Opioid Overdose Mortality Among Former North Carolina Inmates: 2000–2015

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Objectives. To examine differences in rates of opioid overdose death (OOD) between former North Carolina (NC) inmates and NC residents and evaluate factors associated with postrelease OOD.

Methods. We linked NC inmate release data to NC death records, calculated OOD standardized mortality ratios to compare former inmates with NC residents, and calculated hazard ratios to identify predictors of time to OOD.

Results. Of the 229 274 former inmates released during 2000 to 2015, 1329 died from OOD after release. At 2-weeks, 1-year, and complete follow-up after release, the respective OOD risk among former inmates was 40 (95% confidence interval [CI] = 30, 51), 11 (95% CI = 9.5, 12), and 8.3 (95% CI = 7.8, 8.7) times as high as general NC residents; the corresponding heroin overdose death risk among former inmates was 74 (95% CI = 43, 106), 18 (95% CI = 15, 21), and 14 (95% CI = 13, 16) times as high as general NC residents, respectively. Former inmates at greatest OOD risk were those within the first 2 weeks after release, aged 26 to 50 years, male, White, with more than 2 previous prison terms, and who received in-prison mental health and substance abuse treatment.

Conclusions. Former inmates are highly vulnerable to opioids and need urgent prevention measures. (*Am J Public Health.* 2018;108:1207–1213. doi:10.2105/AJPH.2018.304514)

The United States is experiencing an unprecedented opioid epidemic. Between 2000 and 2015, opioid overdose death (OOD) rates quadrupled and more than a quarter million Americans died of an opioid overdose.[1–3] In addition to the escalating rates, the epidemic has also involved rapid changes in the types of involved opioids. In the early 2000s, death rates were largely driven by prescription opioids (e.g., Vicodin, Percocet, OxyContin)[2,3]; however, more recently, they have been driven by heroin and illicitly manufactured fentanyl.[1–3] Although this epidemic has had an adverse impact on nearly every demographic group across the United States, it has had particularly devastating effects on those formerly incarcerated.[4]

In 2015, more than 6.7 million individuals in the United States were either incarcerated or otherwise under correctional supervision and many are released each year.[5] In North Carolina (NC), about 22 000 to 27 000 individuals are released from prison annually. Former inmates are particularly vulnerable to the opioid epidemic. The prevalence of substance abuse among incarcerated individuals is high.[6–8] The Bureau of Justice Statistics estimates that about two thirds of all US inmates suffer from substance use disorders.[7,8] However, only half of those receive some form of in-prison drug treatment.[8] These services are further limited upon release from prison.[9] The 2005 National Criminal Justice Treatment Practices survey found that less than 10% of former inmates had access to substance abuse treatment, the majority of which only involved education and group counseling.[10]

Drug overdose is the leading cause of death among former inmates worldwide.[9,11–19] One previous study found that drug overdose death rates were 9 times higher among former NC inmates as compared with NC residents.[12] Another study among Washington State former inmates observed a 10-fold increase in drug overdose rates compared with Washington residents.[13] Two other studies, 1 conducted in England and Wales and 1 conducted in Australia, observed 8 times and 16 times higher drug-related mortality among former inmates compared with the general population, respectively.[17,19] This risk is highest in the first few weeks after release.[11,13,14,17,20,21]

Although previous research has established former inmates as a high-risk population, the majority of this work has utilized pre-2010 data, with the exception of 1 study conducted in Australia that followed participants through 2011.[20] There are no recent studies, especially from the United States, that examine how the ongoing and changing US opioid epidemic is affecting former inmates.[9,22] This is especially concerning because after 2010 there has been a rapid increase in heroin overdose deaths in the United States, followed by a rapid increase in fentanyl overdose deaths since 2013.[1–3] In 2010 and previous years, the most common opioid involved in an OOD was a prescription opioid[2,3]; however, in 2015, the

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most common opioid involved in OOD was heroin, followed closely by fentanyl.[1] Hence, it is vital to understand how these illicit opioids impact former inmates, a population who is already greatly affected by the prescription opioid epidemic. Moreover, although many prisons provide some form of substance use disorder and mental health treatment, their impact on postrelease OODs has not been well studied. In addition, information about other risk factors of OOD, including demographics, previous prison sentences, drug-related convictions, and mental health problems, will help improve prevention measures for former inmates by targeting high-risk groups with tailored interventions. Hence, in this study, we (1) examined OOD rates among former NC inmates from 2000 to 2015, (2) compared these rates with those of the NC resident population, and (3) evaluated the association of demographic risk factors and in-prison substance abuse and mental health treatment among former inmates with OOD risk after release.

