# Depressive symptoms and use of HIV care and medication-assisted treatment among people with HIV who inject drugs

Oleksandr Zeziulin[a,*], Katie R. Mollan[b,c,*], Bonnie E. Shook-Sa[c], Brett Hanscom[d], Kathryn E. Lancaster[e], Kostyantyn Dumchev[a], Vivian F. Go[c], Viet A. Chu[f], Tetiana Kiriazova[a], Zulvia Syarif[g], Sergii Dvoryak[a], Sarah A. Reifeis[c], Erica Hamilton[h], Riza Sarasvita[i], Scott Rose[h], Paul Richardson[j], William Clarke[j], Carl A. Latkin[k], David S. Metzger[k], Irving F. Hoffman[b] and William C. Miller[e]

**Objective:** Vietnam, Indonesia, and Ukraine have major burdens of IDU and HIV. We estimated the prevalence of depressive symptoms at baseline among people living with HIV who inject drugs, evaluated associations between depression at baseline and 12-month HIV care outcomes and medication-assisted treatment (MAT), and evaluated the study intervention effect by baseline depression subgroups.

**Design:** HPTN 074 was a randomized study. The study intervention included psychosocial counseling, systems navigation, and antiretroviral treatment (ART) at any $CD4^+$ cell count.

**Methods:** Moderate-to-severe depression was defined as a Patient Health Questionnaire-9 score of 10 or above. ART and MAT were self-reported. Eligibility criteria were: 18–60 years of age, active IDU, and viral load of at least 1000 copies/ml. Adjusted probability differences (aPD) were estimated using inverse-probability weighting.

**Results:** A total of 502 participants enrolled from April 2015 to June 2016. Median age was 35 years; 85% identified as men. Prevalence of baseline moderate-to-severe depression was 14% in Vietnam, 14% in Indonesia, and 56% in Ukraine. No evident associations were detected between baseline depression and ART, viral suppression, or MAT at 12-month follow-up. The study intervention improved the proportions of people who inject drugs achieving 12-month viral suppression in both the depressed

[a]Ukrainian Institute on Public Health Policy, Kyiv, Ukraine, [b] School of Medicine, [c]Gillings School of Global Public Health, The University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, [d]Statistical Center for HIV/AIDS Research and Prevention (SCHARP), Fred Hutchinson Cancer Research Center, Seattle, Washington, [e]College of Public Health, The Ohio State University, Columbus, Ohio, USA, [f]UNC Vietnam, Ho Chi Minh City, Vietnam, [g]Abhipraya Foundation & Department Psychiatry Faculty of Medicine, University of Indonesia, Depok, Indonesia, [h]Family Health International (FHI 360), Durham, North Carolina, USA, [i]Indonesia National Narcotics Board & Abhipraya Foundation, East Jakarta, Indonesia, [j]Johns Hopkins University, Baltimore, Maryland, and [k]University of Pennsylvania, Philadelphia, Pennsylvania, USA.

Correspondence to Oleksandr Zeziulin, Ukrainian Institute on Public Health Policy, 5 Biloruska Str., Off. 20, 27, Kyiv 04050, Ukraine.

Tel: +380 44 222 6271/+380 44 587 5061/+380 67 461 7296; e-mail: zeziulin@uiphp.org.ua

[*] Oleksandr Zeziulin and Katie R. Mollan co-led and contributed equally to the article.

Received: 21 May 2020; revised: 9 October 2020; accepted: 19 October 2020.

DOI:10.1097/QAD.0000000000002774

ISSN 0269-9370 Copyright © 2020 Wolters Kluwer Health, Inc. All rights reserved.



Copyright © 2021 Wolters Kluwer Health, Inc. All rights reserved.

[intervention 44%; standard of care 24%; estimated aPD = 25% (95% confidence interval: 4.0%, 45%)] and nondepressed subgroups [intervention 38%; standard of care 24%; aPD = 13% (95% confidence interval: 2.0%, 25%)].

**Conclusion:** High levels of depressive symptoms were common among people living with HIV who inject drugs in Ukraine but were less common in Vietnam and Indonesia. The study intervention was effective among participants with or without baseline depression symptoms. Copyright © 2020 Wolters Kluwer Health, Inc. All rights reserved.

*AIDS* 2021, **35**:495–501

**Keywords: antiretroviral therapy, depression, drug users, HIV, opioid medication assisted treatment, viral load**

## Introduction

Depression is the most commonly reported neuropsychiatric complication among people living with HIV (PLWH) [1]. The prevalence of depression symptoms in people who inject drugs (PWID) is even higher [2–7]. Depression may negatively affect HIV treatment initiation [8,9] and adherence [10,11] and may increase mortality among PLWH who inject drugs [12].

