HHS Public Access

Author manuscript

Prev Med. Author manuscript; available in PMC 2023 April 26.

Published in final edited form as:

Prev Med. 2020 May ; 134: 106011. doi:10.1016/j.ypmed.2020.106011.

Rates of suicidal ideation among HIV-infected patients in care in the HIV Outpatient Study 2000–2017, USA

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Abstract

Background: Suicidal ideation (SI) refers to an individual thinking about, considering or planning suicide. Identifying and characterizing persons with HIV (PWH) at greater risk for SI may lead to better suicide prevention strategies and quality of life improvement.

Methods: Using clinical data gathered from medical chart abstraction for HIV Outpatient Study (HOPS) participants from 2000 to 2017, we assessed SI frequency among PWH in care and explored factors associated with the presence of SI diagnoses using linear mixed models analyses.

Results: Among 6706 participants, 224 (3.3%) had a charted diagnosis of SI. Among those with SI, median age (interquartile range [IQR]) was 43.4 years [IQR: 38.7–50.3], median (IQR) CD4+ cell count was 439 cells/mm^3 (IQR: 237–686), 71.4% were male, 54% were men who have sex with men (MSM), 25.4% heterosexual, and 13.4% persons who inject drugs. In multivariable analysis, persons at increased risk for SI were more likely to be:<50 years old (adjusted rate ratio

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Disclaimers

The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.

Declaration of competing interest

The authors do not have any associations that may pose a conflict of interest.

[aRR] 1.86, 95% confidence interval [95%CI] 1.36–2.53), non-Hispanic/Latino black (aRR 1.75; 95%CI 1.29–2.38), have CD4+ cell count<350 cells/mm^3 (aRR 1.32; 95%CI 1.05–1.65), have a viral load ≥50 copies/mL (aRR 1.49; 95%CI 1.12–1.98), have stopped antiretroviral therapy (aRR 1.46; 95%CI 1.10–1.95), have a history of: alcohol dependence (aRR 2.75; 95%CI 1.67–4.52), and drug overdose (aRR 4.09; 95%CI 2.16–7.71).

Conclusion: Routine mental health assessment and monitoring are needed in HIV clinical practice to better understand factors associated with SI and to inform the development of preventive interventions.

Keywords

Suicidal ideation; Mental health; HIV

1. Introduction

Suicide was one of the top ten leading causes of death in the United States (U.S.) among persons ages 10 to 64 in 2017 (the latest official data) (Ivey-Stephenson et al., 2017; Stone et al., 2018; Centers for Disease Control and Prevention, 2018), and suicide rates in the U.S. increased in nearly all states from 1999 to 2016 (Stone et al., 2018; Centers for Disease Control and Prevention, 2018). Suicidal behavior is complex and can be influenced by numerous social, behavioral and biological factors, such as environmental stresses, substance use, mental health issues, including anxiety, depression or childhood trauma, and adverse experiences or serious or life threating medical conditions (Ahmedani et al., 2017; Webb et al., 2012; Dube et al., 2001; Ports et al., 2017; Ng et al., 2018).

Frequently co-occurring mental health disorders may influence the course and treatment of HIV infection and other medical co-morbidities and overall quality of life. Suicidal ideation (SI), defined as having thoughts about, considering or planning suicide is a cause for concern among persons with HIV (PWH) (Gurm et al., 2015; Quinlivan et al., 2016; Walter and Petry, 2016; Saag et al., 2018; Crosby et al., 2011). Even with the availability of newer antiretroviral (ARV) medications and marked increases in survival, there are inconsistent data regarding potential associations between ARV use and SI. Some studies have reported little to no evidence of an association between the use of specific ARVs, e.g. efavirenz, and SI (Bengtson et al., 2017; Nkhoma et al., 2016), while others have reported an increased risk of SI among patients receiving specific ARVs (Mollan et al., 2017; Arenas-Pinto et al., 2018). Associations between HIV, itself, and suicide have also been reported (Ahmedani et al., 2017). PWH who have substance use disorders have a higher than average lifetime likelihood of suicide attempt, and this likelihood is increased among women or unemployed persons (Gurm et al., 2015; Walter and Petry, 2016). Drug use and sex work have been associated with a greater likelihood of lifetime history of suicide attempts (Jovet-Toledo et al., 2014). Additionally, there is evidence that individuals reporting SI may be more likely to engage in risk behaviors that increase chances of transmitting HIV (Carrico et al., 2010).

