Suicide risk among persons living with HIV

Lily A. Brown, Ph.D.[*,1], **Ifrah Majeed, B.A.**[1], **Wenting Mu, Ph.D.**[1], **Jesse McCann, B.S.**[1], **Stephen Durborow, B.S.**[2], **Song Chen, Ph.D.**[3], **Michael B. Blank, Ph.D.**[1]

[1]University of Pennsylvania, Department of Psychiatry

[2]University of Pennsylvania, Clinical Research Computing Unit

[3]University of Wisconsin, La Crosse, Department of Mathematics and Statistics

Abstract

Persons living with HIV (PLWH) are significantly more likely to die by suicide compared to the general population. This is the first study to examine the impact of posttraumatic stress disorder (PTSD), major depressive disorder (MDD), insomnia, and substance use disorders on suicidal ideation/behavior among PLWH using electronic medical record (EMR) data. We also evaluated the mutual influence of interactions between PTSD and substance use disorders on suicide risk, consistent with the substance abuse, violence exposure, and HIV/AIDS "SAVA" syndemic model. Participants ($n = 2,336$) were HIV+ individuals recruited through the Center for AIDS Research (CFAR). Participants provided informed consent for extraction of their EMR. As hypothesized, univariate analyses revealed that PTSD, MDD, insomnia, alcohol and other substance use disorders (cocaine abuse and cocaine dependence, opioid abuse and dependence, cannabis abuse, other psychoactive substance abuse and dependence, and polysubstance use disorder) were each positively associated with suicidal ideation/behavior. Also as hypothesized, a multivariable analysis found that alcohol and cocaine dependence, MDD, and PTSD were significant predictors of suicidal ideation/behavior. Contrary to hypotheses, none of the interactions between PTSD and substance use disorders were significantly associated with suicidal ideation/behavior.

Keywords

acquired immunodeficiency syndrome (AIDS); suicide; electronic health records; major depression; alcohol use disorders

Introduction

Persons living with HIV are significantly more likely to die by suicide compared to the general population (Badiee et al., 2012; Carrico et al., 2007). About 21% of persons living with HIV (PLWH) report suicidal ideation (Ferlatte et al., 2017), a full 5% report a past-year suicide attempt, and 1–2% of PLWH die by suicide (Gurm et al., 2015; Paparizos et al.,

---

[*]Corresponding author information: Lily A. Brown, Ph.D., 3535 Market Street Suite 600 N, Philadelphia, PA 19147, 215-746-3346, Fax: 215-746-3311, lilybr@upenn.edu.

2017). Among PLWH with virus suppression who died, suicide was the second leading cause of death (Goehringer et al., 2017). In PLWH under 50 years old, suicide was the leading cause of death (17% men, 25% women; Goehringer et al., 2017). To further complicate matters, some types of antiretroviral therapies (ARTs), particularly efavirenz, are associated with increased risk for suicide (Mollan et al., 2017). Given the elevated risk for suicide among PLWH, it is essential to understand predictors of suicidal ideation and behavior in this sample.

Psychiatric comorbidities may serve as important predictors of suicide risk among PLWH given their predictive power in the general population. For instance, posttraumatic stress disorder (PTSD; Brown, Armey, Sejourne, Miller, & Weinstock, 2016), major depressive disorder (MDD), insomnia (Bernert, Hom, Iwata, & Joiner, 2017), and substance use disorders (SUD) (Bohnert et al., 2014) are each independently associated with suicide risk. These disorders are also highly prevalent among PLWH. Rates of trauma exposure and PTSD are disproportionately higher in PLWH compared to the general population (Martinez, Hosek, & Carleton, 2009). About 50% of PLWH have experienced trauma (76% caused by an intimate partner; Tjaden & Thoennes, 1998), half of whom meet diagnostic criteria for PTSD (Botha, 1996; Fellows, Spahr, Byrd, Mindt, & Morgello, 2015; Israelski et al., 2007; Kelly et al., 1998; Martinez, Israelski, Walker, & Koopman, 2002; Olley, Abrahams, & Stein, 2006). Sleep disorders (Rubinstein & Selwyn, 1998), MDD (Nedelcovych et al., 2017), and SUD are also higher in PLWH compared to the general population and are associated with greater risk of trauma exposure (Gilbert et al., 2015).

