Depression, Anxiety, Psychological Symptoms and Health-Related Quality of Life in People Living with HIV

Shaohang Cai 1,*, Lili Liu 2,*, Xiaolu Wu 3, Ye Pan 3, Tao Yu 1, Hongjie Ou 3
1 Department of Infectious Diseases, Nanfang Hospital, Southern Medical University, Guangzhou, People’s Republic of China; 2 Department of Pathology, Sun Yat-sen University Cancer Center, Guangzhou, People’s Republic of China; 3 First Affiliated Hospital of Xiamen University, Xiamen, Fujian Province, People’s Republic of China
*These authors contributed equally to this work

Objective: To investigate the levels of depression, anxiety, psychological symptoms and health-related quality of life (HRQOL) in people infected with human immunodeficiency virus (HIV) and to assess the risk factors.

Methods: A total of 121 people living with HIV (PLWHIV) were included, and 61 health individuals were selected as healthy controls. Their sociodemographic information was collected. The Self-Rating Depression Scale, Self-Rating Anxiety Scale, Symptom Checklist 90 and Short-Form Health Survey-36 were used.

Results: The depression score was higher in PLWHIV (47.83 ± 10.58 vs 36.52 ± 9.69, P<0.001). Similar results were observed in anxiety score (41.06 ± 11.24 vs 32.31 ± 7.99, P<0.001). Multivariable analysis revealed that younger age (OR=0.929, P=0.004) and smoking (OR=4.297, P=0.001) were identified as independent factors of depression while young age (OR=0.890, P=0.008) and alcohol consumption (OR=4.801, P=0.002) were independent factors of anxiety. Results of SCL-90 questionnaire showed that hostility, paranoia ideation were significantly more pronounced when PLWHIV had depression. Results of HRQOL showed that physical functioning (82.88 ± 14.73 vs 93.41 ± 9.22, P<0.001) and mental health (57.46 ± 17.64 vs 65.68 ± 17.44, P=0.012) were lower in PLWHIV with depression. For PLWHIV with anxiety, vitality (56.96 ± 14.61 vs 67.58 ± 17.57, P=0.004), social functioning (64.52 ± 23.97 vs 74.64 ± 21.47, P=0.036) and mental health (52.57 ± 14.21 vs 65.03 ± 17.98, P=0.001) were lower. High depression level was showed the independent risk factor associated with poor HRQOL (OR=0.370, P=0.001).

Conclusion: Depression and anxiety were very common in PLWHIV. Physicians should not only focus on the antiviral treatment of these patients but also monitor their mental status, especially that of younger patients. For PLWHIV with depression and anxiety, psychological intervention should be provided, and social role rebuilding may be good for depression and anxiety alleviation.

Keywords: acquired immunodeficiency syndrome, human immunodeficiency virus, anxiety, mental disorder, depression

Introduction

Acquired immunodeficiency syndrome (AIDS) is a serious infectious disease. AIDS is caused by human immunodeficiency virus (HIV) infection. Since the first case reported in 1981, HIV has spread widely around the world. According to the World Health Organization, 35.3 million individuals were infected with HIV in 2012, with 2.3 million new cases and 1.3 million patients dying of AIDS each year.1,2

Although the introduction of early diagnosis and highly active antiretroviral therapy in clinical practice has allowed control of AIDS and dramatic reduction in
mortality,\textsuperscript{3} AIDS is still considered to be one of top global causes of disability and disease burden in patients, followed by major depression in 2030 as estimated by epidemiologists.\textsuperscript{4}

Depression and anxiety are closely related to many viral-related diseases and may affects the prognosis of patients.\textsuperscript{5,6} Depression is also closely related to people living with HIV (PLWHIV).\textsuperscript{7,8} The relationship between depression and anxiety and HIV is very complicated. Previous studies have suggested that exercise training can be effective in improving anxiety disorder, social function, depression and mental health’s total score in PLWHIV.\textsuperscript{9,10} In addition, another study has suggested that the role of disclosure and discrimination is determinant in HRQOL. HIV should increasingly be regarded as a chronic disease characterized by different pathological conditions requiring a comprehensive and multidisciplinary approach.\textsuperscript{11}

