Published in final edited form as:

Addiction. 2016 March ; 111(3): 499–510. doi:10.1111/add.13200.

Clinical risk factors for death after release from prison in Washington State: A nested case control study

Ingrid A. Binswanger, MD, MPH^{1,2,3}, Marc F. Stern, MD, MPH⁴, Traci E. Yamashita, MS⁵, Shane R. Mueller, MSW^{1,2}, Travis P. Baggett, MD, MPH^{6,7}, and Patrick J. Blatchford, PhD⁸

¹ Kaiser Permanente Colorado, Institute for Health Research, P.O. Box 378066, Denver, CO 80237-8066, USA

² Division of General Internal Medicine, Department of Medicine and Division of Substance Dependence, Department of Psychiatry, University of Colorado School of Medicine, 12631 E. 17th Ave. Aurora, CO 80045

³ Denver Health Medical Center, 660 Bannock St, Denver, CO 80204, USA

⁴ University of Washington School of Public Health, Department of Health Services, H664 Health Sciences Center, 1959 NE Pacific Street, Box 357660, Seattle, WA 98195-7660, USA

⁵ Undergraduate Medical Education, School of Medicine, University of Colorado Denver, Mail Stop F523, 13001 E 17th Place, Aurora CO 80045, USA

⁶ Division of General Internal Medicine, Massachusetts General Hospital, Harvard Medical School, 50 Staniford St, 9th Floor, Boston, MA 02114 Boston, MA 02114, USA

⁷ Boston Health Care for the Homeless Program, 780 Albany St, Boston, MA 02118, USA

⁸ Department of Biostatistics and Informatics, Colorado School of Public Health, University of Colorado Denver, Mailstop B119, 13001 E 17th Ave, Aurora, CO 80045, USA

Abstract

Background and aims—While mortality rates after prison release are high, little is known about clinical risk factors for death. We sought to identify risk and protective factors for all-cause and accidental poisoning (overdose) death.

Design—Nested case control study of people released from prison.

Corresponding Author: Ingrid A. Binswanger, Institute for Health Research, Kaiser Permanente Colorado, P.O. Box 378066, Denver, CO 80237-8066, USA; (tel.) +1 303 614 1263, ingrid.a.binswanger@kp.org.

Declarations of interests: No conflicts of interest to declare.

Author contributions: I.A. Binswanger and M.F. Stern designed the study. I.A. Binswanger wrote the protocol and supervised data collection and analysis. M.F. Stern provided clinical supervision of the data abstraction. I.A. Binswanger and S.R. Mueller conducted literature searches and S.R. Mueller coordinated regulatory approvals. T.E. Yamashita managed the data and data abstraction procedures. P.J. Blatchford undertook the statistical analysis. I.A. Binswanger wrote the first draft of the manuscript. I.B., M.F., T.B., and S.M. participated in interpreting the data. All authors revised and approved the final manuscript.

Contributors: We wish to acknowledge the Washington State Department of Corrections, especially Kathryn Lundy, RHIT, Mike Evans, and David Daniels. We acknowledge Rick Whisenhunt, Melanie Arndt and Marcy Fulmer for their assistance in the execution of this study. We also wish to acknowledge Jason M. Glanz, PhD, and David McClure, PhD for their thoughtful comments on the design and analysis of the study.

Setting—Washington State Department of Corrections, Washington, USA.

Participants—Cases (699 all-cause deaths, of which 88 were among women, and 206 additional overdose deaths, of which 76 were among women) between 1999 and 2009 matched 1:1 to controls on sex, age and year of release using risk set sampling.

Measurements—Prison medical charts were abstracted for clinical information. Independent associations between clinical characteristics and all-cause and overdose mortality were assessed using conditional logistic regression.

Findings—Key independent risk factors for all-cause mortality included homelessness (Odds Ratio [OR] 1.53, 95% Confidence Interval [CI] 1.06, 2.23), injection drug use (OR 1.54, 95% CI 1.15, 2.05), tobacco use (OR 1.50, 95% CI 1.06, 2.12), cirrhosis (OR 4.42, 95% CI 1.63, 11.98), and psychiatric medications before release (OR 2.37, 95% CI 1.71, 3.29). Independent risk factors for overdose mortality included substance dependence (OR 2.33, 95% CI 1.32, 4.11), injection drug use (OR 2.43, 95% CI 1.53, 3.86), panic disorder (OR 3.87, 95% CI 1.62, 9.21), psychiatric prescriptions before release (OR 2.44, 95% CI 1.55, 3.85), and problems with opiates/sedatives (OR 2.81, 95% CI 1.40, 5.63). Substance use disorder treatment during the index incarceration was protective for all-cause (OR 0.67, 95% CI 0.49, 0.91) and overdose (OR 0.57, 95% CI 0.35, 0.90) mortality.

Conclusions—Injection drug use and substance use disorders are risk factors for death after release from prison. In-prison substance use treatment services may reduce the risk.

Keywords

overdose; prison; drug-related mortality; risk factors

INTRODUCTION

More than 10.2 million people worldwide were in prison in 2011-2013; in the United States, approximately 1.6 million people were in prisons at year-end 2013, with another 731,200 in jails. (1, 2) High mortality rates after release from prison have been documented in the United States, the United Kingdom, Australia and France, among others. (3-25) A systematic review examined all-cause mortality after release from prison and found rates ranging from 720-2,054 per 100,000 person years across studies. (27) With few exceptions, (12, 28, 29) most studies suggest the leading cause of death after release is unintentional poisoning (overdose), particularly early after release. An international meta-analysis of drug-related deaths after release identified a three- to eight-fold increased risk in the first two weeks after release compared with subsequent two week periods, up to the twelfth week. (30)

Prior research has identified several socio-demographic and incarceration-related risk factors for all-cause mortality after release from prison, including increasing age, non-Latino ethnicity (specific to the US context), and shorter incarceration. (22, 31, 32) Women may be at higher risk of overdose death after release than men. (22, 24) New evidence from Sweden suggests substance use disorders are associated with all-cause death. (25)

In Australia, people who died from overdose following prison release were younger and less likely to be married than people who died from all other causes. (34) Among drug-involved people who have been incarcerated, risk factors for non-fatal overdose include previous overdose, binge drug use, public injecting, and heroin, benzodiazepine, cocaine or methamphetamine use. (35) Although HIV infection may be associated with mortality from HIV/AIDS and overdose in community settings, (36) HIV may be protective against non-fatal overdose among people recently incarcerated. (35)

Important gaps remain in our knowledge about risk factors for death after prison release. Recent evidence points to the role of pharmaceutical opioids in deaths among people released from prison, (22) but it is not clear whether in-prison treatment of pain with opioids increases the risk for overdose. While suicide is an important cause of death after release from prison, (27) little is understood about the role of mental health disorders in post-release overdose. In Sweden, mental health disorders were not independently associated with all-cause post-release mortality. (25) Pre-existing medical conditions, such as pulmonary and liver disease, may also contribute to post-release overdose mortality. Finally, the extent to which housing, family and social support, military service, educational attainment, and other social factors are protective is unknown. Thus, our objective was to identify clinical, incarceration, and social characteristics associated with all-cause and overdose mortality after prison release using data routinely collected during incarceration.

