Postrelease mortality among persons hospitalized during their incarceration

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ABSTRACT

Purpose: Health and mortality of people released from incarceration have received increased attention, and yet little is known about the postrelease experiences of those hospitalized during incarceration.
Methods: For persons incarcerated and released from the North Carolina (NC) state prison system between January 1, 2008, and June 30, 2015, we examined postrelease mortality from 2008 to 2016 by history of prison hospitalization.
Results: Among 111,479 released persons, 0.9% ($n = 1010$) were hospitalized during their incarceration, and of those, 10.5% ($n = 106$) died during follow-up compared with 3.2% (3511/110,469) of other released persons. Those hospitalized in prison had a higher postrelease death rate (adjusted hazard ratio: 2.44), a lower 8-year conditional probability of survival (0.80 vs. 0.94), and were more likely to die from chronic causes (79.2% vs. 51.0%) than other released persons. The postrelease standardized mortality rate among men hospitalized in prison was 3.1 times higher than that of those not hospitalized and 7.1 times the rate of all NC men.
Conclusions: People hospitalized during incarceration constitute a particularly vulnerable, yet relatively easily identifiable priority population to focus health interventions supporting continuity of care after prison release. Yet such efforts may be particularly challenging in NC and other Medicaid non-expansion states.

Introduction

Over the past four decades, the U.S. prison population has grown to become the largest in the world [1]. The age distribution of the prison population has also increased over time; between 1993 and 2013, the proportion of imprisoned persons aged 55 years or older increased from 3% to 10% [2]. Incarcerated persons often have long histories of behavioral risk factors [3] that lead to poor health outcomes and limited medical care access and use in the communities from which they came [4]. In the context of these

demographic, behavioral, and access-to-care factors, it is unsurprising that correctional populations have a heavy burden of disease. According to the most recent national data, 41% of people incarcerated in a state or federal prison reported having a chronic medical condition [5], and among those aged 50 years or older, 72% had a chronic condition [5].

U.S. prison systems have a court-affirmed obligation to provide health care to their correctional populations [6]. In general, state prison systems are required to provide at least basic health care within their facilities. But more specialized care or care for high acuity patients may necessitate the use of offsite care, including inpatient stays in community hospitals [7]. At the same time, prison systems' use of community hospitalization may be more expensive than onsite care and represent a substantial proportion of their health care budgets. Existing data from state prisons suggest that community hospitalization consumes at least 20% of their health care spending [8]. Beyond the direct health care costs, community hospitalization includes costs of staffing correctional officers to

guard patients for the duration of their hospitalization. In this context, prison systems have a financial incentive to reserve community hospitalization for their highest acuity patients who cannot be cared for adequately onsite. In, to our knowledge, the only published study examining acuity of people who had a community hospitalization during their incarceration, Schneider et al. found that 94% of community hospitalizations used by the Texas prison system were judged "essential to life and health" (69%) or "medically necessary" (25%), reflecting the high level of medical care needed among this population [9].

Although the U.S. prison population has grown and "aged" over the past 4 decades, most incarcerated persons are released back to the community within a few years [2]. Many are without health care coverage upon release—even in Medicaid expansion states——and the transition back to the community can incur increased risk for health problems and for death.

There is a growing body of research to understand mortality risk after prison release. Much of this work has appropriately focused on fatal drug overdose, which is markedly high among people returning from corrections [10—14]. Yet comparatively few studies have examined the mortality outcomes among people with other serious health care needs, including those whose needs were of sufficient acuity to prompt a community hospitalization during their incarceration.

Given high levels of medical acuity among patients who experience community hospitalizations, the substantial cost of these hospitalizations to prison systems, and the difficulty that these formerly incarcerated persons likely experience using health care after their release, we sought to examine mortality among people who experienced a community hospitalization during their incarceration and were subsequently released. We conducted this analysis in the setting of a southern Medicaid nonexpansion state, in which routine access to care after prison release may have been particularly challenging.

Methods

This project was approved by the University of North Carolina at Chapel Hill Institutional Review Board and by the review board of the North Carolina (NC) state prison system.