METHODS

We conducted a retrospective cohort study among former NC inmates who were released between 2000 and 2015 to examine the rate of OOD after release from prison, compare it with the NC general population, and determine the predictors of OOD among former inmates.

Data Sources

We linked 2 secondary data sources—(1) prison release data from the NC Department of Public Safety from January 1, 2000, to December 31, 2015, and (2) NC death records from the NC Division of Public Health from January 1, 2000, to December 31, 2016, by using Soundex codes for last and first names, date of birth, and sex. The NC Department of Public Safety data included personal identifiers such as names, date of birth, sex, race, and ethnicity, along with all dates of prison entry and exit, number of previous incarcerations, cause for incarceration, and participation in mental health and substance abuse treatment programs. The NC death records are publicly available data and include names, date of birth, sex, race, ethnicity, date of death, and cause of death determined by *International Classification of Diseases, 10th Revision* (*ICD-10*; Geneva, Switzerland: World Health Organization; 1992) codes for all NC resident deaths occurring in NC. In addition, we used bridged-race population estimates, 2000 to 2015, from the National Vital Statistics System (managed by the Centers for Disease Control and Prevention) to obtain annual population estimates for NC.

Participants

Figure 1 shows eligible individuals and their person-time accrual. We followed individuals released from a NC prison during the study period until death (person [P]1), reincarceration (P3), or the end of 2016 (P2, P6). We excluded individuals who remained in prison throughout the study period (P5), died before release (P8: in-prison death), or died on the day of release (P10: in-prison death). We excluded time spent in prison for individuals with multiple incarcerations (P3, P4, P7, and P9). For the general population, each NC resident contributed 1 person-year (PY) per calendar year. Between 2000 and 2015, 229 274 NC resident inmates were released from NC prisons. These former inmates accrued 1 975 274 PYs following prison release between 2000 and 2016. During this time, 15 104 died. We excluded all deaths assumed to be in-prison. This included 59 deaths that occurred 1 to 8 days before release and further 959 deaths (including 4 overdose deaths) with date of deaths the same as the day of release (inmates who die in prison are discharged from prison on their day of death). Of the remaining 14 086 out-of-prison deaths, 1329 deaths (9.4%) were OOD (Figure A, available as a supplement to the online version of this article at http://www.ajph.org).

Outcomes

We defined an OOD as any death associated with an *ICD-10* code of T40.0 (opium), T40.1 (heroin), T40.2 (other opioids, commonly prescribed opioids), T40.3 (methadone), and T40.4 (other synthetic narcotics, commonly fentanyl or its analogs). We created binary outcome variables for overdose deaths from all opioids combined and for specific opioids (i.e., heroin, methadone, prescription opioids, and other synthetic narcotics).

