INCARCERATING DEATH: MORTALITY IN U.S. STATE CORRECTIONAL FACILITIES, 1985–1998*

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Using data from the U.S. Bureau of Justice Statistics and Census Bureau, I estimate death rates of working-age prisoners and nonprisoners by sex and race. Incarceration was more detrimental to females in comparison to their male counterparts in the period covered by this study. White male prisoners had higher death rates than white males who were not in prison. Black male prisoners, however, consistently exhibited lower death rates than black male nonprisoners did. Additionally, the findings indicate that while the relative difference in mortality levels of white and black males was quite high outside of prison, it essentially disappeared in prison. Notably, removing deaths caused by firearms and motor vehicles in the nonprison population accounted for some of the mortality differential between black prisoners and nonprisoners. The death rates of the other groups analyzed suggest that prison is an unhealthy environment; yet, prison appears to be a healthier place than the typical environment of the nonincarcerated black male population. These findings suggest that firearms and motor vehicle accidents do not sufficiently explain the higher death rates of black males, and they indicate that a lack of basic healthcare may be implicated in the death rates of black males not incarcerated.

What effect does incarceration have on the lifespan of inmates? Historically, mortality analyses have described aggregate and group-level trends in the longevity of populations. While such description is important, the utility of mortality analyses increases when studies move beyond description to explanation. Why do some groups have higher levels of mortality than others? I seek to answer this question by undertaking the intricate task of examining differentials in mortality by sex and race in U.S. state correctional facilities between 1985 and 1998. The study's key questions are (1) What were the mortality levels in U.S. correctional facilities at the close of the twentieth century?; and (2) How might the mortality levels and differences between groups be explained?

The study of prison mortality is of particular importance in the current era of large prison population growth, which began during the last quarter of the twentieth century. The prevalence of incarceration between 1925 and 1973 was relatively stable at a rate of approximately 110 per 100,000 U.S. residents (Blumstein and Beck 1999). In the 1970s, the number of people imprisoned in the United States grew exponentially (Ruth and Reitz 2003). By the end of 2004, the rate of incarceration in state prisons, local jails, federal prisons, and other facilities was 737 per 100,000 in the United States, which is 6.7 times the rate before 1974 (International Centre for Prison Studies 2007).

Moreover, the incarceration rate varies significantly across racial groups in the United States. The incarceration rate in 2004 for males was 979 per 100,000; however, this figure masks important racial and ethnic differences in the percentage of males in prison. The incarceration rate of Hispanic males was almost triple that of white males; and for black males, the rate was more than two and a half times that of Hispanic males. Although females had lower prevalence rates, averaging about 64 per 100,000 (Harrison and Beck 2005), more limited racial differences were still present. Disaggregating the incarceration

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rate by race/ethnicity and sex reveals that for some groups, serving time in prison has become an unpleasant fact in the twenty-first century. With so many people cycling through the U.S. judicial system, it is imperative to examine if and how prisons change their current and future lives, especially lifelong health.

Using a cloistered sample, I reveal that while most prisoners have higher death rates than their nonprison counterparts do, black males in prison have lower death rates than their free counterparts do. I also reveal that this surprising fact is not attributable to the larger measure of safety that prisons can provide due to protection from handgun deaths and car accidents. I present several hypotheses based on these results, and I argue that the basic healthcare that prisoners receive in prison significantly improves the mortality rates of black males. In conclusion, I suggest further studies to investigate these hypotheses.

This article is divided into four sections: a literature review focused on previous analyses of cloistered populations, a detailed explanation of methods, a description of my findings, and concluding remarks with a summary and suggestions for future study.

LITERATURE REVIEW

Previous studies have demonstrated clear relationships between mortality and sex, age, race, and class. We know that females tend to live longer than males, that mortality increases as age increases, that minorities tend to have poorer health outcomes than whites, and that people of higher socioeconomic status fare better than the poor and working class. Possible explanations of the sex differential in mortality include both social/behavioral factors (Pampel 2002; Preston and Wang 2006; Waldron 1995) and biological factors (Barrett-Connor 1997; Crabbe et al. 2003; Mendelsohn 2002; Murphy and Steenbergen 2007; Puck and Willard 1998; Wingard, Suarez, and Barrett-Connor 1983). Although some past studies have focused on one of these explanations, there is a consensus that both biology and sociology underlie the observed sex difference in death rates.