Setting

The NC state prison system is the 12th largest state U.S. prison system [15], consisting of 55 prisons with a daily average population of about 35,000 incarcerated persons and approximately 23,000 entries and exits each year. The prison system operates its own medical system, including a centrally located 120-inpatient bed medical center. For our purposes, hospitalization refers to inpatient stays at community hospitals, which are independent of the prison system. Authorization of these hospitalizations are provided by the prison systems' Health Services Utilization Management Section, which determines—based on medical necessity, appropriate level of care, appropriate setting, and other factors—whether an incarcerated person requires a community hospitalization.

Data sources

We received individual-level records from the prison system for all people aged 18 years or older who entered prison anytime from 2008 to 2014. Records included identifiers (names and date of birth and social security number [SSN]), demographic characteristics (sex, race, and ethnicity), dates of entry and exit, and indicators for the setting and dates of any health care provided outside of the

prison system. We classified as community inpatient hospitalizations the delivery of health care at a community hospital in which the length of care spanned more than one calendar day. We created a dichotomous variable to represent any versus no community inpatient hospitalizations during imprisonment. We also received an additional data set from the prison system, allowing us to identify reincarcerations through 2016.

We received individual-level death records from the NC State Center for Health Statistics for the years 2008—2016. Records included names, dates of birth, SSN, and the International Classification of Disease version 10 code indicating primary cause of death (COD). To facilitate analysis, we used the Agency for HealthCare Research and Quality's Clinical Classification Software (CCS) to collapse the International Classification of Disease COD codes into 12 main categories and 18 subcategories. We created an additional category for "chronic" conditions, which included all causes of death except for causes classified as "external" (e.g., homicides, poisonings, and motor vehicle accidents) and self-harm codes listed under the category "mental health."

We conducted record linkage using SAS version 9.4 and the Link King software version 9.0, which integrates deterministic matching algorithms with probabilistic matching routines. We used names, dates of birth, and SSN to match death and prisoner records. As a conservative approach, we only accepted as true matches record pairs classified as Level 1 Certainty ("definite match") by the linking software [16]. We then removed all personal identifiers to create our analytic data set. We also excluded 173 people (0.2%) with a date of death before prison exit.

Analysis

We designated the first incarceration as our index incarceration, for which we based our analyses. Among index incarcerations, we examined the distribution of demographic and incarceration characteristics among people incarcerated and released from the prison system anytime between January 1, 2008, and June 30, 2015. We estimated the rate of community hospitalization during the index incarceration estimating incarceration follow-up as number of days between prison entry and release, and we compared the characteristics of people experiencing any of these hospitalizations with the characteristics of those who did not. For the entire population and stratified by hospitalization history, we examined the distribution of primary CODs. We calculated postrelease follow-up time as the number of days between release from the index incarceration and whichever occurred first: death, another incarceration or December 31, 2016. Using this follow-up time, we examined crude rates for each COD category and subcategory, stratified by hospitalization status. Using the demographic composition of the NC resident population, we estimated standardized all-cause mortality rates by prison hospitalization history. We limited this analysis to the 99.9% of people aged 69 years or younger in our study population. Standardization was conducted accounting for age group (18—29, 30—39, …, 60—69 years), sex (male and female), and race (White, Black, and Other).

We used Kaplan—Meier failure curves to examine the postrelease distribution of time until death or censoring for all released persons and stratified by hospitalization history. We also developed Cox proportional hazard models to examine the relationship between a history of prison hospitalization and postrelease all-cause mortality. To adjust for measured confounding, our model included the independent variables age, gender, race, and year of prison release.

Results

During the study period, 111,479 unique individuals were released from the prison system, with an aggregate follow-up time of 471,282 person-years. Among our study population, 0.9% ($n = 1010$) had a community hospitalization during their first incarceration (Table 1), and the rate of hospitalization was 13.9 per 1000. Compared with formerly incarcerated persons without a hospitalization, those with hospitalizations were significantly more likely to be White, female, released later in the study period, older, have served longer sentences, and were more likely to have been convicted of a sex-related offense or "other" type of offense, which excluded those for violence, property, or drug use (Table 1).

