

ORIGINAL RESEARCH



High Risk of Substance Use Disorder–Related Outcomes in Veterans Released from Correctional Facilities in Mid to Late Life

Lisa C. Barry^{1,2}, David C. Steffens¹, Kenneth E. Covinsky^{3,4}, Yeates Conwell⁵, John Boscardin^{3,4}, Yixia Li^{3,6}, and Amy L. Byers^{3,4,7}

¹Department of Psychiatry, UCONN School of Medicine, Farmington, CT, USA; ²UConn Center On Aging, Farmington, CT, USA; ³San Francisco VA Healthcare System, San Francisco, CA, USA; ⁴Department of Medicine, Division of Geriatrics, University of California, San Francisco, USA; ⁵Department of Psychiatry, University of Rochester School of Medicine, Rochester, NY, USA; ⁶Northern California Institute for Research and Education, San Francisco, CA, USA; ⁷Department of Psychiatry, University of California, San Francisco, CA, USA

BACKGROUND: Veterans Affairs (VA) is likely to encounter a growing number of veterans returning to the community in mid to late life following incarceration (i.e., experiencing reentry). Yet, rates of negative health outcomes due to substance use disorders (SUDs) in this population are unknown.

OBJECTIVE: To determine risk of and risk factors for SUD-related emergency department visits and inpatient hospitalizations (ED/IPH) and overdose death among older reentry veterans compared with never-incarcerated veterans.

DESIGN: Retrospective cohort study using national VA and Medicare healthcare systems data.

PARTICIPANTS: Veterans age ≥ 50 , incarcerated for ≤ 5 consecutive years, and released between October 1, 2010, and September 30, 2017 ($N=18,803$), were propensity score–matched 1:5 with never-incarcerated veterans ($N=94,015$) on demographic characteristics, reason for Medicare eligibility, and SUD history.

MAIN MEASURES: SUD-related ED/IPH (overall and substance-specific) were obtained from in-/outpatient VA health services and CMS data within the year following release date/index date (through September 30, 2018). Overdose death within 1 year was identified using the National Mortality Data Repository. Fine-Gray proportional hazards regression compared risk of SUD-related ED/IPH and overdose death between the two groups.

RESULTS: The number of SUD-related ED/IPHs and overdose deaths was 2470 (13.1%) and 72 (0.38%) in the reentry sample versus 4402 (4.7%) and 198 (0.21%) in the never-incarcerated sample, respectively. Mid-to-late-life reentry was associated with higher risk of any SUD-related ED/IPH (13,136.2 vs. 2252.8 per 100,000/year; adjusted hazard ratio [AHR]=2.19; 95% confidence interval [CI]=2.08, 2.30) and overdose death (382.9 vs. 210.6 per 100,000/year; AHR=2.24, 95% CI=1.63, 3.08).

CONCLUSIONS: Older reentry veterans have more than double the risk of experiencing SUD-related ED/IPH (overall and substance-specific) and overdose death, even after accounting for SUD history and other likely confounders. These findings highlight the vulnerability of this population. Improved knowledge regarding

SUD-related negative health outcomes may help to tailor VA reentry programming.

KEY WORDS: aging; substance use disorder; incarceration

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INTRODUCTION

The US Department of Veterans Affairs (VA) has a strong history of providing support to its most vulnerable veterans—those who are or have recently been incarcerated in jails and prisons. Through Veterans Justice Programs, and programming focused on preventing deaths from suicide and overdose, the VA helps to connect incarcerated veterans with social services, community healthcare, and specialized treatment upon their release.^{1–5} To optimize these VA programs and tailor treatment to individuals' needs, it may be important to consider specific socio-demographic subgroups who are reentering the community following incarceration. One such group is those who are experiencing reentry in mid to late life (i.e., age 50 and older).

Consistent with population aging, the median age of incarcerated persons, including both veterans and civilians, has increased considerably over the past two decades.⁶ Since 1999, the number of persons in mid to late life who are incarcerated has grown by more than 280%.² This shift may be salient for incarcerated veterans who are comprised of a higher proportion of persons age ≥ 50 than are incarcerated non-veterans.^{7,8} For veterans in jail, nearly 19% are age ≥ 55 as compared with 3% of non-veterans,⁷ and the average age of veterans incarcerated in state prisons increased from 48 to 52 years between 2011 and 2016.^{7,8} Considering this demographic shift, that the majority of incarcerated persons return to the community (i.e., experience reentry)⁹ and that 70% of veterans, in general, are age 50 and older,¹⁰ the VA is likely to encounter a growing number of individuals experiencing reentry in mid to late life.