In general, minorities and people of poorer segments of the population have poorer health outcomes than their white counterparts and those with higher socioeconomic status. Racial differences in mortality have been attributed to differential access, utilization, and quality of health care (Hargraves and Hadley 2003; Mayberry, Mili, and Ofili 2000; Weinick, Zuvekas, and Cohen 2000). In addition, discrimination (van Ryn and Burke 2000; Williams 1999; Williams and Rucker 2000), neighborhood environments (LeClere, Rogers, and Peters 1997; Williams and Collins 2001), and socioeconomic status (Crimmins and Saito 2001; Williams and Jackson 2005; Wong et al. 2002) also contribute to racial/ethnic differentials in mortality.

Economic models, as outlined by Preston and Taubman (1998), explain health in terms of the consumption of health-related items, the social and physical environment, and medical knowledge. People with higher education, for example, have access to better jobs and higher wages, which in turn enable them to have access to resources such as better housing, better-quality environment, health care, a higher standard of living, and other health assets. Those with better education also benefit from higher levels of medical knowledge and techniques. Individuals with better circumstances take precautions to retain their quality of life and chances of survival by eating well, exercising, and avoiding high-risk behaviors like smoking. Basic health care provided to children of wealthier parents may also have a lasting effect on their lifelong health prospects and cognitive abilities, creating a dynamic and ongoing relationship between health and socioeconomic status (Smith 2004).

Cloistered Populations

In contrast to analyses focused on comparing broad socioeconomic categories of the population, studies of cloistered populations typically study one distinctive population and compare it with a noncloistered, but otherwise similar, sample. The comparison/control population is most often a segment of the general population selected to permit isolation of

a set of social, environmental, or health conditions experienced by the cloistered population. To date, most studies of cloistered populations have focused on religious orders.

Madigan and Vance's (1957) pioneering study of nuns and monks established the relative importance of biological and sociocultural factors in the sex mortality differential. The study's participants were subject to standardized conditions, having had the same occupation and a similar lifestyle (with respect to marital status, military status, access to the same medical and dental health care, diet, and exercise) and background (all were U.S.-born, white, and Catholic) for an extended period of time. Although the study provided evidence in favor of biological sources of sex differences in adult mortality, the study was limited by the small sample size for males. Luy (2003) conducted a similar study that sought to understand the complexity of the sex differentials in mortality over time. His examination of sex differentials in Bavarian Catholic orders and the German population indicated that social change explained the widening of the sex differential, but that a combination of biological and nonbiological causes explained the differential itself.

Other studies of religious orders have focused less on biological/social explanations of sex mortality differentials and more on population-level differences in behavioral and health habits of cloistered populations. Such differences are thought to provide either an advantage or disadvantage with particular causes of death, overall mortality, and/or morbidity. For example, Timio et al.'s (1999) investigation of blood pressure differences between nuns and laywomen during a 30-year period found that the nuns' blood pressure remained relatively stable compared with laywomen, whose blood pressure elevated over time. Moreover, nuns exhibited lower cardiovascular-related mortality, which led researchers to conclude that the difference resulted from differential stress loads in the lives of the two groups. Other studies have used cloistered populations, such as Seventh Day Adventists, to offer evidence about how cigarette smoking and other dietary habits increased levels of mortality and morbidity (Berkel and de Waard 1983; Hammond 1966).

One recent study used comparisons in non-religious-affiliated cloistered populations—for example, persons who were once members of a cloistered population—to examine the long-term effects of former membership. Gajewski and Poznanska (2008) compared mortality levels among former Olympic athletes, actors, and clergy in Poland, where entry into the study population occurred between 1924 and 2000. They also compared the mortality levels of each of the groups to that of the urban Polish population. Each cloistered group had mortality levels lower than the urban population, as measured by standard mortality ratios. Males who competed in the Olympics during their youth, however, fared better than monks, and monks fared better than actors. The ordering of mortality advantage was the same for females, but the relative differences were smaller. Education levels did not explain these differences because athletes had lower levels than other groups did.