Among all people released from prison, 3.2% ($n = 3617$) died during follow-up, resulting in a crude mortality rate of 767.5 per 100,000. Among those with a history of hospitalization, 10.5% ($n = 106$) died, for a crude mortality rate of 2635.5 deaths per 100,000. Among people with a history of prison hospitalization, the most common major categories of death were circulatory conditions (23.6%), including heart disease (18.9%), external causes (19.8%) including poisonings (15.1%), and neoplasms (17.0%; Table 2). Overall, 79% of deaths among previously incarcerated hospitalized persons were from chronic causes. In contrast, among formerly incarcerated persons without prison hospitalization, 3.2% died, resulting in a crude mortality rate of 751.4 per 100,000. The most common causes of death among nonhospitalized persons included external causes (44.6%), including poisonings (19.1%),

Table 1
Characteristics of adults released from the North Carolina state prison system from 2008 to 2015, by hospitalization status during incarceration

	Total		Hospitalized during incarceration[*]				P[†]
			Yes		No		
	n	%	n	%	n	%	
Total	111,479	—	1010	—	110,469	—	
Race							<.0001
Black, non-Hispanic	56,155	50.4	442	43.7	55,713	50.4	
White, non-Hispanic	46,618	41.8	503	49.8	46,115	41.7	
Other, unknown non-Hispanic	2968	2.7	35	3.5	2933	2.7	
Hispanic	5738	5.1	30	3.0	5708	5.2	
Gender							<.0001
Female	15,112	13.6	334	33.1	14,778	13.4	
Male	96,367	86.4	676	66.9	95,691	86.6	
Prison entry (y)							<.0001
2008	26,108	23.4	302	29.9	25,806	23.4	<.0001
2009	23,601	21.2	198	19.6	23,403	21.2	<.0001
2010	19,885	17.8	172	17.0	19,713	17.8	<.0001
2011	17,188	15.4	157	15.6	17,031	15.4	<.0001
2012	10,187	9.2	83	8.2	10,104	9.2	<.0001
2013	8370	7.5	65	6.4	8305	7.5	<.0001
2014	6140	5.5	33	3.3	6107	5.5	<.0001
Prison exit (y)							<.0001
2008	12,163	10.9	84	8.3	12,079	10.9	<.0001
2009	21,283	19.1	141	14.0	21,142	19.2	<.0001
2010	20,277	18.2	162	16.0	20,115	18.2	<.0001
2011	19,073	17.1	172	17.0	18,901	17.1	<.0001
2012	13,546	12.2	138	13.7	13,408	12.1	<.0001
2013	10,915	9.8	122	12.1	10,793	9.8	<.0001
2014	10,285	9.2	143	14.2	10,142	9.2	<.0001
2015	3937	3.5	48	4.7	3889	3.5	<.0001
Age at entry (y)							<.0001
18−24	28,907	25.9	154	15.3	28,753	26.0	
25−30	24,009	21.5	154	15.3	23,855	21.6	
31−40	29,514	26.5	225	22.3	29,289	26.5	
41−87	29,049	26.1	477	47.2	28,572	25.9	
Age at exit (y)							<.0001
18−24	25,508	22.9	117	11.6	25,391	23.0	
25−30	24,459	21.9	157	15.5	24,302	22.0	
31−40	30,373	27.3	222	22.0	30,151	27.3	
41−88	31,139	27.9	514	50.9	30,625	27.7	
Sentence length (mo)[‡]							<.0001
Quartile (q) 1 (0−5 mo)	26,369	23.7	104	10.3	26,265	23.8	
q2 (6−10)	27,955	25.1	212	21.0	27,743	25.1	
q3 (11−21)	28,924	25.9	233	23.1	28,691	26.0	
q4 (22−12,258)	28,219	25.3	461	45.6	27,758	25.1	
Crime category[§]							<.0001
Violent	19,089	17.2	172	17.1	18,917	17.2	
Sex	3864	3.5	60	5.9	3804	3.4	
Property	26,891	24.2	172	17.1	26,719	24.3	
Drugs/alcohol	40,602	36.5	374	37.1	40,228	36.5	
Other types of crimes	20,718	18.6	231	22.9	20,487	18.6	

[*] Defined as any external health care admissions with service length spanning at least two consecutive days.
[†] Comparing row percentages (χ^2 probability of general association; df = rows − 1).
[‡] Excludes 12 prisoners without a sentence length.
[§] Excludes 315 prisoners without a crime category code.

