option that most accurately described their level of understanding of the risks associated with HIV transmission during sexual activity, using a 3-point Likert scale (aware, moderately aware, not aware).

Interaction with healthcare was explored with satisfaction with health care support, and communication with health providers about sexuality using a 3-point Likert scale.

Data analysis

R was used for data management and statistical analysis (R Core Team 2013). Through descriptive analysis, the two populations of heterosexual men and MSM were compared in relation to their demographic and medical characteristics using t-student tests and chi-square test.

Variance inflation factors (VIF) were used to analyze the existence of potential collinearity problems (VIF ≥ 5) among the independent variables. Missing data of explanatory variables were handled with K-Nearest Neighbor method (K=5) (package: caret). Variable selection for the final linear model was done by stepwise AIC method (package: MASS). Stepwise validation of was done using the bootstrap method (package: caret). Finally, we added country as a random effect to the retained variables to perform a linear mixed effects model to explore the relationship between the score of each dimension and explanatory variables (package: lme4) separately for MSM and heterosexual men. Variance explained by the entire model, including both fixed and random effects was calculated using Pseudo-R-squared (package: MuMIn). Participants who reported not being in a sexual relationship during the last four weeks were not included in the regression model of the PAR and DRG/SOF dimensions. As the data regarding

the type of HIV treatment was accessible only for participants in Brazil, France and Canada, therefore we didn't enter this factor as a variable in the model.

Of the 615 recruited participants, 13 were excluded based on incomplete socio demographics and 21 were removed due to a HIV negative status. After these exclusions 581 men (Australia: 109; Brazil: 139; Canada: 79, France: 190; USA: 64) remained and were included in the analyses.

Ethical consideration

Potential participants were informed orally about the study, or received written information about the study, voluntariness was underscored, before consent was obtained. The project was approved by ethics committee in each of participating countries: respecting legal authorities in France, Australia, USA, Brazil, and Canada. The project was registered on clinicalTrials.gov (NCT03468673).

Results

Participants' characteristics related to the explanatory factors

Among 581 participants, 81.6% were MSM, the mean age (SD) was 49 (± 11.8) years, 76.8% identified themselves as Caucasians, 55.6% were employed and 61% were single. Almost half of the participants attained university level (49.1%).

Clinical-related variables

Almost two-thirds (63.4%) of the participants reported a current CD4 count higher than 500 cells/mm^3, and the majority (95.2%) reported an undetectable HIV viral load. Data on HIV treatment were available in only three countries (Brazil, France and Canada) which shows that the antiretroviral most used was Integrase inhibitors (INI) (36.8%).

The prevalence of comorbidities, including cardiovascular diseases, HCV coinfection, HBV coinfection, diabetes, psychiatric disorders, and clinical depression, varied from 28% to 7%. The occurrence of clinical depression was noted at a significant rate of 28%.

In relation to the presence of depressive symptoms, slightly fewer than half of the participants noted a sense of low interest of life, while a significant number of respondents conveyed experiencing frequent feelings of sadness/hopelessness (42%).

Health-related behaviors

Regarding alcohol consumption and smoking, they were disclosed by 23% and 13% of the participants, respectively. Additionally, engaging in sexual activity without using condoms was reported by 37% of the participants. Almost half of the participants reported having been able to talk with health providers about sexuality (48.8%) or satisfied about healthcare (54.1%).

Compared to heterosexual men, MSM were less likely to be married, and less likely to report: smoking, cardiovascular, diabetes comorbidities, using treatment of Bactrim prophylaxis and HCV coinfection. They were more likely to report university as level of education. A higher proportion of MSM compared to the heterosexual men reported a CD4 cell counts above 500 cell/mm3. It was noted that, MSM were more frequently able to talk with health providers about sexuality comparing to heterosexual men (Table 2).

Prevalence of sexual difficulties

The prevalence of medium to high frequency of erectile difficulty, ejaculation difficulty, and low sexual desire was respectively in 42.3%, 30.1% and 54.6% of the participants. MSM have reported more often lower level of sexual desire comparing to Heterosexual men ($p<0.001$) (Table 3).