Covariates

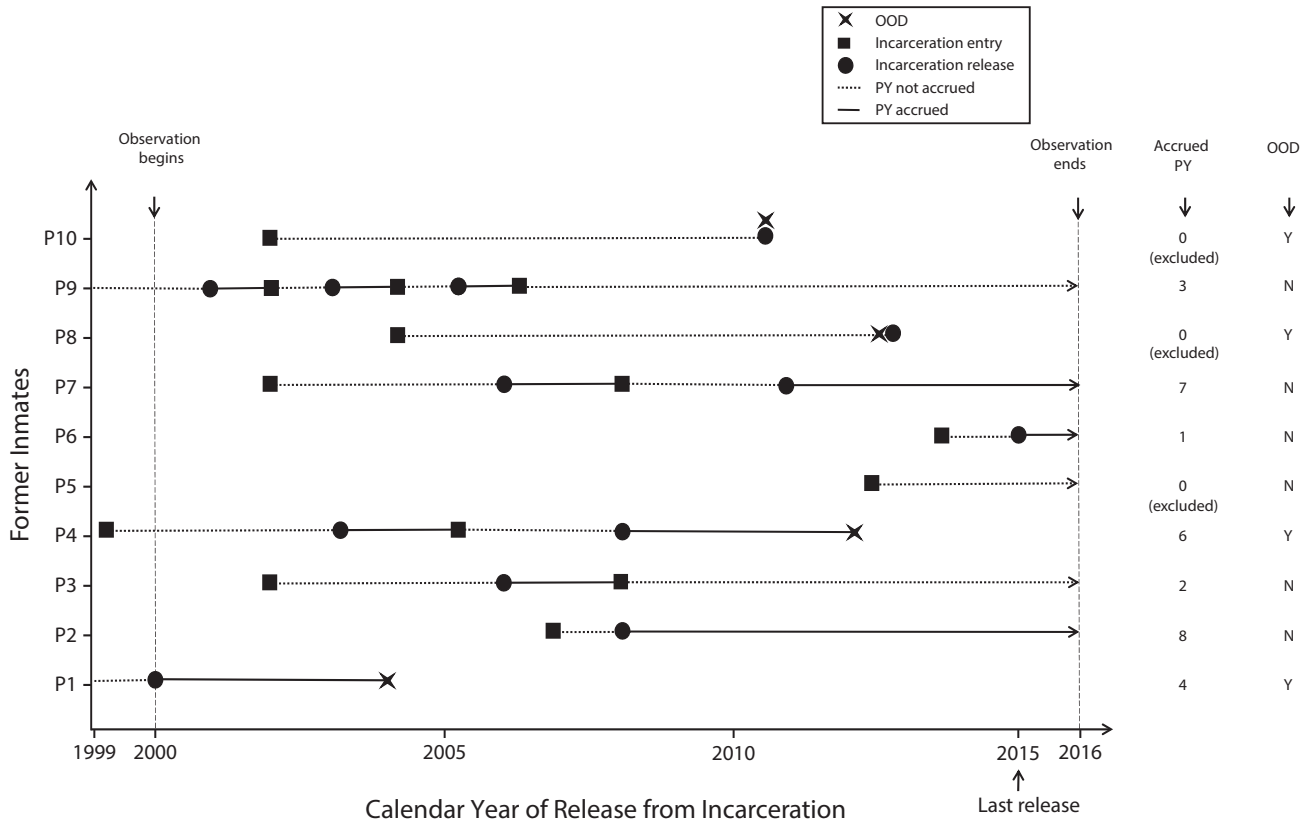
We considered several predictors of OODs among former inmates including age (18–25, 26–50, and ≥ 51 years), sex (female or male), race (White or non-White), in-prison mental health treatment (received or not received), in-prison substance abuse treatment (none, education, short- to intermediate-term treatment, or intermediate- to long-term treatment [as defined by the NC Department of Public Safety]), number of previous incarcerations (none, 1–2, or > 2), and drug conviction as a cause of incarceration (yes or no). Drug conviction was determined according to the reason for incarceration codes provided by the Department of Public Safety, including use, possession, selling, trafficking, manufacturing, defrauding tests, and mixing (with food) of controlled substances.

Statistical Analysis

We calculated annual OOD rates for former inmates by dividing the number of OODs to the PY contributed at 2-weeks, 1-year, and complete follow-up after prison release. We calculated OOD rates for NC residents by dividing OODs among NC residents to the resident population in each year.