Table 2

Caption: all-cause and cause-specific mortalities among adults released from the North Carolina prison system from 2008 to 2015, by incarceration hospitalization status (n = 111,479)

	All			Hospitalized during incarceration			Not hospitalized during incarceration		
	n	%	Rate[*,†]	n	%	Rate[*,†]	n	%	Rate[*,†]
All	3617	100.0	767.5	106	100.0	2635.5	3511	100.0	751.4
Chronic diseases[‡]	1875	51.8	397.9	84	79.2	2088.5	1791	51.0	383.3
Infectious and parasitic diseases	173	4.8	36.7	5	4.7	124.3	168	4.8	36.0
HIV infection	67	1.9	14.2	3	2.8	74.6	64	1.8	13.7
Hepatitis	57	1.6	12.1	2	1.9	49.7	55	1.6	11.8
Hepatitis C	48	1.3	10.2	1	0.9	24.9	47	1.3	10.1
Neoplasms	474	13.1	100.6	18	17.0	447.5	456	13.0	97.6
Colorectal cancer	38	1.1	8.1	0	0.0	—	38	1.1	8.1
Cancer of bronchus, lung	146	4.0	31.0	6	5.7	149.2	140	4.0	30.0
Endocrine, nutritional, and metabolic diseases and immunity disorders	105	2.9	22.3	5	4.7	124.3	100	2.8	21.4
Diabetes mellitus	70	1.9	14.9	5	4.7	124.3	65	1.9	13.9
Diseases of the blood and blood-forming organs	14	0.4	3.0	2	1.9	49.7	12	0.3	2.6
Mental illness	359	9.9	76.2	10	9.4	248.6	349	9.9	74.7
Alcohol and substance-related disorders	172	4.8	36.5	6	5.7	149.2	166	4.7	35.5
Suicide and intentional self-inflicted injury	179	4.9	38.0	3	2.8	74.6	176	5.0	37.7
Diseases of the nervous system and sense organs	47	1.3	10.0	2	1.9	49.7	45	1.3	9.6
Diseases of the circulatory system	566	15.6	120.1	25	23.6	621.6	541	15.4	115.8
Diseases of the heart	392	10.8	83.2	20	18.9	497.3	372	10.6	79.6
Cerebrovascular disease	79	2.2	16.8	5	4.7	124.3	74	2.1	15.8
Diseases of the respiratory system[§]	123	3.4	26.1	7	6.6	174.0	116	3.3	24.8
Chronic obstructive pulmonary disease and bronchiectasis	71	2.0	15.1	5	4.7	124.3	66	1.9	14.1
Asthma	4	0.1	0.8	0	0.0	—	4	0.1	0.9
Diseases of the digestive system	116	3.2	24.6	6	5.7	149.2	110	3.1	23.5
Liver disease	78	2.2	16.6	4	3.8	99.5	74	2.1	15.8
Diseases 10—15	53	1.5	11.2	5	4.7	124.3	48	1.4	10.3
Symptoms, signs, and ill-defined conditions and factors influencing health status	1	0.0	0.2	0	0.0	—	1	0.0	0.2
Residual codes, unclassified, and all external codes[‖]	1586	43.8	336.5	21	19.8	522.1	1565	44.6	334.9
Motor vehicle traffic	325	9.0	69.0	1	0.9	24.9	324	9.2	69.3
Homicide and injury purposely inflicted by other persons ((E960—E969)	395	10.9	83.8	4	3.8	99.5	391	11.1	83.7
Poisoning	688	19.0	146.0	16	15.1	397.8	672	19.1	143.8
Poisoning except suicide and homicide	663	18.3	140.7	14	13.2	348.1	649	18.5	138.9
Opioid poisoning (illicit and prescription)[¶]	460	12.7	97.6	8	7.5	198.9	452	12.9	96.7

[*] Death rate = number of deaths divided by total postrelease survival time per 100,000 person-years.