Scores of PROQOL- SexLife dimensions

Taking into account that a lower score indicates a higher level of sexual quality of life, we have examined the average of the dimensions within two populations. The characteristics of PROQOL- SexLife dimensions and scores for each population are shown in table 4.

In MSM, the mean (±SD) score was ranged from 28 (±22) for PAR dimension to 78 (±23) for DRG dimension. While in heterosexual, it was ranged from 36 (±24) for DIS dimension to 51 (±15) for PAR dimension. Both the MSM population and the heterosexual population exhibit similar levels of stigma and social distress in the STI dimension. The scores for this dimension are almost identical between the two groups, with 42 (±23) for heterosexual individuals and 42 (±27) for MSM.

Factors associated with PROQOL- SexLife dimensions

Visual inspection of residual plots did not reveal any obvious deviations from homoscedasticity or normality except for drug consumption dimension for MSM. Variance inflation factors (VIF) indicated the absence of serious collinearity problems. The significant variables found in each linear mixed model dimension are shown in tables 5 and 6.

MSM population

After conducting mixed linear regression analyses, it was discovered that individuals living with a partner (as opposed to those living alone) as well as those who expressed satisfaction with their health services, were positively associated with positive perception of sexual experiences in POP dimension (better SQoL). Regarding the STI dimension, it was observed that single participants or those with cardiovascular complications were more prone to experiencing stigma and fear. Notably, frequent condom use was associated with a 9unit increase in the STI dimension compared to category of "not frequently", as outlined in table 5.

Within the DIS dimension, encompassing issues such as erectile problems and low sexual desire, a negative association was found between SQoL and the use of Viagra and undergoing anti-cholesterol treatment. Moreover, living with a partner was associated with fewer instances of sexual difficulties among MSM.

Regarding the PAR/SOF dimension, higher scores in this domain were indicative of less frequent and less varied sexual practices. Within the PAR dimension, factors such as being HCV-positive and utilizing anti-cholesterol treatment were associated with less varied sexual practices with a partner, while satisfaction with healthcare services appeared to be positively linked with a higher frequency of sexual activities. Soft practices were more prevalent among individuals with higher education and those living with children, but less common among older men and those of Maghreb origin.

In the DRG dimension, specific to MSM, co-infection with HCV was found to be associated with higher values or consumption in this realm. As predicted, the consumption of Viagra also yielded significant implications.

Heterosexual men

In POP dimension being unemployed was found to be associated with a decreased level of positive sexual perception, while having African origin was found to be associated with an increased level of positive sexual perception.

Looking at sexual practices with a partner dimension (PAR), consumption of Viagra was found to be associated with a reduced frequency and diversity of sexual practices with a partner while Hispanic origin was associated positively with a greater frequency and diversity of sexual practices. In STI dimension, frequent alcohol consumption was found to be linked to an elevated perception of stigma and fear (Table 6).

Mental health morbidity-related factors

Mental health-related factors, including a history of clinically diagnosed depression, the presence of depressive symptoms, and a preoccupation with the risk of HIV transmission during sexual activity, were negatively associated with better outcome of SQoL in the three dimensions (POP, DIS, STI) among MSM. These mental health morbidity-related variables were associated with at least 6 to 13 points decrease in SQoL among MSM. Among heterosexual men being very preoccupied with risk of HIV transmission variable was significant in POP and DIS dimension.

Country effect

By demonstrating the results of SQoL according to country (figure 1 & 2), we observe that the POP dimension has been skewed toward better outcome (β=-9) for Brazil among MSM. The STI dimension is skewed toward slightly better outcome of SQol for France (β=-4), figure 1. By choosing country as a random effect, our model was able to show the potential intra-country differences; however, the intra-class correlation (ICC) in all dimensions did not exceed 0.15, and stayed in mild level, which implies overall small part of variation in the model is explained by country effect.

