

Determinants of psycho-social factors in relation to health-related quality of life of people living with HIV attending a public health care setting in South Africa

Abstract

Background: With the advent of Highly Active Antiretroviral Therapy (HAART), people living with HIV/AIDS (PLWHA) and on antiretroviral therapy (ART) have their life expectancy increased because ART improves their longevity. However, psychosocial challenges are a great threat to their health-related quality life (HRQOL). People Living With HIV/AIDS can now live longer but with increasing rates of comorbidities. Thus, prevention of comorbidities is crucial to maintain and gain health-related benefits and to maximise the HRQOL in the long-term management of PLWHA. Aim of the study: The aim of this study was to determine psychosocial factors that influence HRQOL of PLWHA on ART.

Methods: A cross-sectional study was conducted using a convenient sampling to select 100 PLWHA and attending at the HIV-clinic. Health Related Quality of life was assessed using WHOQOL-HIV-BREF questionnaire and demographic information was collected using a semi-structured-questionnaire. Data were analysed using SPSS-22 for basic descriptives. Independent-samples-test and ANOVA were used to determine significant differences at $P < 0.05$.

Results: Of 100 interviewed, 63% females and 37% males had mean-age of 38 years with 36% in age-range 31-40 years, 47% had secondary-education, 20% were contract-employees, 32% receiving \geq ZAR10000 monthly, 55% were living in rural-areas and 42% were singles. Good health-status was reported in 92%, 72% having initial-CD4-count of \geq 500cells/mm³, 54% having initial-viral-load \geq 10000copies/mL and 98% undetectable. Asymptomatic were 62% and 43% WHO-clinical stage of 2. Only 24% had acceptable adherence-rate of \geq 90%. In terms of psychological factors, there was a correlation between anxiety/depression, satisfaction with their health and acceptance of bodily image and appearance.

Conclusion: The study demonstrated that psychological factors that were of significant association with HRQOL were anxiety, depression, satisfaction with their health, acceptance of bodily image and appearance. Individuals with abnormal anxiety or depression are associated with poor quality of life. Therefore, the healthcare system needs to strengthen their social support.

Keywords: quality of life, antiretroviral therapy, health-related quality of life, plwha, psychosocial factors

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Introduction

HIV/AIDS, also known as Acquired Immune Deficiency Syndrome, is a chronic illness that can be controlled with highly active antiretroviral therapy (HAART) throughout the rest of one's life. However, the condition combined with the long-term toxicities of antiretroviral medications (ARVs) has a major impact. Each of these has an impact on a person's health-related quality of life (HRQOL)^{1,2} as well as their social, psychological, physical, and financial well-being. Lower HRQOL is a result of poor adherence to ART and greater rates of treatment cessation in People living with HIV/AIDS (PLWHA), according to Mannheimer et al. (2005).³ The objectives of the national AIDS control program may be seriously hampered by the above mentioned. According to estimates from the Global HIV

and AIDS Statistics, there were 37.9 million PLWHA (including 1.7 million children) globally in 2018 and an adult HIV prevalence of 0.8%. Of these same individuals, almost 21% were unaware that they were infected (UNAIDS, 2019).⁴ Globally, HIV/AIDS is a public health problem.

The life expectancy of PLWHA significantly increased with the introduction of ART. Therefore, an improvement in quality of life (QOL) is anticipated. All of which highlight the critical need of evaluating QOL and ART adherence in HIV-positive individuals. Even though HIV/AIDS is a chronic illness, studies conducted by Murray et al.⁵ and Nakagawa, May & Philips⁶ showed that widespread use of ART has made HIV manageable. Evidence is currently available to support the advantages of ART in enhancing PLWHA's life expectancy and Health-related quality of life (HRQOL) results.

