



Depressive Symptoms, Quality of Life, and Worry Among People Living with HIV and Community Controls: A Cross-sectional Comparative Study in Tehran, Iran

Farshad Aliyari ¹, Abbas Masjedi-Arani ^{1,*}, SeyedAhmad SeyedAlinaghi ², Amir Sam Kianimoghadam ¹, Maryam Bakhtiari ¹

¹ Department of Clinical Psychology, School of Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran

² Iranian Research Center for HIV/AIDS, Iranian Institute for Reduction of High-Risk Behaviors, Tehran University of Medical Sciences, Tehran, Iran

*Corresponding Author: Department of Clinical Psychology, School of Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran. Email: a.masjedarani@sbmu.ac.ir

Received: 22 May, 2026; Revised: 5 June, 2026; Accepted: 17 June, 2026

Abstract

Background: Mental health problems are common among people living with HIV and may adversely affect treatment adherence, disease progression, and quality of life.

Objectives: This study compared depressive symptoms, quality of life, and worry among adults living with HIV and community controls in Tehran, Iran.

Methods: We conducted a cross-sectional comparative study of 48 adults living with HIV and 71 community controls recruited through convenience sampling in Tehran, Iran. Participants completed the Depression subscale of the Depression Anxiety Stress Scales-21, the World Health Organization Quality of Life-BREF, and the Penn State Worry Questionnaire. Between-group differences were assessed using independent-samples t tests and Pearson's chi-square tests. Binary logistic regression was used to examine cross-sectional associations of age and psychological variables with group membership (0 = HIV, 1 = community controls), with a sensitivity analysis additionally adjusting for education.

Results: Compared with community controls, adults living with HIV reported significantly higher depressive symptoms ($P = 0.013$, Cohen's $d = 0.50$) and lower quality of life ($P = 0.015$, $d = -0.50$), whereas worry did not differ significantly ($P = 0.355$, $d = 0.17$). Educational attainment also differed significantly between the groups ($\chi^2(2) = 27.50$, $P < 0.001$). In the complete-case logistic model ($n = 108$), older age (odds ratio [OR] = 0.94, 95% confidence interval [CI], 0.90 - 0.98, $P = 0.002$) and higher depressive symptom scores (OR = 0.84, 95% CI, 0.74 - 0.96, $P = 0.008$) were associated with lower odds of community-control membership, corresponding to higher odds of HIV-group membership. Quality of life and worry were not independently associated with group membership. When education was added ($n = 105$), university-level education was strongly associated with control membership (OR = 5.63, 95% CI, 2.10 - 15.10), the depressive-symptom association was attenuated (OR = 0.86, 95% CI, 0.75 - 1.00, $P = 0.047$), and age was no longer significant ($P = 0.069$).

Conclusions: In this sample, adults living with HIV reported higher depressive symptoms and lower quality of life than community controls. Depressive symptoms were the only measured psychological variable associated with group membership in the primary model, although this association was attenuated after adjustment for education. These findings support further evaluation of mental health assessment and psychosocial support within HIV care; however, causal inferences and the effectiveness of specific screening or intervention strategies require longitudinal and interventional research.

Keywords: HIV, Depressive Symptoms, Quality of Life, Worry, Mental Health, Cross-sectional Study

1. Background

Despite considerable advances in HIV prevention and expanded global access to antiretroviral therapy (ART), HIV infection remains a major public health issue worldwide. Millions of people live with HIV, placing a persistent burden on health care systems and society. UNAIDS estimates that approximately 41.0 million people were living with HIV worldwide at the end of 2025; in that year, approximately 1.2 million people acquired HIV and 570,000 died of AIDS-related causes (1). Iran had an estimated

43,000 people living with HIV in 2023, yet only approximately 24,000 were diagnosed and registered in the health system, indicating a substantial gap in diagnosis and access to care. Approximately 1,900 AIDS-related deaths were estimated in Iran in the same year (2).

Beyond its physical effects, HIV imposes substantial psychological and social burdens, including stigma and emotional distress, that undermine quality of life (3). Patients with chronic illnesses may also experience a wide range of challenges, including increased health care-related expenses, social isolation and loneliness, functional

limitations, fatigue, pain, psychological distress, anger, hopelessness, anxiety, depression, and other mental health concerns (4, 5). Poor mental health may, in turn, increase the likelihood of harmful behaviors, including suboptimal adherence to treatment, substance use, and high-risk sexual behaviors. Such behaviors can contribute to unfavorable long-term health outcomes and increase the potential for secondary transmission of HIV (6). Furthermore, psychological distress occurring alongside HIV infection may affect immune system functioning and, consequently, contribute to more rapid disease progression (7).

Over the last two decades, accumulating evidence has consistently indicated a higher prevalence of mental health disorders among people living with HIV than in the general population (8). Findings from systematic reviews suggest that approximately one-third to two-thirds of individuals living with HIV experience clinically significant psychological symptoms at some point during their lifetime (9). In a large North American cohort study including 122,896 people living with HIV, 55.1% had at least one diagnosed mental health disorder, including depressive disorders (39%), anxiety disorders (28%), bipolar disorder (10%), and schizophrenia (5%) (10). Comparable findings have been reported from other regions, indicating substantial psychiatric morbidity among people living with HIV. For instance, studies conducted in India and China found depressive symptoms in 59% and 61% of participants, respectively (11, 12).