These examples illustrate that studies of cloistered populations have demonstrated the relative importance of biology, behavior, culture, and other social factors in mortality differentials. By investigating features of the cloistered populations (e.g., length of membership, timing of membership, habit/behaviors) as well as making comparisons to control groups, scholars have accumulated evidence of a likely treatment effect, which may lead to further studies that more firmly establish a causal relationship.

Although studies of cloistered populations have standardized and/or controlled for sex and age differences, few have controlled for racial/ethnic and socioeconomic differences. With respect to race, because most studies were conducted in other countries, they examined populations that do not have the same racial/ethnic structure as the United States. Those studies that did rely on U.S. data typically limited study and comparison groups to white individuals (e.g., Madigan and Vance 1957). Inclusion of other races would enhance the robustness of results and potentially advance understanding of racial/ethnic differences in health in the United States.

Prisoners as a Cloistered Population

Based solely on the gender, racial/ethnic, and socioeconomic composition of the prison population, one would hypothesize that mortality levels inside prison would be greater than outside of prison. Prison populations overrepresent males, who comprised 89% of prisoners in 2000 (Beck and Karberg 2001). State prison populations also overrepresent people with lower socioeconomic status and racial minorities. According to the 2000 census estimates, African Americans accounted for less than 15% of the total U.S. population; yet they represented nearly 50% of all incarcerated offenders. Hispanics represented only 12% of the total U.S. population, but over 16% of the incarcerated population (Beck and Karberg 2001).

Prisoners are disproportionately from disadvantaged areas that are typified by limited job opportunities and social isolation (Massey and Denton 1993; Wilson 1993). In 1997, 44% of prisoners in state correctional facilities did not have a high school education prior to admission, compared with 18% of their nonprison counterparts (Harlow 2003). The high percentage of minorities, poorer people, people with lower levels of education, and people with higher levels of morbidity suggests that levels of mortality in prison would be higher than the mortality levels of the nonincarcerated population. However, relying solely on demographic indicators of the prison population suggests that the demographic indicators describe the cause of higher mortality, rather than merely indicate the presence of commonly traveled routes to higher mortality risks.

Several prison mortality studies illustrate findings that contrast with the expectation of higher mortality in prison. Novick and Remmlinger's (1978) examination of mortality in New York City correctional facilities revealed lower all-cause mortality than the inmates' nonprison counterparts for each of the 10-year age groups studied (ages 15–64) between 1971 and 1976. Prisoners had higher age-specific death rates from suicide, which was the leading cause of death, and lower age-specific death rates from homicide. Similarly, Ruback and Innes's (1988) examination of the mortality of male prisoners in 1984 indicated lower expected mortality from homicide and illness compared with the general population, but higher suicide mortality. They speculated that the lower mortality was due to limitations placed on inmates' high-risk lifestyles, in addition to protection from two of the leading causes of death among younger people—accidental deaths and motor vehicle deaths. Salive, Smith, and Brewer (1990) found that Maryland male inmates had a 39% lower all-cause death rate than the general male population between 1979 and 1987 after adjusting for age and race. International studies also present similar findings, where prisoners experience lower levels of mortality than their nonprison counterparts (Clavel, Benhamou, and Flamant 1987; Fazel and Benning 2005). Thus, the walls of prison may alter the usual associations between demographic characteristics and mortality.

More recently, Mumola (2007) published a brief that shows prisoners having lower mortality than nonprisoners, reporting that state prisoners had a 19% lower death rate than the complete United States resident population for the period 2001–2004. Among the top five leading causes of death in prison were heart disease, cancer, liver disease, AIDS, and suicide. This study, however, does not consider important group differences in mortality levels, such as age, sex, and race. Instead, Mumola compared all U.S. residents to all residents in state correctional facilities. This comparison is problematic for two reasons. First, it compares the largely male (89% in 2000) prison population to the more gender-balanced U.S. population (Beck and Karberg 2001; Spraggins 2005). Second, it compares the older U.S. resident population to a much younger prison population. In 2002, 29% of the population was 55 or older relative to 3% of the prison population (Harrison and Beck 2003; U.S. Census Bureau 2003). Because morbidity and mortality increase with age, this older age distribution is certain to raise the crude death rate relative to the prison population.