As a complex human behavior that can be exacerbated by serious illness, SI may interfere with successful HIV treatment (i.e., viral suppression), and thereby affect rates of HIV transmission (Carrico et al., 2010). Identifying and characterizing PWH who are at greater

risk for SI may lead to the development of better suicide prevention strategies and improvements in quality of life. Using data from the HIV Outpatient Study (HOPS), we sought to describe the frequency of SI among PWH receiving regular medical care, and to examine correlates of SI.

2. Methods

2.1. The HIV outpatient study (HOPS)

The HOPS is an ongoing prospective observational cohort study of HIV-infected adults, 18 years and older, receiving care at eight participating HIV clinics (university-based, public, and private) in six U.S. cities (Chicago, IL; Denver, CO; Stony Brook, NY; Philadelphia, PA; Tampa, FL; and Washington, DC) since 1993 (Palella et al., 1998). The HOPS is an open cohort: patients may enter the study at any point after a diagnosis of HIV infection regardless of treatment history and may leave the study at any point for a variety of reasons such as patient request or loss to follow-up (Moorman et al., 1999). Since its inception, the HOPS has been approved by institutional review boards at the Centers for Disease Control and Prevention (Atlanta, GA), Cerner Corporation (Kansas City, MO), and each of the local sites. Patient data, including sociodemographic characteristics, diagnoses, antiretroviral therapy (ART) use and other treatments, and laboratory values (including CD4+ lymphocyte cell counts/mm^3 [CD4 count] and plasma HIV RNA levels (viral load, HIV VL) were abstracted from medical charts and entered into an electronic database by trained medical record abstractors with backgrounds in nursing or other healthcare-related fields.

2.2. Study population

We analyzed data from 6706 HOPS participants who were seen during 2000-2017 and had a CD4 count or viral load entered into the HOPS database. Among these participants, at or after the later of first HOPS visit or 01/01/2000, 224 participants had a diagnosis of SI extracted from their medical records and entered into the HOPS database. Of these 224 participants, 80 had a suicide attempt diagnosis entered in the database. To assess the correlates of SI, we conducted a nested case-control study. The 224 participants with SI were case-matched 1:4. Matching factors were sex, HIV transmission risk group (men who have sex with men [MSM], men/women who engage in sexual activity only with members of the opposite sex (heterosexual), and persons who inject drugs [PWID]), and by HOPS clinic city, and controls were selected from the pool of 6482 persons from our cohort with no reported SI during 2000–2017 (See Figure 1).

2.3. Measurements and definitions

The outcome of interest was a charted diagnosis of SI occurring any time from 2000 to 2017. Data were obtained through medical record chart abstraction and were analyzed for the presence of the diagnosis code for SI. The predictor variables were demographic characteristics, CD4 count, HIV VL, history alcohol use (none,<7 drinks/week, 7–14 drinks/week, and>14 drinks/week) as measured at first HOPS visit, history of psychiatric diagnoses and selected medication prescriptions, including medications associated with psychiatric adverse events in prior research or clinical practice. For the Poisson regression, the dependent variable was the rate (per person-years) of SI during each calendar year of

follow-up. Independent variables (CD4 count, HIV VL, alcohol use, psychiatric diagnoses and selected prescription medications) either were determined at beginning of observation or were time-updated by calendar year for time-varying covariates.

2.4. Statistical analysis

We generated descriptive statistics that included sample means and standard deviations or medians and inter-quartile ranges for continuous measures, and frequencies and relative frequencies for categorical measures. Linear regression was used to determine if SI frequencies were correlated by calendar year. We used bivariate analyses to compare distributions of risk factors between persons with versus without SI. Categorical measures using Pearson's Yates continuity-adjusted chi square test compared distributions between persons with versus without SI. Expected cell amounts were verified to contain at least five for>80% of cell counts in each of these analyses to justify use of this asymptotic test. For continuous measures, we used the two-sample *t*-test, after performing residual analyses to verify the assumptions of normality (residual histograms and quantile-quantile plots, and homogeneous variances by comparing estimated standard deviations).

To control for potential confounding, we performed case matching with four controls (i.e., persons from our cohort with no reported SI during observation) to each case. Matching was done by sex, HIV risk, and by HOPS clinic city. This allowed us to assess whether findings were robust when controlling for different confounders through matching. We compared study characteristics between cases and controls. Categorical measures compared SI versus none adjusted for matched pair using the Yates-corrected chi-square test. We used linear mixed models (LMMs) to compare means between persons with versus without reported SI using match groupings as a random intercept to account for correlations within matched pairs in these comparisons.