Depression is among the most common mental health conditions in people living with HIV. A recent systematic review and meta-analysis reported a mean prevalence of depressive symptoms of 33.8% among people living with HIV, although substantial variability was observed across studies (13). Several factors may contribute to the development of depression in this population, including the psychological impact of receiving an HIV diagnosis, HIV-related stigma, ongoing treatment-related demands, and the potential neurotropic effects of the virus on the central nervous system. Depression has also been consistently associated with poorer adherence to ART, greater use of health care services, and lower quality of life among people living with HIV (14).

An HIV diagnosis can substantially compromise quality of life (QoL) (15). The World Health Organization (WHO) defines QoL as an individual's perception of their position in life in the context of their culture and value systems and in relation to their goals, expectations, and concerns (16). People living with HIV may experience considerably poorer QoL, even compared with individuals with other chronic medical conditions (17). Quality of life is a multidimensional construct with important implications

for functional capacity, social relationships, psychological well-being, somatic comfort, and overall satisfaction with life (18, 19).

Generalized anxiety disorder (GAD) is also common among people living with HIV and may have significant consequences for psychological well-being and treatment-related outcomes (20, 21). Based on the diagnostic criteria described in the Diagnostic and Statistical Manual of Mental Disorders (DSM), GAD is characterized by excessive, persistent, and difficult-to-control worry. The estimated 12-month prevalence of GAD among people living with HIV ranges from 6.5% to 20% (22). Although research has extensively examined depression, generalized anxiety, and quality of life among people living with HIV, comparatively little empirical attention has focused on worry as an independent cognitive construct. Worry is a transdiagnostic cognitive process characterized by repetitive negative thinking about uncertain future events. Given the potential interplay among these variables, the present study assessed worry alongside depression and quality of life in this population.

2. Objectives

This cross-sectional comparative study compared depressive symptoms, quality of life, and worry between people living with HIV and community controls in Tehran, Iran. Given the burden of HIV in Iran and the paucity of mental health research in this population, these findings may inform future research on clinical screening and health policy planning.

3. Methods

3.1. Study Design and Participants

This cross-sectional comparative study was conducted in Tehran, Iran, to compare depressive symptoms, quality of life, and trait worry between adults living with HIV and adults without HIV. Data were collected between March 2025 and August 2025. Participants in the HIV group were recruited through the Iranian Research Center for HIV/AIDS at Imam Khomeini Hospital Complex, Tehran University of Medical Sciences. The physician in charge referred patients who were available at the center during the data collection period, including those attending for medication refills, to the research team (convenience sampling). Control participants were recruited from the community in Tehran using convenience sampling. Participants in the HIV group completed the questionnaires at the center, whereas controls completed them at a location where they could do so without

disturbance. The final sample comprised 119 participants: 48 adults living with HIV and 71 community controls.

3.2. Inclusion and Exclusion Criteria

HIV group. Inclusion criteria were age 18 years or older, residence in Tehran, sufficient Persian-language literacy to complete the questionnaires, written informed consent, and a documented diagnosis of HIV infection in the medical records at the Iranian Research Center for HIV/AIDS. Participants were referred by the physician in charge, who identified patients with a confirmed diagnosis established during routine clinical care. According to the physician, the center's diagnostic procedure consists of a rapid HIV test followed, if positive, by two enzyme-linked immunosorbent assays from different manufacturers; the diagnosis is confirmed when both are positive. The research team did not review individual laboratory results, and HIV serostatus was not retested for this study.

Control group. Inclusion criteria were age 18 years or older, residence in Tehran, sufficient Persian-language literacy, written informed consent, and no known history of HIV infection. HIV-negative status was based on self-report and was not laboratory-confirmed.

Exclusion criteria (both groups). Participants were excluded if they (a) returned questionnaires with incomplete or missing responses on the primary psychological measures (Depression Anxiety Stress Scales-21 (DASS-21) Depression subscale, World Health Organization Quality of Life-BREF (WHOQOL-BREF), or Penn State Worry Questionnaire (PSWQ)); (b) self-reported current use of psychiatric medication; or (c) were unable to complete the assessment because of severe physical or cognitive impairment. These criteria were applied identically to both groups. Other health conditions were not assessed in the control group; the only health-related exclusion criteria were self-reported current psychiatric medication use and severe physical or cognitive impairment.

In the HIV group, 5 participants were excluded because of incomplete questionnaires, leaving 48 participants. In the control group, 3 participants were excluded for the same reason, leaving 71 participants. No participants were excluded for current psychiatric medication use or severe physical or cognitive impairment. The total number of individuals initially approached was not systematically recorded.

The groups were not individually matched on demographic characteristics because of practical and logistical constraints in recruiting strictly matched community controls. To address baseline imbalances, age was included in an additional logistic regression analysis, and education was added in a sensitivity analysis. Because

the groups were recruited from different sources (a specialist HIV center and the community), they may differ systematically in health care contact, socioeconomic position, and other determinants of psychological health. Apart from adjustment for age and, in the sensitivity analysis, education, no additional measures were available to evaluate or reduce selection bias (see Section 5.1).