[†] Total follow-up time (471,282 person-years) and follow-up time among those ever hospitalized (4022 person-years) and not (467,260 person-years).

[‡] Chronic diseases—infectious and parasitic diseases, neoplasms, endocrine; nutritional; and metabolic diseases and immunity disorders, diseases of the blood and blood-forming organs, mental illness (except suicide and intentional self-inflicted injury [662]), diseases of the nervous system and sense organs, diseases of the circulatory system, diseases of the respiratory system, diseases of the digestive system, or CCS diseases categories 10—15 defined as diseases of the genitourinary system [10]; complications of pregnancy, childbirth, and the puerperium [11]; diseases of the skin and subcutaneous tissue [12]; diseases of the musculoskeletal system and connective tissue [13]; congenital anomalies [14]; certain conditions originating in the perinatal period [15].

[§] Includes one prisoner matching via Link King Certainty 1, ever released, but lack a primary COD value (ICD-10 code of J09—"Influenza due to certain identified influenza viruses").

[‖] Includes 16 prisoners matching via Link King Certainty 1, ever released, but lack a primary COD value.

[¶] Opioid poisoning (illicit and prescription)—underlying primary poisoning and secondary contributing opioid CODs.

circulatory problems (15.4%), and neoplasms (13.0%). Overall, 51% among nonhospitalized persons were attributable to chronic health conditions.

The age-, race-, and sex-standardized all-cause mortality rate among hospitalized persons was 2405.0 per 100,000 and among nonhospitalized persons was 1026.2 per 100,000. Among men, the standardized mortality rates among those hospitalized and not hospitalized were 3949 and 1267 per 100,00, whereas among women, they were 930 and 796 per 100,000, respectively.

Examining the Kaplan—Meier failure curves for people released from prison, the probability of death was statistically greater across the study period (log-rank P < .001) for those with a history of hospitalization. Based on the Kaplan—Meier curves, the conditional probability of survival was 0.97 and 0.80 at Years 1 and 8 among those with a history of hospitalization and 0.99 and 0.94 at Years 1 and 8 among those with a history of no hospitalization (Fig. 1).

The unadjusted and adjusted hazard ratios for mortality among those who had been hospitalized during prison compared with other incarcerated persons was 3.54 (95% confidence interval, 2.92—4.29) and 2.44 (95% confidence interval, 2.01—2.96; Table 3).

Discussion

When incarcerated persons are released from prison and return to their communities, they often face an array of economic and social challenges [17]. Those returning citizens who have serious health conditions have the additional burden of accessing and paying for health care [4,18]—and lack of care can result in greater morbidity and mortality. In this study, we examined the postrelease mortality among people who had a community hospitalization during their imprisonment. We found that, compared with other released persons, those hospitalized during incarceration were at elevated risk of death and overwhelmingly died from chronic health conditions.

During incarceration, about 1% of our population experienced a community inpatient hospitalization during incarceration. This percentage is generally aligned with our derived estimate from the
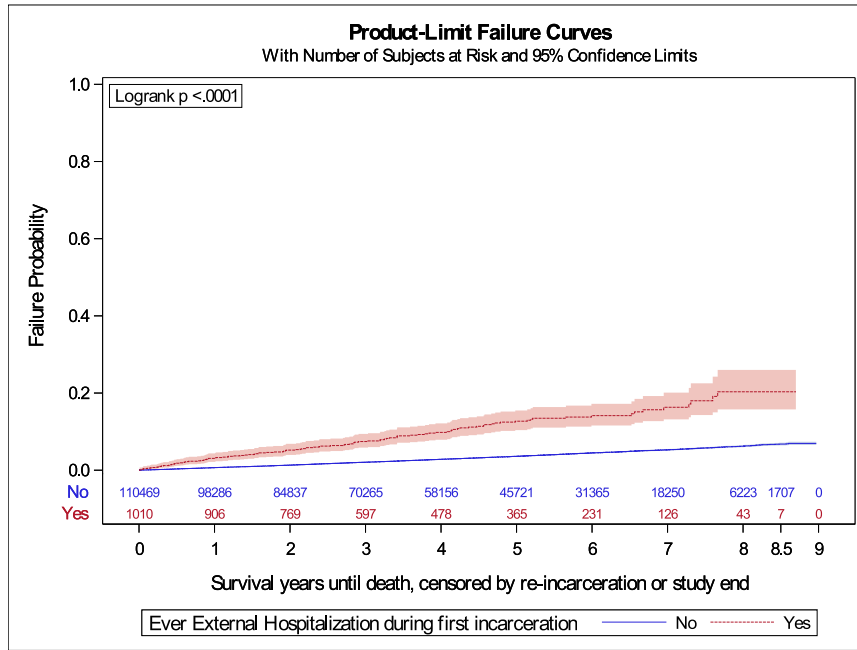
Fig. 1. Product-limit failure curves.
Source: authors' analysis of data from the NC state prison system (2008−2015) and NC State Center for Health Statistics (2008−2016).