We used Poisson regression in a generalized linear mixed model (GLMM) context to derive adjusted models predicting SI. These models used the case-matched subjects and included a random intercept term to account for the matched design. These Poisson models were offset by the natural log of total time spent under observation in the analysis (from the later of first HOPS visit or January 1, 2000 to last HOPS contact). To generate adjusted models, initial variable screening was performed by identifying, from bivariate models, factors associated with SI with *P*-values of<0.05. These selected variables were then simultaneously included in a multivariable model, and those with P-values<0.05 in these adjusted models were retained in our final models. SAS version 9.4 (SAS Institute, Cary, NC) was used for all analyses.

3. Results

Among the 10,777 patients enrolled in HOPS as of March 31, 2017, we excluded 4071 for the following reasons: 3984 were not seen in the HOPS during 2000 or later and 87 did not have a CD4 count or HIV VL value available in the HOPS database.

We identified 6706 patients who received care in the HOPS from January 1, 2000 – March 31, 2017 and met study inclusion criteria with a median follow-up of 5.4 years (IQR:

2.2–11.0 years), during which 224 (3.3%) had a charted diagnosis of SI during. Of persons identified with SI (median age 43.4 years, median CD4 count closest to most recent SI diagnosis or HOPS contact 439 cells/mm^3), 71.4% were male, 54.0% were MSM, 25.4% were heterosexual, and 13.4% were PWID. Patients with an SI diagnosis differed from those without SI by age, sex, race/ethnicity, level of education, insurance payor, and other sociodemographic, clinical, and HIV treatment-related factors (Table 1). They also differed by multiple charted diagnoses and treatments including depression, anxiety, and bipolar disorder, as well as use of efavirenz and raltegravir (Table 2). Of the patients with an SI diagnosis, 17% had two or more such diagnoses recorded while under observation (from the later of first HOPS visit or January 1, 2000 to last HOPS contact) and 54% (n = 123) had a recorded suicide attempt. No trends for SI frequency and calendar year were observed. (data not shown).

Using Poisson regression, we conducted bivariate and multivariable analyses examining the associations of demographic and clinical factors with SI (Table 3). Bivariate analyses indicated that patients who were younger (< 50) vs. older (≥50), non-Hispanic/Latino black vs. non-Hispanic/Latino white or of other/unknown race/ethnicity, those with public insurance vs. private insurance payors, and those with a CD4 count < 350 cells/mm^3 and VL ≥ 50 copies/mL were at greater risk for SI.

In multivariable analysis, persons at increased risk for SI were more likely to be:<40 years of age (adjusted rate ratio [aRR] 2.41, 95% confidence interval [95%CI] 1.66–3.49), 40–49 year old (aRR 1.65; 95%CI 1.19–2.29), non-Hispanic/Latino black (aRR 1.70; 95%CI 1.25–2.31), have CD4+ cell count<350 cells/mm^3 (aRR 1.30; 95%CI 1.03–1.63), viral load ≥50 copies/mL (aRR 1.48; 95%CI 1.12–1.97), have stopped antiretroviral therapy (aRR 1.43; 95%CI 1.07–1.90), have a history of: alcohol dependence (aRR 2.71; 95%CI 1.65–4.46), drug overdose (aRR 4.28; 95%CI 2.26–8.09), depression (aRR 4.65; 95%CI 3.54–6.10), bipolar disorder (aRR 1.77; 95%CI 1.09–2.89), psychosis/schizophrenia (aRR 4.55; 95%CI 2.41–8.58), anti-anxiolytic use (aRR 2.14; 95%CI 1.60–2.86), antidepressant use (aRR 3.48; 95%CI 2.62–4.64), and or raltegravir use (aRR 0.45; 95%CI 0.31–0.65) were at greater risk for SI (all P-values were<0.05). Type of insurance payor, type of clinic (public or private), anxiety diagnosis, and prescription of efavirenz, or dolutegravir were not associated with SI in multivariable analysis.

4. Discussion

In this well-characterized, diverse, prospective cohort of adult PWH in care, we observed over an almost 18-year period that approximately 3.3% of persons reported SI and about17% of these persons had two or more instances of SI documented from 2000 to 2017 (median duration of observation among patients was 5.4 years). Published studies have reported rates of SI from 13% - 28% among PWH, using various time-frames (lifetime or present) and different measurement methods (Carrico et al., 2010; Badiee et al., 2012; Lopez et al., 2018) Although diagnoses of SI were not made through mental health screening tools to the best of our knowledge, we found that the overall SI frequency reported in our cohort of PWH is similar to that reported for the U.S. general population (Centers for Disease Control and Prevention, n.d.; Substance Abuse and Mental Health Services Administration, 2017).