3.3. Measures

Depressive symptoms were measured using the seven-item depression subscale of the DASS-21. Items are rated from 0 (did not apply to me at all) to 3 (applied to me very much or most of the time) and summed to yield a raw score from 0 to 21, with higher scores indicating more depressive symptoms. Scores were not multiplied by two, and no severity cutoffs were used; the score was analyzed as a continuous variable. The Persian version has shown adequate reliability and validity (Cronbach's alpha = 0.85) (23). Cronbach's alpha in the present sample was 0.86.

Quality of life was measured with the 26-item WHOQOL-BREF, which covers four domains (physical health, psychological health, social relationships, and environment) plus two items on overall quality of life and general health. Each item is rated on a five-point scale. After reverse-scoring items 3, 4, and 26, all 26 items were summed to yield a total score from 26 to 130, with higher values indicating better perceived quality of life. This summed score served as a single global indicator, an approach that differs from the domain-based scoring recommended by WHO (24); domain scores were not analyzed. The Persian version has shown acceptable domain-level reliability in an Iranian population-based sample, with Cronbach's alpha above 0.70 for all domains except social relationships (alpha = 0.55) (25). In the present sample, the 26-item total score showed excellent internal consistency (alpha = 0.93).

Worry was measured using the 16-item PSWQ, which captures the generality, excessiveness, and uncontrollability of worry on a five-point scale from 1 (not at all typical of me) to 5 (very typical of me) (26). Reverse-scored items were recoded, and all items were summed to yield a total score from 16 to 80; higher scores indicate greater trait worry. The Persian version has shown good reliability and validity in Iranian samples (Cronbach's alpha = 0.88) (27). Cronbach's alpha in the present sample was 0.88.

Only questionnaires with complete responses on all three measures were analyzed; therefore, no missing item responses were imputed.

3.4. Statistical Analysis

Table 1. Group Differences in Depression, Quality of Life, and Worry^a

Variables	HIV Group	Control Group	t	df	95% CI of mean difference	Cohen's d / P
Depression	8.38 ± 5.47	6.03 ± 4.08	2.53	81.37	[0.50, 4.19]	d = 0.50, P = 0.013
Quality of life	80.13 ± 18.72	87.92 ± 13.25	-2.49	78.20	[-14.01, -1.57]	d = -0.50, P = 0.015
Worry	48.46 ± 10.46	46.53 ± 11.54	0.93	117.00	[-2.18, 6.04]	d = 0.17, P = 0.355

^a Values are expressed as mean ± SD. Degrees of freedom for depression and quality of life reflect Welch's correction for unequal variances. Cohen's d was computed using the pooled standard deviation of the two groups. Abbreviations: df, degrees of freedom; CI, confidence interval.

No a priori sample-size or power calculation was performed. The sample size reflected the number of eligible participants available during recruitment (48 with HIV and 71 community controls), and the precision of the group differences is shown by the 95% confidence intervals (CIs) in [Table 1](#).

Depressive symptoms, quality of life, and worry were the outcomes of interest in the primary comparisons between the HIV group and community controls. Normality was assessed using the Shapiro-Wilk test and Q-Q plots. Because parametric tests tolerate moderate departures from normality, group means were compared using independent-samples t tests, with Welch's correction applied when Levene's test indicated unequal variances. Education level (three categories) was compared between groups using Pearson's chi-square test. Cohen's d, based on the pooled standard deviation, was used as the effect size for continuous variables.

In an additional analysis, binary logistic regression with group membership as the dependent variable (0 = HIV, 1 = control) examined which measured characteristics were jointly associated with group membership. Age, depressive symptoms, quality of life, and worry were entered as independent variables. Age was included because the groups differed in age ([Table 2](#)). The predictor set was not formally prespecified in a statistical analysis plan; it was selected on the basis of the observed group difference in age, the existing literature, and the opinion of a specialist at the HIV center. The coefficients are interpreted as cross-sectional associations with group membership, not as measures of risk or prediction. Eleven participants (3 in the HIV group and 8 controls) had missing age data; therefore, this model was restricted to complete cases (n = 108). Model fit was assessed with the Hosmer-Lemeshow test.

Model assumptions were examined as follows. Multicollinearity was assessed using tolerance, variance inflation factors, and Pearson correlations among the independent variables. Linearity in the logit was tested using the Box-Tidwell approach by adding the product of each continuous predictor and its natural logarithm to the model. For depressive symptoms, which included zero values, the natural logarithm of the score plus one was

used. A Bonferroni-adjusted threshold of 0.0125 was applied to the four tests. As a sensitivity check for age, a model with a quadratic age term was also fitted. Influential observations were screened using Cook's distance (values above 1) and standardized residuals (absolute values above 3). Discrimination was summarized as the area under the receiver operating characteristic (ROC) curve with its 95% confidence interval, estimated in the same sample used to fit the model.

Because educational attainment differed markedly between groups, a sensitivity analysis added education (university-level, defined as an associate degree or higher, versus sub-university) to the logistic model. Education was not included in the primary model because all missing education values occurred in the control group. Analyses were performed using IBM SPSS Statistics, and results were considered statistically significant at $P < 0.05$.