With an estimated 7.7 million individuals living with HIV in 2018, South Africa (SA) had the largest and most well-known HIV epidemic globally, according to a 2019 UNAIDS report.⁴ One-third of newly diagnosed HIV cases in Southern Africa are in South Africa.⁷ According to UNAIDS estimates for 2019, there were 240,000 new HIV infections and 71,000 AIDS-related deaths in South Africa in 2018.⁴ In the second half of 1990s, there were advances in pharmaceutical research and advent of ARV protease inhibitors, with a new phase of ART internationally known as HAART.⁸

Long-term results for PLWHA depend on achieving high levels of ART adherence. A study performed by Biraguma et al.⁹ stated that it is necessary to identify factors that influence ART adherence. This would aid in comprehending the tactics to improve ART adherence in order to gradually raise HRQOL. Research conducted by Call et al.¹⁰ concluded that the benefits of PLWHA on ART for health outcomes have now shifted from survival to HRQOL. Despite PLWHAs' increasing life expectancy, Nakagawa et al.⁶ noted that PLWHAs' quality of life (QOL) may be impacted by HIV progression, the side effects of antiretroviral therapy (ART), and aging. It is, therefore, crucial to identify factors influencing HRQOL in PLWHA.

To further understand the impact of psychosocial factors on PLWHA's HRQOL, further research is required. Interventions could contribute to PLWH's improved HRQOL. The term «HRQOL» describes how illness and treatment affect quality of life. It is mostly composed of self-reported measurements of mental and physical health, and it is becoming a more and more common subjective approach of evaluating health in chronic illnesses. In their study, Kaplan and Ries¹¹ noted that while conducting follow-up consultations with patients who have chronic diseases, it is critical to evaluate HRQOL since it not only contributes to the explanation of the disease burden but also evaluates the effectiveness and quality of the healthcare system.

Life expectancy has increased as a result of the introduction of ART, which has improved the quality of life for individuals living with HIV. As previously mentioned, in addition to this shift in perspective, there have also been psychosocial changes that have led to a reduction in the fear of impending death. As a result, one now needs to rearrange their life in order to adapt to their new circumstances. According to Calvetti et al.¹² this also include the potential to forge new relationships with others outside of one's circle of friends, family, and co-workers in addition to the potential to preserve current relationships with these individuals.

Impaired quality of life (QOL) may be linked to a variety of HIV-related psychosocial problems. In their research, several writers showed how psychosocial variables impact HRQOL. Nanni et al.¹³ highlighted depression as a common issue among PLWHA, while Ballester et al.¹⁴ pointed out financial problems, and Breet and Seedat¹⁵ emphasized stigma and discrimination. Inconsistent relationships between these variables and PLWHA HRQOL have been reported by other studies. These correlations across HIV-positive populations have implications for health policies, resource distribution, and, eventually, bettering daily functioning and quality of life for patients. Therefore, this study aimed to determine psychosocial factors that influence HRQOL of PLWHA on ART in this region of South Africa.

Significance of the problem

Different studies have been done to measure HRQOL in people living with HIV. These studies provide a foundation for developing and implementing group-specific interventions to improve HRQOL as

well as treatment outcomes for PLHA. Few studies have been done in primary healthcare setting. Therefore, this study is significant because it uses a standardized tools that has been recommended the World Health Organization to measure HRQOL and related psychosocial factors.

Methodology

Study design and population

Data was gathered from PLWHA who visit the HIV clinic for ART, medical consultations, and counselling support using a cross-sectional quantitative methodology. Others came to the clinic for laboratory testing, together with those who need assessment of their biomedical markers (CD4 count and viral load).

Study area and sample selection

The study site was at the HIV clinic of the public primary health care clinic, in Mthatha – Eastern Cape Province of South Africa. The clinic serves a population of 45,600. Of this population, 3800 were PLWHA and attended the HIV clinic and were on ART. A convenient sampling method was used to select 100 participants.

Sample size determinants

Based on a 10% confidence level, a 95% confidence level ($Z_{\alpha}=1.96$), and the percentage of participants who had strong awareness of their disease ($P=55\%$), the sample size was determined.

The formula $n = \text{from the average and variance}$ was used to estimate the sample size. With a 95% confidence level, the numbers in each group were determined to be representative of the population. Using the formula $n = Z^2 * P(100-P)/e^2$, $n = (1.96)^2 * 55(100-55)/102 = 95$, the sample size estimation was calculated. As a result, the sample size fell between 75 and 100.

The participants who were selected had a level of knowledge or understanding of a problem. It involves gaining an understanding of the key variables and issues involved, as well as any potential solutions or strategies that could be employed to address the issue. Strong awareness is defined by a focused understanding of something, such as an issue or a feeling. The survey was carried out on the 1st of January 2022 to the 28th of February 2022.