SI can be influenced by numerous social, behavioral and biological factors, such as environmental stresses, substance use, mental health issues such as anxiety, depression or childhood trauma, and adverse experiences or serious or life threating medical conditions (Ahmedani et al., 2017; Webb et al., 2012; Dube et al., 2001; Ports et al., 2017). Historically, social isolation, lack of social support, and experiencing multiple forms of stigma have been associated with SI (Badiee et al., 2012; Ferlatte et al., 2017). We identified several risk factors associated with SI in our cohort of PWH. Younger age, non-Hispanic/Latino black ethnicity, and diagnoses of alcohol dependence, depression, psychosis/schizophrenia, and drug overdose were associated with a diagnosis of SI, consistent with results from some earlier studies (Walter and Petry, 2016; Substance Abuse and Mental Health Services Administration, 2017; Kennedy et al., 2015). Type of insurance payor, type of clinic (public or private), diagnosed anxiety, and prescription of dolutegravir or raltegravir were not associated with SI. There have been some findings that efavirenz containing regimens are associated with suicidal ideation. However, similar to other recent published findings (Bengtson et al., 2017; Chang et al., 2018) we found no association between the use of efavirenz and SI.

Our study had limitations. In some cases, SI was patient-reported and, to the best of our knowledge, the data identifying patients with SI were not systematically collected via mental health screening tools such as the Patient Health Questionnaire-9 (PHQ9) or similar instruments since there was no documentation indicating the presence of any type of diagnostic assessment of mental health. This lack of a systematic method of capturing and classifying a diagnosis of SI may limit the accuracy of current findings, and likely represents the minimum estimate of SI in this population. We also cannot exclude the possibility that some patients may have had previous diagnoses of SI captured elsewhere prior to HOPS enrollment or diagnoses that were unknown or undisclosed to their HOPS HIV care providers. Therefore, instances of SI may have been under-reported. The HOPS does not include a comparison group of HIV-uninfected persons with similar sociodemographic characteristics, and therefore we cannot comment on the possible association between HIV infection and SI in our study. Due to the composition of the HOPS cohort (primarily non-Hispanic/Latino white MSM), our findings may be less generalizable to the larger population of PWH in the U.S. including patients out of care, women, and persons of color. Additionally, we did not ascertain how many HOPS sites provide access to mental health treatment, so the differences observed, compared to other reports, might be related to patient access to mental health services that may ameliorate their risk of suicidal ideation. The ability to identify individuals who are at risk of suicide may facilitate prevention and allocation of adequate resources but unfortunately, factors that allow for the differentiation between those with suicidal ideation and those who may attempt suicide are not readily identifiable. It is therefore not possible to accurately predict immediate suicide risk for individual persons.

In conclusion, we noted that rates of SI among adult PWH who were in care were similar to rates reported in the general population (Centers for Disease Control and Prevention, n.d.). Based on the findings in this analysis, particularly for younger persons and non-Hispanic blacks, efforts to decrease SI need to focus on the development of comprehensive approaches to combat SI among persons living with HIV. Suicide prevention efforts should

focus on the individual, family, relationships, community and societal related factors in the development of strategic interventions (Stone et al., 2017). Additionally, prevention efforts addressing modifiable risk factors such as alcohol and drug dependence, drug overdose risk, treating mental health disorders (depression, psychosis/schizophrenia), and disclosure of HIV status may have a measurable impact on the rates of SI and quality of life among PWH.

Financial support

Centers for Disease Control and Prevention (contract nos. 200-2001-00133, 200-2006-18797, 200-2011-41872 and 200-2015-63931)

Appendix 1.: HIV outpatient study investigators

The HIV Outpatient Study (HOPS) Investigators include the following persons and sites:

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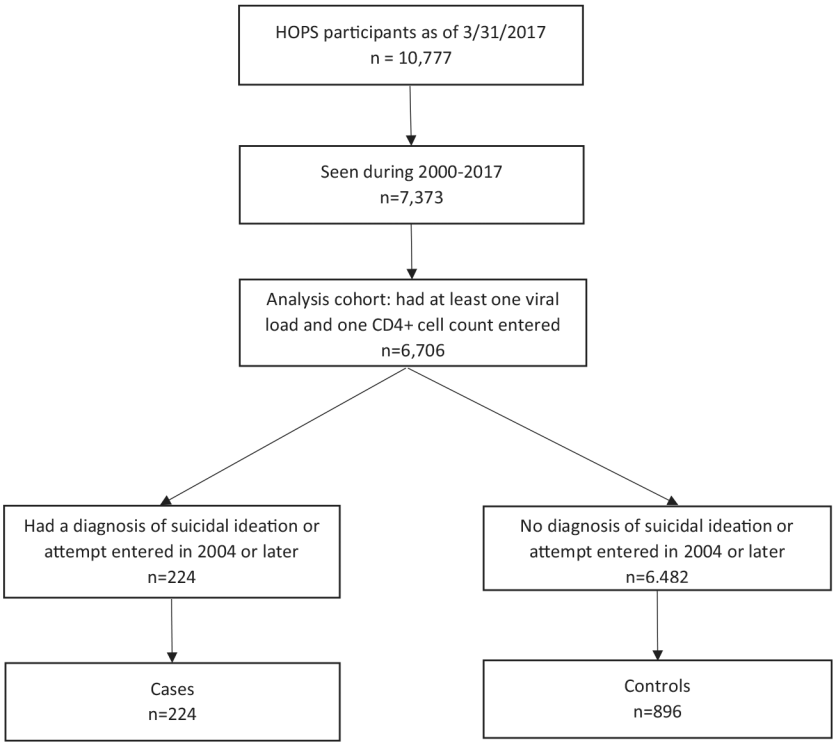