3.5. Ethical Considerations

Approval was granted by the Research Ethics Committee of the School of Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran (code IR.SBMU.MSP.REC.1402.210). All participants provided written informed consent before participation, and the study followed the ethical principles applicable to research involving human participants.

4. Results

4.1. Preliminary Analyses

Case-processing summaries confirmed complete data for depression, quality of life, and worry across all 119 participants (48 participants with HIV and 71 controls; 0% missing for the primary psychological scales). The demographic characteristics of the HIV and control groups are presented in [Table 2](#). Missing data occurred only for demographic variables. Age and education level each had 11 missing values (3 and 8 for age in the HIV and control groups, respectively; all 11 for education in the control group). Sex was reported by only 8 of 48 participants in the

Table 2. Demographic Characteristics of the HIV and Control Groups ^a

Variables	HIV Group	Control Group	Test Statistic	P-Value
Age (y)	42.09 ± 9.94 (n = 45)	34.24 ± 11.56 (n = 63)	t(102.33) = 3.78	< 0.001
Education level			$\chi^2(2) = 27.50$	< 0.001
Sub-university	33 (68.8)	14 (23.3)		
Bachelor's / Associate	11 (22.9)	16 (26.7)		
Postgraduate (Master/PhD)	4 (8.3)	30 (50.0)		

^a Values are expressed as mean ± SD or No. (%). Total enrolled sample was N = 119 (48 participants with HIV, 71 controls). For age, valid responses were available for n = 45 in the HIV group and n = 63 in the control group (11 missing values overall: 3 in HIV, 8 in controls). Degrees of freedom for age reflect Welch's correction for unequal variances. For education, valid responses were available for n = 48 in the HIV group and n = 60 in the control group (11 missing values, all in controls).

HIV group and 5 of 71 controls, and socioeconomic status by 15 and 10 participants, respectively; these variables were therefore not tabulated or analyzed. Marital status and employment status were not collected. Shapiro–Wilk tests indicated minor deviations from normality for depression and worry in the control group; however, inspection of Q–Q plots showed that the observed scores closely followed the expected normal trajectory, supporting the use of parametric tests. Participants in the HIV group were significantly older than controls (mean 42.09 vs. 34.24 years; Table 2), and the distribution of educational attainment differed significantly between groups, with a higher proportion of sub-university education in the HIV group (68.8% vs. 23.3%; Table 2).

4.2. Group Comparisons of Depression, Quality of Life, and Worry

Levene's test indicated unequal variances for depression ($F = 7.35$, $P = 0.008$) and quality of life ($F = 6.57$, $P = 0.012$); therefore, Welch-corrected statistics are reported for these variables. Variances were equal for worry ($F = 0.59$, $P = 0.443$). Independent-samples t tests showed that the HIV group reported significantly higher depression than the control group, $t(81.37) = 2.53$, $P = 0.013$, $d = 0.50$ (medium effect size), and significantly lower quality of life, $t(78.20) = -2.49$, $P = 0.015$, $d = -0.50$ (medium effect size). Worry scores did not differ significantly between groups, $t(117) = 0.93$, $P = 0.355$, $d = 0.17$ (Table 1).

4.3. Logistic Regression of Group Membership

A binary logistic regression was performed to examine whether age, depressive symptoms, quality of life, and worry were jointly associated with group membership (0 = HIV, 1 = control; complete-case sample $n = 108$). The overall model was statistically significant, $\chi^2(4) = 26.88$, $P < 0.001$. The model explained between 22.0% (Cox & Snell R^2) and 29.7% (Nagelkerke R^2) of the variance in group

membership and showed satisfactory calibration (Hosmer–Lemeshow $\chi^2(8) = 3.20$, $P = 0.921$).

As shown in Table 3, older age was associated with lower odds of control-group membership ($B = -0.067$, standard error [SE] = 0.021, Wald = 9.94, odds ratio [OR] = 0.94, 95% CI [0.90, 0.98], $P = 0.002$), that is, with higher odds of being in the HIV group. Higher depressive symptoms were also associated with lower odds of control-group membership ($B = -0.174$, SE = 0.066, Wald = 7.04, OR = 0.84, 95% CI [0.74, 0.96], $P = 0.008$). Quality of life ($B = 0.017$, OR = 1.02, 95% CI [0.98, 1.05], $P = 0.354$) and worry ($B = 0.036$, OR = 1.04, 95% CI [0.99, 1.09], $P = 0.159$) were not significantly associated with group membership after adjustment for the other variables in the model.

4.4. Model Diagnostics

Multicollinearity was not a concern (variance inflation factors 1.07 to 1.82; tolerance 0.55 to 0.94). Depressive symptoms were moderately correlated with quality of life ($r = -0.54$) and worry ($r = 0.57$). The Box-Tidwell test did not indicate departures from linearity in the logit for depressive symptoms ($P = 0.106$), quality of life ($P = 0.430$), or worry ($P = 0.075$). For age, the Box-Tidwell term was $P = 0.044$, which did not reach the Bonferroni-adjusted threshold of 0.0125 for four tests. In a sensitivity model that added a quadratic age term, the association for depressive symptoms was essentially unchanged (OR = 0.84, $P = 0.009$). No influential observations were identified (maximum Cook's distance = 0.26; standardized residuals ranged from -2.66 to 2.28). The area under the ROC curve was 0.78 (95% CI [0.69, 0.87]); this estimate was computed in the same sample used to fit the model and is therefore likely optimistic.