Study participants

Inclusion and Exclusion criteria of participants

Inclusion criteria: The following inclusion criterion was used to sample the participants. Adult males and females aged over 18 years; living with HIV and AIDS. Those who attend the HIV clinic monthly for their ART repeat treatments and or medical reviews. Those who were able to sign a written informed consent.

Exclusion criteria: Patients who refused consent or who were very unwell and needed hospitalization or medical attention were not allowed to participate in the study.

Ethical considerations: Permission and ethical approval to conduct the study was sought from Walter Sisulu University - Research Innovation, Higher Degrees and Ethics Committees of the faculty of Medicine and Health Sciences (approval # 031/2017). After the issue of Ethical Clearance Certificate, the proposal was loaded into the department of health website. Then further clearance to conduct the study was sought from the manager of the municipality under which

the clinic is, and finally from the manager of the HIV clinic where data were collected. Following the acquisition of the necessary clearances, a participant information sheet was used to notify the participants of the purpose and nature of the study in the language of their choice.

The research's objectives and benefits were elucidated to the participants using the participant information sheet. Informed consent forms were also distributed to the participants. By being informed that their names and identity would remain secret, the participants were given the utmost confidentiality during the study. The participants were made aware that there was no dangerous procedure involved, that they may withdraw from the study at any time, and that they would not be forced to answer any questions that made them uncomfortable.

Data collection

Demographic-data were collected using standardized-questionnaire and psychological data was obtained from HRQOL data using WHOQOL-HIV-BREF questionnaire. Biomedical-markers were obtained from patient's medical-records; ART-adherence was calculated after performing pill-count method. An overall adherence rates was calculated using the following equation: Adherence rate = (Number of days of medication supplied within the refill interval / number of days in refill interval) X 100. The acceptable adherence rates were between 90% and 100%.

Procedure

After obtaining consent from the clinic manager, individual participant data were gathered once. The researcher conducted in-person interviews with individuals to gather information, and the questionnaire was distributed. The sociodemographic information collected included information on gender, age, marital status, educational attainment, employment status, monthly income, and status as well as details about domicile, HIV status, mode of ART use, and HIV-related information. Biomedical markers, such as WHO status, viral load, and CD4 count were acquired from the participants' clinical and medical records to guarantee the accuracy of the data. ART adherence was measured using the pill-count method, and the adherence percentage was computed using a formula.

A WHOQOL-HIV BREF questionnaire with a 5-point Likert scale was used to measure the respondents' quality of life. The WHO created and validated WHOQOL-HIV, a questionnaire designed especially for people living with HIV/AIDS, to assess quality of life (QOL) across six categories. A shortened version of the WHOQOL-HIV BREF comprises 31 questions, items, and facets that are divided into six QOL assessment domains: physical health, psychological health, level of dependence, social relationships, environmental health, and spiritual/religious/personal beliefs (SRPB) in addition to one overall perception component. As mentioned above, these inquiries were split up over six websites. The realm of physical health measures the following aspects: energy and weariness, sleep and rest, and pain and discomfort.

The Likert-type scale used to frame the WHOQOL-HIV-BREF questions determines the grades based on the characteristics of the domains and aspects. Every item has a rating of five on a Likert scale, where one represents a negative impression and five represents a favourable one. Higher scores suggest a higher quality of life, and as a result, the final results are graded positively. The QOL score was compared to the WHOQOL-100 score by adding the mean domain scores of each domain to 25, resulting in a score range of 00

(minimum) to 100 (maximum), where higher values denoted a higher quality of life. The domain score, or average of the question scores, is determined by taking into account the answers to the questions inside each QOL domain.

The psychological components were taken out of the sphere of psychological health. Positive emotions, cognition, learning, memory and focus, self-esteem, physical attractiveness and image, and negative emotions are all measured in this domain. The domain of level of independence assesses aspects related to daily living, work ability, mobility, and reliance on medications or treatments. Aspects of interpersonal relationships, social support, social inclusion, and sexual activity are all included in the social connections area. Physical safety and security, home environment, social and health care quality, and opportunities to learn new skills and knowledge are all measured in the environmental domain. The SRPB domain also covers the following aspects: individual views, accepting responsibility and forgiving others, worries about the future death, and dying.