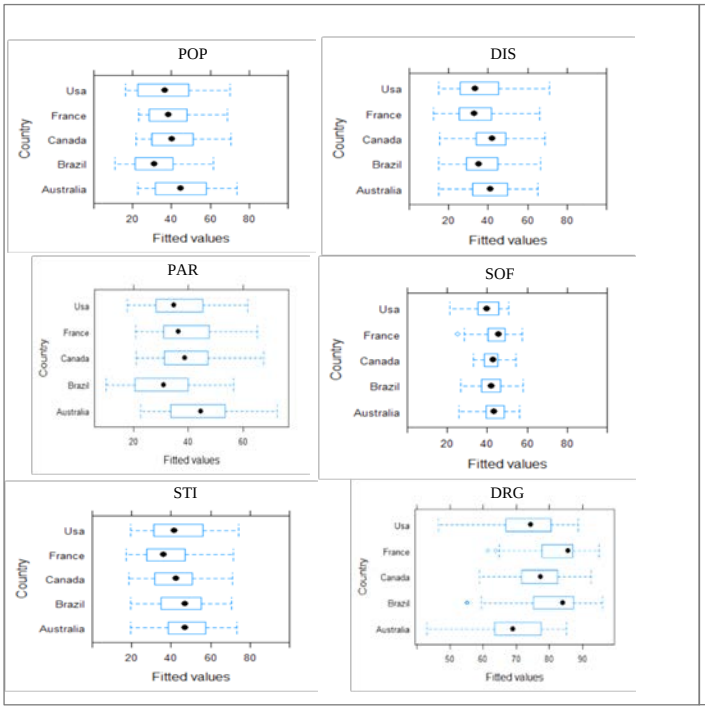

Figure 1. Variation of scores due to random effect (country) among MSM

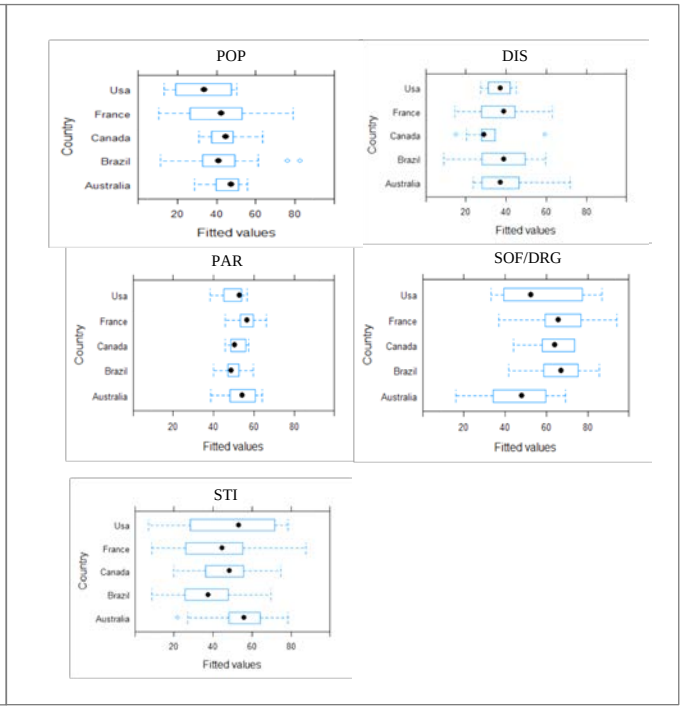

Figure 2. Variation of scores due to random effect (country) among heterosexual men

Discussion:

The aim of this study was to establish prevalence of sexual difficulties and determine factors associated with SQoL amongst HIV-positive men. To our knowledge, this is the first study that has investigated the quality of sexual life in men living with HIV by using a gender-tailored instrument (PROQOL-SexLife).

The prevalence of erectile difficulty among men with HIV reported in the literature ranges from 30% to 60% [15,16], while in our study, 42% of participants reported having a medium to high frequency of erectile difficulty. In our study, MSM exhibited a significantly higher prevalence of low sexual desire compared to heterosexual men. Various aspects of MSM's sexological and behavioral life could potentially influence sexual function, including sexual desire. However it is important to consider that low sexual desire is highly associated with demographic factors such as age, ethnicity, HIV parameters or type of HIV treatments (especially protease inhibitors) [17,18,19]. We have reported the prevalence of sexual difficulties in these two groups of men without controlling all the mentioned factors.