4.5. Sensitivity Analysis Adjusting for Education

Because educational attainment differed markedly between groups (Table 2), the model was re-estimated with

Table 3. Binary Logistic Regression of Group Membership (0 = HIV, 1 = Control) ^a

Predictor	B	SE	Wald	df	OR [95% CI]	P
Age	-0.067	0.021	9.94	1	0.94 [0.90, 0.98]	0.002
Depression	-0.174	0.066	7.04	1	0.84 [0.74, 0.96]	0.008
Quality of life	0.017	0.018	0.86	1	1.02 [0.98, 1.05]	0.354
Worry	0.036	0.025	1.99	1	1.04 [0.99, 1.09]	0.159
Constant	0.988	2.608	0.14	1	2.69	0.705

^a Analytical complete-case sample n = 108 (45 participants with HIV, 63 controls). Model: $\chi^2(4) = 26.88$, $P < 0.001$; $-2LL = 119.83$; Cox & Snell $R^2 = 0.220$; Nagelkerke $R^2 = 0.297$; Hosmer-Lemeshow $\chi^2(8) = 3.20$, $P = 0.921$. Dependent variable coded as 0 = HIV and 1 = Control. Abbreviations: OR, odds ratio; CI, confidence interval; B, regression coefficient; SE, standard error. df, degrees of freedom.

Table 4. Sensitivity Analysis: Binary Logistic Regression of Group Membership Including Education (0 = HIV, 1 = Control) ^a

Predictor	B	SE	OR [95% CI]	P
Age	-0.043	0.024	0.958 [0.915, 1.003]	0.069
Depression	-0.146	0.073	0.864 [0.749, 0.998]	0.047
Quality of life	0.025	0.020	1.025 [0.986, 1.066]	0.217
Worry	0.054	0.029	1.055 [0.997, 1.117]	0.065
Education (university vs. sub-university)	1.728	0.503	5.631 [2.100, 15.104]	0.001
Constant	-2.617	3.008	0.073	0.384

^a Analytical sample n = 105 (45 HIV, 60 controls). Education was coded 0 = sub-university and 1 = university-level. Abbreviations: OR, odds ratio; CI, confidence interval; B, regression coefficient; SE, standard error.

education added as a dichotomous variable (university vs. sub-university), reducing the sample to n = 105 (45 HIV, 60 controls; Table 4). University-level education was strongly associated with control-group membership (OR = 5.63, 95% CI [2.10, 15.10], $P = 0.001$). Depressive symptoms remained associated with group membership, but the estimate was attenuated and its confidence interval approached the null value (OR = 0.86, 95% CI [0.75, 1.00], $P = 0.047$). The association for age was no longer statistically significant (OR = 0.96, 95% CI [0.92, 1.00], $P = 0.069$), and quality of life and worry remained nonsignificant. These findings indicate that the estimates for age and depressive symptoms were sensitive to adjustment for education and that residual confounding cannot be excluded.

5. Discussion

The aim of this study was to compare depressive symptoms, quality of life, and worry between people living with HIV and community controls. The results showed that people living with HIV reported significantly higher depressive symptoms and lower quality of life than controls, whereas the two groups did not differ significantly in worry. In the logistic regression model, age and depressive symptoms were associated with group

membership; however, these associations were attenuated in a sensitivity analysis that included education.

One of the principal findings of the present study was the higher level of depressive symptoms among people living with HIV compared with community controls. Several factors may contribute to this group difference, including dissatisfaction with life circumstances, poor somatic health, perceived stigma, and treatment-related challenges (28). In addition, the neurotropic effects of HIV and the potential neuropsychiatric effects of long-term antiretroviral therapy have been proposed as contributors to mood disturbances (29); these mechanisms were not examined in the present study.

People living with HIV in the present study reported significantly lower quality of life than controls, consistent with previous research in this population (15, 17). Several factors may contribute to this difference, including socioeconomic conditions, immunological status, HIV-related symptoms, and psychological comorbidity, particularly depression, which have been associated with health-related quality of life among people living with HIV (30).

Contrary to what might be expected given the elevated GAD prevalence in HIV, no significant between-group difference was observed in worry ($d = 0.17$). This finding

may reflect a conceptual distinction between worry as a trait-like cognitive process and the diagnosis-specific construct of generalized anxiety disorder. Although GAD prevalence has been shown to be elevated among people with HIV (22), worry itself may represent a widespread cognitive vulnerability that is not specific to HIV status. Alternatively, this null finding could reflect a shared elevated baseline of worry across both groups due to broader socioeconomic stressors in the study context (31) or limited statistical power. In the Iranian context, this study is among the first to examine worry as a distinct cognitive process among people living with HIV, and these findings should be replicated in larger samples.