There are very few studies examining the impact of psychiatric conditions on suicide risk in PLWH. Risk for suicidal behavior is higher following trauma exposure in PLWH compared to HIV- controls (Kagee, Bantjes, & Saal, 2017), such that PLWH are 4.7–7.6 times more likely to report suicidal ideation and suicide attempts if they have trauma-related disorders (Fellows et al., 2015; Fortuna et al., 2016; Kagee et al., 2017). Similarly, PLWH are also significantly more likely to report suicidal ideation if they are depressed or experiencing poor sleep (Dabaghzadeh, Jabbari, Khalili, & Abbasian, 2015). In the general population, substance use and sleep disorders have also been linked to increased risk for suicide and are common among PLWH compared to HIV- controls (Bernert et al., 2017; Ferrari et al., 2014; Norman, Chediak, Kiel, & Cohn, 1990); however, it remains unclear whether PLWH with SUDs and sleep disorders are at greater risk for suicide compared to PLWH who do not have these diagnoses. PLWH who use psychoactive drugs are 3–7 times more likely to attempt suicide than PLWH who do not, and PLWH who report frequent difficulty sleeping are 1.6–5 times more likely to attempt suicide (Quintana-Ortiz, Gomez, Baez Feliciano, & Hunter-Mellado, 2008). While each of these psychiatric conditions may independently confer risk for suicide among PLWH, interactions between these variables may serve as even stronger predictors of risk, consistent with a syndemic model (Reitmanova & Gustafson, 2012).

The syndemic model of "*S*ubstance *A*buse, intimate partner *V*iolence, and *A*IDS/HIV", or SAVA, was coined to refer to the frequent co-occurrence and mutual influence between these risk factors (Singer, 1994). One study of the SAVA syndemic found that substance use and intimate partner violence (often a cause of PTSD; Brown, Burnette & Cerulli, 2014) were associated with subsequent depression symptoms among women infected with HIV

(Illangasekare, Burke, Chander, & Gielen, 2013). Furthermore, depression symptoms contributed to increased use of substances in this sample. In general, existing approaches to understanding suicidal ideation and behavior, such as STORM (Oliva et al., 2017) for opioid related suicide deaths and REACH-VET for predicting suicide risk in the Department of Veterans Affairs (VA; McCarthy et al., 2015), are consistent with a syndemic approach in that they value exploration of multimorbidity as opposed to individual predictors of suicide. However, the SAVA syndemic has not been explored in relationship to risk for suicidal ideation/behavior among PLWH.

The present study examined the impact of psychiatric disorders on risk for suicidal ideation and behavior among PLWH. Using data extracted from electronic health records of PLWH recruited through the Penn Center for AIDS Research (CFAR), the first goal for this study was to understand the extent to which PTSD, MDD, sleep disorders, and SUD contribute to risk for suicidal ideation/behavior among PLWH. We hypothesized that each of these psychiatric disorders would be independently associated with suicidal ideation/behavior among PLWH. Furthermore, we hypothesized that PTSD and SUD would be significantly associated with suicidal ideation/behavior above and beyond the influence of MDD and insomnia. Finally, we evaluated the influence of interactions between PTSD and SUDs on suicidal ideation/behavior, consistent with the SAVA syndemic model. We hypothesized that the presence of PTSD would interact with SUDs to confer enhanced risk for suicidal ideation/behavior.

Methods

Participants.

Participants ($n = 2,336$) were HIV+ individuals recruited through the Penn Center for AIDS Research (CFAR) Longitudinal Database at the University of Pennsylvania, Philadelphia, PA. Demographic information and diagnostic code frequencies are reported in Table 1. All CFAR participants in this study provided informed consent allowing for the extraction of their EMR data. Encounters were extracted from September 2006 to September 2018.

Suicide Codes.

Consistent with prior research (Assari, 2018; Hedegaard et al., 2018), a variety of codes reflecting suicidal ideation, suicidal behavior, and self-harm behavior were extracted from the electronic medical record (see Supplemental Digital Table 1). These codes identified 48 patients, some of whom had multiple codes documented, including suicidal ideation ($n = 28$), suicide attempt ($n = 2$), poisoning by propionic acid derivatives ($n = 2$), poisoning by 4-aminophenol derivatives ($n = 1$), poisoning by benzodiazepines ($n = 1$), poisoning by anti-allergic and antiemetic drugs ($n = 1$), poisoning by unspecified psychotropic drug ($n = 1$), poisoning by other drugs, medicaments, and biological substances ($n = 1$), poisoning by other antidepressants ($n = 1$), encounter for observation for other suspected diseases and conditions ruled out ($n = 15$; with some indication of self-harm or suicide risk). Control comparisons were PLWH who did not have any documented evidence of these suicidal ideation/behavior codes.