Fig. 1.

Selection steps outlining patients included in the current analysis, HIV Outpatient Study 2000–2017, United States.

Prev Med. Author manuscript; available in PMC 2023 April 26.

Table 1

Characteristics of HIV Outpatient Study participants active during 2000–2017, United States ($n = 6706$) with recorded suicidal ideation diagnosis, versus those without and a subset case-matched without suicidal ideation diagnosis.

Patient characteristics closest to most recent date of suicide ideation diagnosis or most recent HOPS contact	Suicidal ideation diagnosis $n = 224$		No suicidal ideation diagnosis $n = 6482$	P-value[a]	No suicidal ideation diagnosis, case-matched ($n = 896$)	P-value[b]
	n (%) or median (IQR)	Row %	n (%) or median (IQR)		n (%) or median (IQR)	
Age in years				< 0.001		0.017
< 40	70 (31.3)		1651 (25.5)		268 (29.9)	
40–49	95 (42.4)		2098 (32.4)		274 (30.6)	
≥50	59 (26.3)		2733 (42.2)		354 (39.5)	
Median (IQR)	43.4(38.7–50.3)		47.4(39.6–54.9)	< 0.001	46.8(38.2–54.7)	0.002
Sex				0.021		1.00
Male	160 (71.4)	3.1	5068 (78.2)		640 (71.4)	
Female	64 (28.6)	4.3	1414 (21.8)		256 (28.6)	
Race/ethnicity				0.009		0.07
Non-Hispanic/Latino white	98 (43.8)	3.0	3205 (49.4)		427 (47.7)	
Non-Hispanic/Latino black	89 (39.7)	3.8	2229 (34.4)		323 (36.0)	
Hispanic/Latino	35 (15.6)	4.2	807 (12.4)		116 (12.9)	
Other/unknown race/ethnicity	2 (0.9)	0.8	241 (3.7)		30 (3.3)	
Education *				< 0.001		0.002
None or not entered	46 (20.5)	3.2	1398 (21.6)		221 (24.7)	
Some high school	48 (21.4)	5.4	836 (12.9)		122 (13.6)	
High school graduate	91 (40.6)	3.6	2414 (37.2)		323 (36.0)	
College graduate	32 (14.3)	2.5	1245 (19.2)		159 (17.7)	
Post graduate	7 (3.1)	1.2	589 (9.1)		71 (7.9)	
Employment *				< 0.001		< 0.001
Yes (full or part time)	80 (35.7)	2.3	3365 (51.9)		434 (48.4)	
No	144 (64.3)	4.4	3117 (48.1)		462 (51.6)	
HIV transmission risk group				0.26		1.00
PWID	30 (13.4)	4.6	617 (9.5)		120 (13.4)	
MSM	121 (54.0)	3.2	3672 (56.6)		484 (54.0)	