In the primary logistic model, older age and higher depressive symptoms were each associated with higher odds of belonging to the HIV group, whereas quality of life and worry were not independently associated with group membership. Depressive symptoms were therefore the only measured psychological variable associated with group membership in this model. However, the groups differed markedly in educational attainment, and when education was added in a sensitivity analysis ($n = 105$), the association for depressive symptoms was attenuated and its confidence interval approached the null value, while the association for age was no longer statistically significant. These findings suggest that the association between depression and group membership is sensitive to adjustment for education, and residual confounding by education and other unmeasured factors cannot be excluded.

These findings may have implications for mental health care within HIV services in Iran. The higher depressive symptoms observed among people living with HIV support further evaluation of mental health assessment and psychosocial support in this setting. However, this study did not evaluate any screening strategy or intervention; therefore, conclusions about diagnostic performance, intervention effectiveness, or population-level benefit cannot be drawn, and these questions require longitudinal and interventional research. Because participants were recruited through convenience sampling in Tehran, with the HIV group drawn from a single specialist center, generalizability to other settings is limited.

5.1. Limitations and Future Directions

First, the cross-sectional design precludes causal conclusions about the temporal relationship between depression and HIV status, including whether pre-existing depressive vulnerability increased risk behaviors leading to infection or whether depressive symptoms emerged in response to the diagnosis and its consequences.

Longitudinal studies tracking newly diagnosed cohorts are needed to clarify this temporal relationship.

Second, sex and socioeconomic status were reported by only a small number of participants (sex: 8 of 48 in the HIV group and 5 of 71 controls; socioeconomic status: 15 and 10, respectively), and marital status and employment status were not collected. Consequently, these variables could not be included in the analyses, limiting our ability to assess their potential confounding effects. The control group also had a significantly higher level of educational attainment ($\chi^2(2) = 27.50, P < 0.001$). Education was not included in the primary logistic model because all 11 missing values occurred in the control group. In a sensitivity analysis that added dichotomized education ($n = 105$), university-level education was strongly associated with control-group membership, the association for depressive symptoms was attenuated (OR = 0.86, 95% CI [0.75, 1.00]), and the association for age was no longer significant. Residual confounding by educational differences, sex, socioeconomic status, and other unmeasured factors therefore cannot be excluded. The primary group comparisons (independent-samples t tests) were also unadjusted for age and education. Both groups were recruited through convenience sampling, and the HIV group consisted of patients available at a single specialist center, which limits generalizability beyond this setting. In addition, the questionnaires were completed in different settings (a clinical center for the HIV group and varied community locations for controls), which may have influenced responses.

Third, the relatively modest sample size of the HIV group ($n = 48$) may have provided insufficient statistical power to detect small effect sizes in trait worry, potentially increasing the risk of type II error. All psychological variables were self-reported and may therefore be affected by social desirability and reporting bias. Quality of life was analyzed as the summed total of all 26 WHOQOL-BREF items rather than as separate domain scores; future studies could examine domain-specific differences. In addition, the area under the ROC curve was estimated in the same sample used to fit the model and is likely optimistic.

Finally, biomedical information, including CD4+ T-cell count, plasma viral load, time since diagnosis, and ART regimen, was not collected. HIV status in the HIV group was based on a diagnosis documented in clinical records and established through the center's standard diagnostic procedure, without review of individual laboratory results by the research team. HIV-negative status among controls was self-reported rather than laboratory-verified. Furthermore, other medical and psychiatric conditions were not screened for in the control group, so controls may differ from the HIV group in comorbidity and other health-

related characteristics. Incorporating detailed clinical markers alongside standardized psychiatric diagnostic interviews is an important direction for future multicenter research.

5.2. Conclusions

In conclusion, people living with HIV in this sample exhibited significantly higher depressive symptoms and lower quality of life than community controls, whereas worry did not differ significantly between groups. Depressive symptoms were associated with HIV-group membership after accounting for age, but this association was attenuated when education was added in a sensitivity analysis, and residual confounding cannot be excluded. These findings support further evaluation of mental health assessment and psychosocial support within HIV clinical care in Tehran, Iran; however, causal conclusions and the effectiveness of specific screening or intervention strategies require longitudinal and interventional research.

Acknowledgements

We thank the staff of the Iranian Research Center for HIV/AIDS (Imam Khomeini Hospital Complex, Tehran) for their assistance and for facilitating access to the setting and data.

Footnotes

AI Use Disclosure: Claude (Anthropic) was used for language editing and translation of the abstract and other sections of the manuscript, with a moderate level of AI assistance.

Authors' Contribution: All authors contributed to the study and manuscript, reviewed the final version, and approved it for submission.

Conflict of Interests Statement: The authors declare that they have no conflict of interest related to this study.

Data Availability: The datasets generated and/or analyzed during the current study are not publicly available because they contain potentially sensitive health information. Data may be made available from the corresponding author on reasonable request and subject to applicable ethical restrictions.

Ethical Approval: This study was approved by the Research Ethics Committee of the School of Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran (IR.SBMU.MSP.REC.1402.210).

Funding/Support: No external funding was reported for this study.

Informed Consent: Written informed consent was obtained from all participants before participation in the study.