We observed that the patterns of contributors to PROQoL's dimensions have not been same among MSM and heterosexual men as some variables shown to be significant only among one population for a given dimension while not significant among the other population for the same dimension, for instance, unemployment was significant among heterosexual men in the POP dimension but not significant among MSM. However, we observed many similarities among two population; especially we observed a close association between impaired mental health and adverse SQol's outcomes reported by both MSM and heterosexual men. This confirms previous findings that have also showed a significant association between sexual satisfaction of PLWHA and psychosocial factors, i.e. depression or anxiety and social factors, such as experiences of HIV related discrimination [20].

Feeling preoccupied with risk of HIV transmission reflects the influence of psychological distress within the context of intimate relationships. In addition to that, another source of distress among PLWHA was the fear of contracting new infections from sexual activities. This variable is one of the variables constructing the stigma and fear dimension (STI) in PROQOL-SexLife.

Certain studies have demonstrated that relational aspects, including intimate connections within couples, serve as robust predictors of sexual satisfaction for both heterosexual and homosexual

men. Factors such as feeling preoccupied with risk of HIV transmission or fear of reinfection may affect SQoL by negatively affecting intimacy [21].

Regarding to preventive behaviors and possible association with SQoL, we found that frequent condom use was associated with higher values of STI dimension among MSM. Considering that fear of reinfection was a constructing element in the STI dimension (as mentioned above), the observed association is comprehensible. But it could also imply that even with safer sex practices, anxiety of reinfection could still impair SQoL.

None of the HIV-related biological parameters in our study (CD4, viral load), in none of the study populations, appeared relevant to SQoL, which is consistent with the results reported from a large representative study in France [22]. Nonetheless, a study conducted in the United States with a male sample, as well as a separate study conducted in the UK, discovered an association between CD4 counts below 200 and the presence of sexual difficulties. [23,24]. The cumulative effect of antiviral therapy has also been discussed as a potential factor in SQoL in the literature [16]. In our study, duration of treatment has lost its significance on SQol results after adding other HIV-related comorbidities (treatment for anti-cholesterol treatment). Other studies have found dyslipidemia as a significant risk factor for erectile difficulty symptom among HIV-positive men [25].

Although we have not assessed dyslipidemia directly, the prevalence of anti-cholesterol treatment was used as a proxy of dyslipidemia. In our study, being under anti-cholesterol therapy was a significant variable in DIS and PAR dimensions among MSM. Since dyslipidemia has been described as one of the side effects of highly active antiretroviral therapy on long term (HAART), this study emphasizes on cumulative side effect of antiviral therapy, specifically dyslipidemia.

Apart from existing health conditions and mental health, the role of socio-economic status such as unemployment, was found to be correlated with SQoL in the current study among heterosexual men. This finding aligns with results from other studies conducted among the general population [26]. However, unemployment was not significant among MSM, who had much higher rates of employment and levels of education compared to the heterosexual participants. The fact that unemployment is a marker of socioeconomic status shows the importance of controlling for these factors in future HIV studies.

A striking finding of our study is related to the role of satisfaction from health services on the POP dimension among MSM. Being under well support by health providers, could decrease

the distress and anxiety related to living with HIV. Also, the perception of receiving high quality of health services, may improve the patient's self-efficacy to cope with sexual related issues.

The current study had several limitations. We could not estimate the impact of type of HIV treatment as a potential factor. However, the literature results are inconsistent regarding to the association of antiretroviral therapy and sexual difficulties. Studies reported HAART as a causal factor for sexual difficulties, particularly Protease inhibitors including a large study of 900 men from 10 European countries who found Protease inhibitors as a risk factor for sexual difficulties [12,27].

Another limitation of this study arises from the fact that the current assessment of behaviors was based on convenient sampling, thus our study is not representative of the populations of MSM and heterosexual men living with HIV in the investigated countries, which induces a non-participation bias. One of the most significant limitations of a cross sectional study design is that temporal relationships cannot be determined since explanatory elements and sexual outcomes were assessed at a single time point. In addition, our analysis is not allowing addressing causality association between SQoL outcomes and the associated factors. One of the limitations of this study is that it did not create a composite measure of sexual quality of life. Instead, it relied on individual measures or factors related to sexual well-being, which may not capture the full complexity of this multidimensional concept.