Patient characteristics closest to most recent date of suicide ideation diagnosis or most recent HOPS contact	Suicidal ideation diagnosis *n* = 224		No suicidal ideation diagnosis *n* = 6482	P-value[a]	No suicidal ideation diagnosis, case-matched (*n* = 896)	P-value[b]
	n (%) or median (IQR)	Row %	n (%) or median (IQR)		n (%) or median (IQR)	
Heterosexual	57 (25.4)	3.1	1794 (27.7)		228 (25.4)	
Other/unknown	16 (7.1)	3.9	399 (6.2)		64 (7.1)	
Clinic type				0.06		0.94
Public	98 (43.8)	3.9	2426 (37.4)		387 (43.2)	
Private	126 (56.2)	3.0	4056 (62.6)		509 (56.8)	
Insurance payer				< 0.001		< 0.001
Public	138 (61.6)	4.6	2861 (44.1)		426 (47.5)	
Private	76 (33.9)	2.4	3086 (47.6)		407 (45.4)	
None/unknown/other	10 (4.5)	1.8	535 (8.3)		63 (7.0)	
Nadir CD4+ cell count (cells/mm^3)				0.09		< 0.001
< 100	84 (37.5)	4.1	1987 (30.7)		169 (18.9)	
100–199	45 (20.1)	3.9	1123 (17.3)		113 (12.6)	
200–349	46 (20.5)	2.7	1658 (25.6)		190 (21.2)	
350–499	28 (12.5)	2.7	1009 (15.6)		175 (19.5)	
500+	21 (9.4)	2.9	705 (10.9)		249 (27.8)	
CD4+ cell count (cells/mm^3)				0.021		0.017
< 100	20 (8.9)	3.4	575 (8.9)		93 (10.4)	
100–199	24 (10.7)	4.9	467 (7.2)		66 (7.4)	
200–349	49 (21.9)	4.7	1002 (15.5)		125 (14.0)	
350–499	35 (15.6)	2.8	1200 (18.5)		157 (17.5)	
500+	96 (42.9)	2.9	3238 (50.0)		455 (50.8)	
CD4+ cell count (cells/mm^3), median (IQR)	439(237–686)		499(292–723)	0.023	504 (283–720)	0.07
Viral load (copies/mL)				< 0.001		0.002
< 50	112 (50.0)	2.6	4232 (65.3)		343 (38.3)	
≥ 50	112 (50.0)	4.7	2250 (34.7)		553 (61.7)	
Viral load, copies/mL, detectable				< 0.001		0.002
No	105 (46.9)	2.5	4027 (62.1)		527 (58.8)	
Yes	119 (53.1)	4.6	2455 (37.9)		369 (41.2)	
Prior AIDS diagnosis				0.38		0.42

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Patient characteristics closest to most recent date of suicide ideation diagnosis or most recent HOPS contact	Suicidal ideation diagnosis *n* = 224		No suicidal ideation diagnosis *n* = 6482	P-value[a]	No suicidal ideation diagnosis, case-matched (*n* = 896)	P-value[b]
	n (%) or median (IQR)	Row %	n (%) or median (IQR)		n (%) or median (IQR)	
Yes	144 (64.3)	3.5	3962 (61.1)		547 (61.0)	
No	80 (35.7)	3.1	2520 (38.9)		349 (39.0)	
Current or prior smoker				< 0.001		< 0.001
Yes	151 (67.4)	4.2	3465 (53.5)		482 (53.8)	
No	73 (32.6)	2.4	3017 (46.5)		414 (46.2)	
Years ARV use, median (IQR)	4.7(1.6–8.1)		6.8(2.8–12.7)	< 0.001	6.2 (2.6–11.8)	< 0.001
Alcohol use				< 0.001		0.002
None reported	100 (44.6)	3.0	3274 (50.5)		440 (49.1)	
< 7 drinks/week	80 (35.7)	3.1	2506 (38.7)		346 (38.6)	
7–14 drinks/week	17 (7.6)	3.8	435 (6.7)		68 (7.6)	
> 14 drinks/week	27 (12.1)	9.2	267 (4.1)		42 (4.7)	
Number of suicidal ideation diagnoses recorded in follow-up						
1	186 (83.0)					
2	21 (9.4)					
≥3	17 (7.6)					

Abbreviations: IQR: inter-quartile range; PWID: persons who inject drugs; MSM: gay, bisexual, and other men who have sex with men; ARV: antiretroviral therapy.

*Assessed at HOPS entry.

[a]Yates-corrected chi-square test for categorical or binary variables and Kruskal-Wallis test for continuous variables.

[b]Cochran mantel-Haenzel test for categorical or binary variables and linear mixed models for continuous variables.

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Table 2

Chart abstracted diagnoses and selected medication use of HIV Outpatient Study patients active during 2000–2017, United States.