Data analysis

For basic descriptive analysis, SPSS-22 was used to analyze the data. For every variable, descriptive statistics were produced. The mean and standard deviations were used to summarize continuous variables. Categorical variables were summarized using frequency percentages. Whereas the Independent-samples t-test and ANOVA were utilized to assess the mean score on psychological HRQOL and social relations HRQOL with a statistical significance value of $P \leq 0.05$, Pearson's Chi-square was employed to show the relationships between participant features.

Results

Socio-demographic, Clinical, behavioural and biological characteristics

Of the 100 people surveyed, 63% were women and 37% were men. Their mean age was 38.0 years, with a range of 18 to 53 years. The majority (36%) were between the ages of 31 and 40, 47% had completed secondary school, 20% had contract jobs, 32% made less than R10,000 a month, and 55% resided in rural regions. Of them, 42% were unmarried. 92% of respondents said their physical health was in good condition. 72% of the samples had an initial CD4+count of less than 500 cells/mm³, 54% had an initial viral load greater than 10,000 copies/mL, and 98% had an undetectable viral load. Seventy-one percent said they had a male infection. Sixty-two percent had no symptoms, and forty-three percent were in WHO clinical stage 2. The adherence rate was just 24% satisfactory (Table 1).

Majority of participants were unemployed, and this leads to low QOL. The main aim of this study was not to look at professional relationship. This could be looked at in future studies. The distribution according to gender was 63% females and 37% male. The study was a cross-sectional quantitative methodology using a convenient sampling. The aim of this study was not to analyse factors considering gender. This will be done in my next study that I intend to do.

Results of Mean Quality of Life Scores in Domains of Health-related Quality of Life revealed that Environmental health domain had the highest mean score, while Spiritual/Religious/Personal Beliefs domain had the lowest mean score. Table 2 displays this. The instrument's internal reliability was evaluated. WHOQOL-HIV-BREF (Cronbach's alpha). The Cronbach's alpha coefficient scores

for the following domains were satisfactory: SRPB (0.669), social relations (0.346), psychological health (0.298), environmental health (0.294), physical health (0.268), and level of independence (0.369).

Table 1 Sociodemographic and clinical characteristics of the HIV-infected patients (n = 100)

Characteristic	n	%
Gender		
Female	63	63
Male	37	37
Age group (years)		
18 – 30	30	30
31 – 40	36	36
41 – 50	24	24
> 50	10	10
Educational level		
Illiterate	2	2
Primary	24	24
Secondary	47	47
Tertiary	27	27
Marital Status		
Single	42	42
Married	37	37
Co-habiting	7	7
Separated	8	8
Divorced	1	1
Widowed	5	5
Employment type		
Permanent	12	12
Contract	20	20
Unemployed	33	33
Self-employed	15	15
Income earned		
≥5000	12	12
5000-10000	20	20
10000	68	68
Residence Area		
Urban	45	45
Rural	55	55
Health Status		
Neither poor nor good	3	3
Good	92	92
Very good	5	5
Initial CD4 count		
>500	73	73
<500	27	27
Initial Viral Load		
>10000	54	54
<10000	46	46

Table 1 Continued...

Current Viral Load		
>10000	2	2
<10000	98	98
Adherence rate		
Acceptable	24	24
Unacceptable	76	76
WHO Staging		
Asymptomatic (Stage 1)	34	34
Mild Symptomatic (Stage 2)	43	43
Advanced (Stage 3)	23	23

Table 2 Mean quality of life scores in domains of health-related quality of life

Dependent Variables	Study Participants (N=100)		
	Mean (±SD)	Minimum	Maximum
Environmental health	77.00(±14.94)	25	100
Social relations	74.25(±22.88)	00	100
Psychological health	74.00(±12.77)	25	100
Level of Independence	64.50(±19.84)	00	100
Physical health	43.25(±25.09)	00	75
Spiritual/Religious/ Personal Beliefs	26.25(±26.44)	25	100

SD = Standard deviation

Psychological factors were obtained from the results of distribution of HRQOL and were measured by WHOQOL-HIV BREF questionnaire. The questionnaire consisted of 8 facets including level of concentration, satisfaction with quality of life, satisfaction with health, life being meaningful, participants being blamed for their HIV-status, enjoying everyday life, self-satisfaction, feeling of mood swings, depression, and anxiety. Based on these facets, mean scores were calculated obtaining the distribution of means, SD, median as shown in Table 3. As demonstrated in Table 3 distribution of demographic score were significant in educational level (F=2.838; P=0.042). Furthermore, other scores that were of statistical significance were in initial CD4 count (F=4.936; P=0.029).