Psychiatric Codes.

Psychiatric codes for posttraumatic stress disorder (PTSD), depressive disorders, sleep disorders, substance abuse, and substance dependence were extracted from the electronic health record. Polysubstance use disorder was calculated as the presence of more than 1 substance use disorder.

Extraction Procedures.

The University of Pennsylvania maintains a research repository of electronic health information that is compiled from multiple University of Pennsylvania Health System (UPHS) clinical information databases and is updated daily. This repository was used to query all hospital encounter records for participants enrolled in the CFAR registry to identify occurrences of the diagnoses of interest. Extracted data sets identified participants using only CFAR registry participant IDs to protect participant confidentiality.

Data Analysis.

First, the suicidal ideation/behavior classifier (0 = no indication of suicidal ideation/behavior; 1 = indication of suicide ideation/behavior) was compared against demographic information to determine whether there were differences in demographics based on suicidal ideation/behavior. Then, a series of chi-square analyses were run in which each psychiatric diagnosis was compared against the suicidal ideation/behavior classification. To correct for multiple comparisons for this analysis, the Benjamini-Hochberg correction was used (Benjamini & Hochberg, 1995).

Next, a multivariable logistic regression model was run in which PTSD, MDD, insomnia, alcohol dependence, cocaine dependence, cannabis dependence, opioid dependence, and other psychoactive substance dependence were each entered as independent variables to predict suicidal ideation/behavior classification. Sedative dependence and hallucinogen dependence were dropped from the model due to low base rates.

Finally, to explore SAVA syndemic interactions between substance use and trauma-related symptoms, multivariable logistic regression models were run to examine main effects of PTSD and substance dependence and a PTSD × substance dependence interaction. This analysis was repeated, in turn replacing substance dependence with substance abuse, alcohol dependence, alcohol abuse, and polysubstance use disorders.

Given that there was a significant difference in gender between the suicidal ideation/behavior classifier, gender was included as a covariate in all analyses. This covariate did not change any of the results. Results are reported without the covariate included.

Results

Electronic Health Record Analyses

Univariate analyses.—After correcting for multiple post hoc comparisons, PTSD, major depressive disorder, insomnia, alcohol abuse, alcohol dependence, cocaine abuse, cocaine dependence, opioid abuse, opioid dependence, cannabis abuse, other psychoactive substance

abuse, other psychoactive substance dependence, any substance abuse, any substance dependence, and polysubstance use disorder were each positively associated with suicidal ideation/behavior categorization (see Table 1). Rates of documented sedative and hallucinogen abuse and dependence were too low for inclusion in Benjamini-Hochberg corrections.

Multivariable analyses.—When all variables were entered into a simultaneous model (using only "dependence" substance use disorder variables and excluding "abuse" substance use disorder variables due to multicollinearity), major depression, alcohol dependence, cocaine dependence and PTSD were significant predictors of suicidal ideation/behavior categorization (Table 2).

Interactions between PTSD and substance use on suicidal ideation/behavior categorization.—When PTSD, substance dependence, and the PTSD × substance dependence interaction were entered as predictors of suicidal ideation/behavior categorization, substance dependence and PTSD were significantly associated with suicidal ideation/behavior categorization, whereas the interaction term was not (see Table 2). Similar results emerged when substance abuse, alcohol dependence and abuse and polysubstance use disorder were each entered as a predictors of suicidal ideation/behavior categorization along with the main effect of and interaction with PTSD.

Discussion

In this large sample of PLWH, several psychiatric diagnoses were strongly associated with suicide risk in the EHR. In univariate analyses, a number of substance use disorders as well as PTSD, MDD, and insomnia were associated with suicidal ideation/behavior. However, in a multivariable analysis, MDD, alcohol use disorder, cocaine use disorder and PTSD were the only significant predictors of suicide risk. These findings held after controlling for the effect of gender. To our knowledge, this was the first study of its kind to demonstrate the unique importance of MDD, PTSD, cocaine and alcohol use disorders in PLWH for predicting suicidal ideation/behavior from the medical record.