METHODS

Design, Setting and Study Population

We conducted a case control study nested within a cohort study of people released from the Washington State Department of Corrections (WA DOC) from July 1999 through December 2009. This time span was the longest for which there was available data from both the DOC and the National Death Index at the time this study was conducted. The cohort included 76,208 individuals released from prison 192,869 times. It was not feasible to obtain clinical information from the paper-based prison medical records of all 76,208 individuals in our cohort (the average number of hours per chart abstraction was 1.4). Thus, we conducted a nested case control study to efficiently evaluate the association between exposures and death. (37, 38) We matched personal identifiers to the National Death Index (NDI) to identify deaths and causes of deaths through the end of 2009, as previously described. (19, 22) We excluded deaths in prison and deaths while on medical parole (release due to life limiting medical conditions), which left 2,462 deaths during the post-release period. In a preliminary study, we observed absent or inadequate medical record data among those who only had incarcerations for violations of community supervision, as these are generally very brief stays in prison. Thus, we restricted the cohort to individuals who had at least one incarceration due to a sentence (rather than a violation) during the study period. The final cohort had 1,972 all-cause deaths which occurred after release from prison.

Ethical Approval

This study was approved by the Colorado Multiple Institutions Review Board with a Waiver of Consent, the National Death Index, and the Washington Department of Corrections

research review committee. We obtained a Federal Certificate of Confidentiality from the National Institute on Drug Abuse.

Definition and Selection of the Cases

We expected 800 deaths (cases) during the study period, with 90.5% having data available on substance dependence diagnoses. This was anticipated to provide power of 0.92 to detect an odds ratio of 1.44, assuming 71% of the cases had substance dependence. However, more deaths than anticipated occurred in the cohort (N=1,972 all-cause deaths, including 427 overdose deaths). In the interest of efficiency, given the time required per chart abstraction, we therefore abstracted a random sample of all-cause deaths (n=699, 35.4%). We oversampled overdose cases to improve power for that outcome, selecting 206 overdose cases in addition to the 154 included among the selected all-cause deaths, resulting in a total of 380 overdose cases (89.0% of all overdose deaths). Cases for which records could not be located (n=3) were excluded.

Selection of Controls

We selected controls using risk set sampling. For each case, the release closest to their death served as the index release. The risk set for each case included all individuals who were alive and not re-incarcerated for the same length of time as the case's release-to-death time. For instance, if a case died 100 days after release, the risk set included all other individuals still alive and not back in prison 100 days after release from prison. We used this approach because the risk of death changes as a function of time since release. (22) Cases and controls were matched on sex, age (± 1 year), and year of release. Among eligible controls for each case (range 1-1,467), one control was randomly selected for each case. Nineteen cases without eligible controls were excluded. Twenty-two cases served as controls for another case, given that they were still alive during the risk period, and 16 controls served as controls for more than one case.

Data Abstraction

Our primary data sources were medical records collected in the course of routine medical practice in prison. These included intake health screenings for medical, mental health, and substance use problems, nurse and provider notes, internal and external laboratory or radiological test results, discharge summaries from hospitalizations, pharmacy records, and medical problem lists. We also collected data from substance use treatment and behavioral health records. Additional data sources were custody charts, including legal records, administrative records, and visitor logs. Some scanned records were retrieved electronically. Abstractions were limited to the incarceration immediately preceding the index release and prior incarcerations; no data recorded subsequent to the index release date were abstracted.

Three trained abstractors, supervised by a study physician, independently abstracted charts between April 2012 and April 2013 using a Microsoft Access database designed for this study. Abstractors had access to detailed coder instructions and weekly meetings were scheduled to address questions related to coding and process. Abstractors had prior experience with medical record management but did not necessarily have formal medical training. Databases were periodically uploaded to a secure server.

Data Elements

Sociodemographic characteristics—Age, race/ethnicity, gender, year of release, length of incarceration, and type of release (community service/work release vs. expired sentence/other) were obtained from the electronic database. Race and ethnicity were determined by self-report at DOC intake and combined at the analytic stage to create mutually exclusive groups (Hispanic, Non-Hispanic White, Non-Hispanic African-American, Non-Hispanic American Indian/Eskimo/Aleutian, and Other [includes Asian]). Custody level at time of release was abstracted and combined for analysis to minimal vs. medium/maximum. Evidence of prior military service was also abstracted. Education variables included years of education prior to incarceration and GED attainment during incarceration. Measures of family and social support included marital status, having children at the time of release and having any visitors during the index incarceration. Individuals were considered homeless at release if there was no residential address listed for the place of release.

Medical and psychiatric diagnoses—HIV infection was based on a recorded diagnosis of HIV or AIDS or a positive HIV laboratory test. Those without a diagnosis of HIV in the medical record or with a documented negative HIV test were coded as not having HIV. Other clinical diagnoses abstracted from the records included depression, panic disorder, bipolar disorder, schizophrenia, suicide attempt prior to incarceration, tobacco use, hepatitis C, cirrhosis, asthma, chronic obstructive pulmonary disease (COPD), and any pain complaint. Narcotic and psychiatric prescriptions within 60 days before release were listed in drop down menus for abstractors to select, with generic and brand names of formulary medications.

Substance use disorders and treatment—During the study period, the DOC administered standardized Drug Dependence Screens to individuals entering prison, with questions corresponding to Diagnostic and Statistical Manual of Mental Disorders, 4th Edition criteria for substance abuse and dependence. This instrument also asked about which substances caused the “MOST serious problems,” injecting “drugs with a needle”, and heroin use in the 6 months before incarceration. Screening results were used by the DOC to select people for further diagnostic examination and programming. Based on the screening results, substances that caused the most serious problems were grouped as alcohol, opiate/sedative, cocaine/other stimulant/inhalant, marijuana, and none. Our variable on injection drug use and heroin use was based on affirmative screen responses, diagnostic evaluation and ad hoc documentation in the medical record. Infractions for drug possession during the index incarceration were also abstracted from the records. Substance abuse treatment services delivered in prison were classified as inpatient or outpatient. Drug possession-related arrest (including attempted delivery of illegal drugs) was also captured.