We calculated standardized mortality ratios (SMRs) and 95% confidence intervals (CIs) to compare the OOD rates between former NC inmates and the general NC population using indirect standardization by age, sex, race, and calendar year of prison release.[11–13,19] We further calculated SMRs and 95% CIs to compare heroin overdose rates, methadone overdose rates, prescription opioid overdose rates, and other synthetic narcotic overdose rates among former inmates to NC residents. We report SMRs at 2-weeks, 1-year, and complete follow-up comparing overdose deaths rates among former NC inmates to NC residents. Complete follow-up indicates follow-up through the end of the study, reentry to prison, or death, whichever occurs first.

We evaluated the association of age, sex, race, number of previous incarcerations, drug convictions, and in-prison mental health and



Note. OOD = opioid overdose death; P = person; PY = person-years.

FIGURE 1—Eligibility and Person-Time Accrual of North Carolina Former Inmates: 2000–2015

substance abuse treatment with time to OOD among former inmates by using Cox proportional hazards regression, while also accounting for competing risks from death attributable to other causes of death and reincarceration. We adjusted the models for measured covariates identified by using directed acyclic graphs. We report unadjusted and adjusted hazard ratios (AHRs) for time to OOD at 2-weeks, 1-year, and complete follow-up after release.

RESULTS

Of the 229 274 NC resident inmates who were released from NC prisons between 2000 and 2015, 38% reentered the prison system and were released more than once (range = 2–31) for a total of 387 913 releases during the 16-year time period. The median age was 34 years (range = 18–92), 86% were men, 60% were non-White, 50% had no previous incarcerations before the current release, and 23% had been incarcerated on a drug-related charge (Table A, available as a supplement to the online version of this article at http://www.ajph.org). Of the released inmates, a small proportion (12%) received in-prison mental health treatment, and more than two thirds received some form of in-prison substance abuse treatment (Table A).

The OOD rates among former inmates were highest in the first 2 weeks following release from prison. Two-weeks postrelease OOD rates attributable to all opioids, heroin, prescription opioids, and methadone were 3 to 4 times higher than 1-year postrelease rates, and about 5 times higher than complete follow-up postrelease rates (Table 1). However, OOD rates attributable to other synthetic narcotics such as fentanyl were similar at 2-weeks, 1-year, and complete follow-up after release. Compared with NC residents, former inmates were 40 times (95% CI = 30, 51), 11 times (95% CI = 9.5, 12), and 8.3 times (95% CI = 7.8, 8.7) more likely to die from opioid overdose by 2-weeks, 1-year, and complete follow-up after release from prison, respectively. During the 16-year study period, the age-, sex-, race-, and calendar year–adjusted OOD rate among former NC inmates increased from 54 per 100 000 PY (95% CI = 22, 86) in the year following release in 2000 to 179 per 100 000 PY (95% CI = 125, 233) in the year following release in 2015. The adjusted OOD rate among NC residents ranged from 4.2 per 100 000 PY in 2000 to 13.6 per 100 000 PY in 2015 (Figure 2). The SMR comparing OOD rates between former inmates and NC residents increased from 2000 to 2015 (Figure 2).

When we examined by the type of opioid involved in the overdose, former inmates were 74 times, 18 times, and 14 times more likely to die from heroin overdose at 2-weeks, 1-year, and complete follow-up after release from prison, respectively (Table 1). Similarly, the standardized death rates attributable to prescription opioid, methadone, and synthetic narcotic overdose were very high

TABLE 1—Adjusted Postrelease Opioid Overdose Death Rates and Standardized Mortality Ratios Comparing Former North Carolina (NC) Inmates With NC Residents: 2000–2015