Univariate results were largely consistent with a priori hypotheses that PTSD, MDD, insomnia and substance disorders would each demonstrate a significant association with suicide risk among PLWH. These findings are consistent with prior research that established a link between psychiatric and sleep disorders and suicide risk among the general population (e.g., Bohnert et al., 2014; Brown et al., 2016; Bernert et al., 2017) and among PLWH (Dabaghzadeh et al., 2015; Fellows et al., 2015; Quintana-Ortiz et al., 2008). However, these findings were especially interesting because our prior research demonstrated that MDD was one of the only diagnoses among PLWH that was accurately documented in the EHR when compared to national epidemiological studies (Brown, Mu, McCann, Durborow, & Blank, 2020). Our findings suggest that even though substance use disorders, PTSD, and insomnia are under-diagnosed in this sample, these diagnoses have strong predictive power for suicidal ideation and behavior.

In multivariable analyses, MDD, PTSD, cocaine, and alcohol use disorders were most strongly associated with suicidal ideation/behavior classification. The relative risk of suicidal ideation/behavior increased by 15 times for a diagnosis of MDD, nearly 8 times for alcohol use disorder, over 4 times for cocaine use disorder, and over 3 times for PTSD. These findings were consistent with our hypotheses, as prior research has demonstrated an association between these disorders and suicide risk among the general population (Bohnert et al., 2014; Brown et al., 2016) and among PLWH (Quintana-Ortiz et al., 2008). Given that this is the first study of its kind to be conducted using EHR data, these findings should be replicated before any conclusions are drawn.

Contrary to hypotheses, there were no significant interactions between PTSD and substance use disorders in predicting suicidal ideation/behavior classification. These results are inconsistent with prior SAVA studies on the effect of substance use and intimate partner violence on depression among PLWH (Illangasekare, Burke, Chander, & Gielen, 2013). However, it should be noted that past research measured partner violence (not PTSD), depression (not suicide risk) and utilized a female sample of PLWH. In addition, the current study measured just the presence or absence of PTSD or substance use disorder, and not the severity of the disorders, which may reveal a different pattern in predicting suicide risk. Given that this is the first study to explore SAVA syndemic effects on suicide risk, more research is needed on this topic.

This study has several clinical implications for the treatment and assessment of psychiatric disorders among PLWH, specifically substance abuse, MDD and PTSD. As PLWH are significantly more likely to die by suicide compared to the general population (Badiee et al., 2012; Carrico et al., 2007), it is critical for clinicians to be aware of psychiatric disorders associated with suicide risk among PLWH clients. First, clinicians should regularly assess for substance use disorders, MDD and PTSD among all of their patients with HIV. Second, clinicians should ensure close documentation of these diagnoses in the medical records to promote awareness of the diagnoses across the treatment team. Prior research by our team (Brown et al., 2020) demonstrated that psychiatric disorders tend to be under-diagnosed among PLWH. Without documentation of these disorders, clinicians are unlikely to refer for appropriate treatment. Third, clinicians should be aware that several evidence-based practices exist for these disorders. Some research suggests that evidence-based treatments for these disorders can reduce suicide risk (e.g., Brown et al., 2019). With appropriate diagnosis, documentation, and referral to evidence-based practices, PLWH may experience a reduction in suicide risk.

There are several limitations of this study which should be considered when evaluating the findings. First, this study relied on documentation of suicide risk through diagnostic codes rather than through analysis of free-text notes. We are currently pilot testing a natural language processing algorithm to allow for the detection of suicide risk in free-text notes, and plan to repeat these analyses using data from free-text if the algorithm has high sensitivity and specificity for suicidal ideation/behavior classification. Second, this study sample was mostly middle aged, male, and African American, and all participants consented to have their health information included as data in the CFAR registry. Results may not generalize to other samples with differing demographics or in participants unwilling to

participate in research. Finally, the number of participants with documented evidence of suicidal ideation or behavior was relatively small. Results need to be replicated in a sample with more individuals who endorsed suicidal thoughts or behaviors.

In summary, this is the first study in a large sample of PLWH to demonstrate that MDD, PTSD, insomnia and substance use disorders were significantly associated with suicide risk using data entirely from the EHR. Alcohol and cocaine use disorders as well as MDD and PTSD were most strongly associated with suicidal ideation/behavior classification in a multivariable analysis. This study did not find any significant interactions between PTSD and substance use disorders in predicting suicidal ideation/behavior classification. Overall, these findings highlight the role that substance use, MDD and PTSD play in suicide risk for PLWH, and stress the importance of the assessment and treatment of these psychiatric comorbidities among PLWH.