Our report examines the relationships between preexisting depressive symptoms and prospectively measured antiretroviral treatment (ART), viral suppression, medication-assisted treatment (MAT), mortality, and daily IDU. We also assess depression subgroup effects of the randomly assigned intervention from the parent HPTN 074 trial [13].

## Methods

HPTN 074 was a randomized, controlled, phase 3 feasibility and efficacy study among index PLWH who inject drugs and their HIV-negative injecting partners [13]. The study was conducted in three sites: Kyiv, Ukraine; Thai Nguyen, Vietnam; and Jakarta, Indonesia. Depression symptoms were measured among the HIV-positive index participants who served as the cohort for this assessment. Respondents were surveyed by personnel certified to use nonjudgmental interviewing techniques. In prespecified analyses, participants with a baseline Patient Health Questionnaire-9 (PHQ-9) score of 10 or above were classified as having moderate or severe depression (D+), and participants scoring 0–9 were classified as having no or mild depression (D−). In a sensitivity analysis, participants with a PHQ-9 score of 5 or above were classified as having mild-to-severe depression. The prevalence of baseline D+ was estimated by site. Estimated probability differences compared participants with baseline D+ to those who were D− (referent) using inverse probability weighted linear-binomial models. Adjusted probability ratios were estimated using an inverse probability weighted modified-Poisson model [14]. Throughout, 95% confidence intervals (CIs) are constructed with no adjustment for multiplicity. At 12-month follow-up, we compared the proportions of participants who were on ART, virally suppressed, on MAT, and reporting daily IDU (see Text, Supplemental Digital Content 1 where we provide additional Methods information, http://links.lww.com/QAD/B908).

## Results

### Participant characteristics

Between April 2015 and June 2016, 502 eligible PLWH who inject drugs were enrolled [13,15]. 194 (39%) were enrolled in Vietnam, 187 (37%) in Ukraine, and 121 (24%) in Indonesia. The majority identified as men (427, 85%), and most participants who identified as women were enrolled in Ukraine (84% or 63/75) (see Table, Supplemental Digital Content 2 for participant baseline characteristics by site and depression status, http://links.lww.com/QAD/B909).

### Depression at baseline

At study entry, the estimated prevalence of moderate/severe depression symptoms was heterogeneous across sites: 14% in Indonesia, 56% in Ukraine, and 14% in Vietnam. Median PHQ-9 depression scores were 4 (Q1, Q3: 3, 7) in Indonesia, 10 (7, 15) in Ukraine, and 5 (2, 8) in Vietnam. (see Table, Supplemental Digital Content 3 for details regarding the prevalence of depression and suicidal thoughts, http://links.lww.com/QAD/B910).

### Antiretroviral treatment and viral suppression

At 12-month follow-up, in Indonesia, the percentage of participants on ART was 55% in the D+ group and 34% in the D− group [estimated adjusted probability difference (aPD) 21% (95% confidence interval (CI): −13%, 56%), Table 1]. In Ukraine the percentage on ART was 47% among D+ participants and 39% among D− participants with aPD 8% (95% CI: −8%, 23%). In Vietnam, the percentage on ART was higher, 67 and 60%

Copyright © 2021 Wolters Kluwer Health, Inc. All rights reserved.

**Table 1. Association between baseline depression and HIV and IDU outcomes at month 12 ($n = 502$).[a]**

| Month 12 outcomes | Estimated probability of outcome | | Probability difference (95% CI) | Probability ratio (95% CI) |
|---|---|---|---|---|
| | D+ | D− | | |
| Alive and using ART | | | | |
| Indonesia | 55.2 | 34.2 | 0.21 (−0.13, 0.56) | 1.61 (0.82, 3.15) |
| Ukraine | 46.8 | 39.2 | 0.08 (−0.08, 0.23) | 1.20 (0.83, 1.73) |
| Vietnam | 67.1 | 60.5 | 0.07 (−0.09, 0.22) | 1.11 (0.78, 1.58) |
| Overall | 53.0 | 46.0 | 0.07 (−0.17, 0.30) | 1.15 (0.89, 1.49) |
| Alive with viral suppression (<40 copies/ml) | | | | |
| Indonesia | 12.4 | 12.6 | 0.00 (−0.20, 0.20) | 0.92 (0.22, 3.78) |
| Ukraine | 30.7 | 35.8 | −0.05 (−0.20, 0.10) | 0.86 (0.54, 1.35) |
| Vietnam | 22.3 | 33.6 | −0.11 (−0.30, 0.07) | 0.66 (0.30, 1.47) |
| Overall | 24.3 | 29.2 | −0.05 (−0.16, 0.06) | 0.83 (0.54, 1.27) |
| Alive and using MAT | | | | |
| Indonesia | 15.0 | 18.2 | −0.03 (−0.19, 0.13) | 0.82 (0.29, 2.33) |
| Ukraine | 18.4 | 25.3 | −0.07 (−0.21, 0.07) | 0.73 (0.39, 1.35) |
| Vietnam | 48.4 | 35.8 | 0.13 (−0.13, 0.38) | 1.35 (0.78, 2.33) |
| Overall | 25.9 | 27.9 | −0.02 (−0.13, 0.09) | 0.93 (0.62, 1.39) |
| Daily IDU or deceased | | | | |
| Indonesia | 49.3 | 32.7 | 0.17 (−0.20, 0.53) | 1.49 (0.67, 3.28) |
| Ukraine | 61.3 | 54.5 | 0.07 (−0.09, 0.22) | 1.13 (0.86, 1.48) |
| Vietnam | 16.3 | 29.3 | −0.13 (−0.30, 0.04) | 0.55 (0.21, 1.46) |
| Overall | 42.4 | 40.1 | 0.02 (−0.11, 0.16) | 1.06 (0.76, 1.46) |