Statistical Analysis

Individuals who had no indication of a characteristic or condition in available records (*i.e.*, missing) were grouped with those with documentation that the clinical condition was not present (*i.e.*, the response was “no”). For multi-level nominal categorical variables, we used Greenacre’s method which hierarchically collapses levels with similar proportions of events

based on the least reduction of the overall chi-square statistic. (39) Any variables with zero events in either group (cases or controls) were removed from further consideration (e.g. paraphernalia possession infraction in prison). We examined candidate variables for correlation using divisive clustering and eliminated redundant variables. This approach identifies clusters of variables that are highly correlated. We then selected a single variable from each cluster, taking into account clinical considerations. Leaving redundant variables can make the parameter estimates unstable and confound interpretation. For instance, history of heroin use was highly correlated with injection drug use. We used this process to eliminate heroin use, which was highly correlated with injection drug use, from further consideration in multivariable models, but left tobacco use, which was not highly correlated with other variables (e.g. substance dependence)

We generated unadjusted odds ratios (OR), 95% confidence intervals (CI) and *P*-values. We used conditional logistic regression to account for the matched case-control design. Variables known to be associated with mortality from prior research (race/ethnicity and length of incarceration) (22) and variables which were our primary hypothesized exposure variables (e.g. injection drug use, having a positive screen for substance dependence, hepatitis C, and HIV) were considered for further inclusion in the multivariable models. Variables not associated with case control status (*P*-value of <0.40) were excluded from further consideration. We also considered interactions between key variables of interest, including substance dependence and injection drug use; major psychiatric conditions and receipt of psychotropic medications; and alcohol as the most serious substance causing problems and pharmaceutical opioid use and heroin use.

We constructed two multivariable models, one for all-cause mortality and one for overdose mortality. We used a best subsets approach to find groups of variables that yielded the most predictive models. This method considers all possible models, and rank-orders them using the score chi-square statistic. The variables which were most predictive using this approach (e.g., years incarcerated, psychiatric medications, injection drug use, cirrhosis, tobacco use, and most serious drug causing problems for all-cause mortality) were included in the final models. The final model was chosen based on a combination of best statistical performance and the desire for a parsimonious model. To investigate the consistency between the variables chosen using this approach, we also used different model selection procedures (e.g. stepwise selection), but these did not substantially change our findings. We also conducted exploratory analyses to examine the effect of treatment setting (inpatient, outpatient, vs. none) on mortality.

Analyses were performed with SAS 9.3 (Cary, NC).

RESULTS

Among 699 all-cause deaths, the mean age at release from prison was 41.4 years and 12.6% were female (Table 1). Among 380 overdose cases, the mean age at release was 40.0 years and 20.0% were female. Cases and controls were similar in age, sex and release year, due to matching.

All-cause mortality

For all-cause deaths, cases and controls were similar in terms of drug-possession related arrests, education, receipt of a narcotic medication before release, HIV prevalence, and pain (Table 1). We therefore did not further consider these variables for inclusion in the multivariable model. We identified no significant interactions between key variables of interest.

In the final multivariable model for all-cause mortality (Table 2), factors associated with an increased risk of death included homelessness at release, history of injection drug use, tobacco use, history of substance abuse treatment during a prior incarceration, cirrhosis, and receipt of psychiatric medications in the 60 days before release. Compared with individuals who had no problematic substance use in the six months before incarceration, individuals who primarily used cocaine/stimulants/inhalants had a lower risk of death. Hispanic ethnicity and American Indian race were associated with a reduced risk of death compared with non-Hispanic whites. Substance abuse treatment during the index incarceration was protective. GED completion, military service, having children, and visits during incarceration were not independently associated with all-cause mortality ($p < 0.10$), such as. In exploratory unadjusted analysis, outpatient treatment setting was protective for all-cause mortality compared to no treatment, (OR 0.63, 95% CI 0.48, 0.84); inpatient did not reach statistical significance (OR 0.74, 95% CI 0.43, 1.28).

Overdose mortality

For overdose mortality (Table 1), cases and controls were similar in mean educational attainment, having at least one visit during incarceration, HIV prevalence, and pain; these variables were not considered for further inclusion in the multivariable model (Table 3).

In the final multivariable model for overdose mortality (Table 3), risk factors included having a positive screen for substance dependence, history of injection drug use, history of panic disorder, receipt of a psychiatric prescription in the 60 days before release, and opiates/sedatives as the drug causing the most serious problem. Hispanic ethnicity and other race/ethnicity were associated with a reduced risk of overdose death compared with non-Hispanic whites. Other protective factors included having a child and receiving substance abuse treatment during the index incarceration. GED completion, military service, and depression were not independently associated with overdose mortality ($p < 0.100$). In exploratory, unadjusted analyses, treatment setting was not significantly associated with overdose mortality (OR 0.53, 95% CI 0.25, 1.16 for inpatient; OR 0.83, 95% CI 0.59, 1.18 for outpatient)

DISCUSSION

Our study identified important clinical and social risk factors for all-cause and overdose death after release from prison. For all-cause mortality, these included injection drug use, tobacco use, cirrhosis, receipt of psychiatric medications in prison, and homelessness upon release. Factors associated with an increased risk of overdose death included substance

dependence, injection drug use, receipt of psychiatric medications in prison, panic disorder and problems with opiates and sedatives.

Receipt of substance use disorder treatment during the index incarceration was associated with a reduced risk for both all-cause death and overdose death even though pharmacotherapy for opioid dependence, particularly opioid agonist therapy (OAT), was not available. Various types of treatment available in prison over the course of the study included Therapeutic Community, Narcotics Anonymous, Alcoholics Anonymous, intensive outpatient or inpatient care, Social Treatment Opportunity Program, education, continuing care, acupuncture, long term residential care, Recovery House, Moral Reconation Therapy, or Relapse Prevention. Opioid use disorders are best treated with a combination of pharmacotherapy and behavioral intervention. (40, 41) Among people with opioid dependence in a large cohort from New South Wales, Australia, OAT in prison was associated with a 75% reduction in all-cause post-release mortality in the 4 weeks after release. (33) Further, the World Health Organization issued a report recommending that pharmacotherapy for opioid use disorders be initiated or continued in prison. (42) However, this treatment is not commonly available to people who are incarcerated. (43) There is also unmet need for treatment in the community. (44) Further research on reducing barriers to OAT in prison and after release is indicated. Additionally, our findings that cocaine/stimulants/inhalants as the most serious substance causing problems was protective requires confirmation in other studies.

Another intervention being implemented and evaluated in several countries to reduce post-release mortality is overdose education and take-home naloxone distribution. (45, 46) The World Health Organization recommended overdose response education for people with opioid use disorders releasing from prison and their family/community supporters. (42) These interventions were not implemented in the prison system at the time of this study, so we are unable to ascertain their effect on mortality risk.