An association was studied between psychosocial risk factors of health-related quality of life with HIV/AIDS in quality of life, satisfaction with health, level of concentration, being blamed for HIV status, accepting bodily appearance, health safety and despair/anxiety. As shown in Table 4, it is observed that in the psychological domain there was a highly significant correlation in quality of life (r=0.601, p<0.001), satisfaction with health (r=0.484, p<0.001), acceptance of bodily appearance (r=0.352, P<0.001). Then an inverse correlation between life being meaningful (r=-0.269, p=0.022), as well as people being blamed for their HIV status (r=-0.268, p=0.007). Furthermore, there was a highly significant correlation with quality of life (r=0.601, p<0.001), satisfaction with health (r=0.484, p<0.001), acceptance of bodily appearance (r=0.352, P<0.001).

Then in social relation domain, a highly significant correlation in acceptability by people one knows (r=0.270, p <0.000) as demonstrated in Table 5.

In terms of quality-of-life domains the following domains stood out to be showing highly significant correction: psychological domain (r=0.425, p<0.001), followed by social relations (r=0.424, p<0.001) and environmental (r=0.398, p< 0.001) as demonstrated in Table 6.

Table 3 Distribution of demographic scores and psychological health domain

Variables	N	Mean ±SD	Minimum	Maximum	F Value	P Value
Gender					0.212	0.646
Female	63	59.63±8.07	44.9	75		
Male	37	58.84±8.67	37.4	44.9		
Age group					0.72	0.542
18-30	30	59.99±7.49	47.5	72.5		
31-40	36	58.46±7.45	44.9	70		
41-50	24	60.83±9.90	45	77.5		
>50	10	56.99±9.36	37.4	65		
Educational level					2.838	0.042
Illiterate	2	48.70±15.98	37.4	60		
Primary	24	56.87±6.72	45	70		
Secondary	47	61.27±8.92	44.9	77.5		
Tertiary	27	58.34±8.26	45	75.5		
Marital Status					0.896	0.489
Single	42	57.79±7.83	44.9	72		
Married	37	59.59±9.08	37.4	75		
Co-habiting	7	63.21±6.87	52.5	75		
Separated	8	60.00±9.63	40.5	77.5		
Divorced	1	62.50±9.15	62	62.5		
Widowed	5	63.50±2.85	60	67.5		
Employment Status					0.877	0.456
Permanent	30	60.49±8.24	45	77.5		
Contract	32	59.77±8.30	45	72.5		
Unemployed	33	59.39±7.74	37.4	72.5		
Self-employed	15	56.34±9.45	44.9	75.5		
Initial CD4					4.936	0.029
>500	72	58.22±7.99	37.4	77.5		
<500	27	62.31±8.55	44.9	75		
Adherence Rate					3.69	0.058
Acceptable	24	56.55±8.27	45	77.5		
Unacceptable	76	60.22±8.12	37.4	75		

Table 4 Correlation between psychosocial factors and HRQOL of people living with HIV/AIDS

Psychological domain facets	Pearson correlation coefficient	P Value
Variable	r	P
Quality of life	0.601	<0.001
Satisfaction with health	0.484	<0.001
Acceptance of bodily appearance	0.352	<0.001
Life being meaningful	-0.269	0.022
People blaming you for your HIV status	-0.268	0.007
Depression, moods, anxiety	-0.130	0.196
Enjoying everyday life	0.211	0.0035
Self-Satisfaction	0.200	0.048

Table 5 Social relations domain facets

Acceptability by people you know	0.27	<0.000
Satisfaction with personal relations	0.000	1
Sex life	0.178	0.077
Support from friends	0.035	0.728

Table 6 Quality of life in relation to HRQOL

Quality of life (WHOQOL-HIV BREF)	r	P
Physical	0.250	0.005
Level of independence	0.280	0.005
Social Relations	0.424	<0.001
Psychological	0.425	<0.001
Environmental	0.398	<0.001
Spirituality/Religious/Personal beliefs	0.060	0.551

Discussion

The study determines the association between Psycho-social factors, and HRQOL in people living with HIV attending a public health care setting in South Africa. It is the first study of its kind to use the WHOQOL-HIV BREF to determine how psychosocial factors affect HRQOL across a range of domains. Among the six domains of HRQOL, the mean score of 77.00 (± 14.94) was highest in the environment health domain. This domain includes physical security, housing, finances, and care.