ART, antiretroviral treatment; CI, confidence interval; MAT, medication-assisted treatment.
[a]Adjusted estimates accounted for the following baseline covariates: study site, study arm, sex (Ukraine only), educational attainment (Ukraine only), employment status, ART status, MAT status, relationship status, age, $CD4^+$ cell count, years since HIV diagnosis, and age of IDU initiation. Continuous variables were fit using a restricted cubic spline with 4 equally spaced knots. Multiple imputation was used throughout, and probabilities of each outcome were estimated from adjusted models.

in the D+ and D− groups, respectively [aPD 7% (95% CI: −9%, 22%)].

The proportions of participants achieving viral suppression (<40 copies/ml) were similar between D+ (12%) and D− (13%) in Indonesia [aPD 0% (95% CI: −20%, 20%)], and in Ukraine [31 vs. 36%; aPD −5% (95% CI: −20%, 10%), Table 1]. Though imprecise, in Vietnam, the proportion of people with viral suppression was lower for D+ (22%) compared with the D− (34%) group [aPD −11% (95% CI: −30%, 7%)].

## Medication-assisted treatment and daily IDU

At 12-month follow-up, the percentage of participants on MAT in Indonesia was 15% for D+ vs. 18% for D− [aPD −3% (95% CI: −19%, 13%)] (Table 1). In Ukraine, 18% of D+ and 25% of D− participants were on MAT [aPD −7% (95% CI: −21%, 7%)]. More frequent MAT use was observed in Vietnam with D+ 48% vs. D− 36% [aPD 13% (95% CI: −13%, 38%)].

Daily IDU was more prevalent among D+ participants in Ukraine and Indonesia at 12 months compared with D− participants, with the largest estimated difference in Indonesia: D+ 49% vs. D− 33% [aPD 17% (95% CI: −20%, 53%)] (Table 1). In Vietnam, daily IDU was more frequent in D− [aPD −13%, (95% CI: −30%, 4%)].

## Mortality

The estimated 12-month, unadjusted mortality rate was 11% (95% CI: 7%, 18%) among D+ participants and 11% (95% CI: 8%, 14%) among D− participants, overall, with an estimated difference of 0.6% (95% CI: −6%, 7%). Unadjusted mortality CIs for D+ and D− participants overlapped, overall and within site (see Figure, Supplemental Digital Content 4 where we display crude mortality estimates, http://links.lww.com/QAD/B911).

## Effect of intervention by baseline depression subgroup

The intervention was effective at increasing self-reported ART use at 12-month follow-up in both the D+ [78% of intervention vs. 42% of standard of care (SOC); estimated aPD 33% (95% CI: 13%, 53%)] and D− subgroups [68% intervention vs. 41% SOC; aPD 25% (95% CI: 12%, 37%)] (Table 2). The study intervention improved 12-month viral suppression in both the D+ [44% intervention vs. 24% SOC; estimated aPD 25% (95% CI: 4%, 45%)] and D− subgroups [38% intervention vs. 24% SOC; aPD 13% (95% CI: 2%, 25%)].

MAT use was more frequent in the intervention arm with a more pronounced effect among D− participants [aPD 15% (95% CI: 3%, 26%)] compared with D+ participants [aPD 3%, (95% CI: −14%, 21%)]. The effect of the intervention on 12-month daily IDU varied by baseline depression status. Among D− participants, the percentage of people having daily IDU was substantially lower in the intervention arm (24%) compared with the SOC arm (40%) [aPD −17% (95% CI: −28%, −6%)]. Yet among D+ participants, daily IDU was similar in the intervention and SOC arms [aPD 4% (95% CI: −17%, 26%)].