Homelessness is common among people released from correctional facilities and has been associated with a higher risk of subsequent re-incarceration (47) and certain causes of death. (23) Our study extends this body of evidence by demonstrating an elevated risk of all-cause mortality among people released homeless. This finding suggests that pre-release planning for incarcerated individuals should include a comprehensive assessment of the anticipated post-release living situation combined with consideration of a “critical time intervention” approach (48, 49) to mitigate the risk of homelessness through supportive housing, case management, and other community re-entry services.

We observed an association between tobacco use history and all-cause mortality, consistent with similar observations in the general population. (50) WA DOC became smoke-free partway during the course of this study (2003) and provided smoking cessation pharmacotherapy to people in prison at the time of the transition. Further research on effective tobacco cessation interventions for people in prisons and releasing from prisons is indicated given high rates of relapse after release from smoke-free prisons. (51) Cirrhosis was also a risk factor for all-cause mortality. Preventive interventions in prison, such as

education about and treatment for hepatitis C and alcohol use disorders, may have long term benefit.

Receipt of psychiatric medications in prison during the 60 days prior to release was associated with all-cause and overdose death. We believe this variable was a general marker of severe mental health disorder requiring treatment. Other factors that may have contributed to this association include poor continuity of medication treatment for mental health disorders after release, (52) difficulty coping with the stress of the transition to the post-release environment among people with mental health disorders, or medication interactions which predispose to overdose. With the exception of panic disorder, individual diagnoses (depression, schizophrenia, and bipolar disorder) were not strongly associated with mortality when adjusted for receipt of medication. Ongoing efforts to improve the transition of care for people with psychiatric disorders leaving prison are indicated.

Our findings could lead to predictive models to target interventions to the highest risk groups. In the future, important risk factors for death could be efficiently identified in records collected by correctional departments as part of their routine clinical, legal and administrative processes using electronic health records (EHRs), which many correctional systems have already implemented. These EHR systems may be harnessed to collect this information, which can then be used to selectively apply risk reduction interventions. This process will have to be cautiously designed to protect individual privacy.

Our study was limited by several issues related to the use of medical record abstraction in prison. First, some charts were missing or missing key items, particularly for individuals with short stays or who received little or no medical care. However, our exposure factors were based on what prison authorities had knowledge of in a real-world setting. Second, although we cannot be certain that all diagnoses were identified, we do not expect under-ascertainment to be different between cases and controls. Further, prior research has shown reasonable concordance between prison medical records and self-report for major medical conditions. (53, 54) Medical records can be also used to obtain information on exposure among individuals who have died. This study was conducted in a single state and may therefore not be generalizable to states with different correctional systems, treatment services, and patterns of community drug use. Some individuals may have died in other facilities rather than in the community if they were re-incarcerated or transferred to a different system (e.g. jail or the federal system). We did not examine heterogeneity among prisons in post-release mortality, which should be assessed in future research.

Future research should assess the effects of overdose education and naloxone, improved transitional programs and health services for people with mental health conditions, and alternatives to incarceration on mortality. Injection drug use and substance dependence, particularly problems with opioids and sedatives, are risk factors for post-release death. In-prison substance use treatment services have the potential to reduce the risk. It is imperative to expand access to high quality evidence-based substance use disorder treatment for this population.

ACKNOWLEDGEMENTS

Funding for this study was provided by the National Institute on Drug Abuse (R21DA031041) and the Robert Wood Johnson Foundation. Dr. Baggett's effort was supported by the National Institute on Drug Abuse (K23DA034008). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health or the Robert Wood Johnson Foundation.

REFERENCES

1. WALMSLEY, R. World Prison Population List. 10th. International Centre for Prison Studies; London UK: 2013.
2. GLAZE, LE.; KEUBLE, D. Correctional populations in the United States, 2013. Bureau of Justice Statistics; 2014.
3. PRATT D, PIPER M, APPLEBY L, WEBB R, SHAW J. Suicide in recently released prisoners: a population-based cohort study. *Lancet*. 2006; 368:119–123. [PubMed: 16829295]
4. JOUKAMAA M. The mortality of released Finnish prisoners; a 7 year follow-up study of the WATTU project. *Forensic Sci Int*. 1998; 96:11–19. [PubMed: 9800361]
5. HARDING-PINK D. Mortality following release from prison. *Med Sci Law*. 1990; 30:12–16. [PubMed: 2304391]
6. SATTAR G. The death of offenders in England and Wales. *Crisis*. 2003; 24:17–23. [PubMed: 12809148]
7. CHRISTENSEN PB, HAMMERBY E, SMITH E, BIRD SM. Mortality among Danish drug users released from prison. *International Journal of Prisoner Health*. 2006; 2:13–19.
8. SEAMAN SR, BRETTLE RP, GORE SM. Mortality from overdose among injecting drug users recently released from prison: database linkage study. *BMJ*. 1998; 316:426–428. [PubMed: 9492665]
9. SEYMOUR A, OLIVER JS, BLACK M. Drug-related deaths among recently released prisoners in the Strathclyde Region of Scotland. *J Forensic Sci*. 2000; 45:649–654. [PubMed: 10855971]
10. HOBBS M, KRAZLAN K, RODOUT S, MAI Q, KNUIMAN M, CHAPMAN R. Mortality and morbidity in prisoners after release from prison in Western Australia 1995–2003. *Trends & Issues in Crime and Criminal Justice*. 2006:1–6.
11. KARIMINIA A, LAW MG, BUTLER TG, LEVY MH, CORBEN SP, KALDOR JM, et al. Suicide risk among recently released prisoners in New South Wales, Australia. *Med J Aust*. 2007; 187:387–390. [PubMed: 17908000]
12. ROSEN DL, SCHOENBACH VJ, WOHL DA. All-cause and cause-specific mortality among men released from state prison, 1980–2005. *Am J Public Health*. 2008; 98:2278–2284. [PubMed: 18923131]
13. KRINSKY CS, LATHROP SL, BROWN P, NOLTE KB. Drugs, detention, and death: A study of the mortality of recently released prisoners. *Am J Forensic Med Pathol*. 2009; 30:6–9. [PubMed: 19237844]
14. VERGER P, ROTILY M, PRUDHOMME J, BIRD S. High mortality rates among inmates during the year following their discharge from a French prison. *J Forensic Sci*. 2003; 48:614–616. [PubMed: 12762532]
15. STEWART LM, HENDERSON CJ, HOBBS MS, RIDOUT SC, KNUIMAN MW. Risk of death in prisoners after release from jail. *Aust N Z J Public Health*. 2004; 28:32–36. [PubMed: 15108744]
16. BIRD SM, HUTCHINSON SJ. Male drugs-related deaths in the fortnight after release from prison: Scotland, 1996–99. *Addiction*. 2003; 98:185–190. [PubMed: 12534423]
17. FARRELL M, MARSDEN J. Acute risk of drug-related death among newly released prisoners in England and Wales. *Addiction*. 2008; 103:251–255. [PubMed: 18199304]
18. SINGLETON N, PENDRY E, TAYLOR C, FARRELL M, MARSDEN J. Drug-related mortality among newly released offenders. Home Office Online Report Series. 2003
19. BINSWANGER IA, STERN MF, DEYO RA, HEAGERTY PJ, CHEADLE A, ELMORE JG, et al. Release from prison—a high risk of death for former inmates. *N Engl J Med*. 2007; 356:157–165. [PubMed: 17215533]