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An increasing population of older reentry veterans is noteworthy. The US Federal Bureau of Prisons and the National Institute of Corrections each consider incarcerated persons age ≥ 50 as “older” or “elderly” given their propensity to experience accelerated aging related to stresses of incarceration and unhealthy lifestyles inside and outside the corrections system.^{11–13} Many older reentry veterans are thus likely to have high rates of comorbid medical and psychiatric conditions¹⁴ and substantial healthcare costs.^{15–19} In addition, many will also have histories of substance use disorders (SUDs).^{6–8,14,20} Among incarcerated individuals, both veterans and non-veterans have similarly high rates of SUDs compared to non-incarcerated individuals.^{21–23} However, SUD rates among the incarcerated are growing most rapidly among those aged ≥ 50 and older.^{24,25} This trend likely reflects steeper increases in rates of SUDs, SUD-related admissions, and overdose deaths over the past two decades experienced by persons in mid to late life, in general, as compared with younger groups.^{26–30} Consequently, older reentry veterans may be at high risk of SUD-related emergency department visits and inpatient hospitalizations (ED/IPHs) and overdose death. Yet, there is limited information available regarding the risk of and risk factors for these costly^{31–33} and potentially avoidable outcomes in this population.

It is well-established in both veteran and non-veteran samples that the risk of all-cause ED/IPH is high in the year following release from prison or jail as compared with the never-incarcerated.^{34–37} Relatedly, prior studies indicate elevated mortality rates among both veterans and non-veterans after release, particularly during the first 12 months, with overdose a leading cause of death.^{38–41} However, a primary limitation of these prior studies, which includes our own work,⁴² was the inability to account for pre-incarceration history of SUDs and other important risk factors such as medical/psychiatric conditions. In addition, while studies have found elevated rates of SUD-related ED visits in the year following release from incarceration as compared with the general community,⁴³ substance-specific rates are not available.

It is critical to understand the risk of SUD-related ED/IPH and death by overdose in those transitioning from incarceration to community in mid to late life to better characterize the growing burden of SUDs among this age group, to provide an indication of service needs, and identify opportunities to tailor interventions and promote continuity of care in this growing population. We sought to compare the risk of SUD-related ED/IPH and overdose death (overall and substance-specific) in reentry veterans in mid to late life versus their never-incarcerated peers, after accounting for pre-incarceration SUD history. We also sought to determine medical and psychiatric factors associated with the increased risk of these outcomes. To achieve our objectives, we leveraged a linkage of national datasets from the Centers for Medicare and Medicaid Services (CMS) and the Veterans

Health Administration (VHA) and compared veterans aged ≥ 50 years who were recently released from incarceration to a matched cohort of never-incarcerated veterans.

METHODS

Data and Participants

Study participants were VA-eligible veterans aged ≥ 50 who were enrolled in Medicare services between October 1, 2010, and September 30, 2017 (fiscal year). Using the procedure previously outlined by Wang et al.,⁴⁴ we used three variables in Medicare’s enrollment database to identify veterans who had been incarcerated and released. These variables include an indicator of whether or not a beneficiary has ever been incarcerated, incarceration start date, and incarceration end date, with start/end dates available for each incarceration episode. This information has been systematically provided to CMS by the Social Security Administration since 2002 because federal Medicare dollars cannot be used to fund healthcare costs for individuals who are incarcerated (including those who are arrested but not yet convicted).^{45–47}

Based on the most recent incarceration episode, we identified 20,502 veterans aged ≥ 50 who were released during the aforementioned time period. We then limited the sample to the 18,803 individuals who were incarcerated for ≤ 5 consecutive years, which comprised 92% of the initial sample. This decision ensured that 3 years of both VHA and CMS administrative claims data (October 1, 2002 to September 30, 2017) were available for each individual in the reentry sample to assess their pre-incarceration medical history. Thus, at the earliest, for an individual released on October 1, 2010, after a 5-year incarceration that began on October 1, 2005, we evaluated their pre-incarceration medical history from October 1, 2002, to September 30, 2005. We further took a 10% random sample of never-incarcerated veterans from the same study time frame and 1:20 matched on index date, age, and sex. The index date for the reentry veterans was their most recent release date because that is when they became eligible for Medicare services. The index date for the never-incarcerated veterans was defined as their birthdate (i.e., Medicare eligibility at study start) matched in the same year nearest to the release date of the reentry veteran. This created a pool of never-incarcerated individuals that could be utilized for comparison in the analyses.

We then performed 1:5 propensity score matching to create a balanced comparison sample of never-incarcerated veterans ($N=94,015$). The propensity score-matched variables, which will be described further, included age, sex, race/ethnicity, Medicare eligibility due to end-stage renal disease (ESRD), and SUD history. Propensity score matching was performed with no replacement using nearest-neighbor caliper matching with a caliper width of 0.2 SDs of the logit

of the propensity score Stata/MP, version 16.1 (StataCorp LLC). University of California, San Francisco, and San Francisco VA Medical Center Institutional Review Boards approved this study.