Overdoses and Time Since Release	Adjusted Rate[a]		Deaths Among Former Inmates, No.		SMR (95% CI)[b]
	Population	Former Inmates	Observed	Expected	
All opioids					
2 wk	9.3	376.3	54[c]	1.3	40.5 (29.7, 51.3)
1 y	9.3	98.5	339[d]	32.0	10.6 (9.5, 11.7)
Complete follow-up	9.3	76.7	1329[e]	160.9	8.3 (7.8, 8.7)
Heroin					
2 wk	1.4	102.5	21	0.28	74.4 (42.6, 106.3)
1 y	1.4	24.4	119	6.7	17.7 (14.6, 20.9)
Complete follow-up	1.4	19.7	407	28.5	14.3 (12.9, 15.7)
Methadone					
2 wk	2.9	96.8	14	0.42	33.5 (15.9, 51.0)
1 y	2.9	27.6	96	10.1	9.5 (7.6, 11.5)
Complete follow-up	2.9	17.4	348	57.7	6.0 (5.4, 6.7)
Other opioids (commonly prescribed)					
2 wk	4.2	150.8	19	0.53	35.9 (19.8, 52.1)
1 y	4.2	34.3	104	12.7	8.2 (6.6, 9.8)
Complete follow-up	4.2	30.7	457	62.5	7.3 (6.6, 8.0)
Other synthetic narcotics (e.g., fentanyl)					
2 wk	1.7	21.4	3	0.24	12.4 (0, 26.5)
1 y	1.7	20.3	68	5.8	11.8 (9.0, 14.6)
Complete follow-up	1.7	20.5	314	26.3	11.9 (10.6, 13.2)

Note. CI = confidence interval; NC = North Carolina; SMR = standardized mortality ratio.

[a]Rate per 100 000 person-years adjusted for age, sex, race, and calendar year of prison release.

[b]Calculated using indirect standardization for age, sex, race, and calendar year of prison release.

[c]The sum of opioid-specific overdose deaths (n = 57) exceeds the total opioid overdose deaths (OOD; n = 54) because there were 3 deaths with multiple opioids involved.

[d]The sum of opioid-specific overdose deaths (n = 387) exceeds the total OOD (n = 339) because there were 48 deaths with multiple opioids involved.

[e]The sum of opioid-specific overdose deaths (n = 1526) exceeds the total OOD (n = 1329) because there were 198 deaths with multiple opioids involved.

among former inmates compared with NC residents (Table 1).

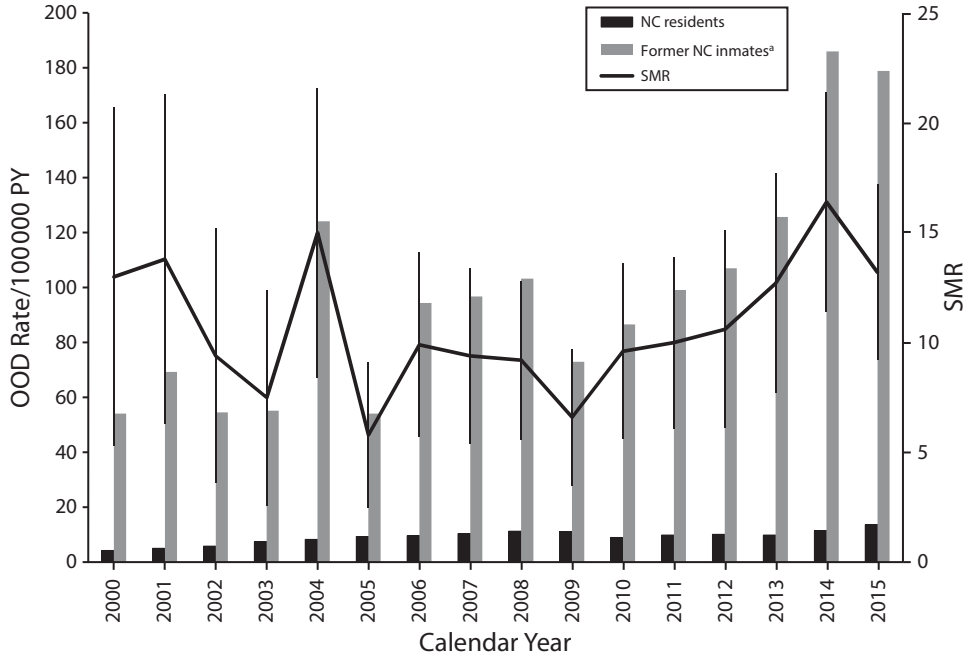
Former inmates who received in-prison mental health treatment had about twice the risk of OOD over the study period as those who did not receive mental health treatment (AHR = 1.9; 95% CI = 1.7, 2.2; Table 2). Receiving in-prison intermediate to long-term substance abuse treatment was associated with a slight increase in OOD over the complete follow-up after release (AHR = 1.2; 95% CI = 1.0, 1.4). The adjusted OOD risk within the first 2 weeks after release among those aged 26 years or older was 7 to 9 times that of those aged 18 to 25 years. However, AHRs declined with follow-up, such that there was little, if any, difference in complete follow-up OOD risk between these inmate age groups. The AHR comparing OOD risk between men and women suggested increased risk for men in the first 2 weeks, but no difference over the complete follow-up. Former inmates with more than 2 previous incarcerations had a consistently higher risk of opioid overdose mortality compared with former inmates with no previous incarcerations before their current release. Incarceration because of drug-related conviction was also associated with consistently higher OOD risk as compared with other causes of incarceration. Race was most strongly associated with OOD risk. The adjusted OOD risk among White former inmates was 6 times the risk among non-Whites 2 weeks after release, and increased up to 11.3 times for the complete follow-up after release (Table 2).