Copyright © 2021 Wolters Kluwer Health, Inc. All rights reserved.

**Table 2. Effect of randomized intervention by baseline depression subgroups at month 12.**

| Month 12 outcomes | Intervention | Standard of care | Adjusted probability difference (95% CI)[a] | Interaction *P* value[b] |
|---|---|---|---|---|
| ART | | | | 0.50 |
| Depressed | 25/32 (78.1) | 50/118 (42.4) | 0.33 (0.13, 0.53) | |
| Not depressed | 64/94 (68.1) | 105/258 (40.7) | 0.25 (0.12, 0.37) | |
| Viral suppression (<40 copies/ml) | | | | 0.37 |
| Depressed | 14/32 (43.8) | 28/118 (23.7) | 0.25 (0.04, 0.45) | |
| Not depressed | 36/94 (38.3) | 61/258 (23.6) | 0.13 (0.02, 0.25) | |
| MAT | | | | 0.29 |
| Depressed | 10/32 (31.3) | 27/118 (22.9) | 0.03 (−0.14, 0.21) | |
| Not depressed | 37/94 (39.4) | 58/258 (22.5) | 0.15 (0.03, 0.26) | |
| Daily IDU | | | | 0.08 |
| Depressed | 16/32 (50.0) | 61/118 (51.7) | 0.04 (−0.17, 0.26) | |
| Not depressed | 23/94 (24.5) | 102/258 (39.5) | −0.17 (−0.28, −0.06) | |

Depressed is defined as moderate/severe depression on PHQ-9 at baseline. Deceased participants are counted as failures for each outcome. Unadjusted event/*n* (%) results are shown, and multiple imputation was used throughout. Standard of care arm is the referent. ART, antiretroviral treatment; CI, confidence interval; MAT, medication-assisted treatment; PHQ-9, Patient Health Questionnaire-9.
[a]Adjusted for the following baseline covariates: study site, depression group, ART status, MAT status, relationship status, age, $CD4^+$ cell count, years since HIV diagnosis, and age of IDU initiation.
[b]Statistical interaction test between study arm and baseline depression group.

In a sensitivity analysis, a PHQ-9 score of 5 or above was classified as depression (mild, moderate, or severe) and depressed participants were compared with participants without depressive symptoms. The results were similar to the primary approach (see Table, Supplemental Digital Content 5 where we discuss results of the sensitivity analysis, http://links.lww.com/QAD/B912).

## Discussion

Prevalence of depressive symptoms measured by PHQ-9 was strikingly higher in Ukraine compared with Vietnam and Indonesia. However, we saw little relationship between baseline depressive symptoms among PLWH who inject drugs on ART use, MAT uptake, viral suppression, daily IDU, and mortality. Importantly, the study intervention was effective in improving ART use and viral suppression among participants with or without baseline depression.

In recent studies from Ukraine, the prevalence of self-reported depression among PWID as measured by CES-D and Hospital Anxiety and Depression Scale has been high, up to 60%, which is similar to our findings [16,17]. Among PLWH in Ukraine, the prevalence of depression was 25% [18] compared with 12% in the general population [19]. The high depression prevalence is exacerbated by the military conflict with Russia in Eastern Ukraine, which has displaced approximately 1.5 million people since 2014. The prevalence of depression in these displaced people is estimated to be 25% [20].

Our participants from Indonessia and Vietnam were primarily men, which may have led to a lower estimate of depression prevalance given that sex is a recognized risk factor for depression, with women at increased risk [1,21–24]. In Vietnam, we detected a lower depression prevalence (14%) than was recently described in a study among men living with HIV who inject drugs, where 40% reported severe depressive symptoms on the CES-D scale [4]. Similarly, in Indonesia, PLWH who inject drugs had a higher depression prevalence measured by CES-D (33%) than in our sample [5].

Discrepancies in depression prevalence may be explained by differences in study-population characteristics; for example, rural vs. urban, levels of social support, employment status, and similar factors. Alternatively, differences in depression measurement instruments, specifically the use of the PHQ-9 vs. the CES-D, may explain the observed differences compared with previous studies in Vietnam and Indonesia.

In our study, self-reported ART was not markedly different between depressed and nondepressed participants. In a recent meta-analysis, depression was negatively associated with ART initiation [25]. However, this relationship is inconsistent. In some studies, PLWH, and especially PWID [26–28], with depression were less likely to initiate ART [9,26,29–33]; but, in other studies, PLWH with depression had increases in ART use [34–37].