Schneider et al.'s study, which analyzed community hospitalization use by the Texas prison system [9]. And yet hospitalization rates among our correctional study population (13.9 per 1000) were about one-sixth to one-eighth the rates among 18- to 64-year-olds in the general U.S. population [19]. The relative rarity of community hospitalizations among our population of incarcerated persons corroborates our supposition that hospitalizations during incarceration were largely reserved for high acuity patients, many of whom would require postrelease health care.

In our study, those with community hospitalizations were older and more likely to be White than other incarcerated persons. These findings are aligned with other studies of correctional populations, reporting that incarcerated Whites tend to have a heavier burden of health care needs than people who identify in other racial groups [20,21]. This dynamic may reflect the overrepresentation of people

of color in the criminal justice setting; in this context, Whites who do become incarcerated may have a particularly high level of sociobehavioral, economic need, which is reflected by their excess health problems. An alternative explanation is that Whites had greater access to health care, similar to patterns seen in the general population. We also found that women were more likely than men to be hospitalized, a result congruent with nationally representative studies finding greater burden of disease among incarcerated women compared with men [22,23].

Overall, more than one in 10 people who were hospitalized during the index incarceration died during the follow-up period, compared with about one in every 31 nonhospitalized persons. After standardizing by age, race, and sex, the mortality rate among those hospitalized was 2.3 times as high as the rate among those not hospitalized and greater than 5 times the mortality rate among

Table 3
Associations between mortality, hospitalization during incarceration, and other characteristics of adult formerly incarcerated persons released from the North Carolina State prison system from 2008 to 2015 (n = 111,479)

Characteristics	Level	Unadjusted		Adjusted	
		HR (95% CI)	P	HR (95% CI)	P
Ever hospitalized during index incarceration*		3.54 (2.92−4.29)	<.0001	2.44 (2.01−2.96)	<.0001
Female**		0.82 (0.74−0.90)	<.0001	0.74 (0.67−0.81)	<.0001
Age at release (1 y increase)		1.06 (1.06−1.06)	<.0001	1.06 1.06−1.06)	<.0001
Race	Black	2.55 (2.06−3.16)	<.0001	2.06 (1.66−2.55)	<.0001
	White	4.46 (3.61−5.52)	<.0001	3.64 (2.95−4.51)	<.0001
	Indian/Asian/other/unknown	1		1	
Year of release					
	2008	1		1	
	2009	0.93 (0.83−1.03)	.176	0.93 (0.83−1.04)	.184
	2010	0.97 (0.86−1.09)	.588	0.96 (0.86−1.08)	.541
	2011	1.01 (0.89−1.13)	.92	1 (0.89−1.13)	.946
	2012	1.01 (0.88−1.16)	.872	0.99 (0.86−1.13)	.853
	2013	1.09 (0.93−1.27)	.293	1.02 (0.87−1.19)	.817
	2014	1.2 (1.01−1.43)	.041	1.07 (0.89−1.27)	.482
	2015 (through June 30)	0.98 (0.71−1.36)	.923	0.84 (0.61−1.17)	.309

CI = confidence interval; HR = hazard ratio.
Reference level: *Never hospitalized during index incarceration. **Male.

persons in the general state population (2163 vs. 452 per 100,000) [24]. Mortality among hospitalized men was greater than three times that of those not hospitalized and greater than seven times that of general population males (3949 vs. 558 per 100,000) [24]. For all hospitalized persons, deaths were predominantly from chronic health conditions and occurred at a steady rate for several years after release, suggesting that many who were hospitalized during incarceration have long periods requiring disease management.