In conclusion, the considerable significance of psychological factors coupled with the lack of association with HIV-related biological parameters (CD4, viral load) in our study underscores the necessity of encompassing both clinical and non-clinical factors in order to comprehensively and accurately assess all elements of SQoL. Recognizing and addressing the factors associated with SQoL is essential for improving the overall well-being and quality of life for patients. Clinicians play a vital role in ensuring that individuals receive the support and care they need to overcome sexual challenges and lead fulfilling lives. They should conduct a comprehensive assessment that considers physical, psychological, and social aspects of a patient's life. This holistic approach can reveal underlying factors affecting SQoL life that may not be immediately apparent.

Competing interest

None of the authors have declared any competing interest.

Authors 'contributions

EF and DM designed the study. AA, RT, DM, JI and GJ collected the data. EF conducted the main statistical analyses with assistance from BP. EL, RS, JI, IY, TF and CO provided editorial support, reviewed and revised the manuscript. All the authors read and provided feedback on drafts of the manuscript. All the authors contributed to the final manuscript.

Acknowledgements:

We acknowledge people living with HIV who have contributed to this study.

Funding:

French National agency of research on the Aids and Hepatitis (ANRS)

Data Availability statement

Data are available from Dr Martin Duracinsky.

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Table1. Examples of the questions in the PROQOL-SexLife questionnaire (MSM and Heterosexual men)

Dimension	Example of the statement	Responses
POP	In general, my sexual life is…	very good/ good/average/not good/very bad
STI	I am afraid of being rejected in my sexual life	never/rarely/sometimes/most of the time/ all the time
DIS	I had low sexual desire	never/rarely/sometimes/most of the time/ all the time
PAR	during the last four weeks I had sexual activities such as oral-anal sex or oro-vaginal with a partner	never/rarely/sometimes/most of the time/ all the time
SOF	during last four weeks I had sexual dreams	never/rarely/sometimes/most of the time/ all the time
DRG	I have used alcohol or drugs to have sex	never/rarely/sometimes/most of the time/ all the time

Table 2: Characteristics of the study's participants (N=581)