In HPTN 074, baseline depressive symptoms were not substantially associated with 12-month viral suppression, which was observed in several other studies [38–42]. However, again the results are inconsistent, depression was found to decrease viral suppression in PLWH in some settings [43,44]. Lower adherence to ART appears to be one mechanism for these effects [10,45–47], although adherence does not explain all of the observed differences [48].

In our study, overall, MAT use was similar among depressed and nondepressed participants. In previous studies, PWID with depressive symptoms were more

Copyright © 2021 Wolters Kluwer Health, Inc. All rights reserved.

likely to enroll in MAT [49–51]. Depression was also associated with willingness to begin MAT in Ukraine [17].

PWID with depressive symptoms may use drugs more frequently than those without depressive symptoms [52]. However, we did not observe this relationship, which also has not been consistent in other studies. In Vietnam, daily injections were more common among respondents with depression in a previous study [4], but, among HIV outpatients in Vietnam, drug use was not associated with depressive symptoms [53]. Similarly, in Ukraine, depressive symptoms were not associated with frequency of injection [16,54]. In contrast, in Indonesia, depressive symptoms have been associated with recent substance use [5].

The HPTN 074 study intervention was effective in improving 12-month ART use and viral suppression in both the depressed and nondepressed subgroups. However, the effectiveness of the intervention on MAT use in PWID with depression was not conclusive. In participants with no/mild depressive symptoms at baseline, the intervention substantially reduced daily IDU use compared with our standard of care. However, there was no clear evidence of an intervention impact upon daily IDU among PWID with moderate/severe depressive symptoms at baseline. Importantly, the intervention included modules on depression and injection risk reduction and it is possible that these modules affected self-reported ART and daily IDU in the intervention group.

HPTN 074 was a rigorously conducted study in three diverse sites. Depression in PLWH who inject drugs has been understudied, and this analysis serves to help fill an important research gap. But our analyses of depression were limited by small numbers of people reporting depressive symptoms, especially in Indonesia and Vietnam, which limits precision. In addition, our results were heterogeneous across the three sites and therefore the overall combined results should be interpreted with caution.

In HPTN 074, we did not identify associations between moderate/severe depression at baseline and 12-month HIV or MAT outcomes. In addition, the study intervention effect on HIV outcomes was not substantially modified by baseline depression. Our results indicate that the intervention was effective in terms of viral suppression and self-reported ART in both people with and without depressive symptoms. Unlike previous studies, we did not find a clear link between prior depression and HIV outcomes.

## Acknowledgements

We thank FHI 360 for their crucial role in the study implementation. We thank Fred Hutch for their crucial role in data collection and oversight. We thank the UNC Center for AIDS Research for their role in dataset derivation and mentorship. We thank Gabrielle Streeter for helping with editing figures included in this report. Finally, we thank all of the HPTN protocol team, the site staff in Indonesia, Vietnam, and Ukraine for their dedication to the study, and the participants for their willingness to share their experiences through the study.

Author contributions: O.Z., K.R.M., K.E.L., K.D., V.F.G., C.A.L., D.S.M., I.F.H., and W.C.M. conceived of the aims and proposal for this analysis. K.R.M. and B.E.S.-S. developed the statistical analysis plan; B.E.S.-S. analyzed the data in collaboration with K.R.M. and S.A.R. C.A.L., D.S.M., I.F.H, and W.C.M. conceived the main HPTN 074 study. V.F.G., C.A.L., D.S.M., I.F.H., W.C.M. planned for the collection of depression symptoms during the study design. K.D., V.F.G., V.A., T.K., Z.S., S.D., E.H., R.S., S.R., H.B. made major contributions to study conduct. O.Z. and K.R.M. drafted the article and all authors edited, reviewed, and approved the final article.

The current work was supported by the National Institute of Allergy and Infectious Diseases (NIAID), the National Institute of Mental Health (NIMH), and the National Institute on Drug Abuse (NIDA) of the National Institutes of Health (NIH); award numbers UM1AI068619 (HPTN Leadership and Operations Center), UM1AI068617 (HPTN Statistical and Data Management Center), UM1AI068613 (HPTN Laboratory Center), and the University of North Carolina at Chapel Hill Center for AIDS Research (P30 AI50410). The content of this article is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.

### Conflicts of interest

There are no conflicts of interest.