Measures

Outcomes. SUD-Related ED Visit/Hospitalization (ED/IPH) SUD-related ED/IPHs were determined using data from the National Patient Care Database (NPCD), which is derived from the Corporate Data Warehouse data and provides similar inpatient and outpatient VA and Medicare claims data. Claims data within the year following the release date/index date (from October 1, 2010, through September 30, 2018) were evaluated. The event date was defined as the first date of SUD-related ED/IPH in the year following the release date/index date. Supplemental Table 1 only includes the ICD-9/10 codes defining the SUD-related diagnoses for the ED/IPH, which are based on primary or secondary ICD codes at the time of visit. To determine if a clinic visit was an ED visit, we used clinic stop code 130 for VA data and outpatient/inpatient revenue center code values 0450–0459 and 0981, as well as inpatient MedPAR emergency room charge amount >\$0, for Medicare data. To determine if a clinic visit was an inpatient visit, we used the separate inpatient files for VA and Medicare data.

Death Due to Drugs and/or Alcohol Overdose (Overdose Death) The cohort was further linked to the VA National Mortality Data Repository (MDR), which contains cause-specific mortality data (primary underlying cause and date of death) drawn largely from the Centers for Disease Control and Prevention's (CDC's) National Death Index.^{48,49} Overdose death due to drugs and/or alcohol within the year following the release date/index date was defined using the following codes: intentional death by drug/alcohol overdose (ICD-10 codes X60-X65), unintentional death by drug/alcohol overdose (ICD-10 codes X40-X45), or undetermined

(unknown intent) death by drug/alcohol overdose (ICD-10 codes Y10-Y15). Corresponding dates of death for these ICD-10 codes were included in the MDR database.

Variables Selected for Propensity Score Matching and Variables Selected for Inclusion as Covariates Variables considered for inclusion in either the propensity score matching or for inclusion as covariates were those likely to be associated with incarceration and/or with the outcomes based on prior literature. These variables included demographic characteristics (i.e., age, sex, and race/ethnicity),⁵⁰ Medicare eligibility due to ESRD,⁵¹ SUD history,^{25,52,53} chronic medical conditions,^{16,53} psychiatric disorders,⁵³ homelessness,⁵³ and traumatic brain injury (TBI).⁵⁴ We wanted to make the reentry and never-incarcerated samples balanced in terms of the same underlying distribution profiles. However, we were also interested in evaluating the effects of confounding from key variables (e.g., TBI). Including all of the aforementioned variables in the propensity score would have precluded us from being able to show how specific variables contribute to ED/IPH and overdose death. Thus, we opted to use partial propensity scoring. The propensity score was derived using variables traditionally used in matching (i.e., age, sex, and race/ethnicity), ESRD status to account for reason for Medicare eligibility, and SUD history to account for the variable most likely to be the greatest confounder of the association between reentry and SUD-related ED/IPH and overdose death. Age at release/index date, sex, and race/ethnicity were extracted from the CMS Master Beneficiary Summary File, which had minimal missing records (<5%). However, if data were missing from the Summary File, we then pulled data from the NPCD inpatient and outpatient files and the VA vital status files, prioritizing information available closest to release/index date then available data from other years. Race/ethnicity was categorized as non-Hispanic White, non-Hispanic Black, Hispanic/Other.^{55,56} Because both the reentry and never-incarcerated cohorts were aged ≥ 50 and enrolled in Medicare, we included Medicare eligibility due to ESRD, as determined via the Medicare enrollment database, as a

Table 1 Factors used to create the propensity-matched samples of reentry and never-incarcerated veterans ($N = 112,818$)

Characteristics <i>n</i> (%) or mean (SD)	Reentry ($N = 18,803$)	Never incarcerated ($N = 94,015$)	Standardized difference
Demographics			
Age at release year/matched year, years, mean (SD)	62.90 (7.69)	62.77 (7.70)	.016
Female	511 (2.72)	2831 (3.01)	.018
Race/ethnicity			-.014
Non-Hispanic White	12,159 (64.67)	60,966 (64.85)	
Non-Hispanic Black	5840 (31.06)	28,081 (29.87)	
Hispanic/Other	804 (4.28)	4968 (5.28)	
Medicare status			.001
ESRD-related	90 (0.48)	443 (0.47)	
Not ESRD-related	18,713 (99.52)	93,572 (99.53)	
History of SUDs	9467 (50.35)	47,328 (50.34)	<.001

Abbreviations: *SD*, standard deviation; *ESRD*, end-stage renal disease; *SUD*, substance use disorder

variable in the propensity score matching. Although only 1% of all Medicare beneficiaries qualify for Medicare due to ESRD, the majority of those who meet this criterion are aged 50–64.⁵⁷ History of any SUDs was ascertained from VA and/or CMS database records for the 3 years before the most recent incarceration for reentry veterans and the same 3-year timeframe for matched never-incarcerated veterans. SUD categories included alcohol use disorder, drug induced mental disorder, opioids use disorder, amphetamines use disorder, cannabis use disorder, cocaine use disorder, sedatives use disorder, and other substance use disorders. ICD-9 and ICD-10 codes indicating SUD are listed in Supplemental Table 1.