Although the morbidity in depression is high in late-stage AIDS,\textsuperscript{12} depression can also occur in various stages of HIV infection.\textsuperscript{13} This indicates the need for clinical monitoring for the occurrence of depression in patients infected with HIV. Early detection of high-risk patients is a practical clinical strategy by exploring the related risk factors. However, in the Asia-Pacific region, where the prevalence of HIV is rapidly increasing, there are only few contradictory studies of the incidence and risk factors of depression and anxiety in PLWHIV.

Therefore, our study aimed to investigate the levels of depression and anxiety in PLWHIV and to assess the risk factors for depression and anxiety. We also explored the relationship of psychological symptoms and health-related quality of life (HRQOL) with depression and anxiety in PLWHIV. We speculate that PLWHIV with depression and anxiety have different HRQOL and psychological symptoms. Our study can effectively assess the risk of depression, anxiety and poor HRQOL for PLWHIV.

**Subjects and Methods**

**Subjects**

This is a cross-sectional study. PLWHIV were recruited continuously from First Affiliated Hospital of Xiamen University and Nanfang Hospital, Southern Medical University. We have also enrolled 61 subjects who received health examinations as healthy controls. We enrolled a total of 121 PLWHIV, and 61 healthy controls. In the PLWHIV group, the average age was 31.4±10.64 with a total of 79 male (65.3%). In the healthy control group, the average age was 33.66±10.95 with 41 male (67.2%). Social demographic data of all patients enrolled were recorded, including gender, age, education, income level, smoking and alcohol consumption. Characteristics of patients enrolled are shown in Table 1. We obtained evidence of smoking and alcohol consumption based on patients’ self-reports.

**Inclusion and Exclusion Criteria**

Inclusion criteria was as followed: All patients enrolled were confirmed to have positive HIV-1 antibody findings. Exclusion criteria were as followed: 1) Patients are excluded if their age is less than 18 years old. 2) Patients combined with central nervous system diseases. The institutional review board of the First Affiliated Hospital of Xiamen University approved the study. All patients provided informed consent. All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. Informed consent was obtained from all patients for inclusion in the study.

**Table 1 Characteristics of PLWHIV Group and Health Control**

| Sample Size | PLWHIV Group | Health Control | P value |
|-------------|--------------|----------------|---------|
| Age, years  | 121          | 61             | 0.190   |
| Male        | 79 (65.3)    | 41 (67.2)      | 0.796   |
| Female      | 42 (34.7)    | 20 (32.8)      |         |
| Smoking     | Yes          | 41 (33.9)      | 0.770   |
| No          | 80 (66.1)    | 22 (36.1)      |         |
| Alcohol consumption | Yes | 52 (43.0) | 23 (37.7) | 0.495 |
| No          | 69 (57.0)    | 38 (62.3)      |         |
| Level of education | Primary | 33 (27.3) | 15 (24.6) | 0.116 |
|              | Secondary    | 30 (24.8)      | 24 (39.3) |
|              | Tertiary     | 58 (47.9)      | 22 (36.1) |
| Income      | Low          | 33 (27.3)      | 13 (21.3) | 0.404 |
| Middle      | 59 (48.8)    | 28 (45.9)      |         |
| High        | 29 (24.0)    | 20 (32.8)      |         |

**Abbreviation:** PLWHIV, people living with HIV.
Questionnaires
All patients enrolled were completed the following questionnaires, including Self-Rating Depression Scale (SDS), Self-Rating Anxiety Scale (SAS), Symptom Checklist 90 questionnaire (SCL-90) and Short-Form Health Survey (SF-36).

All the subjects finished the questionnaires in a quiet room without any disruptions and implications. They were informed that if they had any problems in understanding the questionnaires, they could seek for professional help.