Participants characteristics	Total (N= 581)		Heterosexual (N= 107)		MSM (N= 474)		P-value*
	N	n or(± SD or %) mean	N	n or(± SD or %) mean	N	n or(± SD or %) mean	
Sociodemographic							
Age, years	**581**	49(± 11.8)	**107**	48(± 12.4)	**474**	49(± 11.7)	0.811
University level, *yes*	**560**	275(49.1%)	**106**	37(34.9%)	**454**	238(52.4%)	**<0.001**
Professional activity	**576**		**107**		**469**		**0.048**
Active		320(55.6%)		50(46.7%)		270(57.6%)	
Retired		118(20.5%)		26(24.3%)		92(19.6%)	
Student		17(2.9%)		1(0.9%)		16(3.4%)	
Unemployed		121(21.0%)		30(28.0%)		91(19.4%)	
Marital status	**577**		**107**		**470**		**<0.001**
Married		190(32.9%)		51(47.7%)		139(29.5%)	
Single		352(61.0%)		42(39.2%)		310(66.0%)	
Other		35(6.1%)		14(13.1%)		21(4.5%)	
Living mode	**581**		**107**		**474**		**<0.001**
Alone		274(47.2%)		35(32.7%)		239(50.4%)	
With a partner		171(29.4%)		27(25.2%)		144(30.4%)	
Other		127(21.9%)		39(36.5%)		88(18.6%)	
With children		9(1.5%)		6(5.6%)		3(0.6%)	
Ethnicity	**547**		**100**		**447**		**<0.001**
Caucasian		420(76.8%)		58(58.0%)		362(81.0%)	
African		63(11.5%)		28(28.0%)		35(7.8%)	
Hispanic		19(3.5%)		4(4.0%)		15(3.4%)	
Asian		35(6.4%)		9(9.0%)		26(5.8%)	
Maghreb		7(1.3%)		0(0.0%)		7(1.6%)	
Aborigines		3(0.5%)		1(1.0%)		2(0.4%)	
Clinical related variables							
Duration of HIV treatment, *years*	**581**	13(±8.6)	**107**	13(±8.9)	**474**	13(± 8.6)	0.982
Type of HIV treatment[a]	**408**		**87**		**321**		0.587
INI		150(36.8%)		36(41.4%)		114(35.5%)	
NNRTIs		107(26.2%)		22(25.3%)		85(26.4%)	
NRTIs		9(2.2%)		0(0.0%)		9(2.8%)	
PIs		84(20.6%)		16(18.4%)		68(21.2%)	
PIs + INI		36(8.8%)		8(9.2%)		28(8.7%)	
Others		22(5.4%)		5(5.7%)		17(5.3%)	
HIV-RNA	**560**		**99**		**461**		0.117
Undetectable(<=50)		533(95.2%)		91(91.9%)		442(95.9%)	
Detectable(>50)		27(4.8%)		8(8.1%)		19(4.1%)	
CD4 count, cell/mm3	**511**		**94**		**417**		**<0.001**
CD4 (0-199)		51(10.0%)		22(23.4%)		29(7.0%)	
CD4 (200-499)		136(26.6%)		22(23.4%)		114(27.3%)	
CD4 (>500)		324(63.4%)		50(53.2%)		274(65.7%)	
Co-morbidities and Mental health	**581**		**107**		**474**		
Diabetes, *yes*		54(9.3%)		16(15.0%)		38(8.0%)	**0.026**
Cardiovascular diseases, *yes*		95(16.4%)		26(24.3%)		69(14.6%)	**0.014**
Psychiatric disorder, *yes*		45(7.7%)		5(4.7%)		40(8.4%)	0.188
Clinical depression, *yes*		163(28.1%)		23(21.5%)		140(29.5%)	0.094
HBV coinfection, *yes*		73(12.6%)		16(15.0%)		57(12.0%)	0.409
HCV coinfection, *yes*		92(15.8%)		32(29.9%)		60(12.7%)	**<0.001**

Medical treatment	**581**		**107**		**474**	
Bactrim prophylaxis, yes		40(6.9%)		12(11.2%)	28(5.9%)	**0.050**
Anti-depressant/psychiatric treatment, yes		120(20.7%)		18(16.8%)	102(21.5%)	0.278
Anti-cholesterol, yes		80(13.8%)		17(15.9%)	63(13.3%)	0.481
Depressive symptoms	**581**		**107**		**474**	
Feeling sad/hopeless, *yes*		246(42.3%)		50(46.7%)	196(41.4%)	0.309
Low interest for life, *yes*		259(44.6%)		51(47.7%)	208(43.9%)	0.477
Health-related behaviors						
Consumption behavior	**581**		**107**		**474**	
Alcohol, *yes*		136(23.4%)		26(24.3%)	110(23.2%)	0.809
Smoking, *yes*		73(12.6%		34(31.8%)	39(8.2%)	**<0.001**
Cocaine, *yes*		46(7.9%)		13(12.1%)	33(7.0%)	0.073
Cialis/Viagra, *yes*		119(20.5%)		17(15.9%)	102(21.5%)	0.192
Knowledge of risk of HIV transmission	**580**		**106**		**474**	0.595
Aware		510(87.9%)		90(84.9%)	420(88.4%)	
Moderately aware		25(4.3%)		6(5.6%)	19(4.1%)	
Not aware		45(7.8%)		10(9.4%)	35(7.5%)	
Preoccupation with risk of HIV transmission	**575**		**104**		**471**	0.106
Not preoccupied		265(46.1%)	39	(37.5%)	226(48.0%)	
Moderately		231(37.0%)	42	(40.4%)	171(36.3%)	
Very preoccupied		97(16.9%)	23	(22.1%)	74(15.7%)	
Condom use	**575**		**106**		**471**	0.106
Not frequently		213(37.0%)		42(39.2%)	171(36.3%)	
Sometimes		265(46.1%)		39(36.4%)	226(48.0%)	
Frequently		97(16.9%)		23(21.5%)	74(15.7%)	
Sexuality and health care						
Erectile difficulties	**581**		**107**		**474**	0.846
Not frequently		335(57.7%)		60(56.1%)	275(58.0%)	
Sometimes		129(22.2%)		26(24.3%)	103(21.7%)	
Frequently		117(20.1%)		21(19.6%)	96(20.3%)	
Ejaculatory difficulties	**581**		**107**		**474**	0.331
Not frequently		406(69.9%)		69(64.5%)	338(71.3%)	
Sometimes		85(14.6%)		17(15.9%)	67(14.1%)	
Frequently		90(15.5%)		21(19.6%)	69(14.6%)	
Low sexual desire	**581**		**107**		**474**	**<0.001**
Not frequently		264(45.4%)		47(43.9%)	119(25.1%)	
Sometimes		172(29.6%)		34(31.8%)	217(45.8%)	
Frequently		145(25.0%)		26(24.3%)	138(29.1%)	
Able to talk with health providers about sexuality	**580**		**106**		**474**	**<0.01**
No		164(28.2%)		42(39.6%)	122(25.7%)	
Sometimes		133(22.8%)		15(14.1%)	118(24.9%)	
Yes		283(48.8%)		49(46.2%)	234(49.4%)	
Health care satisfaction	**576**		**106**		**470**	0.306
No		156(27.0%)		35(33.0%)	121(25.7%)	
Sometimes		108(18.7%)		19(17.9%)	89(18.9%)	
Yes		312(54.1%)		52(49.0%)	260(55.3%)	