References

1. Unaid; UNAIDS. *UNAIDS. AIDS*; 2026, [cited 2026 Oct 9]. Global HIV & AIDS statistics - fact sheet. Available from: <https://www.unaids.org/en/resources/fact-sheet>.
2. Seyed Alinaghi SA, Rezaei M, Mirzapour P. Knowledge Translation for Practical Use of HIV Care. *Applied Psychology for Health Promotion*. 2025;2(2). e162968. <https://doi.org/10.5812/aphp-162968>.
3. Kolobova I, Danchenko N, Jacob I, Rice D, Jones S, Matthews E, et al. The burden of HIV-related stigma on clinical and quality of life outcomes: results from a systematic literature review. *Health Psychology and Behavioral Medicine*. 2026;14(1). 2672790. [PubMed ID: 42534623]. [PubMed Central ID: PMC13421116]. <https://doi.org/10.1080/21642850.2026.2672790>.
4. Van Wilder L, Pype P, Mertens F, Rammant E, Clays E, Devleeschauwer B, et al. Living with a chronic disease: insights from patients with a low socioeconomic status. *BMC Family Practice*. 2021;22(1). 233. [PubMed ID: 34789153]. [PubMed Central ID: PMC8598397]. <https://doi.org/10.1186/s12875-021-01578-7>.
5. M S, S M, Vadakkiniath IJ, A G. Prevalence and correlates of stress, anxiety, and depression in patients with chronic diseases: a cross-sectional study. *Middle East Current Psychiatry*. 2023;30(1). 66. <https://doi.org/10.1186/s43045-023-00340-2>.
6. L'akoa RM, Noubiap JJN, Fang Y, Ntone FE, Kuaban C. Prevalence and correlates of depressive symptoms in HIV-positive patients: a cross-sectional study among newly diagnosed patients in Yaoundé, Cameroon. *BMC psychiatry*. 2013;13(1). 228. [PubMed ID: 24053612]. [PubMed Central ID: PMC3849101]. <https://doi.org/10.1186/1471-244X-13-228>.
7. Pierce LJ, Regan S, Idigbe I, Adeola J, Musa Z, Ezechi O, et al. Psychological distress increases 30-fold among people with HIV in the first year on ART in Nigeria-a call for integrated mental health services. *International journal of behavioral medicine*. 2023;30(1):38-48. [PubMed ID: 35226343]. [PubMed Central ID: PMC8883753]. <https://doi.org/10.1007/s12529-022-10068-8>.
8. Magee C, Nathani H, Chan M, Takeh B, Budu M, Kooij KW, et al. Comorbidity prevalence and healthcare costs in people living with HIV compared with the general population: a 19-year retrospective cohort study in British Columbia, Canada. *BMJ Open*. 2025;15(7). e099263. [PubMed ID: 40669894]. [PubMed Central ID: PMC12273141]. <https://doi.org/10.1136/bmjopen-2025-099263>.
9. Hoare J, Sevenoaks T, Mtukushe B, Williams T, Heany S, Phillips N. Global Systematic Review of Common Mental Health Disorders in Adults Living with HIV. *Current HIV/AIDS Reports*. 2021;18(6):569-80. [PubMed ID: 34792706]. [PubMed Central ID: PMC8600343]. <https://doi.org/10.1007/s11904-021-00583-w>.
10. Lang R, Hogan B, Zhu J, McArthur K, Lee J, Zandi P, et al. The prevalence of mental health disorders in people with HIV and the effects on the HIV care continuum. *AIDS (London, England)*. 2022;37(2):259-269. [PubMed ID: 36541638]. [PubMed Central ID: PMC9782734]. <https://doi.org/10.1097/QAD.0000000000003420>.
11. Niu L, Luo D, Liu Y, Silenzio VMB, Xiao S. The Mental Health of People Living with HIV in China, 1998 - 2014: A Systematic Review. *PLoS One*. 2016;11(4). e0153489. [PubMed ID: 27082749]. [PubMed Central ID: PMC4833336]. <https://doi.org/10.1371/journal.pone.0153489>.