In this article, I offer several corrections to estimating procedures used in past studies of prison mortality. For this study, I use life-table-based techniques that not only measure

mortality but also permit me to examine the pathways to differentials in mortality. In doing so, I quantify the impact of incarceration on mortality in three periods (1985–1987, 1990–1992, and 1996–1998) and locate the findings within the larger context of the mortality literature. I use age-specific death rates, rather than crude rates, to eliminate the influence of differences in the age distribution of the populations under study. Even without knowing the cause of death, age patterns tell us much in terms of explaining differences between the mortality of prisoners and of those not in prisons. In addition, the analysis disaggregates the population by sex, race, and socioeconomic status, which are the primary indexing variables in mortality analyses. This disaggregation facilitates greater understanding of the factors associated with mortality differences by creating groups that mirror the general population. This form of analysis connects this area of study to the larger literature on cloistered populations, providing an opportunity to advance understanding of the sources of mortality differentials.

DATA AND METHODS

The following analysis uses the period life table. This method relies on age-specific death rates during a specified period, or interval of time, to calculate years of life lost between ages 18 and exact age 65. Calculation of age-specific death rates, ${}_nM_x$, requires an estimate of person-years lived and the number of deaths for a specified period. The estimate of person-years lived uses the mid-period population at the time of the survey multiplied by the length of the period (in years). Thus, the following equation represents the age-specific death rate between year Y and $Y + z$:

$$ {}_nM_x[Y, Y+z] = \frac{{}_nD_x[Y, Y+z]}{{}_nN_x \cdot z}, $$

where ${}_nD_x$ is the number of deaths occurring between ages x and $x + n$ during the time period $[Y, Y + z]$; ${}_nN_x$ is the mid-period population for the age category of x to $x + n$; and z is the number of years in the period.

Estimates for age-specific death rates of prisoners come from data collected by the Bureau of Justice Statistics (U.S. Department of Justice, Bureau of Labor Statistics, various years). The numerator for each age-specific death rate comes from the release data files of the National Corrections Reporting Program (NCRP). The NCRP data provide comprehensive records of admissions, releases from prison, and releases from parole for each calendar year from 1983 to 2001.[1] The records are individual-level, providing descriptive information, such as age, sex, education, race, state, ethnicity, and the offense resulting in incarceration. Records do not include a person whose admission or release is temporary for purposes such as waiting for a court appearance (and not yet convicted) or medical services. In addition, these data are not comprehensive at the national level but are limited to the states that choose to report in any given year. For this analysis, I use data from 29 states[2] that reported information on deaths for the three periods of study. These states represent approximately 74% of the total state prison population and 75% of deaths occurring in state prisons during the three periods of study. Each period (1985–1987, 1990–1992, and 1996–1998) represents three years of data on deaths to ensure robust estimates of mortality, as the number of deaths occurring in any single year is insufficient for some of the subpopulations examined. Executions are not included in the count of deaths.

1. The NCRP data provide detailed information for the numerator but do not permit estimation of the person-years lived for the resident prison population in the states of interest.

2. The 29 states used reported for all three periods: Alabama, California, Colorado, Hawaii, Illinois, Kentucky, Maryland, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, Tennessee, Texas, Utah, Virginia, Washington, West Virginia, and Wisconsin.

The denominator of the prisoners' age-specific death rates is derived from the NCRP data and two other sources of data. As noted above, I use mid-period population as the estimate of person-years lived. The Survey of Inmates of State Correctional Facilities[3] provides nationally representative information on inmates in state prisons, collecting valuable information such as background, personal characteristics (age, sex, race, etc.), and criminal history through personal interviews every six years. The survey enables estimation of the age distribution of the prison population of the entire United States and is not state-specific; it does, however, provide information on the region of the United States where the personal interview took place.