Acknowledgements

References

Assari S Suicide Attempts in Michigan HealthCare System; Racial Differences Brain Sciences, 2018;8(7).

Austin PC. An Introduction to Propensity Score Methods for Reducing the Effects of Confounding in Observational Studies. Multivar Behavl Res. 2011;46(3):399–424. doi:10.1080/00273171.2011.568786

Badiee J, Moore DJ, Atkinson JH, et al. Lifetime suicidal ideation and attempt are common among HIV+ individuals. J Affect Disord. 2012;136(3):993–999. doi:10.1016/j.jad.2011.06.044 [PubMed: 21784531]

Benjamini Y, Hochberg Y. Controlling the False Discovery Rate: A Practical and Powerful Approach to Multiple Testing. J Roy Stat Soc. 1995;57(1):289–300.

Bernert RA, Hom MA, Iwata NG, et al. Objectively Assessed Sleep Variability as an Acute Warning Sign of Suicidal Ideation in a Longitudinal Evaluation of Young Adults at High Suicide Risk. J Clin Psychiatry. 2017;78(6):e678–e687. doi:10.4088/JCP.16m11193 [PubMed: 28682534]

Bohnert KM, Ilgen MA, McCarthy JF, et al. Tobacco use disorder and the risk of suicide mortality. Addiction. 2014;109(1):155–162. 10.1111/add.12381 [PubMed: 24134689]

Botha KF. Posttraumatic stress disorder and illness behaviour in HIV+ patients. Psychol Rep. 1996;79(3 Pt 1):843–845. doi:10.2466/pr0.1996.79.3.843 [PubMed: 8969092]

Brown J, Burnette ML, Cerulli C. Correlations Between Sexual Abuse Histories, Perceived Danger, and PTSD Among Intimate Partner Violence Victims. J Interpers Violence. 2014;30(15):2709–2725. doi:10.1177/0886260514553629 [PubMed: 25324230]

Brown LA, Armey MA, Sejourne C, et al. Trauma history is associated with prior suicide attempt history in hospitalized patients with major depressive disorder. Psychiatry Res. 2016;243:191–197. doi:10.1016/j.psychres.2016.06.046 [PubMed: 27416539]

Brown LA, McLean CP, Zang Y, et al. Does prolonged exposure increase suicide risk? Results from an active duty military sample. Behav Res Ther. 2019;118:87–93. doi:10.1016/j.brat.2019.04.003 [PubMed: 31022593]

Brown LA, Mu W, McCann J, Durborow S, & Blank MB (2020). Under-documentation of psychiatric diagnoses among persons living with HIV in electronic medical records. AIDS Care, 1–5. doi:10.1080/09540121.2020.1713974

Carrico AW, Johnson MO, Morin SF, et al. Correlates of suicidal ideation among HIV-positive persons. AIDS. 2007;21(9):1199–1203. doi:10.1097/QAD.0b013e3281532c96 [PubMed: 17502730]

Dabaghzadeh F, Jabbari F, Khalili H, et al. Associated factors of suicidal thoughts in HIV-Positive Individuals. Iran J Psychiatry. 2015;10(3):185–191. [PubMed: 26877752]

Fellows RP, Spahr NA, Byrd DA, et al. (2015). Psychological trauma exposure and co-morbid psychopathologies in HIV+men and women. Psychiatry Res. 2015;230(3):770–776. doi:10.1016/j.psychres.2015.11.011 [PubMed: 26599389]

Ferlatte O, Salway T, Oliffe JL, et al. Stigma and suicide among gay and bisexual men living with HIV. AIDS Care. 2017;29(11):1346–1350. doi:10.1080/09540121.2017.1290762 [PubMed: 28278571]

Ferrari AJ, Norman RE, Freedman G, et al. The Burden Attributable to Mental and Substance Use Disorders as Risk Factors for Suicide: Findings from the Global Burden of Disease Study 2010. PLOS One. 2014;9:e91936. [PubMed: 24694747]

Fortuna LR, Alvarez K, Ramos Ortiz Z, et al. Mental health, migration stressors and suicidal ideation among Latino immigrants in Spain and the United States. Eur Psychiatry. 2016;36:15–22. doi:10.1016/j.eurpsy.2016.03.001 [PubMed: 27311103]

Gilbert L, Ra A, Hien D, et al. Targeting the SAVA (Substance Abuse, Violence, and AIDS) Syndemic among Women and Girls: A Global Review of Epidemiology and Integrated Interventions. J Acquir Immune Defic Syndr. 2015;69:S118–S127. [PubMed: 25978478]

Goehringer F, Bonnet F, Salmon D, et al. Cause of death in HIV-Infected individuals with immunovirologic success in a national prospective survey. AIDS Research and Human Retroviruses. 2017;33(2).