SDS
SDS questionnaires contains 20 items. A total score was obtained by adding those 20 items scores. The depression score was a total score \( \times 1.25 \). Patients with depression scores <50 points were divided into non-depression groups, and patients with depression scores \( \geq 50 \) points were divided into depression groups.\(^{14,15}\)

SAS
The anxiety score assessed using the SAS was calculated as same as the depression score. The patients with SAS scores of \( \geq 50 \) points were regarded to have anxiety.\(^{16,17}\)

SCL-90
The SCL-90 questionnaire contains 90 questions divided into 10 dimensions: somatization, obsessive-compulsive symptoms, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoia ideation, psychosis, and other items (eg, appetite and sleep).\(^{18,19}\)

SF-36
SF-36 is a self-administered quality of life questionnaire. SF-36 includes 8 items: physical functioning (PF), role limitations due to physical problems (PRF), bodily pain (BP), general health (GHP), vitality (VIT), social functioning (SRF), role limitations due to emotional problems (ERF), and mental health (MH)). The higher the score, the better the HRQOL.

Statistical Analysis
In our study, we used mean ± standard deviation, and categorical variables to express variable when appropriate. Chi-square test and t-test were used to determine whether the results are significantly different. We also used univariate and multivariate logistic regression analysis to determine factors related to depression and anxiety. The significance level was set as \( P <0.05 \) (two-tailed). Data analysis and quality control procedures were performed using SPSS 13.0 (Chicago, USA).

Results
Demographic Data of Patients Enrolled
A total of 121 PLWHIV were included and completed the questionnaires. The characteristics are shown in Table 1. There was no significant difference between the PLWHIV and healthy controls, regardless of sex, age, smoking, alcohol consumption, educational level, and income level.

Depression and Anxiety Levels Among PLWHIV
A total 52 people infected with HIV (43.0%) were diagnosed with depression and 28 (23.1%) diagnosed with anxiety. In the comparison between the PLWHIV and healthy controls, we observed that the depression level of PLWHIV were significantly higher than controls (Figure 1A). A similar trend was also observed in the anxiety level (Figure 1B).

Factors Related with Depression and Anxiety in the People Infected with HIV
To determine the related factors associated with depression and anxiety among the PLWHIV. We conducted univariate and multivariate analyses and the results revealed that younger age (OR=0.929, \( P=0.004 \)) and smoking (OR=4.297, \( P=0.001 \)) were the independent factors related with depression among the people infected with HIV (Table 2). Furthermore, multivariate analysis revealed that young age (OR=0.890, \( P=0.008 \)) and alcohol consumption (OR=4.801, \( P=0.002 \)) were the independent factors related with anxiety (Table 3).

Association of Psychological Symptoms with Depression and Anxiety in the People Infected with HIV
Based on the results of the SCL-90 questionnaire, we evaluated the association of psychotic symptoms with depression or anxiety in the people infected with HIV further. We compared the eight symptom scores based on whether the PLWHIV had depression or anxiety. The analysis showed that hostility, paranoia ideation, and other items (eg, bad appetite and poor sleep quality) were significantly more pronounced when the people infected with HIV had depression than when they had no
depression (Figure 2A). We also compared the scores for the symptoms in the people infected with HIV experiencing anxiety. The analysis showed that all the eight symptoms were more pronounced when the patients had anxiety than when they had no anxiety (Figure 2B).

Association of HRQOL in PLWHIV with Depression and Anxiety

We next evaluate the association of HRQOL in PLWHIV with depression or anxiety. We found that at the quality of life in physiological level and mental health are significantly lower in PLWHIV with depression (Figure 3A). For PLWHIV with anxiety, the vitality, social functioning, and mental health are significant lower (Figure 3B).

To further identify the factors related with poor HRQOL in PLWHIV, univariate and multivariate analyses were conducted. The multivariate analysis revealed that only depression level was the risk factor related with poor HRQOL among PLWHIV (OR=0.370, P=0.001, Table 4). The higher the level of depression in HIV patients, the poorer their level of HRQOL.