ICD-9 and ICD-10 codes included in VA and/or CMS database records were also used to determine medical and psychiatric history in the 3 years before the most recent incarceration for reentry veterans and the same 3-year timeframe for matched never-incarcerated veterans. Chronic medical conditions included hypertension, myocardial infarction, congestive heart failure, stroke, diabetes mellitus, arthritis, hip fracture, chronic lung disease, cancer, liver disease, HIV/AIDS, hepatitis C, sexually transmitted disease, and tobacco dependence. We then created a summary variable for the total number of these 14 chronic conditions (range 0 to 14). Psychiatric disorders included any mood disorders (i.e., depression [major depression; depression not otherwise specified], dysthymia, and bipolar disorder), any anxiety disorders (i.e., posttraumatic stress disorder, generalized anxiety disorder, panic, and phobia), schizophrenia, and primary psychotic illness. Homelessness in the 3 years prior to incarceration and in the same 3-year timeframe for the never-incarcerated matched veterans was indicated in the NCPD data files as homelessness indicator = 1, clinic stop codes 28, 37, 522, 528, 529, 530, 590, or ICD-9 code V60.0 and ICD-10 code Z59.0 (“lack of housing”).⁵⁸ These same ICD-9/10 codes were also used to identify homelessness in the CMS data files. ICD-9/10 codes for TBI history were determined using the Defense and Veterans Brain Injury Center and the Armed Forces Health Surveillance Branch for TBI surveillance 2012 criteria.⁵⁹

Statistical Analyses

Characteristics used for matching were summarized using means and standard deviations or frequencies and proportions. These characteristics were compared between the reentry and never-incarcerated samples using standardized mean differences. This same procedure was used to compare the medical and psychiatric conditions between the reentry and never-incarcerated groups. We used Fine-Gray proportional hazards regression, which accounts for the competing risk of death, to determine the time to SUD-related ED/IPH within 1 year of release/index date. MDR data was used to identify those who died and date of death. We first examined

the association between reentry status (never-incarcerated as the reference group) and risk of SUD-related ED/IPH purely based on propensity score–matched samples. Next, we re-examined the model after adjusting for homelessness, sum of the 14 chronic medical conditions, and TBI. Finally, we adjusted for the aforementioned factors and history of any psychiatric disorder. We repeated this process to determine the association between reentry status and risk of substance-specific ED/IPH. Thus, we ran Fine-Gray models for each of the 9 outcomes; any SUD-related ED/IPH and ED/IPH due to each of the 8 SUD categories (e.g., ED/IPH due to alcohol use disorder and ED/IPH due to cocaine use disorder). This process was also used to determine the association between reentry status and overdose death, where deaths considered as competing risks in the Fine-Gray proportional hazards regression were all deaths other than overdose deaths. Times were censored for 1 year if the events or competing events did not occur. Fine-Gray assumptions were evaluated graphically and statistically and were satisfied for all models. Statistical tests for models were two-tailed with $P < 0.05$ defining statistical significance.

For each of the aforementioned fully adjusted models, we conducted sensitivity analyses utilizing *E*-value estimates.^{60,61} *E*-value is an estimate of the minimum strength of the hazard ratio (HR) that an unmeasured confounder would need to have with both predictor and outcome to fully explain away the association. Larger *E*-values indicate a lower likelihood of unmeasured confounding.

All analyses were performed using SAS version 9.4 (SAS Institute Inc, Cary, North Carolina) and STATA version 16 (StataCorp, College Station, TX).

RESULTS

Sample Characteristics

The final cohort included 112,818 beneficiaries (18,803 reentry veterans and 94,015 never-incarcerated veterans). The two groups were well matched with respect to characteristics used for propensity score matching (Table 1). Both samples were approximately 97% male with a mean (SD) age of 63 ± 8 years. The race/ethnicity distribution in both samples was about 65% non-Hispanic White, 30% non-Hispanic Black, and 5% Hispanic/Other. Approximately half of the veterans in each group had a SUD history.