20. GRAHAM A. Post-prison mortality: Unnatural death among people released from victorian prisons between January 1990 and December 1999. *Aust N Z J Criminol.* 2003; 36:94–108.
21. KARIMINIA A, BUTLER T, CORBEN S, LEVY M, GRANT L, KALDOR J, et al. Extreme cause-specific mortality in a cohort of adult prisoners--1988 to 2002: a data-linkage study. *Int J Epidemiol.* 2007; 36:310–316. [PubMed: 17158524]
22. BINSWANGER IA, BLATCHFORD PJ, MUELLER SR, STERN MF. Mortality after prison release: opioid overdose and other causes of death, risk factors, and time trends from 1999 to 2009. *Ann Intern Med.* 2013; 159:592–600. [PubMed: 24189594]
23. LIM S, SELIGSON AL, PARVEZ FM, LUTHER CW, MAVINKURVE MP, BINSWANGER IA, et al. Risks of drug-related death, suicide, and homicide during the immediate post-release period among people released from New York City jails, 2001-2005. *Am J Epidemiol.* 2012; 175:519–526. [PubMed: 22331462]
24. GRAHAM L, FISCHBACHER CM, STOCKTON D, FRASER A, FLEMING M, GREIG K. Understanding extreme mortality among prisoners: a national cohort study in Scotland using data linkage. *The European Journal of Public Health.* 2015 cku252.
25. CHANG Z, LICHTENSTEIN P, LARSSON H, FAZEL S. Substance use disorders, psychiatric disorders, and mortality after release from prison: a nationwide longitudinal cohort study. *The Lancet Psychiatry.* 2015; 2:422–430. [PubMed: 26360286]
26. MERRALL ELC, KARIMINIA A, BINSWANGER IA, HOBBS MS, FARRELL M, MARSDEN J, et al. Meta-analysis of drug-related deaths soon after release from prison. *Addiction.* 2010; 105:1545–1554. [PubMed: 20579009]
27. ZLODRE J, FAZEL S. All-cause and external mortality in released prisoners: systematic review and meta-analysis. *Am J Public Health.* 2012; 102:e67–75. [PubMed: 23078476]
28. SPAULDING AC, SEALS RM, MCCALLUM VA, PEREZ SD, BRZOZOWSKI AK, STEENLAND NK. Prisoner survival inside and outside of the institution: Implications for health-care planning. *Am J Epidemiol.* 2011
29. SPAULDING AC, SHARMA A, MESSINA LC, ZLOTORZYNSKA M, MILLER L, BINSWANGER IA. A Comparison of Liver Disease Mortality With HIV and Overdose Mortality Among Georgia Prisoners and Releasees: A 2-Decade Cohort Study of Prisoners Incarcerated in 1991. *American journal of public health.* 2015; 105:e51–57. [PubMed: 25790417]
30. MERRALL EL, KARIMINIA A, BINSWANGER IA, HOBBS MS, FARRELL M, MARSDEN J, et al. Meta-analysis of drug-related deaths soon after release from prison. *Addiction.* 2010; 105:1545–1554. [PubMed: 20579009]
31. KINNER SA, BINSWANGER IA. Mortality After Release from Prison. *Encyclopedia of Criminology and Criminal Justice: Springer.* 2014:3157–3167.
32. BINSWANGER IA, BLATCHFORD PJ, LINDSAY RG, STERN MF. Risk factors for all-cause, overdose and early deaths after release from prison in Washington state. *Drug Alcohol Depend.* 2011; 117:1–6. [PubMed: 21295414]
33. DEGENHARDT L, LARNEY S, KIMBER J, GISEV N, FARRELL M, DOBBINS T, et al. The impact of opioid substitution therapy on mortality post-release from prison: retrospective data linkage study. *Addiction.* 2014; 109:1306–1317. [PubMed: 24612249]
34. ANDREWS JY, KINNER SA. Understanding drug-related mortality in released prisoners: a review of national coronial records. *BMC Public Health.* 2012; 12:270. [PubMed: 22475069]
35. KINNER SA, MILLOY MJ, WOOD E, QI J, ZHANG R, KERR T. Incidence and risk factors for non-fatal overdose among a cohort of recently incarcerated illicit drug users. *Addict Behav.* 2012; 37:691–696. [PubMed: 22385733]
36. GREEN TC, MCGOWAN SK, YOKELL MA, POUGET ER, RICH JD. HIV infection and risk of overdose: a systematic review and meta-analysis. *AIDS.* 2012; 26:403–417. [PubMed: 22112599]
37. WACHOLDER S. Practical considerations in choosing between the case-cohort and nested case-control designs. *Epidemiology (Cambridge, Mass.* 1991; 2:155–158.
38. KOEPESELL, TD.; WEISS, NS. *Epidemiologic Methods.* Oxford University Press; New York: 2003.
39. GREENACRE MJ. Clustering the rows and columns of a contingency table. *Journal of Classification.* 1988; 5:39–51.