## References

1. Nanni MG, Caruso R, Mitchell AJ, Meggiolaro E, Grassi L. **Depression in HIV infected patients: a review.** *Curr Psychiatry Rep* 2015; **17**:530.
2. Li J, Gu J, Lau JT, Chen H, Mo PK, Tang M. **Prevalence of depressive symptoms and associated factors among people who inject drugs in China.** *Drug Alcohol Depend* 2015; **151**:228–235.
3. Remien RH, Stirratt MJ, Nguyen N, Robbins RN, Pala AN, Mellins CA. **Mental health and HIV/AIDS: the need for an integrated response.** *AIDS* 2019; **33**:1411–1420.
4. Levintow SN, Pence BW, Ha TV, Minh NL, Sripaipan T, Latkin CA, *et al.* **Prevalence and predictors of depressive symptoms among HIV-positive men who inject drugs in Vietnam.** *PLoS One* 2018; **13**:e0191548.
5. Li Y, Hershow R, Irwanto, Praptoraharjo I, Setiawan M, Levy J. **Factors associated with symptoms of depression among injection drug users receiving antiretroviral treatment in Indonesia.** *J AIDS Clin Res* 2014; **5**:303.

Copyright © 2021 Wolters Kluwer Health, Inc. All rights reserved.

6. Bouhnik AD, Preau M, Vincent E, Carrieri MP, Gallais H, Lepeu G, *et al*. **Depression and clinical progression in HIV-infected drug users treated with highly active antiretroviral therapy.** *Antivir Ther* 2005; **10**:53–61.
7. Anagnostopoulos A, Ledergerber B, Jaccard R, Shaw SA, Stoeckle M, Bernasconi E, *et al*. **Frequency of and risk factors for depression among participants in the Swiss HIV Cohort Study (SHCS).** *PLoS One* 2015; **10**:e0140943.
8. Dombrowski JC, Simoni JM, Katz DA, Golden MR. **Barriers to HIV care and treatment among participants in a public health HIV care relinkage program.** *AIDS Patient Care STDS* 2015; **29**:279–287.
9. Goodness TM, Palfai TP, Cheng DM, Coleman SM, Bridden C, Blokhina E, *et al*. **Depressive symptoms and antiretroviral therapy (ART) initiation among HIV-infected Russian drinkers.** *AIDS Behav* 2014; **18**:1085–1093.
10. Starace F, Ammassari A, Trotta MP, Murri R, De Longis P, Izzo C, *et al*. **Depression is a risk factor for suboptimal adherence to highly active antiretroviral therapy.** *J Acquir Immune Defic Syndr* 2002; **31 (Suppl 3)**:S136–S139.
11. Gonzalez JS, Batchelder AW, Psaros C, Safren SA. **Depression and HIV/AIDS treatment nonadherence: a review and meta-analysis.** *J Acquir Immune Defic Syndr* 2011; **58**:181–187.
12. Levintow SN, Pence BW, Ha TV, Le Minh N, Sripaipan T, Latkin CA, *et al*. **Depressive symptoms at HIV testing and two-year all-cause mortality among men who inject drugs in Vietnam.** *AIDS Behav* 2019; **23**:609–616.
13. Miller WC, Hoffman IF, Hanscom BS, Ha TV, Dumchev K, Djoerban Z, *et al*. **A scalable, integrated intervention to engage people who inject drugs in HIV care and medication-assisted treatment (HPTN 074): a randomised, controlled phase 3 feasibility and efficacy study.** *Lancet* 2018; **392**:747–759.
14. Zou G. **A modified poisson regression approach to prospective studies with binary data.** *Am J Epidemiol* 2004; **159**:702–706.
15. Lancaster KE, Hoffman IF, Hanscom B, Ha TV, Dumchev K, Susami H, *et al*. **Regional differences between people who inject drugs in an HIV prevention trial integrating treatment and prevention (HPTN 074): a baseline analysis.** *J Int AIDS Soc* 2018; **21**:e25195.
16. Vasylyev M, Davtyan H, Denisiuk O, Chadwick Jayaraj J, Koval T, Piddubna A, *et al*. **Anxiety, depression, and quality of life among HIV positive injection drug users in Ukraine, 2017.** *J Infect Dev Ctries* 2019; **13**:111S–117S.
17. Makarenko I, Mazhnaya A, Polonsky M, Marcus R, Bojko MJ, Filippovych S, *et al*. **Determinants of willingness to enroll in opioid agonist treatment among opioid dependent people who inject drugs in Ukraine.** *Drug Alcohol Depend* 2016; **165**:213–220.
18. Bailey H, Malyuta R, Semenenko I, Townsend CL, Cortina-Borja M, Thorne C, *et al*. **Prevalence of depressive symptoms in pregnant and postnatal HIV-positive women in Ukraine: a cross-sectional survey.** *Reprod Health* 2016; **13**:27.
19. Tintle N, Bacon B, Kostyuchenko S, Gutkovich Z, Bromet EJ. **Depression and its correlates in older adults in Ukraine.** *Int J Geriatr Psychiatry* 2011; **26**:1292–1299.
20. Kuznetsova I, Mikheieva O, Catling J, Round R, Babenko S. The Mental Health of IDPs and the general population in Ukraine: the Results of a National Survey and Interviews with Professionals. Briefing paper; 2019. doi: 10.5281/zenodo.2585564
21. Richards D. **Prevalence and clinical course of depression: a review.** *Clin Psychol Rev* 2011; **31**:1117–1125.
22. Ickovics JR, Hamburger ME, Vlahov D, Schoenbaum EE, Schuman P, Boland RJ, *et al*. **Mortality, CD4 cell count decline, and depressive symptoms among HIV-seropositive women: longitudinal analysis from the HIV Epidemiology Research Study.** *JAMA* 2001; **285**:1466–1474.
23. Robertson K, Bayon C, Molina JM, McNamara P, Resch C, Munoz-Moreno JA, *et al*. **Screening for neurocognitive impairment, depression, and anxiety in HIV-infected patients in Western Europe and Canada.** *AIDS Care* 2014; **26**:1555–1561.