Even after propensity score matching for demographic characteristics and SUD history, there were substantial differences between the groups. The average number of chronic conditions was lower in the reentry group. However, this group had a higher proportion of chronic lung disease, HIV/AIDS, sexually transmitted diseases, and tobacco dependence. In contrast, the never-incarcerated group had a higher proportion of several cardiac-related conditions (i.e., hypertension, congestive heart failure, and stroke), diabetes, and

cancer. There were no differences between the groups in the proportion with myocardial infarction, arthritis, hip fracture, and liver disease. With the exception of anxiety, the reentry group had a higher proportion of persons with any psychiatric illness. The reentry group also had a greater proportion of individuals with a history of homelessness and TBI (Table 2).

SUD-Related ED Visit/Hospitalization (ED/IPH)

A total of 2470 (13.1%) of the reentry sample experienced a SUD-related ED/IPH within 1 year of reentry versus 4402 (4.7%) of the never-incarcerated sample, with annual rates of 13,136.2 vs. 2252.8 per 100,000 per year. In the propensity score–matched model without adjustment for any additional covariates, the HR was 2.74 (95% CI, 2.61–2.88). The significantly higher rate of ED/IPH in the reentry sample remained, albeit was attenuated, after adjusting for homelessness, TBI, and sum of chronic conditions. After additional adjustment for any psychiatric disorder, the risk of SUD-related ED/IPH was still more than twice that of the never-incarcerated sample (HR was 2.19; 95% CI, 2.08–2.30). Each of the covariates was also associated with a significantly increased risk of SUD-related ED/IPH, with the strongest association for any psychiatric disorder (HR = 2.88; 95% CI, 2.71–3.07) (Table 3).

Table 3 also presents the rates per 100,000/year, HRs, and 95% CIs for substance-specific ED/IPH. For both reentry and never-incarcerated samples, the highest rates of SUD-related ED/IPH were due to alcohol use disorder. However, when comparing these groups, the risk of experiencing ED/IPH due to alcohol use disorder was more than twice as high in the reentry group as compared with the never-incarcerated, even after full adjustment (8791.2 vs. 3058.0 per 100,000 per year; HR = 2.42; 95% CI, 2.27–2.58; *p* < 0.001). The risk of ED/IPH due to cannabis and cocaine use disorders was nearly three times as high in the reentry group, and the risk of ED/IPH due to amphetamines was more than 7 times higher (HR = 7.01 (95% CI, 5.32–9.24; *p* < 0.001). The risk of all other SUD-specific ED/IPHs was at least twice that of the never-incarcerated group. In addition, with *E*-values >3.6 for all fully adjusted HRs, unmeasured confounding would be unlikely to diminish the strength of these results (Supplemental Table 2).

Overdose Death (Death Due to Alcohol and/or Drugs)

A total of 72 (0.38%) of the reentry sample experienced an overdose death within 1 year of reentry versus 198 (0.21%) of the never-incarcerated sample, with rates of 382.9 vs. 210.6 per 100,000/year (Table 4). With the exception of 7 alcohol-induced deaths in the never-incarcerated group, all

Table 2 Medical and psychiatric conditions of reentry and never-incarcerated beneficiaries (N = 112,818)

	Reentry (N = 18,803)	Never incarcerated (N = 94,015)	Standardized difference
Sum of 14 chronic medical conditions, mean (SD)	2.25 (1.91)	2.35 (1.79)	-.051
Hypertension	10,878 (57.85)	62,467 (66.44)	-.178
Myocardial infarction	1581 (8.41)	7652 (8.14)	.010
Congestive heart failure	1615 (8.59)	10,130 (10.77)	-.074
Stroke	2173 (11.56)	13,066 (13.90)	.070
Diabetes mellitus	4738 (25.20)	29,386 (31.26)	-.135
Arthritis	391 (2.08)	2084 (2.22)	-.009
Hip fracture	167 (0.89)	776 (0.83)	.007
Chronic lung disease	5811 (30.90)	28,150 (29.94)	.021
Cancer	1739 (9.25)	13,696 (14.57)	-.165
Liver disease	960 (5.11)	4829 (5.14)	-.001
HIV/AIDS	399 (2.12)	1573 (1.67)	.033
Hepatitis C	2862 (15.22)	9184 (9.77)	.165
Sexually transmitted disease	304 (1.62)	1170 (1.24)	.031
Tobacco dependence	8752 (46.55)	36,577 (38.91)	.155
Psychiatric disorders			
Any mood	8579 (45.63)	39,681 (42.21)	.069
Any anxiety	4644 (24.70)	22,651 (24.09)	.014
Schizophrenia ^a	2563 (13.63)	7091 (7.54)	.199
Primary psychotic illness ^b	3380 (17.98)	9875 (10.50)	.215
Any above psychiatric illness	10,156 (54.01)	47,053 (50.05)	.079
Homelessness	1369 (7.28)	1055 (1.12)	.311
Traumatic brain injury	2070 (11.01)	5504 (5.85)	.186