Table 2 Factors Associated Depression Among People Living with HIV

| Variables          | Univariate Analysis | Multivariate Analysis |
|--------------------|---------------------|-----------------------|
|                    | OR      | 95% CI     | P        | OR      | 95% CI     | P        |
| Gender             | 1.548   | 0.728–3.294 | 0.256   | 0.929   | 0.884–0.977 | 0.004   |
| Age                | 0.921   | 0.877–0.967 | 0.001   | 0.871   | 0.813–0.956 | 0.002   |
| Level of education | 0.965   | 0.630–1.480 | 0.871   | 0.659   | 0.677–1.854 | <0.001  |
| Income             | 1.120   | 0.677–1.854 | 0.037   | 4.297   | 1.837–10.046 | 0.001   |
| Smoking            | 5.026   | 2.228–11.334 | <0.001 | 1.120   | 0.659–3.294 | 0.008   |
| Alcohol consumption| 2.187   | 1.047–4.570 | 0.37    | 0.860   | 0.460–1.670 | 0.141   |

Abbreviation: OR, odds ratio.

Table 3 Factors Associated Anxiety Among People Living with HIV

| Variables          | Univariate Analysis | Multivariate Analysis |
|--------------------|---------------------|-----------------------|
|                    | OR      | 95% CI     | P        | OR      | 95% CI     | P        |
| Gender             | 1.913   | 0.807–4.532 | 0.141   | 0.890   | 0.816–0.970 | 0.008   |
| Age                | 0.882   | 0.813–0.956 | 0.002   | 0.882   | 0.813–0.956 | 0.002   |
| Level of education | 1.805   | 1.028–3.170 | 0.040   | 0.882   | 0.813–0.956 | 0.002   |
| Income             | 1.574   | 0.860–2.879 | 0.141   | 0.882   | 0.813–0.956 | 0.002   |
| Smoking            | 2.973   | 1.246–7.096 | 0.014   | 0.920   | 0.920–9.200 | 0.002   |
| Alcohol consumption| 6.000   | 2.302–15.637 | <0.001 | 4.801   | 1.772–13.003 | 0.002   |

Abbreviation: OR, odds ratio.
### Discussion

A retrospective study showed that the prevalence of depression in people infected with HIV in China is greater than 60% and that the prevalence of anxiety disorders is greater than 40%.

Studies conducted by Korean scholars have shown that the prevalence of anxiety and depressive symptoms in people infected with HIV is significantly higher than in the general population.

### Table 4 Factors Associated Poor Health-Related Quality of Life Among People Living with HIV

| Variables          | Univariate Analysis | Multivariate Analysis |
|--------------------|---------------------|-----------------------|
|                    | OR                  | 95% CI                | P        | OR                  | 95% CI                | P        |
| Gender             | 0.985               | 0.471–2.215           | 0.953    | 0.985               | 0.471–2.215           | 0.953    |
| Age                | 1.018               | 0.983–1.053           | 0.321    | 1.018               | 0.983–1.053           | 0.321    |
| Level of education | 0.679               | 0.439–1.051           | 0.083    | 0.679               | 0.439–1.051           | 0.083    |
| Income             | 0.817               | 0.491–1.361           | 0.438    | 0.817               | 0.491–1.361           | 0.438    |
| Smoking            | 0.794               | 0.368–1.714           | 0.557    | 0.794               | 0.368–1.714           | 0.557    |
| Alcohol consumption| 0.638               | 0.316–1.372           | 0.265    | 0.638               | 0.316–1.372           | 0.265    |
| Depression level   | 0.370               | 0.174–0.788           | 0.010    | 0.370               | 0.174–0.788           | 0.010    |
| Anxiety level      | 0.686               | 0.292–1.614           | 0.388    | 0.686               | 0.292–1.614           | 0.388    |

**Abbreviation:** OR, odds ratio.
infected with HIV is 32% and 36%, respectively;21 further, even if disease treatment progresses, the negative psychological problems of people infected with HIV will persist for a long time.22 A survey of people infected with HIV showed that the psychological problems of female patients were significantly more severe than those of male patients.23 Based on our results, we confirmed that the incidence of depression is high in populations infected with HIV. We further found that this clinical dilemma is more prominent in young patients. Moreover, The higher the level of depression in HIV patients, the poorer their level of HRQOL. Physicians should then pay attention to anxiety disorders and depression in people infected with HIV. Especially for young patients with smoking and alcohol consumption, psychological investigations should be conducted, and timely interventions should be provided.