Recall that NCRP data provide information on individual-level (state-specific) data on entrances and exits for the prison population, and that these may be grouped at the regional level. Combining this information with the National Adult Correction Census (NACC)—which offers prison-level, state-specific information that can also be grouped at the regional level (and stratified by race and sex)—enables forward and backward projection to the midyear of the survey. The survey is then used to infer the midyear age distribution by region of the prison population for the selected states. After obtaining the regional populations, disaggregated by sex, age, and race, I collapse the regions such that they once again represent the aggregate of the 29 states for the three survey years—1986, 1991, and 1997. Thus, the denominator of the age-specific death rate adjusts for regional differences and assumes that the states of interest conform to their regional age distribution.[4]

I estimated the age-sex-race–specific death rates for the U.S. population using the Multiple Cause of Death data. The denominator for these rates comes from estimates of the yearly midyear population[5] based on the decennial census estimates (U.S. Census Bureau 2000, 2001a, 2001b) projected forward via the cohort-component method. Counts from the incarcerated population are subtracted from the numerator and denominator. Thus, computations treat the two populations as mutually exclusive.

The age-specific rates for prisoners are smoothed using quadratic nonparametric smoothing with regard to local areas of the scatter points. This method ensures that outliers do not distort the underlying distribution (Cleveland, Devlin, and Grosse 1988; Cleveland and Grosse 1991). This nonparametric method uses regression surfaces and makes no assumptions about the parametric function. In choosing a smoothing parameter, I minimize an improved version of the Akaike (1973) information criterion, termed the AIC_c, as proposed by Hurvich, Simonoff, and Tsai (1998). This criterion improves upon the usual AIC by avoiding large variability and by its tendency to undersmooth compared with other approaches that have been used to choose a smoothing parameter in the past. Using the smoothed age-specific rates, I then apply life-table methods to and compute the number of years lost between the ages of 18 and 64. For a detailed description of life-table methods, see Preston, Heuveline, and Guillot (2001).

3. The title of the survey varies depending on whether it includes state and/or federal correctional facilities. Each survey year collects information for the state correctional facilities; however, the federal correctional facilities are included only in 1991 and 1997.

4. The means describing the three period populations are in an online appendix on Demography's Web site (http://www.popassoc.org/i4a/pages/index.cfm?pageid=3576).

5. In the first period, the midyear population of the United States male population by race requires the use of two data sets. The first provides the percentage of the 29 states in each of the five-year age categories, because the single-year data set does not specify the state involved. Thus, I assume that the percentage of persons residing in the 29 states is constant in each five-year age category. This percentage is multiplied by the single-year age population to get an estimate of the race-age-specific population for the 29 states.

RESULTS

Years Lost Inside and Outside of Prison by Sex

Table 1 details the years of life lost by sex and race of people incarcerated in U.S. state correctional facilities and the U.S. civilian population for the selected states. The first column lists the demographic group studied. The top row displays the period, with subheadings underneath indicating the population estimated (imprisoned or not imprisoned). The next row provides the number of years lost for persons in prison, followed by persons in the U.S. civilian population and the ratio of years lost by prisoners to years lost by the nonprison population. Asterisks by the ratio denote that it is significantly different from 1, indicating that mortality differs significantly between the two populations.

During the first period, 1985–1987, male prisoners lost 13% more years of life than male nonprisoners, and female prisoners lost 76% more years of life than female nonprisoners. Over time, the ratio decreased for both female and male prisoners. Calculated confidence intervals for the ratios (not displayed) confirm that the male/female ratios and the prisoner/nonprisoner ratios changed across periods. Despite the significant decrease across the three periods, female prisoners still fared worse than female nonprisoners in the last period. In contrast, by the last period, male prisoners actually fared slightly better than male nonprisoners.