Abbreviations: *SD*, standard deviation

^aSchizophrenia includes schizophrenia or schizoaffective disorder (all-inclusive ICD-9 codes: 295.0–295.4 and 295.6–295.9)

^bPrimary psychotic illness includes ICD-9 codes 297.1 (delusional), 298.8 and 298.9 (brief psychotic and other psychotic), 295.7 (schizoaffective), 295.9 (unspecified schizophrenia), and 293.81 and 293.82 (psychosis due to medical condition)

Table 3 Rates and hazard ratios for substance-specific emergency department visits and inpatient hospitalizations (ED/IPH); reentry in mid to late life versus never incarcerated (NI)

	Reentry veterans experiencing event (N = 18,803)		Never-incarcerated (NI) veterans experiencing event (N = 94,015)		HRs (95% CI) Reentry vs. NI (ref) ^b	HRs (95% CI) Reentry vs. NI (ref) ^c	HRs (95% CI) Reentry vs. NI (ref) ^d
	N (%) within 1 year	Rates/100,000/year	N (%) within 1 year	Rates/100,000/year			
Any SUD-related ED/IPH ^a	2470 (13.1%)	13,136.2	4402 (4.7%)	2252.8			
Reentry					2.74 (2.61–2.88)	2.26 (2.15–2.38)	2.19 (2.08–2.30)
Homelessness						2.49 (2.29–2.70)	2.15 (1.98–2.32)
Traumatic brain injury						1.91 (1.79–2.04)	1.70 (1.60–1.81)
Sum of 14 chronic medical conditions						1.23 (1.22–1.24)	1.16 (1.15–1.18)
Any psychiatric disorder							2.88 (2.71–3.07)
Substance-specific ED/IPHs							
Alcohol use disorder	1653 (8.79)	8791.2	2875 (3.06)	3058.0	2.98 (2.81–3.17)	2.47 (2.32–2.64)	2.42 (2.27–2.58)
Drug-induced mental disorder	370 (1.97)	1967.8	681 (0.72)	724.4	2.73 (2.41–3.10)	2.18 (1.89–2.51)	2.10 (1.83–2.41)
Opioids use disorder	332 (1.77)	1765.7	606 (0.64)	644.6	2.76 (2.41–3.15)	2.27 (1.96–2.64)	2.18 (1.88–2.52)
Amphetamines use disorder	143 (0.76)	760.5	87 (0.09)	92.5	8.25 (6.32–10.77)	7.27 (5.51–9.60)	7.01 (5.32–9.24)
Cannabis use disorder	160 (0.85)	850.9	210 (0.22)	223.4	3.82 (3.11–4.70)	3.03 (2.42–3.81)	2.94 (2.35–3.68)
Cocaine use disorder	585 (3.11)	3111.2	787 (0.84)	837.1	3.76 (3.38–4.19)	3.05 (2.71–3.45)	2.95 (2.61–3.32)
Sedatives	32 (0.17)	170.2	49 (0.05)	52.1	3.27 (2.09–5.10)	2.42 (1.48–3.95)	2.31 (1.42–3.76)*
Other substance use disorder	321 (1.71)	1707.2	400 (0.43)	425.5	4.04 (3.49–4.68)	3.12 (2.65–3.69)	3.00 (2.55–3.54)

Abbreviations: SUD, substance use disorder; ED, emergency department; IPH, inpatient hospitalization; NI, never incarcerated; HR, hazard ratio; CI, confidence interval

^aSee eAppendix Table 1 for codes

^bPropensity score–matched models

^cModels further adjusted for homelessness, traumatic brain injury, and sum of 14 medical conditions

^dModels further adjusted for homelessness, traumatic brain injury, sum of 14 medical conditions, and any psychiatric disorder (any mood, any anxiety, schizophrenia, and primary psychotic illnesses)

*.001 < *P* < .05, others *P* < .001

other deaths were due to drug overdoses. After applying propensity score matching and adjusting for homelessness, TBI, sum of chronic conditions, and any psychiatric disorder, the risk of overdose death in the reentry group as compared with the never-incarcerated was 2.24 (95% CI 1.63–3.08). The *E* value for this model was 3.91 (95% CI 2.64–5.61) indicating that unmeasured confounding would be unlikely to diminish the strength of these results. Similar to the findings regarding SUD-related ED/IPH, each of the covariates was also associated with a significantly increased risk of overdose death, and any psychiatric disorder showed the strongest association (HR = 2.88; 95% CI, 2.71–3.07) (Table 3).

DISCUSSION

In this national study of US veterans aged ≥ 50 , we sought to determine if veterans reentering the community in mid to late life following incarceration were at heightened risk of experiencing SUD-related ED/IPH or overdose death within 1 year of release as compared with their never-incarcerated peers. By propensity matching for SUD history, then controlling for important potential confounders including history of homelessness, TBI, chronic conditions, and

psychiatric disorders, these findings indicate that reentry is a strong risk factor for experiencing SUD-related ED/IPH. We also found that reentry veterans had a higher risk of experiencing ED/IPH related to individual SUD categories and that the risk of overdose death was also twice as high in the reentry group.