Among different patients with depression and anxiety, the symptoms may vary, especially in those with chronic diseases.24,25 For people with HIV infection, understanding the sociological symptoms of depression and anxiety can help in intervening and alleviating these conditions better.26,27 Our analysis revealed that the patients with HIV infection and depression had more pronounced symptoms associated with psychological abnormalities than the patients with HIV infection without depression. Among them, hostility, paranoia ideation and other items (eg, bad appetite and poor sleep quality) was the most common symptom. Therefore, for people with HIV infection and depression, both immune function and social role improvements are particularly important. Helping people infected with HIV integrate into society may help alleviate their depression. Interestingly, we also found that anxiety is also very common in people infected with HIV. Moreover, people with HIV infection and anxiety disorders have more severe symptoms of psychological abnormalities than patients without anxiety. Providing timely psychological intervention to alleviate paranoia symptoms may help alleviate anxiety symptoms.

Aweto et al showed that PLWHIV benefit greatly from sports.28 Because of the low cost of this intervention, it is very suitable in developing countries. Another study has suggested that the role of disclosure and discrimination is determinant in HRQOL.11 Moreover, previous studies have also suggested that the community accommodation study had significant reductions in rates of depression.29,30 Novel approaches such as exercise, sigma reduction, or community accommodation need further research to confirm.

In our study, we found that there were significant differences in HRQOL among PLWHIV with or without depression and anxiety. Further multivariate analysis suggested that depression level was the factors associated with HRQOL. Emphasis needs to be placed on monitoring the mental status and HRQOL of PLWHIV. Psychological intervention may be necessary for PLWHIV at risk of having poor HRQOL, especially for depressed patients. Poor HRQOL and poor psychological conditions may induce poor treatment adherence, which in turn will induce relapse and resistance of virus. It is interesting that whether improving the patient’s depression level can increase the HRQOL of PLWHIV. However, it still needs further exploration.

Our study has some limitations. First, we did not consider the severity of the HIV infection. Second, the related small sample size of our study may induce bias. The conclusion generalized need more cautious among all PLWHIV. Third, there is no information provided regarding HIV disease variables in our study. CD4 is closely related to the duration of ART treatment. The length of antiviral time of the patients we enrolled varies, so there is no relationship between CD4 level and depression and anxiety. A multi-center prospective study is still needed.

Conclusions
At present, mental abnormality such as depression and anxiety, are very common, and the incidence is higher in patients with chronic physical diseases. The psychological problems in people infected with HIV are more prominent. Further, people infected with HIV experience both physical and psychological disorders, which seriously affect their HRQOL and treatment outcomes. For virus-induced diseases, especially AIDS, physicians should not only focus on the antiviral treatment of patients (especially younger patients) but also monitor their mental status.31,32 For patients with depression and anxiety, psychological intervention should be provided, and social role rebuilding, such as helping them integrate into society, may be good for depression alleviation.

Abbreviations
AIDS, acquired immunodeficiency syndrome; HIV, human immunodeficiency virus; SDS, Self-Rating Depression Scale; SAS, Self-Rating Anxiety Scale; SCL-90, Symptom Checklist 90 questionnaire.

Ethics Approval and Consent to Participate
The Institutional Review Board of First affiliated hospital of Xiamen university had approved this study. All procedures followed were in accordance with the ethical standards of the
responsible committee on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. Informed consent was obtained from all patients for inclusion in the study.

Acknowledgments

We want to thank Jianyong Zeng for the helpful assistance.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

Work on this project was supported by Clinical Research Startup Program of Southern Medical University by High-level University Construction Funding of Guangdong Provincial Department of Education (LC2016PY003).

Disclosure

All authors declare that they have no conflicts of interest.