Yet as a Medicaid nonexpansion state, there are few options to continue health care for low-income people re-entering the community. Despite a prison-based program that facilitates Medicaid enrollment (based on nonexpansion eligibility criteria) to pay for community hospitalization during incarceration [25], some qualitative evidence suggests that there may be substantial barriers to retaining and continuing Medicaid enrollment postrelease [18]. And only a small proportion of those hospitalized in our study (<3%) were old enough to eligible for Medicare.

Although prison system policy is to provide a medical referral to released prisoners who have chronic conditions, patients' follow-up is likely limited by inadequate access to routine care and competing priorities such as substance use recovery and establishing housing and employment [4,26]. Existing research suggests that people released from prison rely heavily on emergency departments (EDs) for health care. For example, about one-fourth of people released from the Rhode Island correctional system had an ED visit within the following year [27], and in a study of HIV-positive persons leaving the Connecticut correctional system, 56% had an ED visit in the following year [28]. Limited continuity of routine care, as reflected by heavy ED use, not only portends poor health outcomes among released persons but also suggests that prison systems' sizable financial investment in health care during incarceration will have at best a modest impact on long-term, post-release health. In NC, the prison system spends $250 million in health care annually [7], of which, we estimate $50 million is spent on hospitalizations [8]. Greater investment in continuity of care to complement health care spending during incarceration could potentially reduce postrelease ED overutilization and improve health and longevity.

One mechanism to support continuity of care is the Transitions Clinic Model [29]. This model, which has been implemented in 11 states and Puerto Rico and was recently established in NC, uses community health workers with an incarceration history to facilitate returning citizens' linkage to and retention in a community health clinic. There are four transition clinics currently in NC, but further expansion is needed to provide coverage for the 23,000 people annually released from the state prison system, one-third of which are conservatively estimated to have chronic health problems [30]. Such an expansion would likely require not only expanded Medicaid eligibility but also state and local dollars to support the clinics and community health workers.

Deaths among those who had not been hospitalized were most commonly from accidents including poisoning, which is commonly referred to as drug overdose. Although these patterns were not unexpected [11], it could be misleading to think of risk among nonhospitalized and hospitalized persons as discrete, as nearly half of people without a hospitalization died from chronic health problems, and 15% of those with a hospitalization died from drug overdose. Notably, deaths attributable to heroin overdose could be greatly diminished with greater access to appropriate medications, such as buprenorphine, during incarceration and at release [31]. More generally, the increased mortality rate among those who were hospitalized and the relatively small size of this population compared with other incarcerated persons suggest that it could be feasible to identify and prioritize this population for more robust postrelease services. Our findings suggest that such prioritization is particularly needed for men who experience hospitalization during incarceration consideration their disproportionately high death rates and limited eligibility for Medicaid.

This study has some limitations. First, we did not have information on the entire prison population but rather a cohort of people who entered from 2008 to 2014. Accordingly, the number of deaths in our study does not represent the total number of deaths among people released from the prison system during this period. Second, our data did not include information on postrelease health or health care nor did it include hospitalization reason during incarceration. Accordingly, people hospitalized during their incarceration may not have necessarily had major health needs from the time of the release to the time of their death. This was likely true among women more often than for men. Finally, the NC prison system has its own onsite medical center and thus may use outside hospitalizations less frequently and for higher acuity patients than other state prison systems.

In conclusion, we found that more than one in 10 people hospitalized during their imprisonment died in the postrelease period resulting in a standardized mortality rate 2.3 times as high as that of other released persons. And yet few deaths among this population occurred soon after release, suggesting that many of these people had long periods of substantial health care need when in the community. Given high mortality rates among this population—and substantial financial resources that prison systems invest in these patients' hospitalizations—people hospitalized during incarceration may constitute a relatively easily identifiable, priority population to focus health interventions fostering greater continuity of postrelease care. However, interventions will likely require an expansion of Medicaid eligibility as well as funding support at the state and local levels.

Acknowledgments

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