As the average age of the US incarcerated population continues to rise, increasingly larger numbers of veterans are likely to transition from incarceration back to the community in mid to late life. We found that 13% of older reentry veterans had a SUD-related ED/IPH within 1 year of reentry as compared with less than 5% of the never-incarcerated. Even after using propensity score matching to mitigate the strong link between SUDs and incarceration,^{25,62} this difference translates to an additional 10,883 SUD-related ED/IPH per 100,000 person-years among the older reentry veterans. Because SUD-related ED/IPH are considered potentially avoidable, as SUDs can often be managed through outpatient care,^{31,64} these findings suggest opportunities for prevention and intervention among veterans released from incarceration in mid to late life.

Existing programs, including Veterans Justice Outreach (VJO) and Health Care for Reentry Veterans (HCRV), were developed by the VA to meet the needs of two populations of justice-involved veterans. VJO identifies veterans in the jail

Table 4 Rates and hazard ratios for drug/alcohol overdose death: reentry in mid to late life versus never incarcerated (NI)

	Reentry veterans experiencing event (N=18,803)		Never-incarcerated (NI) veterans experiencing event (N=94,015)		HRs (95% CI) Reentry vs. NI (ref) ^b	HRs (95% CI) Reentry vs. NI (ref) ^c	HRs (95% CI) Reentry vs. NI (ref) ^d
	N (%) within 1 year	Rates/100,000/ year	N (%) within 1 year	Rates/100,000/ year			
Overdose death ^a	72 (0.38%)	382.9	198 (0.21%)	210.6	2.91 (2.17–3.90)	2.30 (1.67–3.16)	2.24 (1.63–3.08)
Reentry							
Homelessness						3.23 (2.00–5.22)	2.76 (1.74–4.40)
Traumatic brain injury						1.74 (1.15–2.63)	1.56 (1.05–2.33)
Sum of 14 chronic medical conditions						1.19 (1.12–1.28)	1.13 (1.05–1.21)
Any psychiatric disorder							2.87 (1.98–4.17)

Abbreviations: SUD, substance use disorder; ED, emergency department; IPH, inpatient hospitalization; NI, never incarcerated; HR, hazard ratio; CI, confidence interval

^a See eAppendix Table 1 for codes

^b Propensity score–matched models

^c Models further adjusted for homelessness, traumatic brain injury, and sum of 14 medical conditions

^d Models further adjusted for homelessness, traumatic brain injury, sum of 14 medical conditions, and any psychiatric disorder (any mood, any anxiety, schizophrenia, and primary psychotic illnesses)

*.001 < P < .05, others P < .001

system to connect them with VA services and community support. HCRV identifies veterans incarcerated in state or federal prisons, who are typically sentenced and are serving at least 1 year of time, and connects them with community services for assistance with food, housing, and healthcare needs as they are discharged from prison and reenter the community.^{1,4,5} For example, a study by Finlay et al. (2017) found that among reentry veterans aged ≥18 with SUDs who utilized the HCRV program, 37% entered SUD treatment within 1 month of HCRV outreach.¹ Because we could not confirm eligibility for either VJO or HCRV, we did not compare outcomes between those reentry veterans who did and did not utilize these services. However, given the high rates of SUD-related ED/IPH among older reentry veterans, VJO and HCRV may encounter a growing number of older reentry veterans who may benefit from integrated care between geriatric medicine and addiction medicine as a means of preventing ED/IPH.

These findings also suggest that ED/IPHs can serve as a means of engaging these individuals in treatment and potentially preventing re-incarceration. Future research should determine the feasibility of establishing care linkages for these individuals across the healthcare continuum and ascertain cost-effectiveness resulting from such linkages. Moreover, the 30 days following incarceration release are associated with the highest suicide risk.^{40,65} Because men in mid to late life, in general, have the highest suicide rates⁶⁶, and given increasing rates of SUDs among those aged ≥50⁶⁷, SUD-related ED/IPHs early after prison release may also serve as a significant point of intervention/suicide prevention for this vulnerable group.

Our findings also extend the current literature by quantifying the imminent risk of ED/IPH related to specific SUD

categories among reentry veterans as compared with their never-incarcerated peers. Regardless of the SUD related to ED/IPH, rates were consistently higher in the reentry group. While alcohol use disorder, generally the most common SUD in this age group,⁴² accounted for the majority of events in both the reentry and never-incarcerated groups, there were still high rates of illicit drug use. With increasing rates of illicit drug use reported by this age group, in general,^{67–70} and the legalization of marijuana in many US states,⁷¹ it will be important to enhance best practices and reduce barriers to treating SUDs in older individuals.