24. Morrison MF, Petitto JM, Ten Have T, Gettes DR, Chiappini MS, Weber AL, *et al*. **Depressive and anxiety disorders in women with HIV infection.** *Am J Psychiatry* 2002; **159**:789–796.
25. Tao J, Vermund SH, Qian HZ. **Association between depression and antiretroviral therapy use among people living with HIV: a meta-analysis.** *AIDS Behav* 2018; **22**:1542–1550.
26. Tegger MK, Crane HM, Tapia KA, Uldall KK, Holte SE, Kitahata MM. **The effect of mental illness, substance use, and treatment for depression on the initiation of highly active antiretroviral therapy among HIV-infected individuals.** *AIDS Patient Care STDS* 2008; **22**:233–243.
27. Tran BX, Ohinmaa A, Duong AT, Do NT, Nguyen LT, Nguyen QC, *et al*. **Changes in drug use are associated with health-related quality of life improvements among methadone maintenance patients with HIV/AIDS.** *Qual Life Res* 2012; **21**:613–623.
28. Chander G, Himelhoch S, Moore RD. **Substance abuse and psychiatric disorders in HIV-positive patients: epidemiology and impact on antiretroviral therapy.** *Drugs* 2006; **66**:769–789.
29. Martinez P, Andia I, Emenyonu N, Hahn JA, Hauff E, Pepper L, *et al*. **Alcohol use, depressive symptoms and the receipt of antiretroviral therapy in southwest Uganda.** *AIDS Behav* 2008; **12**:605–612.
30. Cook JA, Grey DD, Burke-Miller JK, Cohen MH, Vlahov D, Kapadia F, *et al*. **Illicit drug use, depression and their association with highly active antiretroviral therapy in HIV-positive women.** *Drug Alcohol Depend* 2007; **89**:74–81.
31. Cohen MH, Cook JA, Grey D, Young M, Hanau LH, Tien P, *et al*. **Medically eligible women who do not use HAART: the importance of abuse, drug use, and race.** *Am J Public Health* 2004; **94**:1147–1151.
32. Hightow-Weidman LB, Jones K, Phillips G 2nd, Wohl A, Giordano TP, YMSM of Color SPNS Initiative Study Group. **Baseline clinical characteristics, antiretroviral therapy use, and viral load suppression among HIV-positive young men of color who have sex with men.** *AIDS Patient Care STDS* 2011; **25 (Suppl 1)**:S9–S14.
33. Lillie-Blanton M, Stone VE, Snow Jones A, Levi J, Golub ET, Cohen MH, *et al*. **Association of race, substance abuse, and health insurance coverage with use of highly active antiretroviral therapy among HIV-infected women, 2005.** *Am J Public Health* 2010; **100**:1493–1499.
34. Baez Feliciano DV, Gomez MA, Fernandez-Santos DM, Quintana R, Rios-Olivares E, Hunter-Mellado RF. **Profile of Puerto Rican HIV/AIDS patients with early and nonearly initiation of injection drug use.** *Ethn Dis* 2008; **18 (2 Suppl 2)**:S2-99–S2-104.
35. Himelhoch S, Moore RD, Treisman G, Gebo KA. **Does the presence of a current psychiatric disorder in AIDS patients affect the initiation of antiretroviral treatment and duration of therapy?** *J Acquir Immune Defic Syndr* 2004; **37**:1457–1463.
36. Mijch A, Burgess P, Judd F, Grech P, Komiti A, Hoy J, *et al*. **Increased healthcare utilization and increased antiretroviral use in HIV-infected individuals with mental health disorders.** *HIV Med* 2006; **7**:205–212.
37. Tao J, Vermund SH, Lu H, Ruan Y, Shepherd BE, Kipp AM, *et al*. **Impact of depression and anxiety on initiation of antiretroviral therapy among men who have sex with men with newly diagnosed HIV infections in China.** *AIDS Patient Care STDS* 2017; **31**:96–104.
38. Pence BW, Ostermann J, Kumar V, Whetten K, Thielman N, Mugavero MJ. **The influence of psychosocial characteristics and race/ethnicity on the use, duration, and success of antiretroviral therapy.** *J Acquir Immune Defic Syndr* 2008; **47**:194–201.
39. Paterson DL, Swindells S, Mohr J, Brester M, Vergis EN, Squier C, *et al*. **Adherence to protease inhibitor therapy and outcomes in patients with HIV infection.** *Ann Intern Med* 2000; **133**:21–30.
40. Belenky NM, Cole SR, Pence BW, Itemba D, Maro V, Whetten K. **Depressive symptoms, HIV medication adherence, and HIV clinical outcomes in Tanzania: a prospective, observational study.** *PLoS One* 2014; **9**:e95469.
41. Shacham E, Onen NF, Donovan MF, Rosenburg N, Overton ET. **Psychiatric diagnoses among an HIV-infected outpatient clinic population.** *J Int Assoc Provid AIDS Care* 2016; **15**:126–130.
42. Cerutti B, Broers B, Masetsibi M, Faturiyele O, Toti-Mokoteli L, Motlatsi M, *et al*. **Alcohol use and depression: link with adherence and viral suppression in adult patients on antiretroviral therapy in rural Lesotho, Southern Africa: a cross-sectional study.** *BMC Public Health* 2016; **16**:947.
43. Pence BW, Miller WC, Gaynes BN, Eron JJ Jr. **Psychiatric illness and virologic response in patients initiating highly active antiretroviral therapy.** *J Acquir Immune Defic Syndr* 2007; **44**:159–166.
44. J P. Depression associated with failure to suppress viral load. In. International AIDS Conference: International AIDS Conference; 2014.