Diagnoses and selected medications closest to most recent date of suicide ideation diagnosis or most recent HOPS contact*	Suicidal ideation diagnosis n = 224		No suicidal ideation diagnosis n = 6482	P-value[a]	No suicidal ideation diagnosis, case matched *n* = 896	P-value[b]
	n (%) or median(IQR)	Row %	n (%) or median (IQR)		n (%) or median (IQR)	
Alcohol dependence				< 0.001		< 0.001
Yes	31 (13.8)	11.5	239 (3.7)		35 (3.9)	
No	193(86.2)	3.0	6243(96.3)		861 (96.1)	
Depression diagnosis				< 0.001		< 0.001
Yes	169(75.4)	5.8	2745(42.3)		417 (45.5)	
No	55 (24.6)	1.5	3737(57.7)		479 (53.5)	
Bipolar disorder				< 0.001		< 0.001
Yes	58 (25.9)	12.2	417 (6.4)		62 (6.9)	
No	166(74.1)	2.7	6065(93.6)		834 (93.1)	
Psychosis/schizophrenia				< 0.001		< 0.001
Yes	21 (9.4)	14.4	125 (1.9)		25 (2.8)	
No	203(90.6)	3.1	6357(98.1)		871 (97.2)	
Anxiety diagnosis				< 0.001		0.001
Yes	75 (33.5)	5.3	1346(20.8)		203 (22.7)	
No	149(66.5)	2.8	5136(79.2)		693 (77.3)	
Insomnia diagnosis				< 0.001		0.008
Yes	72 (32.1)	5.0	1368 (21.1)		208 (23.2)	
No	152(67.9)	2.9	5114(78.9)		688 (76.8)	
Drug overdose				< 0.001		< 0.001
Yes	10 (4.5)	25.0	30 (0.5)		8 (0.9)	
No	214(95.5)	3.2	6452(99.5)		888 (99.1)	
Anti-anxiolytic use				< 0.001		< 0.001
Yes	101(45.1)	5.3	1808(27.9)		266 (29.7)	
No	123(54.9)	2.6	4674(72.1)		630 (70.3)	
Pain diagnosis (any)				0.002		0.019
Yes	64 (28.6)	4.7	1290(19.9)		188 (21.0)	
No	160(71.4)	3.0	5192(80.1)		708 (79.0)	

Diagnoses and selected medications closest to most recent date of suicide ideation diagnosis or most recent HOPS contact*	Suicidal ideation diagnosis n = 224		No suicidal ideation diagnosis n = 6482	P-value[a]	No suicidal ideation diagnosis, case matched *n* = 896	P-value[b]
	n (%) or median(IQR)	Row %	n (%) or median (IQR)		n (%) or median (IQR)	
Opioids prescribed				< 0.001		< 0.001
Yes	62 (27.7)	7.7	748 (11.5)		115 (12.8)	
No	162(72.3)	2.8	5734(88.5)		781 (87.2)	
Antidepressant use				< 0.001		< 0.001
Yes	157(70.1)	5.2	2841(43.8)		405 (45.2)	
No	67 (29.9)	1.8	3641(56.2)		491 (54.8)	
Stroke or myocardial infarction				0.22		0.52
Yes	5 (2.2)	1.8	266 (4.1)		30 (3.3)	
No	219(97.8)	3.4	6216(95.9)		866 (96.7)	
Chantix© use				1.00		0.54
Yes	4 (1.8)	2.7	143 (2.2)		25 (2.8)	
No	220(98.2)	3.3	6339(97.8)		871 (97.2)	
Singulair© use				1.00		0.50
Yes	8 (3.6)	3.3	231 (3.6)		44 (4.9)	
No	216(96.4)	3.3	6251(96.4)		852 (95.1)	
Glucocorticoid use (not inhaled)				0.041		0.84
Yes	50 (22.3)	4.4	1093(16.9)		192 (21.4)	
No	174(77.7)	3.1	5389(83.1)		704 (78.6)	
Efavirenz use				0.002		0.019
Yes	81 (36.2)	2.6	3033 (46.8)		404 (45.1)	
No	143 (63.8)	4.0	3449 (53.2)		492 (54.9)	
Raltegravir use				0.22		0.25
Yes	38 (17.0)	2.8	1333(20.6)		185 (20.6)	
No	186(83.0)	3.5	5149(79.4)		711 (79.4)	
Dolutegravir use				0.16		0.06
Yes	7 (3.1)	1.9	358 (5.5)		60 (6.7)	
No	217(96.9)	3.4	6124(94.5)		836 (93.3)	
Alfa-interferon use				1.00		0.82
Yes	5 (2.2)	3.1	157 (2.4)		25 (2.8)	
No	219(97.8)	3.4	6325(97.6)		871 (97.2)	

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*Ever during observation.

[a]Yates-corrected chi-square test for categorical or binary variables and Kruskal-Wallis test for continuous variables.

[b]Cochran Mantel-Haenzel test for categorical or binary variables and linear mixed models for continuous variables.

Table 3

Poisson regression of factors associated with number of suicidal ideations, HIV Outpatient Study, United States 2000–2017 (n = 1120; 224 with suicidal ideation/attempt each matched to four with no attempts during the follow-up period; there were 301 total suicidal ideations among these 224).