Gurm J, Samji H, Nophal A, et al. Suicide mortality among people accessing highly active antiretroviral therapy for HIV/AIDS in British Columbia: a retrospective analysis. CMAJ open. 2015;3(2):E140–E148. doi:10.9778/cmajo.20140101

Hedegaard H, Schoenbaum M, Claassen C, et al. Issues in developing a surveillance case definition for nonfatal suicide attempt and intentional self-harm using International Classification of Diseases, Tenth Revision, Clinical Modification (ICD–10–CM) coded data. National Health Statistics Reports. 2018;108. Hyattsville, MD: National Center for Health Statistics.

Illangasekare S, Burke J, Chander G, et al., The Syndemic Effects of Intimate Partner Violence, HIV/AIDS, and Substance Abuse on Depression among Low-Income Urban Women. Journal of Urban Health : Bulletin of the New York Academy of Medicine. 2013;90(5):934–947. doi:10.1007/s11524-013-9797-8 [PubMed: 23529665]

Israelski DM, Prentiss DE, Lubega S, et al. Psychiatric co-morbidity in vulnerable populations receiving primary care for HIV/AIDS. AIDS Care. 2007;19(2):220–225. doi:10.1080/09540120600774230 [PubMed: 17364402]

Kagee A, Bantjes J, Saal W. Prevalence of Traumatic Events and Symptoms of PTSD Among South Africans Receiving an HIV Test. AIDS Behav. 2017. doi:10.1007/s10461-017-1730-9

Kelly B, Raphael B, Judd F, et al. Posttraumatic stress disorder in response to HIV infection. Gen Hosp Psychiatry. 1998;20(6):345–352. [PubMed: 9854646]

Martinez A, Israelski D, Walker C, et al. (2002). Posttraumatic stress disorder in women attending human immunodeficiency virus outpatient clinics. AIDS Patient Care STDS. 2002;16(6):283–291. doi:10.1089/10872910260066714 [PubMed: 12133263]

Martinez J, Hosek SG, Carleton RA. Screening and assessing violence and mental health disorders in a cohort of inner city HIV-positive youth between 1998–2006. AIDS Patient Care STDS. 2009;23(6):469–475. doi:10.1089/apc.2008.0178 [PubMed: 19519231]

McCarthy JF, Bossarte RM, Katz IR, et al. Predictive Modeling and Concentration of the Risk of Suicide: Implications for Preventive Interventions in the US Department of Veterans Affairs. Am J Public Health. 2015;105(9):1935–1942 [PubMed: 26066914]

Mollan KR, Tierney C, Hellwege JN, et al. Race/Ethnicity and the Pharmacogenetics of Reported Suicidality With Efavirenz Among Clinical Trials Participants. J Infect Dis. 2017;216(5):554–564. doi:10.1093/infdis/jix248 [PubMed: 28931220]

Nedelcovych MT, Manning AA, Semenova S, et al. The Psychiatric Impact of HIV. ACS Chem Neurosci. 2017;8(7):1432–1434. doi:10.1021/acschemneuro.7b00169 [PubMed: 28537385]

Norman SE, Chediak AD, Kiel M, et al. Sleep disturbances in HIV-infected homosexual men. AIDS. 1990;4(8):775–781. [PubMed: 2261133]

Oliva EM, Bowe T, Tavakoli S, et al. Development and applications of the Veterans Health Administration's Stratification Tool for Opioid Risk Mitigation (STORM) to improve opioid safety and prevent overdose and suicide. Psychol Serv. 2017;14(1):34-49. doi:10.1037/ser0000099 [PubMed: 28134555]

Olley BO, Abrahams N, Stein DJ. Association between sexual violence and psychiatric morbidity among HIV positive women in South Africa. Afr J Med Med Sci. 2006;35 Suppl:143–147.