40. AMATO L, MINOZZI S, DAVOLI M, VECCHI S, FERRI MM, MAYET S. Psychosocial and pharmacological treatments versus pharmacological treatments for opioid detoxification. *Cochrane Database Syst Rev*. 2008 CD005031.
41. AMATO L, MINOZZI S, DAVOLI M, VECCHI S, FERRI MM, MAYET S. Psychosocial combined with agonist maintenance treatments versus agonist maintenance treatments alone for treatment of opioid dependence. *Cochrane Database Syst Rev*. 2008 CD004147.
42. WORLD HEALTH ORGANIZATION. Prevention of acute drug-related mortality in prison populations during the immediate post-release period Copenhagen. 2010
43. FRIEDMANN PD, HOSKINSON R, GORDON M, SCHWARTZ R, KINLOCK T, KNIGHT K, et al. Medication-assisted treatment in criminal justice agencies affiliated with the criminal justice-drug abuse treatment studies (CJ-DATS): availability, barriers, and intentions. *Subst Abus*. 2012; 33:9–18. [PubMed: 22263709]
44. VOLKOW ND, FRIEDEN TR, HYDE PS, CHA SS. Medication-assisted therapies--tackling the opioid-overdose epidemic. *N Engl J Med*. 2014; 370:2063–2066. [PubMed: 24758595]
45. STRANG J, BIRD SM, PARMAR MK. Take-home emergency naloxone to prevent heroin overdose deaths after prison release: rationale and practicalities for the N-ALIVE randomized trial. *J Urban Health*. 2013; 90:983–996. [PubMed: 23633090]
46. MCAULEY A, BEST D, TAYLOR A, HUNTER C, ROBERTSON R. From evidence to policy: The Scottish national naloxone programme, *Drugs: Education, Prevention, and Policy*. 2012; 19:309–319.
47. METRAUX S, CULHANE DP. Homeless shelter use and reincarceration following prison release. *Criminol Public Policy*. 2004; 3:139–160.
48. DRAINE J, HERMAN DB. Critical time intervention for reentry from prison for persons with mental illness. *Psychiatr Serv*. 2007; 58:1577–1581. [PubMed: 18048559]
49. HERMAN D, CONOVER S, FELIX A, NAKAGAWA A, MILLS D. Critical Time Intervention: an empirically supported model for preventing homelessness in high risk groups. *J Prim Prev*. 2007; 28:295–312. [PubMed: 17541827]
50. U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES. The Health Consequences of Smoking —50 Years of Progress: A Report of the Surgeon General. Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; Atlanta, GA: 2014.
51. CLARKE JG, STEIN LA, MARTIN RA, MARTIN SA, PARKER D, LOPES CE, et al. Forced smoking abstinence: not enough for smoking cessation. *JAMA Intern Med*. 2013;1–6.
52. BINSWANGER IA, NOWELS C, CORSI KF, LONG J, BOOTH RE, KUTNER J, et al. "From the prison door right to the sidewalk, everything went downhill," a qualitative study of the health experiences of recently released inmates. *Int J Law Psychiatry*. 2011; 34:249–255. [PubMed: 21802731]
53. BAI JR, MUKHERJEE DV, BEFUS M, APA Z, LOWY FD, LARSON EL. Concordance between medical records and interview data in correctional facilities. *BMC medical research methodology*. 2014;14. [PubMed: 24461057]
54. SCHOFIELD P, BUTLER T, HOLLIS S, D'ESTE C. Are prisoners reliable survey respondents? A validation of self-reported traumatic brain injury (TBI) against hospital medical records. *Brain Inj*. 2011; 25:74–82. [PubMed: 21117913]

Table 1

Characteristics of cases and controls for all-cause mortality and overdose mortality.

	All Cause Cases (n=699)	Controls (n=699)	OR (95% CI)	P-value	Overdose Cases (n=380)	Controls (n=380)	OR (95% CI)	P-value
Age, mean years (SD)	41.4 (11.9)	41.4 (11.9)	<i>a</i>	0.980	40 (9.3)	39.9 (9.3)	<i>a</i>	0.920
Sex, n (%)				1.000				1.000
Men	611 (87.4)	611 (87.4)	<i>a</i>		304 (80.0)	304 (80.0)	<i>a</i>	
Women	88 (12.6)	88 (12.6)			76 (20.0)	76 (20.0)		
Release year, n (%)			<i>a</i>	1.000			<i>a</i>	1.000
1999	33 (4.7)	33 (4.7)			21 (5.5)	21 (5.5)		
2000	111 (15.9)	111 (15.9)			40 (10.5)	40 (10.5)		
2001	81 (11.6)	81 (11.6)			41 (10.8)	41 (10.8)		
2002	70 (10.0)	70 (10.0)			39 (10.3)	39 (10.3)		
2003	91 (13.0)	91 (13.0)			37 (9.7)	37 (9.7)		
2004	72 (10.3)	72 (10.3)			37 (9.7)	37 (9.7)		
2005	72 (10.3)	72 (10.3)			48 (12.6)	48 (12.6)		
2006	70 (10.0)	70 (10.0)			30 (7.9)	30 (7.9)		
2007	40 (5.7)	40 (5.7)			39 (10.3)	39 (10.3)		
2008	41 (5.9)	41 (5.9)			30 (7.9)	30 (7.9)		
2009	18 (2.6)	18 (2.6)			18 (4.7)	18 (4.7)		
Race/ethnicity, n (%)								0.084
Non-Hispanic White	493 (70.5)	443 (63.4)	Reference		301 (79.2)	242 (63.7)	Reference	
Non-Hispanic African American	127 (18.2)	129 (18.5)	0.90 (0.69, 1.18)	0.443	51 (13.4)	76 (20.0)	0.53 (0.35, 0.79)	0.002
Non-Hispanic American Indian			0.38 (0.17, 0.88)	0.024			0.87 (0.34, 2.22)	0.770
Hispanic/Latino	53 (7.6)	83 (11.9)	0.57 (0.39, 0.83)	0.003	15 (3.9)	41 (10.8)	0.30 (0.16, 0.56)	<0.001
Non-Hispanic other race	26 (3.7)	44 (6.3)	0.65 (0.34, 1.23)	0.184	13 (3.4)	21 (5.5)	0.27 (0.08, 0.85)	0.025
Length of incarceration, mean years (SD)	1.7 (2.6)	2.2 (3.4)	0.92 (0.88, 0.96)	<0.001	1.3 (3.0)	1.8 (2.9)	0.93 (0.87, 0.99)	0.025
Education, mean years (SD)	10.6 (2.3)	10.6 (2.6)	1.00 (0.96, 1.04)	0.973	10.7 (2.0)	10.7 (2.4)	1.00 (0.94, 1.06)	0.936
GED obtained in prison, n (%)				0.004				0.174
No	368 (52.6)	420 (60.1)	Reference		198 (52.1)	217 (57.1)	Reference	
Yes	331 (47.4)	279 (39.9)	1.38 (1.11, 1.72)		182 (47.9)	163 (42.9)	1.22 (0.92, 1.61)	
Homeless at release, n (%)				<0.001				0.007
No	587 (84.0)	631 (90.3)	Reference		320 (84.2)	345 (90.8)	Reference	
Yes	112 (16.0)	68 (9.7)	1.81 (1.30, 2.53)		60 (15.8)	35 (9.2)	1.86 (1.19, 2.92)	
Had children, n (%)				0.015				0.007
No	264 (37.8)	223 (31.9)	Reference		149 (39.2)	115 (30.3)	Reference	