DISCUSSION

This is the largest study of former inmates in the United States to date with the longest follow-up period and the first to include data beyond 2010. We found that opioid overdose mortality increased among former NC inmates from 2000 to 2015, and the increase was more pronounced than in the NC general population. In the first year after release, former inmates had almost 11 times the risk of OOD than did the general population, and this risk was highest in the first 2 weeks after release. Inclusion of data beyond 2010 allowed us to examine the impact of the changing opioid epidemic, from prescription to illicit opioids, on the former inmate population in NC. Specifically, 2-weeks postrelease heroin overdose mortality risk among former NC inmates was 74 times that in the general NC population.

Other researchers have also found high OOD rates among former inmates, along with increased risk in the first 2 weeks after release.[9,11–19] However, they could not capture the impact of the recent heroin and synthetic narcotic epidemics.[1,2] The high OOD rates among former inmates may be attributable to decreased tolerance as a result of incarceration-induced drug use abstinence.[9,23–25] Depending on the length of incarceration, the potency of opioids may have changed while these individuals were incarcerated[26] which may catch them unaware upon first use after release. This may be driven by the increase in the availability of heroin, heroin mixed with fentanyl, and counterfeit prescription pills containing fentanyl and other synthetic opioids.[26,27] Acknowledging these threats and the enormous prevalence of substance use disorders among inmates,[5–10] many prison systems have instituted in-prison substance abuse treatment programs to help inmates.

In NC, upon prison entry, all inmates take a Substance Abuse Subtle Screening Inventory (SASSI). The SASSI score determines the severity of drug use disorder and allows Department of Public Safety to provide the most rigorous in-prison substance abuse treatment to those with greatest risk. In our study, receiving in-prison substance abuse treatment was associated with very little to no increase in OOD risk as compared with not receiving treatment. This suggests that the



Note. CI = confidence interval; OOD = opioid overdose death; PY = person-years; SMR = standardized mortality ratio. Vertical lines represent 95% CIs for SMRs.
[a]Standardized rate.

FIGURE 2—Annual Opioid Overdose Death Rates Among North Carolina (NC) Residents and Former NC Inmates Along With Standardized Mortality Ratios: 2000–2015

treatment may be beneficial to high-risk individuals in that their posttreatment OOD risk is very similar to the low substance abuse risk (no treatment) group. Regardless, the overall OOD risk among former inmates is very high compared with the general population,[9,11–19] suggesting a need for additional measures to prevent OOD among former inmates.

Although most in-prison treatment is limited to individual and group counseling, many other prevention strategies specific to opioids are not used in prison. Two key strategies to prevent deaths are widespread adoption of medication-assisted treatment and overdose education with naloxone distribution.[28] Sustained medication-assisted treatment, with either buprenorphine or methadone, has been promoted and recommended by the Office of National Drug Control Policy,[29] the President's Commission on Combating Drug Addiction and the Opioid Crisis,[30] and the World Health Organization.[31] Yet a lingering stigma surrounding these modalities limits their use to around 40 of the 5000 local, state, and federal correctional facilities in the United States.[28,32,33] Similarly, overdose education with naloxone distribution programs are also rare in prison systems even as the President's Commission on Combating Drug Addiction and the Opioid Crisis highlights it as a part of overall harm reduction efforts.[28,30] In NC, these efforts are currently spearheaded by the NC Harm Reduction Coalition, the largest such not-for-profit statewide program in the United States.