References

1. Germain A. Women and the global AIDS epidemic. Lancet. 2009;373(9663):544. doi:10.1016/S0140-6736(09)60199-9
2. Stephenson J. Global AIDS epidemic worsens. JAMA. 2004;291:31.
3. Ryom L, Boesecke C, Bracchi M, et al. Highlights of the 2017 European AIDS Clinical Society (EACS) guidelines for the treatment of adult HIV-positive persons version 9.0. HIV Med. 2018;19(5):309. doi:10.1111/hiv.12600
4. Mathers CD, Loncar D, Samet J. Projections of global mortality and burden of disease from 2002 to 2030. PLoS Med. 2006;3(11):e442. doi:10.1371/journal.pmed.0030442
5. Xue X, Cai S, Ou H, Zheng C, Wu X. Health-related quality of life in patients with chronic hepatitis B during antiviral treatment and off-treatment. Patient Prefer Adherence. 2017;11:85. doi:10.2147/PPA.S127319
6. Lai W, Cai S. Comment on “prevalence of anxiety and depression in patients with inflammatory bowel disease”. Can J Gastroenterol Hepatol. 2018;2018:6747630. doi:10.1155/2018/6747630
7. Dube B, Benton T, Cruess DG, Evans DL. Neuropsychiatric manifestations of HIV infection and AIDS. J Psychiatry Neurosci. 2005;30:237.
8. Amare T, Getinet W, Shumet S, Asrat B. Prevalence and associated factors of depression among PLHIV in Ethiopia: systematic review and meta-analysis, 2017. AIDS Res Treat. 2018;2018:5462959:2018.
9. Dianatinasab M, Fararouei M, Padehban V, et al. The effect of a 12-week combinational exercise program on CD4 count and mental health among HIV infected women: a randomized control trial. J Exerc Sci Fit. 2018;16(1):21. doi:10.1016/j.jesf.2018.02.001
10. Dianatinasab M, Ghahtari S, Dianatinasab A, Amanat S, Fararouei M. Effects of exercise on the immune function, quality of life, and mental health in HIV/AIDS individuals. Adv Exp Med Biol. 2020;1228:411.
11. Preau M, Marcellin F, Carrieri MP, Lert F, Obadia Y, Spire B. VESPA Study Group. Health-related quality of life in French people living with HIV in 2003: results from the national ANRS-EN12-VESPA Study. AIDS. 2007;21(Suppl 1):S19.
12. Watkins CC, Treisman GJ. Neuropsychiatric complications of aging with HIV. J Neurovirol. 2012;18:277. doi:10.1007/s13365-012-0108-z
13. Aciati A, Starace F, Scaramelli B, et al. Has there been a decrease in the prevalence of mood disorders in HIV-seropositive individuals since the introduction of combination therapy? Eur Psychiatry. 2001;16(8):491. doi:10.1016/S0924-9338(01)00611-3
14. Lombardi D, Mizuno LT, Thornberry A. The use of the Zung self-rating depression scale to assist in the case management of patients living with HIV/AIDS. Care Manag J. 2010;11:210.
15. Mammadova F, Sultanov M, Hajiyeva A, Aichberger M, Heinz A. Translation and adaptation of the Zung self-rating depression scale for application in the bilingual Azerbaijani population. Eur Psychiatry. 2012;27(Suppl 2):S27.
16. Li H, Jin D, Qiao F, Chen J, Gong J. Relationship between the self-rating anxiety scale score and the success rate of 64-slice computed tomography coronary angiography. Int J Psychiatry Med. 2016;51(1):47. doi:10.1177/00207610145621265
17. Olatunji BO, Deacon BJ, Abramowitz JS, Tolin DF. Dimensionality of semantic complaints: factor structure and psychometric properties of the self-rating anxiety scale. J Anxiety Disord. 2006;20:543. doi:10.1016/j.janxdis.2005.08.002
18. Karlson B, Osterberg K, Orbeck P. Euroquest: the validity of a new symptom questionnaire. Neurotoxology. 2000;21:783.
19. van der Laan L, van Spaendonck K, Horstink MW, Goris RJ. The symptom checklist-90 revised questionnaire: no psychological profiles in complex regional pain syndrome-dystonia. J Pain Symptom Manage. 1999;17:357. doi:10.1016/S0885-3924(99)00009-3
20. Niu L, Luo D, Liu Y, Silenzio VMB, Xiao S, Kumar A. The mental health of people living with HIV in China, 1998–2014: a systematic review. PLoS One. 2016;11(4):e0153489. doi:10.1371/journal.pone.0153489
21. Kee M-K, Lee S-Y, Kim N-Y, et al. Anxiety and depressive symptoms among patients infected with human immunodeficiency virus in South Korea. AIDS Care. 2015;27(9):1174. doi:10.1080/09540121.2015.1035661
22. Kätter JM, Brokamp F, Jäger A, et al. Disclosure behaviour and experienced reactions in patients with HIV versus chronic viral hepatitis or diabetes mellitus in Germany. AIDS Care. 2013;25(10):1259. doi:10.1080/09540121.2013.764387
23. Robertson K, Bayon C, Molina JM, et al. Screening for neurocognitive impairment, depression, and anxiety in HIV-infected patients in Western Europe and Canada. AIDS Care. 2014;26:1555.
24. Evangelis M, Wroe AL. HIV disclosure anxiety: a systematic review and theoretical synthesis. AIDS Behav. 2017;21:1. doi:10.1007/s10461-016-1453-3
25. Koegler E, Kennedy CE. A scoping review of the associations between mental health and factors related to HIV acquisition and disease progression in conflict-affected populations. Confl Health. 2018;12:20. doi:10.1186/s13031-018-0156-y
26. Vreeman RC, McCoy BM, Lee S. Mental health challenges among adolescents living with HIV. J Int AIDS Soc. 2017;20:21497. doi:10.7448/IAS.20.4.21497
27. van Luenen S, Garneski N, Spinhoven P, et al. The benefits of psychosocial interventions for mental health in people living with HIV: a systematic review and meta-analysis. AIDS Behav. 2018;22(1):9. doi:10.1007/s10461-017-1757-y
28. Aweto HA, Aiyegbisi AI, Ugonabo AJ, Adeyemo TA. Effects of aerobic exercise on the pulmonary functions, respiratory symptoms and psychological status of people living with HIV. J Res Health Sci. 2016;16:17.