	All Cause Cases (n=699)	Controls (n=699)	OR (95% CI)	P-value	Overdose Cases (n=380)	Controls (n=380)	OR (95% CI)	P-value
Yes	435 (62.2)	476 (68.1)	0.75 (0.59, 0.94)		231 (60.8)	265 (69.7)	0.65 (0.47, 0.89)	
Custody level, n (%)				0.093				0.176
Maximum/Medium	127 (18.2)	104 (14.9)	Reference		39 (10.3)	51 (13.4)	Reference	
Minimal	572 (81.8)	595 (85.1)	0.78 (0.59, 1.04)		341 (89.7)	329 (86.6)	1.36 (0.87, 2.14)	
Military service, n (%)				0.085				0.413
No	583 (83.4)	561 (80.3)	Reference		333 (87.6)	326 (85.8)	Reference	
Yes	116 (16.6)	138 (19.7)	0.77 (0.56, 1.04)		47 (12.4)	54 (14.2)	0.83 (0.52, 1.31)	
Married, n (%)				0.057				0.197
No	599 (85.7)	573 (82.0)	Reference		338 (88.9)	326 (85.8)	Reference	
Yes	100 (14.3)	126 (18.0)	0.75 (0.56, 1.01)		42 (11.1)	54 (14.2)	0.76 (0.49, 1.16)	
Visits during incarceration, n (%)				0.009				0.541
No	525 (75.1)	482 (69.0)	Reference		293 (77.1)	286 (75.3)	Reference	
Yes	174 (24.9)	217 (31.0)	0.72 (0.57, 0.92)		87 (22.9)	94 (24.7)	0.90 (0.64, 1.27)	
Drug possession-related arrest, n (%)				0.546				0.137
No	340 (48.6)	351 (50.2)	Reference		156 (41.1)	176 (46.3)	Reference	
Yes	359 (51.4)	348 (49.8)	1.07 (0.86, 1.33)		224 (58.9)	204 (53.7)	1.25 (0.93, 1.68)	
Substance dependence by screen, n (%)				0.005				<0.001
No	145 (20.7)	187 (26.8)	Reference		38 (10.0)	92 (24.2)	Reference	
Yes	554 (79.3)	512 (73.2)	1.46 (1.12, 1.90)		342 (90.0)	288 (75.8)	2.86 (1.88, 4.37)	
History of injection drug use, n (%)				<0 .001				<0.001
No	326 (46.6)	437 (62.5)	Reference		99 (26.1)	213 (56.1)	Reference	
Yes	373 (53.4)	262 (37.5)	2.11 (1.66, 2.68)		281 (73.9)	167 (43.9)	3.48 (2.51, 4.83)	
History of heroin use, n (%)				<0.001				<0.001
No	398 (56.9)	504 (72.1)	Reference		126 (33.2)	271 (71.3)	Reference	
Yes	301 (43.1)	195 (27.9)	2.03 (1.60, 2.57)		254 (66.8)	109 (28.7)	5.53 (3.80, 8.06)	
History of pharmaceutical opioid use, n (%)				0.013				<0.001
No	597 (85.4)	628 (89.8)	Reference		295 (77.6)	337 (88.7)	Reference	
Yes	102 (14.6)	74 (10.2)	1.51 (1.09, 2.08)		85 (22.4)	43 (11.3)	2.20 (1.48, 3.28)	
History of tobacco use, n (%)				<0 .001				
No	80 (11.4)	136 (19.5)	Reference		28 (7.4)	52 (13.7)	Reference	0.004
Yes	619 (88.6)	563 (80.5)	1.89 (1.39, 2.56)		352 (92.6)	328 (86.3)	2.14 (1.28, 3.60)	
Substance that causes most serious problems, n (%)								
None	364 (52.1)	360 (51.5)	Reference		185 (48.7)	205 (53.9)	Reference	
Alcohol	91 (13.0)	100 (14.3)	0.91 (0.66, 1.27)	0.588	29 (7.6)	39 (10.3)	0.74 (0.42, 1.31)	0.303

	All Cause Cases (n=699)	Controls (n=699)	OR (95% CI)	P-value	Overdose Cases (n=380)	Controls (n=380)	OR (95% CI)	P-value
Cocaine, other stimulants, inhalants	123 (17.6)	155 (22.2)	0.78 (0.58, 1.06)	0.118	62 (16.3)	97 (25.5)	0.72 (0.48, 1.08)	0.116
Marijuana	30 (4.3)	37 (5.3)	0.79 (0.48, 1.33)	0.380	9 (2.4)	17 (4.5)	0.57 (0.24, 1.35)	0.200
Opiates and sedatives	91 (13.0)	47 (6.7)	2.04 (1.34, 3.10)	<0.001	95 (25.0)	22 (5.8)	4.83 (2.78, 8.37)	<0.001
Substance abuse treatment in prison during index incarceration, n (%)				0.005				0.051
No	531 (76.0)	487 (69.7)	Reference		284 (74.7)	260 (68.4)	Reference	
Yes	168 (24.0)	212 (30.3)	0.70 (0.54, 0.90)		96 (25.3)	120 (31.6)	0.72 (0.52, 1.00)	
Substance abuse treatment in prison during prior incarceration, n (%)				<0.001				0.003
No	463 (66.2)	527 (75.4)	Reference		214 (56.3)	253 (66.6)	Reference	
Yes	236 (33.8)	172 (24.6)	1.69 (1.31, 2.18)		166 (43.7)	127 (33.4)	1.59 (1.17, 2.16)	
Drug possession infraction in prison, n (%)				0.069				0.005
No	619 (88.6)	639 (91.4)	Reference		323 (85.0)	348 (91.6)	Reference	
Yes	80 (11.4)	60 (8.6)	1.40 (0.97, 2.01)		57 (15.0)	32 (8.4)	1.96 (1.22, 3.15)	
Paraphernalia possession infraction in prison, n (%)				0.979				
No	694 (99.3)	699 (100.0)	Reference		378 (99.5)	380 (100.0)	Reference	0.980
Yes	5 (0.7)	0 (0.0)	N/A		2 (0.5)	0 (0.0)	N/A	
Used drugs in prison, n (%)				0.592				0.184
No	648 (92.7)	653 (93.4)	Reference		343 (90.3)	353 (92.9)	Reference	
Yes	51 (7.3)	46 (6.6)	1.12 (0.74, 1.71)		37 (9.7)	27 (7.1)	1.43 (0.84, 2.44)	
HIV, n (%)				0.451				1.000
No	683 (97.7)	687 (98.3)	Reference		374 (98.4)	374 (98.4)	Reference	
Yes	16 (2.3)	12 (1.7)	1.33 (0.63, 2.82)		6 (1.6)	6 (1.6)	1.00 (0.32, 3.10)	
Asthma, n (%)				0.024				
No	596 (85.3)	614 (87.8)	Reference		330 (86.8)	337 (88.7)	Reference	0.420
Yes	103 (14.7)	85 (12.2)	1.22 (0.92, 1.71)		50 (13.2)	43 (11.3)	1.21 (0.77, 1.90)	
COPD, n (%)				0.024				0.277
No	621 (88.8)	645 (92.3)	Reference		349 (91.8)	356 (93.7)	Reference	
Yes	78 (11.2)	54 (7.7)	1.55 (1.06, 2.26)		31 (8.2)	24 (6.3)	1.41 (0.76, 2.63)	
Cirrhosis during incarceration, n (%)				<0.001				0.220
No	671 (96.0)	693 (99.1)	Reference		373 (98.2)	377 (99.2)	Reference	
Yes	28 (4.0)	6 (0.9)	4.67 (1.93, 11.27)		7 (1.8)	3 (0.8)	2.33 (0.60, 9.02)	
Hepatitis C, n (%)				<0.001				<0.001
No	484 (69.2)	561 (80.3)	Reference		220 (57.9)	291 (76.6)	Reference	