There may be other psychosocial causes for OOD among former inmates as indicated by the high OOD risk among those receiving in-prison mental health treatment, those with more than 2 previous incarcerations, and those convicted on drug-related charges as seen in this study. It is well documented that former inmates have difficulty in obtaining societal privileges including housing and food subsidies and are discriminated against for jobs.[4] There is also evidence that incarceration leads to poor mental health outcomes.[34] In the absence of Affordable Care Act–related Medicaid expansion in NC, former inmates also lack needed health care access. The loss of dignity, being judged even after release, discrimination, and lack of health care may worsen mental health outcomes and serve as an impetus for substance use. Overall, imprisonment for individuals with substance use disorder may be more harmful than helpful.

Our findings should be interpreted in the context of several limitations. First, we did not have any data regarding the quality, dosage, or compliance with in-prison mental health or substance abuse treatment among former inmates. It is possible that these variables are better predictors of OOD risk than our binary treatment variables. Similarly, information was not available on factors such as history and severity of substance use disorders, mental health conditions, or medical history, all of which may potentially predict both OOD and in-prison treatment. Second, some opioids involved in overdose deaths may not have been specifically tested for in toxicology panels, leading to undercounting of specific opioid-related OODs (e.g., fentanyl analogs). Third, we excluded

TABLE 2—Inmate Characteristics Associated With 2-Week, 1-Year, and Complete Follow-Up Opioid Overdose Death (OOD) Risk Among Former North Carolina Inmates: 2000–2015

	2-Week OOD Risk		1-Year OOD Risk		Complete Follow-Up OOD Risk	
Predictors	HR (95% CI)	AHR (95% CI)	HR (95% CI)	AHR (95% CI)	HR (95% CI)	AHR (95% CI)
Age, y[a]						
18–25 (Ref)	1	1	1	1	1	1
26–50	7.6 (1.9, 31.0)	7.0 (1.7, 28.8)	2.5 (1.8, 3.6)	2.2 (1.6, 3.2)	1.6 (1.4, 1.9)	1.5 (1.3, 1.7)
≥ 51	9.9 (2.0, 48.9)	8.7 (1.8, 42.5)	2.3 (1.4, 3.8)	2.0 (1.2, 3.3)	1.1 (0.88, 1.5)	1.0 (0.78, 1.3)
Sex[b]						
Female (Ref)	1	1	1	1	1	1
Male	1.7 (0.62, 4.7)	2.4 (0.88, 6.7)	0.81 (0.60, 1.1)	1.2 (0.87, 1.6)	0.69 (0.60, 0.79)	0.96 (0.84, 1.1)
Race[c]						
Non-White (Ref)	1	1	1	1	1	1
White	6.1 (3.1, 11.7)	6.1 (3.1, 11.7)	9.0 (6.7, 12.1)	8.8 (6.5, 11.9)	11.4 (9.7, 13.4)	11.3 (9.6, 13.3)
Previous incarcerations[d]						
0 (Ref)	1	1	1	1	1	1
1 or 2	1.4 (0.72, 2.8)	1.3 (0.63, 2.5)	1.3 (0.99, 1.6)	1.3 (0.98, 1.6)	1.0 (0.88, 1.1)	1.1 (0.95, 1.2)
> 2	2.5 (1.3, 4.9)	2.1 (1.1, 4.2)	1.5 (1.2, 2.0)	1.7 (1.3, 2.2)	1.3 (1.1, 1.5)	1.6 (1.4, 1.8)
Drug-related conviction[e]						
No (Ref)	1	1	1	1	1	1
Yes	1.4 (0.75, 2.5)	2.0 (1.1, 3.7)	1.0 (0.81, 1.3)	1.5 (1.2, 1.9)	1.1 (0.93, 1.2)	1.5 (1.4, 1.8)
In-prison mental health treatment[f]						
Not received (Ref)	1	1	1	1	1	1
Received	1.9 (0.97, 3.6)	1.7 (0.85, 3.3)	2.8 (2.2, 3.5)	2.2 (1.7, 2.9)	2.5 (2.2, 2.8)	1.9 (1.7, 2.2)
In-prison substance abuse treatment[f]						
None (Ref)	1	1	1	1t	1	1
Education	0.61 (0.24, 1.5)	0.57 (0.22, 1.4)	0.78 (0.53, 1.1)	0.73 (0.50, 1.1)	1.0 (0.87, 1.3)	0.93 (0.77, 1.1)
Short-term to intermediate	0.92 (0.48, 1.8)	0.73 (0.38, 1.4)	1.4 (1.1, 1.9)	1.1 (0.84, 1.5)	1.5 (1.3, 1.7)	1.1 (0.95, 1.3)
Intermediate to long-term	1.3 (0.65, 2.7)	1.1 (0.53, 2.3)	1.6 (1.2, 2.2)	1.2 (0.87, 1.6)	1.8 (1.6, 2.1)	1.2 (1.0, 1.4)