12. Bhatia MS, Munjal S. Prevalence of Depression in People Living with HIV/AIDS Undergoing ART and Factors Associated with it. *J Clin Diagn Res.* 2014;**8**(10):Wc01-4. [PubMed ID: 25478433]. [PubMed Central ID: PMC4253251]. <https://doi.org/10.7860/jcdr/2014/7725.4927>.
13. Huang B, Younger A, Gallant MP, O'Grady TJ. Depressive symptoms and HIV viral suppression: a systematic review and meta-analysis. *AIDS and Behavior.* 2025;**29**(3):870-83. [PubMed ID: 39690344]. [PubMed Central ID: PMC11830644]. <https://doi.org/10.1007/s10461-024-04571-0>.
14. Deshmukh N, Borkar A, Deshmukh J. Depression and its associated factors among people living with HIV/AIDS: Can it affect their quality of life? *J Family Med Prim Care.* 2017;**6**(3):549-53. [PubMed ID: 29417006]. [PubMed Central ID: PMC5787953]. <https://doi.org/10.4103/2249-4863.222016>.
15. Maleki MR, Derakhshani N, Azami-Aghdash S, Naderi M, Nikoomanesh M. Quality of life of people with HIV/AIDS in Iran: a systematic review and meta-analysis. *Iranian Journal of Public Health.* 2020;**49**(8):1399. [PubMed ID: 33083316]. [PubMed Central ID: PMC7554383]. <https://doi.org/10.18502/ijph.v49i8.3861>.
16. World Health Organization. *World Health Organization.* 2026, [cited 2026 Oct 19]. WHOQOL: measuring quality of life. Available from: <https://www.who.int/tools/whoqol>.
17. Engelhard EAN, Smit C, van Dijk PR, Kuijper TM, Wermeling PR, Weel AE, et al. Health-related quality of life of people with HIV: an assessment of patient related factors and comparison with other chronic diseases. *Aids.* 2018;**32**(1):103-12. [PubMed ID: 29112062]. <https://doi.org/10.1097/QAD.0000000000001672>.
18. Megari K. Quality of Life in Chronic Disease Patients. *Health Psychol Res.* 2013;**1**(3). e27. [PubMed ID: 26973912]. [PubMed Central ID: PMC4768563]. <https://doi.org/10.4081/hpr.2013.e27>.
19. Psaros C, O'Cleirigh C, Bullis JR, Markowitz SM, Safren SA. The influence of psychological variables on health-related quality of life among HIV-positive individuals with a history of intravenous drug use. *Journal of Psychoactive Drugs.* 2013;**45**(4):304-12. [PubMed ID: 24377169]. [PubMed Central ID: PMC3877931]. <https://doi.org/10.1080/02791072.2013.825030>.
20. Mannes ZL, Dunne EM, Ferguson EG, Cook RL, Ennis N. Symptoms of generalized anxiety disorder as a risk factor for substance use among adults living with HIV. *Aids Care.* 2021;**33**(5):623-32. [PubMed ID: 32835502]. [PubMed Central ID: PMC7902737]. <https://doi.org/10.1080/09540121.2020.1808163>.
21. Mannes ZL, Hearn LE, Zhou Z, Janelle JW, Cook RL, Ennis N. The association between symptoms of generalized anxiety disorder and appointment adherence, overnight hospitalization, and emergency department/urgent care visits among adults living with HIV enrolled in care. *Journal of behavioral medicine.* 2019;**42**(2):330-41. [PubMed ID: 30387009]. [PubMed Central ID: PMC6447438]. <https://doi.org/10.1007/s10865-018-9988-6>.
22. Chaudhury S, Bakhla A, Saini R. Prevalence, impact, and management of depression and anxiety in patients with HIV: a review. *Neurobehavioral HIV Medicine.* 2016;**15**. <https://doi.org/10.2147/NBHIV.S68956>.
23. Asghari A, Saed F, Dibajnia P. Psychometric properties of the Depression Anxiety Stress Scales-21 (DASS-21) in a non-clinical Iranian sample. *International Journal of Psychology.* 2008;**2**(2):82-102.
24. World Health Organization. . Geneva: World Health Organization; 1996.
25. Nedjat S, Montazeri A, Holakouie K, Mohammad K, Majdzadeh R. Psychometric properties of the Iranian interview-administered version of the World Health Organization's Quality of Life Questionnaire (WHOQOL-BREF): a population-based study. *BMC Health Serv Res.* 2008;**8**(1). 61. [PubMed ID: 18366715]. [PubMed Central ID: PMC2287168]. <https://doi.org/10.1186/1472-6963-8-61>.
26. Meyer TJ, Miller ML, Metzger RL, Borkovec TD. Development and validation of the Penn State Worry Questionnaire. *Behav Res Ther.* 1990;**28**(6):487-95. [PubMed ID: 2076086]. [https://doi.org/10.1016/0005-7967\(90\)90135-6](https://doi.org/10.1016/0005-7967(90)90135-6).
27. Dehshiri GR, Golzari M, Borjali A, Sohrabi F. Psychometrics particularity of Farsi version of Pennsylvania State Worry Questionnaire for college students. *Journal of Clinical Psychology.* 2009;**1**(4):67-75. <https://doi.org/10.22075/jcp.2017.1988>.
28. Slot M, Sodemann M, Gabel C, Holmskov J, Laursen T, Rodkjaer L. Factors associated with risk of depression and relevant predictors of screening for depression in clinical practice: a cross-sectional study among HIV-infected individuals in Denmark. *HIV medicine.* 2015;**16**(7):393-402. [PubMed ID: 25585857]. <https://doi.org/10.1111/hiv.12223>.
29. Rodriguez HE, Duconge Y, Molfetto G, Ahmad S, Bais N, Ferrer G. *NeuroAIDS, comorbid mood disorders and neuropsychiatric effects of antiretroviral therapy.* Cham: Springer; 2024. p. 109-126. https://doi.org/10.1007/978-3-031-57369-9_8.
30. Degroote S, Vogelaers D, Vandijck DM. What determines health-related quality of life among people living with HIV: an updated review of the literature. *Archives of Public Health.* 2014;**72**(1). 40. [PubMed ID: 25671112]. [PubMed Central ID: PMC4323115]. <https://doi.org/10.1186/2049-3258-72-40>.
31. Nunes JC, Carroll MK, Mahaffey KW, Califf RM, Doraiswamy PM, Short S, et al. General Anxiety Disorder-7 Questionnaire as a marker of low socioeconomic status and inequity. *Journal of Affective Disorders.* 2022;**317**:287-97. [PubMed ID: 36031002]. <https://doi.org/10.1016/j.jad.2022.08.085>.