* Chi-square, t-student tests

** INI= Integrase inhibitors, NNRTIs= Non-nucleoside reverse transcriptase inhibitors; NRTIs= Nucleoside reverse transcriptase inhibitors; PIs= Protease inhibitors;

[a] only for three country: Brazil, France and Canada

Table 4. *Characteristics of PROQOL sexlife dimensions*

	Dimension (abbreviation)	Mean of score ± SD	The detail of the questions and concepts constructing PROQOL-SexLife dimensions
MSM	Positive sexual perception (POP)	41± 24	• General evaluation of the sex life • Feeling that sex life give a sense of existence • Avoiding sexual relationship • Being satisfied with sex life • Feeling pleasure during sexual activities • Believing that the sexual partner is satisfied form sexual relationship • Having the sexual relationship during the last four weeks
	Stigma and fear(STI)	42± 23	• Having fear of being rejected in relation to sex • Being annoyed by the serum status in relation with emotional and romantic life • Having fear of being infected with another disease during sex • Feeling being less desirable • Experiencing stigma and discrimination in daily life because of sexual orientation
	Sexual difficulties(DIS)	37 ± 25.7	• Feeling less sexual desire • Having the erection difficulties
	With partner sexual practices(PAR)	28 ± 22	• Type of sexual activity: oral-vaginal, oral-anal • Type of sexual activity: anal sex
	Soft practices(SOF)	42 ± 23	• Type of sexual activity: having sexual dreams • Type of sexual activity: masturbation
	Drug consumption(DRG)	78 ± 23	• Taking the drugs or drinking alcohol for having the sexual activities • Type of sexual activity: others
Heterosexual men	Positive sexual perception(POP)	40± 26	• General evaluation of the sex life • Feeling that sex life give a sense of existence • Being satisfied with sex life • Feeling pleasure during sexual activities • Believing that the sexual partner is satisfied form sexual relationship
	Stigma and high social distress(STI)	42± 27	• Having fear of being rejected in relation to sex • Being annoyed by the serum status in relation with emotional and romantic life • Being afraid of infection during sex • Feeling being less desirable
	Sexual difficulties(DIS)	36± 24	• Feeling less sexual desire • Feeling hardly excited sexually • Having the erection difficulties • Avoiding sexual relationship

With partner sexual practices(PAR)	51± 15	• Having the sexual relationship during the last four weeks • Type of sexual activity: preliminary • Type of sexual activity: oral-vaginal, oral-anal • Type of sexual activity: vaginal sex • Type of sexual activity: anal sex
Soft practices(SOF/ DRG)	42± 27	• Taking the drugs or drinking alcohol for having the sexual activities • Type of sexual activity: Having sexual dreams • Type of sexual activity: masturbation