Note. AHR = adjusted hazard ratio; CI = confidence interval; HR = hazard ratio; NC = North Carolina.
[a]Adjusted for sex and race.
[b]Adjusted for age and race.
[c]Adjusted for age and sex.
[d]Adjusted for age, sex, and race.
[e]Adjusted for age, sex, race, and number of previous incarcerations.
[f]Adjusted for age, sex, race, number of previous incarcerations, and drug conviction.

4 OODs with date of deaths the same as the day of release because we considered them in-prison deaths. But, it is likely that 1 or more of these OODs occurred after release. However, even if we considered that all 4 OODs were out-of-prison deaths, the SMRs would only increase nominally (first or second decimal place), and there will be no substantive difference in the interpretation. Finally, because our study focused on former NC inmates, it may not be generalizable to other US states. Despite these limitations, the strength of our findings and consistency with previous literature suggest that current policies and interventions for preventing OOD among former inmates are not effective.

Society incarcerates individuals to punish them for unacceptable behaviors and criminal activities but does very little to rehabilitate them back into the society upon release from incarceration. On the contrary, former inmates may face discrimination and loss of dignity upon release into the society. And even as the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition,* criteria identify substance use disorders as mental health issues,[35] we continue to incarcerate those with substance use disorders. The impact of these discordant approaches goes beyond the formerly incarcerated, to their families, communities, and the whole society.[4] Just as it is important to target high-risk populations in infectious disease epidemics, our society must find additional ways to prevent opioid-related morbidity and mortality among former inmates. Doing so will not only allow us to treat formerly incarcerated individuals fairly, but may also be vital to combat the larger opioid epidemic in the United States.

CONTRIBUTORS

M. E. Shanahan, S. K. Proescholdbell, and S. W. Marshall secured the funding. S. I. Ranapurwala, M.E. Shanahan, and R. B. Naumann conceptualized and designed the study. S. I. Ranapurwala, M. E. Shanahan, S. K. Proescholdbell, R. B. Naumann, and D. Edwards Jr acquired the data. S. I. Ranapurwala and A. A. Alexandridis carried out data linkage. S. I. Ranapurwala carried out the analyses and drafted the initial article along with M. E. Shanahan and A. A. Alexandridis. All authors helped interpret the results and in writing and critically reviewing the article and approved the final article draft.

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Note. The findings and conclusions in this article are those of the author(s) and do not necessarily represent the views of the Centers for Disease Control and Prevention, NC Division of Public Health, or the NC Department of Public Safety.

HUMAN PARTICIPANT PROTECTION

This study was reviewed and approved by institutional review boards at the North Carolina Department of Public Safety and The University of North Carolina at Chapel Hill.

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