	All Cause Cases (n=699)	Controls (n=699)	OR (95% CI)	P-value	Overdose Cases (n=380)	Controls (n=380)	OR (95% CI)	P-value
Yes	215 (30.8)	138 (19.7)	1.97 (1.51, 2.59)		160 (42.1)	89 (23.4)	2.82 (1.96, 4.06)	
Pain during incarceration, n (%)				0.825				0.919
No	127 (18.2)	124 (17.7)	Reference		61 (16.1)	62 (16.3)	Reference	
Yes	572 (81.8)	575 (82.3)	0.97 (0.73, 1.29)		319 (83.9)	318 (83.7)	1.02 (0.69, 1.52)	
Narcotic prescriptions in 60 days before release, n (%)				0.075				0.014
No	629 (90.0)	648 (92.7)	Reference		325 (85.5)	347 (91.3)	Reference	
Yes	70 (10.0)	51 (7.3)	1.40 (0.97, 2.04)		55 (14.5)	33 (8.7)	1.79 (1.12, 2.84)	
History of depression, n (%)				<0.001				<0.001
No	379 (54.2)	438 (62.7)	Reference		177 (46.6)	228 (60.0)	Reference	
Yes	320 (45.8)	261 (37.3)	1.51 (1.19, 1.91)		203 (53.4)	152 (40.0)	1.89 (1.37, 2.61)	
History of panic disorder, n (%)				0.017				<0.001
No	34 (4.9)	17 (2.4)	Reference		345 (90.8)	368 (96.8)	Reference	
Yes	665 (95.1)	682 (97.6)	2.06 (1.14, 3.75)		35 (9.2)	12 (3.2)	3.56 (1.70, 7.45)	
History of bipolar disorder n (%)				<0.001				0.003
No	580 (83.0)	625 (89.4)	Reference		291 (76.6)	324 (85.3)	Reference	
Yes	119 (17.0)	74 (10.6)	1.79 (1.29, 2.47)		89 (23.4)	56 (14.7)	1.79 (1.22, 2.61)	
History of schizophrenia, n (%)				0.013				0.017
No	645 (92.3)	667 (95.4)	Reference		341 (89.7)	358 (94.2)	Reference	
Yes	54 (7.7)	32 (4.6)	1.81 (1.13, 2.90)		39 (10.3)	22 (5.8)	2.06 (1.14, 3.75)	
History of suicide attempt before incarceration, n (%)				0.001				0.292
No	687 (98.3)	689 (98.6)	Reference		370 (97.4)	374 (98.4)	Reference	
Yes	12 (1.7)	10 (1.4)	1.59 (1.20, 2.12)		10 (2.6)	6 (1.6)	1.80 (0.60, 5.37)	
Psychiatric medications in 60 days before release, n (%)				<0.001				<0.001
No	497 (71.1)	594 (85.0)	Reference		249 (65.5)	308 (81.1)	Reference	
Yes	202 (28.9)	105 (15.0)	2.62 (1.94, 3.52)		131 (34.5)	72 (18.9)	2.37 (1.66, 3.39)	

^a Matching criteria

Table 2

Final multivariable model for all-cause mortality

Characteristic	Adjusted OR (95% CI)
Race/ethnicity	
Non-Hispanic White	Reference
Non-Hispanic African American	0.99 (0.74, 1.34)
Hispanic/Latino	0.63 (0.42, 0.95)
American Indian	0.36 (0.15, 0.91)
Other	0.75 (0.36, 1.53)
Length of incarceration, years	0.94 (0.90, 0.99)
Homeless at release	1.53 (1.06, 2.23)
Receipt of psychiatric medications in 60 days before release	2.37 (1.71, 3.29)
Cirrhosis	4.42 (1.63, 11.98)
Substance dependence by screen	1.33 (0.96, 1.86)
History of injection drug use	1.54 (1.15, 2.05)
History of tobacco use	1.50 (1.06, 2.12)
Substance that caused most serious problems in 6 months before incarceration	
None	Reference
Alcohol	1.04 (0.71, 1.54)
Cocaine, other stimulants, inhalants	0.65 (0.45, 0.94)
Marijuana	0.83 (0.46, 1.48)
Opiates and sedatives	1.36 (0.81, 2.28)
Substance abuse treatment during index incarceration	0.67 (0.49, 0.91)
Substance abuse treatment during prior incarceration	1.36 (1.01, 1.84)

Table 3

Final multivariable model for overdose mortality

Characteristic	Adjusted OR (95% CI)
Race/ethnicity	
Non-Hispanic White	Reference
Non-Hispanic African American	0.99 (0.59, 1.66)
Hispanic/Latino	0.40 (0.19, 0.87)
American Indian	0.64 (0.20, 2.03)
Other	0.16 (0.04, 0.70)
Length of incarceration, years	0.94 (0.88, 1.00)
Had children	0.56 (0.37, 0.85)
Minimal custody	1.07 (0.68, 1.65)
Receipt of psychiatric medications in 60 days before release	2.44 (1.55, 3.85)
Hepatitis C	1.49 (0.91, 2.44)
Substance dependence by screen	2.33 (1.32, 4.11)
History of injection drug use	2.43 (1.53, 3.86)
Substance that caused most serious problems in 6 months before incarceration	
None	Reference
Alcohol	0.64 (0.30, 1.36)
Cocaine, other stimulants, inhalants	0.42 (0.24, 0.73)
Marijuana	0.53 (0.19, 1.52)
Opiates and sedatives	2.81 (1.40, 5.63)
Substance abuse treatment during index incarceration	0.57 (0.36, 0.90)
History of panic disorder	3.87 (1.62, 9.21)