Table 5. Significant factors in multivariable mixed regression among MSM

SQoL dimension			Coefficient	Standard Error	p-value
Positive sexual perception (POP)	Fixed Variables	Living mode: Living with a partner	-4.4	2.1	0.045
		Clinical depression: Yes	6.6	2.4	0.007
		Not preoccupied with risk of HIV transmission	-9.4	2.0	0.000
		Very preoccupied with risk of HIV transmission	13.8	2.8	0.000
		Healthcare satisfaction: Yes	-15.1	2.2	0.000
	Random effect parameters	*SD Intercept*	8.1		
		ICC	0.1		
		R^2 *	0.4		
Stigma & fear (STI)	Fixed Variables	Being single	10.0	2.2	0.000
		Condom usage: frequently	9.8	2.9	0.000
		Cardiovascular: Yes	7.1	3.0	0.011
		Depressive symptom(feeling sad/hopeless): Yes	5.9	2.3	0.010
		Not preoccupied with risk of HIV transmission	-13.7	2.1	0.000
		Very preoccupied with risk of HIV transmission during sex	6.8	2.9	0.022
	Random effect parameters	*SD Intercept*	0.0		
		ICC	0.0		
		R^2	0.3		
Sexual difficulties (DIS)	Fixed Variables	Viagra use: Yes	7.9	2.8	0.005
		Clinical depression: Yes	8.6	2.9	0.004
		Living mode: Living with a partner	-5.4	2.5	0.035
		Anti-cholesterol treatment: Yes	9.0	3.3	0.007
		Not preoccupied with risk of HIV transmission	-10.0	2.5	0.000
	Random effect parameters	*SD Intercept*	0.0		
		ICC	0.0		
		R^2	0.2		
Sexual practices with partner (PAR)	Fixed Variables	HCV-coinfection: Yes	11.7	3.7	0.002
		Anti-cholesterol treatment: Yes	8.7	3.9	0.027
		Healthcare satisfaction: Yes	-8.5	3.0	0.005
	Random effect parameters	*SD Intercept*	6.2		
		ICC	0.0		
		R^2	0.2		
Soft sexual practices (SOF)	Fixed Variables	Age group: 40-49	13.8	5.7	0.015
		Age group: 50-59	12.7	5.7	0.026
		University Education	-5.3	2.2	0.018
		Living mode: living with children	-27.0	13.8	0.048
		Origin: Maghreb	18.7	9.2	0.043
	Random effect parameters	*SD Intercept*	2.3		
		ICC	0.0		
		R^2	0.0		
Drug consumption (DRG)	Fixed Variables	Viagra use: Yes	-10.5	2.7	0.001
		HCV-positive	-10.7	3.2	0.005
	Random effect parameters	*SD Intercept*	0.0		
		ICC	0.1		
		R^2	0.1		

* Pseudo-R-squared explaining the variance by the entire model, including both fixed and random effects

Table 6. Significant factors in multivariable mixed regressions among Heterosexual men

SQoL dimension			Coefficient	Std,Error	p-value
Positive sexual perception		Unemployed	12.5	6.2	0.047
(POP)	Fixed Variables	Not preoccupied with risk of HIV transmission	-11.9	5.8	0.046
		Origin: African	-17.5	6.3	0.008
	Random effect parameters	*SD Intercept*	0.5		
		ICC	0.0		
		R^2	0.3		
Stigma/fear (STI)	Fixed Variables	Alcohol consumption: Yes	20.0	7.1	0.007
	Random effect parameters	*SD Intercept*	0.0		
		ICC	0.0		
		R^2	0.28		
Sexual difficulties (DIS)	Fixed Variables	Not preoccupied with risk of HIV transmission	-12.1	6.3	0.055
	Random effect parameters	*SD Intercept*	0.0		
		ICC	0.0		
		R^2	0.2		
Sexual practice with partner (PAR)	Fixed Variables	Origin: Hispanic	29.3	13.7	0.040
		Viagra use: Yes	-12.4	6.0	0.047
	Random effect parameters	*SD Intercept*	0.0		
		ICC	0.0		
		R^2	0.2		