Copyright © 2021 Wolters Kluwer Health, Inc. All rights reserved.

45. Krumme AA, Kaigamba F, Binagwaho A, Murray MB, Rich ML, Franke MF. **Depression, adherence and attrition from care in HIV-infected adults receiving antiretroviral therapy.** *J Epidemiol Community Health* 2015; **69**:284–289.
46. Holzemer WL, Corless IB, Nokes KM, Turner JG, Brown MA, Powell-Cope GM, *et al*. **Predictors of self-reported adherence in persons living with HIV disease.** *AIDS Patient Care STDS* 1999; **13**:185–197.
47. Pecoraro A, Royer-Malvestuto C, Rosenwasser B, Moore K, Howell A, Ma M, *et al*. **Factors contributing to dropping out from and returning to HIV treatment in an inner city primary care HIV clinic in the United States.** *AIDS Care* 2013; **25**:1399–1406.
48. Hartzell JD, Janke IE, Weintrob AC. **Impact of depression on HIV outcomes in the HAART era.** *J Antimicrob Chemother* 2008; **62**:246–255.
49. Amodeo M, Chassler D, Ferguson F, Fitzgerald T, Lundgren L. **Use of mental health and substance abuse treatment services by female injection drug users.** *Am J Drug Alcohol Abuse* 2004; **30**:101–120.
50. Reynoso-Vallejo H, Chassler D, Witas J, Lundgren LM. **Patterns of drug treatment entry by Latino male injection drug users from different national/geographical backgrounds.** *Eval Program Plann* 2008; **31**:92–101.
51. Cantone RE, Garvey B, O'Neill A, Fleishman J, Cohen D, Muench J, *et al*. **Predictors of medication-assisted treatment initiation for opioid use disorder in an interdisciplinary primary care model.** *J Am Board Fam Med* 2019; **32**:724–731.
52. Conner KR, Pinquart M, Duberstein PR. **Meta-analysis of depression and substance use and impairment among intravenous drug users (IDUs).** *Addiction* 2008; **103**:524–534.
53. Thai TT, Jones MK, Harris LM, Heard RC. **The association between symptoms of mental disorders and health risk behaviours in Vietnamese HIV positive outpatients: a cross-sectional study.** *BMC Public Health* 2017; **17**:250.
54. Makarenko I, Mazhnaya A, Marcus R, Pykalo I, Madden L, Filippovich S, *et al*. **Concurrent drug injection during opioid agonist treatment among people who inject drugs in Ukraine.** *J Subst Abuse Treat* 2018; **87**:1–8.

Copyright © 2021 Wolters Kluwer Health, Inc. All rights reserved.