Prior studies indicate that reentry is a high-risk time for SUD-related death across all ages.^{38–40,65} However, given the lack of national-level data that links pre-incarceration medical history with post-incarceration outcomes, these studies were unable to account for the potentially confounding effect of SUD history.^{25,62} Our findings affirm and extend these studies by indicating that reentry substantially increases overdose risk, even after balancing the proportion of those with SUD history in the reentry and never-incarcerated groups. Importantly, rates of overdose death reported here were higher than reported in our prior work.⁴² In the present study, we purposefully limited our sample to those who experienced reentry after five or fewer years of incarceration. Thus, veterans with short incarcerations may have a higher risk of death by overdose than those incarcerated >5 years. Future studies are needed to determine if time incarcerated, or jail stay versus prison stay, impacts the risk of overdose death among veterans reentering the community in mid to late life.

We also found that factors including homelessness, TBI, chronic conditions, and psychiatric disorders were strong

risk factors for overdose death and for ED/IPH. Each of these factors has previously been shown to be associated with SUDs.^{72–74} However, although these factors are associated with an increased risk of SUD-related outcomes, they do not explain why older reentry veterans are at considerably higher risk of SUD-related ED/IPH and overdose death as compared with their never-incarcerated peers. Although we cannot pinpoint what it is about the reentry process that increases the risk of these outcomes, it is likely a combination of inherently stressful circumstances. Examples of these circumstances are a lack of structure, food insecurity, medication insecurity, lack of accessible outpatient services, and limited social support.^{75,76} A study of 101 persons aged 55 and older who were released from jail found that those reporting “geriatric” factors including impairment in activities of daily living, mobility limitations, and recent falls were more likely to experience an all-cause ED visit within 6 months of reentry.⁷⁷ Future research that evaluates social determinants of health as well as geriatric factors is needed to identify actionable risk factors for SUD-related outcomes in older reentry veterans.

Despite balancing the reentry and never-incarcerated groups using propensity score matching, there were still some interesting differences between the groups. Veterans in the reentry group had a lower average number of chronic conditions but had a higher proportion of chronic conditions associated with drug use such as HIV/AIDS and hepatitis C.⁷⁹ They were also more likely to have histories of homelessness, TBI, and psychiatric disorders. These differences highlight the unique vulnerabilities of older reentry veterans and call further attention to the importance of and need for VA programs that support reentry veterans.

There are several limitations to note. The choice of variables used for matching and adjustment in multivariable models was limited to those available in the administrative databases. Thus, we could not account for factors such as social support or mobility limitations. Still, we were able to determine pre-incarceration SUD history albeit whether the incarceration resulted from a drug-related offense was unknown. We also could not verify if study participants had engaged in SUD treatment during or following incarceration. Although we were unable to account for these factors, sensitivity analysis with *E* values indicated minimal unmeasured confounding. To be able to account for SUD history prior to incarceration, we limited our reentry sample to those incarcerated for ≤5 years which provided a look-back period of 3 years. Consequently, our findings may not generalize to older reentry veterans incarcerated for >5 years. Because our study compared reentry and never-incarcerated veterans, we were unable to adjust for time incarcerated as that variable only applied to the reentry sample. As previously noted, future studies should determine if time incarcerated impacts the risk of SUD-related ED/IPH and overdose death in reentry veterans in mid to late life. Our sample is mainly

comprised of male veterans thus limiting generalizability to women and non-veterans. However, the prevalence of SUDs is higher in men than women⁸⁰ and evidence indicates that the prevalence of past-year SUDs does not differ between veterans and non-veterans.^{81,82} Finally, although we matched on age and Medicare eligibility due to ESRD, it is still possible that those aged 50–64 are inherently different from those aged ≥65. However, despite these potential limitations, we have the only national-level data available that includes both pre- and post-incarceration health. Therefore, we have a unique opportunity to improve knowledge regarding the risk of SUD-related outcomes in the oldest and the most infirm beneficiaries.

Our findings indicate that veterans reentering the community in mid to late life after incarceration have more than double the risk of experiencing SUD-related ED/IPH (overall and substance-specific) and overdose death. These findings, which cannot be explained by SUD history or other likely confounders, highlight the vulnerability of this population. Furthermore, our findings point towards SUD-related ED/IPHs as a point of intervention to initiate/enhance treatment. This study is the first to highlight the problem of SUD-related outcomes in veterans reentering the community in mid to late life and draws attention to the potential for the VA to lead efforts in integrating geriatrics and addiction treatment.

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Corresponding Author: Lisa C. Barry; Department of Psychiatry, UCONN School of Medicine, Farmington, CT, USA (e-mail: libarry@uchc.edu).

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