Paparizos V, Triantafyllopoulou I, Kourkounti S, et al. Suicidal behaviour in HIV-infected patients in Greece. Infez Med. 2017;25(1):64–70. [PubMed: 28353458]

Quintana-Ortiz RA, Gomez MA, Báez Feliciano DV, et al. Suicide attempts among Puerto Rican men and women with HIV/AIDS: a study of prevalence and risk factors. Ethn Dis. 2008;18(2): S2–219–24.

Retimanova S, Gustafson DL. Coloring the white plague: a syndemic approach to immigrant tuberculosis in Canada. Ethnicity & Health. 2012;17:403–418. 10.1080/13557858.2011.645156 [PubMed: 22181967]

Rubinstein ML, Selwyn PA. High prevalence of insomnia in an outpatient population with HIV infection. J Acquir Immune Defic Syndr Hum Retrovirol. 1998;19(3):260–265. [PubMed: 9803968]

Singer M AIDS and the health crisis of the U.S. urban poor; the perspective of critical medical anthropology. Soc Sci Med. 1994;39(7):931–948. [PubMed: 7992126]

Tjaden P, Thoennes N. (1998). Prevalence, Incidence and Consequences of Violence Against Women: Findings from the National Violence against Women Survey. 1998. Retrieved from Washington, DC. https://www.ncjrs.gov/pdffiles/172837.pdf

Table 1.

Demographics and Clinical Characteristics based on Electronic Health Record Information

	Total Sample ($n = 2,336$)	Suicide+ ($n = 48$)	Suicide– ($n = 2,288$)	Test Statistic
Age, Mean (*SD*)	52.86 (11.40)	50.14 (9.90)	52.86 (11.42)	$t = 1.641$, $p = .101$
Gender (female) n (%)	632 (27.05)	22 (45.83)	610 (26.66)	$\chi^2 = 8.757$, $p = .003$
Race, n (%)				Fisher's exact = .180
Black/African American	1,474 (63.10)	39 (81.25)	1,435 (62.72)	
White	776 (33.22)	9 (18.75)	767 (33.52)	
Asian	9 (0.39)	0 (0.00)	9 (0.39)	
Native Hawaiian/Pacific Islander	2 (0.09)	0 (0.00)	2 (0.09)	
Other	48 (2.05)	0 (0.00)	48 (2.10)	
Unknown/Missing	27 (1.16)	0 (0.00)	27 (1.18)	
Marital Status				Fisher's exact = .864
Single	1,798 (76.97)	40 (83.33)	1,758 (76.84)	
Divorced	121 (5.18)	1 (2.08)	120 (5.24)	
Widowed	48 (2.05)	1 (2.08)	47 (2.05)	
Separated	56 (2.40)	1 (2.08)	55 (2.40)	
Married	313 (13.40)	5 (10.42)	308 (13.46)	
PTSD	61 (2.61)	10 (20.83)	51 (2.23)	$\chi^2 = 63.987$ $p < .001$, adjusted p value = .031[*]
MDD	450 (19.26)	40 (83.33)	410 (17.92)	$\chi^2 = 129.35$, $p < .001$, adjusted p value = .025[*]
Insomnia	176 (7.53)	10 (20.83)	166 (7.26)	$\chi^2 = 12.442$, $p < .001$, adjusted p value = .044[*]
Alcohol Abuse	81 (3.47)	22 (45.83)	59 (2.58)	$\chi^2 = 262.787$, $p < .001$, adjusted p value = .003[*]
Alcohol Dependence	41 (1.76)	14 (29.17)	27 (1.18)	$\chi^2 = 213.552$, $p < .001$, adjusted p value = .009[*]
Sedative Abuse	4 (0.17)	3 (6.25)	1 (0.04)	Fisher's exact $p < .001$
Sedative Dependence	2 (0.09)	1 (2.08)	1 (0.04)	Fisher's exact $p = .041$
Cocaine Abuse	65 (2.78)	17 (35.42)	48 (2.10)	$\chi^2 = 192.94$, $p < .001$, adjusted p value = .022[*]
Cocaine Dependence	33 (1.41)	12 (25.00)	21 (0.92)	$\chi^2 = 195.77$, $p < .001$, adjusted p value = 0.019[*]
Hallucinogen Abuse	2 (0.09)	0 (0.00)	2 (0.09)	Fisher's exact $p = 1.00$,
Hallucinogen Dependence	1 (0.04)	0 (0.00)	1 (0.04)	Fisher's exact $p = 1.00$,
Cannabis Abuse	13 (0.56)	3 (6.25)	10 (0.44)	Fisher's exact $p = .002$, adjusted p value = .040[*]
Cannabis Dependence	9 (0.39)	1 (2.08)	8 (0.35)	Fisher's exact $p = 0.171$, adjusted p value = .050
Opioid Abuse	14 (0.60)	4 (8.33)	10 (0.44)	Fisher's exact $p < .001$, adjusted p value = 0.034[*]
Opioid Dependence	27 (1.16)	3 (6.25)	24 (1.05)	Fisher's exact $p = .017$, adjusted p value = 0.047[*]
Other psychoactive substance abuse	57 (2.44)	16 (33.33)	41 (1.79)	$\chi^2 = 196.48$, $p < .001$, adjusted p value = 0.016[*]
Other psychoactive substance dependence	14 (0.60)	4 (8.33)	10 (0.44)	Fisher's exact $p < .001$, adjusted p value = 0.038[*]
Any substance abuse	107 (4.58)	23 (47.92)	84 (3.67)	$\chi^2 = 210.58$, $p < .001$, adjusted p value = 0.013[*]
Any substance dependence	66 (2.83)	13 (27.08)	53 (2.32)	$\chi^2 = 105.04$, $p < .001$, adjusted p value = .028[*]