Patient characteristics	Bivariate RR (95% CI)	Multivariable aRR (95% CI)	Final multivariable aRR (95% CI)
Age in years *			
< 40	3.71 (2.73–5.04)	2.48 (1.70–3.60)	2.41 (1.66–3.49)
40–49	2.41 (1.81–3.20)	1.64 (1.17–2.28)	1.65 (1.19–2.29)
≥ 50	Referent	Referent	Referent
Race/ethnicity			
Non-Hispanic/Latino white	Referent	Referent	Referent
Non-Hispanic/Latino black	1.48 (1.15–1.91)	1.66 (1.20–2.30)	1.70 (1.25–2.31)
Hispanic/Latino	1.29 (0.91–1.85)	Referent	Referent
Other/unknown race/ethnicity	Referent	Referent	Referent
Employment			
Yes (full or part time)	Referent		Referent
No	1.99 (1.55–2.55)	1.25 (0.86–1.80)	
Insurance type			
Public	1.68 (1.32–2.15)	0.87 (0.60–1.25)	
Private/self-pay/other	Referent	Referent	
Clinic type			
Public	1.01 (0.80–1.29)		
Private	Referent		
CD4+ cell count (cells/mm^3) *			
< 350	2.06 (1.69–2.51)	1.31 (1.04–1.65)	1.30 (1.03–1.63)
350+	Referent	Referent	
Viral load (copies/mL) *			
< 50	Referent	Referent	Referent
≥ 50	2.61 (2.06–3.30)	1.48 (1.11–1.96)	1.48 (1.12–1.97)
Current or prior smoker			
Yes	1.70 (1.32–2.18)	1.27 (0.92–1.75)	
No	Referent	Referent	
Stopped ARV regimen *			
Yes	3.27 (2.56–4.18)	1.41 (1.06–1.88)	1.43 (1.07–1.90)
No	Referent	Referent	Referent
Alcohol dependence *			
Yes	5.98 (3.92–9.14)	2.49 (1.49–4.14)	2.71 (1.65–4.46)
No	Referent	Referent	Referent
Depression diagnosis *			
Yes	10.69 (8.44–13.55)	4.28 (3.23–5.69)	4.65 (3.54–6.10)
No	Referent	Referent	Referent

Patient characteristics	Bivariate RR (95% CI)	Multivariable aRR (95% CI)	Final multivariable aRR (95% CI)
Bipolar disorder *			
Yes	9.37 (6.38–13.74)	1.70 (1.04–2.78)	1.77 (1.09–2.89)
No	Referent	Referent	
Psychosis/schizophrenia *			
Yes	22.07 (13.36–36.44)	4.68 (2.47–8.86)	4.55 (2.41–8.58)
No	Referent	Referent	Referent
Anxiety diagnosis *			
Yes	4.71 (3.38–6.56)	1.47 (0.98–2.21)	
No	Referent	Referent	
Insomnia diagnosis *			
Yes	3.38 (2.38–4.80)	1.19 (0.78–1.84)	
No	Referent	Referent	
Drug overdose *			
Yes	6.92 (4.44–10.80)	3.82 (1.98–7.36)	4.28 (2.26–8.09)
No	Referent	Referent	Referent
Anti-anxiolytic use *			
Yes	5.20 (4.10–6.59)	1.87 (1.38–2.54)	2.14 (1.60–2.86)
No	Referent	Referent	Referent
Pain diagnosis (any) *			
Yes	2.50 (1.81–3.44)	1.37 (0.94–1.99)	
No	Referent	Referent	
Opioids prescribed *			
Yes	2.94 (2.31–3.73)	1.12 (0.82–1.53)	
No	Referent	Referent	
Substance use *			
Yes	6.18 (3.52–10.84)	1.65 (0.85–3.22)	
No	Referent	Referent	
Antidepressant use *			
Yes	7.67 (6.00–9.81)	3.37 (2.53–4.50)	3.48 (2.62–4.64)
No	Referent	Referent	Referent
Glucocorticoid use (not inhaled) *			
Yes	1.32 (0.80–2.15)		
No	Referent		
Dolutegravir use *			
Yes	1.69 (0.84–3.43)		
No	Referent		
Raltegravir use *			
Yes	0.55 (0.41–0.72)	0.44 (0.30–0.63)	0.45 (0.31–0.65)
No	Referent		
Efavirenz use *			

Patient characteristics	Bivariate RR (95% CI)	Multivariable aRR (95% CI)	Final multivariable aRR (95% CI)
Yes	1.28 (0.81–2.01)		
No	Referent		

Abbreviations: RR: rate ratio; aRR: adjusted rate ratio; CI: confidence interval; ARV: antiretroviral therapy.

* Time-dependent covariate (updated each calendar year).