29. Chidrawi HC, Greeff M, Temane QM, Ellis S. Changeover-time in psychosocial wellbeing of people living with HIV and people living close to them after an HIV stigma reduction and wellness enhancement community intervention. Afr J AIDS Res. 2015;14(1):1. doi:10.2989/16085906.2014.961940

30. Thomson DR, Rich ML, Kaigamba F, et al. Community-based accompaniment and psychosocial health outcomes in HIV-infected adults in Rwanda: a prospective study. AIDS Behav. 2014;18(2):368. doi:10.1007/s10461-013-0431-2

31. Baker WC. A triple threat. HIV, mental illness and chemical addiction. Adv Nurse Pract. 2002;10(28):33.

32. Meyer P. Consumer representation in multi-site HIV, mental health, and substance abuse research: the HIV/AIDS treatment adherence, health outcomes and Cost Study. AIDS Care. 2004;16(Suppl Sup1):S137. doi:10.1080/09540120412331315240

---

**Patient Preference and Adherence**

**Publish your work in this journal**

Patient Preference and Adherence is an international, peer-reviewed, open access journal that focuses on the growing importance of patient preference and adherence throughout the therapeutic continuum. Patient satisfaction, acceptability, quality of life, compliance, persistence and their role in developing new therapeutic modalities and compounds to optimize clinical outcomes for existing disease states are major areas of interest for the journal. This journal has been accepted for indexing on PubMed Central. The manuscript management system is completely online and includes a very quick and fair peer-review system, which is all easy to use. Visit http://www.dovepress.com/testimonials.php to read real quotes from published authors.

Submit your manuscript here: https://www.dovepress.com/patient-preference-and-adherence-journal