	Total Sample (*n* = 2,336)	Suicide+ (*n* = 48)	Suicide− (*n* = 2,288)	Test Statistic
Polysubstance use disorder	56 (2.40)	18 (37.50)	38 (1.66)	$\chi^2 = 258.09$, $p < .001$, adjusted *p* value = .006 [*]

Note:

[*] indicates psychiatric variables that were significantly associated with suicidal ideation/behavior classification after the Benjamini-Hochberg (1995) correction from which the adjusted *p* values were derived. Psychiatric variables survived this correction if the adjusted *p* value was larger than the original *p* value.

Table 2.

Multivariable and interaction analyses based on electronic health record data

Predictor	OR (95% CI)	SE	z	p
Multivariable analysis				
PTSD	3.150 (1.213 – 8.182)	1.534	2.36	.018
MDD	15.412 (6.807–34.895)	6.426	6.56	<.001
Alcohol dependence	7.973 (2.763 – 23.005)	4.311	3.84	<.001
Other psychoactive substance dependence	1.824 (0.372 – 8.956)	1.481	0.74	.459
Opioid dependence	0.560 (0.093 – 3.391)	0.515	−0.63	.528
Cocaine dependence	4.658 (1.375, 15.781)	2.900	2.47	.013
Cannabis dependence	0.198 (0.016 – 2.497)	0.256	−1.25	.211
Insomnia	0.979 (0.423 – 2.267)	0.419	−0.05	.961
Interaction Analyses: PTSD and Alcohol Abuse				
PTSD	8.628 (2.859 – 26.042)	4.863	3.82	<.001
Alcohol Abuse	29.401 (14.625 – 59.104)	10.475	9.49	<.001
PTSD × Alcohol Abuse	0.469 (0.085 – 2.607)	0.411	−0.86	.387
Interaction Analyses: PTSD and Alcohol Dependence				
PTSD	9.673 (3.832 – 24.421)	4.571	4.80	<.001
Alcohol Dependence	31.600 (13.881 – 71.937)	13.263	8.23	<.001
PTSD × Alcohol Dependence	0.517 (0.065 – 4.088)	0.545	−0.63	.532
Interaction Analyses: PTSD and Substance Abuse				
PTSD	10.049 (3.302, 30.583)	5.706	4.06	<.001
Substance Abuse	23.662 (11.986 –46.712)	8.211	9.12	<.001
PTSD × Substance Abuse	0.260 (0.053 – 1.280)	0.211	−1.66	.098
Interaction Analyses: PTSD and Substance Dependence				
PTSD	8.111 (3.009 – 21.866)	4.104	4.14	<.001
Substance Dependence	12.426 (5.409 – 28.544)	5.273	5.94	<.001
PTSD × Substance Dependence	0.604 (0.108 – 3.366)	0.529	−0.58	0.565
Interaction Analyses: PTSD and Polysubstance Use Disorder				
PTSD	7.749 (2.804 – 21.412)	4.018	3.95	<.001
Polysubstance use disorder	30.395 (14.333 – 64.454)	11.657	8.90	<.001
PTSD × Polysubstance use disorder	0.823 (0.107 – 6.328)	0.856	−0.19	.851

Note: MDD = major depressive disorder; PTSD = posttraumatic stress disorder