The high quality of life in the environment health domain indicates better health care services. This implies that PLWHA have access to social services, high-quality healthcare, learning opportunities, and leisure time. The outcomes of different research projects vary. In the physical domain, for instance, the results of a study conducted in Nigeria by Odili et al.¹⁶ showed a better mean quality of life score of 15.9 ± 3.05 .

In this study the lowest mean score of $26.25 (\pm 26.44)$ was revealed in Spiritual/Religious/Personal beliefs domain. On the contrary, a study performed in India obtained the mean quality of life score of $11.96 (\pm 3.15)$ as stated by Wig et al.² In this study, results of Correlation between Psychosocial factors and HRQOL of people living with HIV/AIDS revealed the following variables: quality of life, satisfaction with health, acceptance of bodily appearance, life being meaningful, people blaming others for their HIV status had strong correlation with $p < 0.001$.

Results obtained in this study revealed that depression, moods and anxiety had no association with psychological domain. In contrast, a study found that anxiety and sadness can have a variety of causes.¹⁷ Among these variables are HIV test results that are positive and subsequent disease progression. Depression and anxiety may also be exacerbated by HIV-related symptoms and the disease's effects on social variables, such as unemployment's decreased social support. The correlations between abnormal anxiety and depression and poor quality of life (QOL) suggest that early detection of these psychiatric comorbidities among PLWHA is necessary to enhance their HRQOL and medication adherence for HIV.¹⁸

The findings of this study indicated a low quality of life in the area of social relationships. The perception of a person toward interpersonal relationships, social support, social inclusion, and sexual activity is measured in this domain. Consequently, stigmatization and HIV-related prejudice experienced by PLWHA, along with reduced sexual

activity, may be reflected in the results. Furthermore, as the disease progresses, some HIV-positive people may quit their occupations, which has an impact on their financial resources. They may then become socially isolated as a result of being unable to engage in social and recreational activities. This is also reflected in the results of no association between employment status and psychological health domain.

Limitations of the study

Since this study only included participants on HAART, it had some limitations. A more thorough outcome would have been obtained if individuals living with HIV who did not begin HAART had also been included. This suggests that this disadvantage can potentially be solved by researchers using alternative study designs, such as qualitative approaches. Another limitation to this study is that the study employed a cross-sectional study; meaning that a temporary association cannot be established. An additional limitation of this research was that the participant sample was selected from a public health facility; hence, PLWA who receive care at private health facilities were excluded from the study, potentially restricting the applicability of the findings.

Conclusion

The six domains of HRQOL were found to be high except the Spiritual/Religious/Personal Beliefs domain. The environmental health, social health and psychological health of patients were higher than the rest of the HRQOL domains. Most psychological domain facets had a correlation with psychological factors and HRQOL of PLWA except depression and anxiety. In respect to social relations domain facets, acceptability by people one knows, and sex life were significant in relation to QOL. The rest of domains were significant except the Spiritual/Religious/personal beliefs. Moreover, poor HRQOL was linked to anxiety and depression, particularly in the areas of physical, psychological, and social relationships.

Therefore, the healthcare system needs to strengthen. The primary healthcare support can be used to improve the level of independence, physical health and SRPB of PLWA. Furthermore, societal sensitization is required to prevent stigma and discrimination against PLWA. This will enhance those HRQOL domains, as well as provide PLWA with a sense of safe living circumstances or enable them to get the support they require from others who know them.

There low adherence rate to ART of 24% is due to certain factors like unemployment, anxiety, depression. Other factors that lead to failure to adherence could be due to multiple factors including late detection, stigma and discrimination, and difficulty in accessing health facilities, adverse effects of drugs, comorbidities, psychosocial factors, economic constraints, and availability of ART, lack of education from the providers to give special instructions on how to take ART. Furthermore, adherence is simultaneously influenced by multiple factors such as social and economic factors, health care system, characteristics of the disease, disease therapies, and patient-related factors. It is necessary to tackle issues associated with each factor.

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Conflicts of interest

The authors declare no potential conflicts of interest.

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