Another feature of Table 1 is the ratio of the years of life by sex, computed separately for prisoners and nonprisoners. In the first period, the male-female ratio of years lost in the civilian population was 2.04. That is, males lost twice as many years of life as females

Table 1. Expected Number of Years Lost Between Ages 18 and 65, by Sex and Race: U.S. State Correctional Facilities Versus the U.S. Population, Selected States[a]

	1985–1987			1990–1992			1996–1998		
Demographic Indicator	Prison	U.S.	Prison:U.S. Ratio	Prison	U.S.	Prison:U.S. Ratio	Prison	U.S.	Prison:U.S. Ratio
Sex									
Male	3.760 (0.013)	3.325 (0.000)	1.131**	3.278 (0.007)	3.291 (0.000)	0.996	2.712 (0.005)	2.879 (0.000)	0.942**
Female	2.871 (0.062)	1.630 (0.000)	1.761**	2.195 (0.036)	1.558 (0.000)	1.409**	1.727 (0.022)	1.489 (0.000)	1.160**
Male:Female ratio	1.310**	2.040**		1.493**	2.112**		1.570**	1.934**	
Race[b]									
White	4.003 (0.018)	3.032 (0.000)	1.320**	3.146 (0.009)	2.956 (0.000)	1.064**	2.850 (0.008)	2.597 (0.000)	1.097**
Black	3.787 (0.021)	6.527 (0.001)	0.580**	4.060 (0.016)	6.921 (0.001)	0.587**	3.068 (0.012)	6.024 (0.001)	0.509**
White:Black ratio	1.057**	0.465**		0.775**	0.427**		0.929**	0.431**	

Notes: Numbers in parentheses are standard errors. The calculation for years lost in prison uses death data over the three-year period specified. The estimate of years lost for the total enumerated population uses data from the middle year in the period. See the text for further details.

Source: Calculations using data from Bureau of Justice Statistics, U.S. Census Bureau, and National Center of Health Statistics.

[a]The maximum number of years of life lived or lost between ages 18 and 65 is 47. The calculations use the 29 states that reported deaths in state correctional facilities for each of the periods studied.

[b]Race includes estimates for males only.

**Ratio is significantly different from 1 ($p < .01$).

between the ages of 18 and 65. However, inside prison, that ratio was 1.31. Furthermore, the ratio between males and females in prison increased significantly between the first and second periods; nevertheless, the ratio between males and females in prison was always less than the ratio between males and females outside of prison.

The bottom section of Table 1 displays the differences in years of life lost between the ages of 18 and 65 for males by race. The racial comparison focuses on white and black males because these two groups make up the majority of prisoners (94%–96%), thus providing enough cases to produce stable estimates.[6] Ideally, data on ethnicity would permit further partitioning of males. Unfortunately, there were year-to-year inconsistencies for the ethnicity variable. Rather than classifying them as a separate ethnic group, I included Hispanics based on the racial category (either black or white) denoted in the NCRP and inmate surveys.

Within these limitations, the data analyses revealed four significant findings: (1) Black male prisoners exhibited lower death rates than their nonprison counterparts; (2) By the last study period, black male prisoners, white male prisoners, and white male nonprisoners exhibited no significant difference in their age-specific mortality rates; (3) Safety alone did not explain the lower mortality of black males; and (4) Prisoners experienced lower mortality than their socioeconomic status implied. I discuss these findings in detail below.

Years Lost Inside and Outside of Prison by Race

Between 1985 and 1987, white males in prison lost 32% more years of life than white males not in prison, but black males in the nonprison U.S. population lost more years of life than those inside prison. The ratio for white males in and outside of prison approached 1 over time, although the ratio was always statistically significantly different from 1. In contrast, the relative gap between years of life lost for black males in and outside of prison widened between the first and last periods. In the last period, black males not in prison lost almost twice as many years of life between the ages of 18 and 65 as black males in prison. White males lost slightly more years of life in prison than outside of prison (2.850 vs. 2.597), with a ratio of 1.097. Thus, the black male population was the driving force for the overall decline in the male prison versus nonprison mortality ratio to below 1. The mortality ratio resulted from black males' high mortality outside of prison, their comparatively low level while in prison, and the compositional contributions made to the two populations (i.e., the high mortality outside of prison for black males makes a smaller contribution to the whole than the low level in prison). These results document the importance of decomposing the population by race and sex.

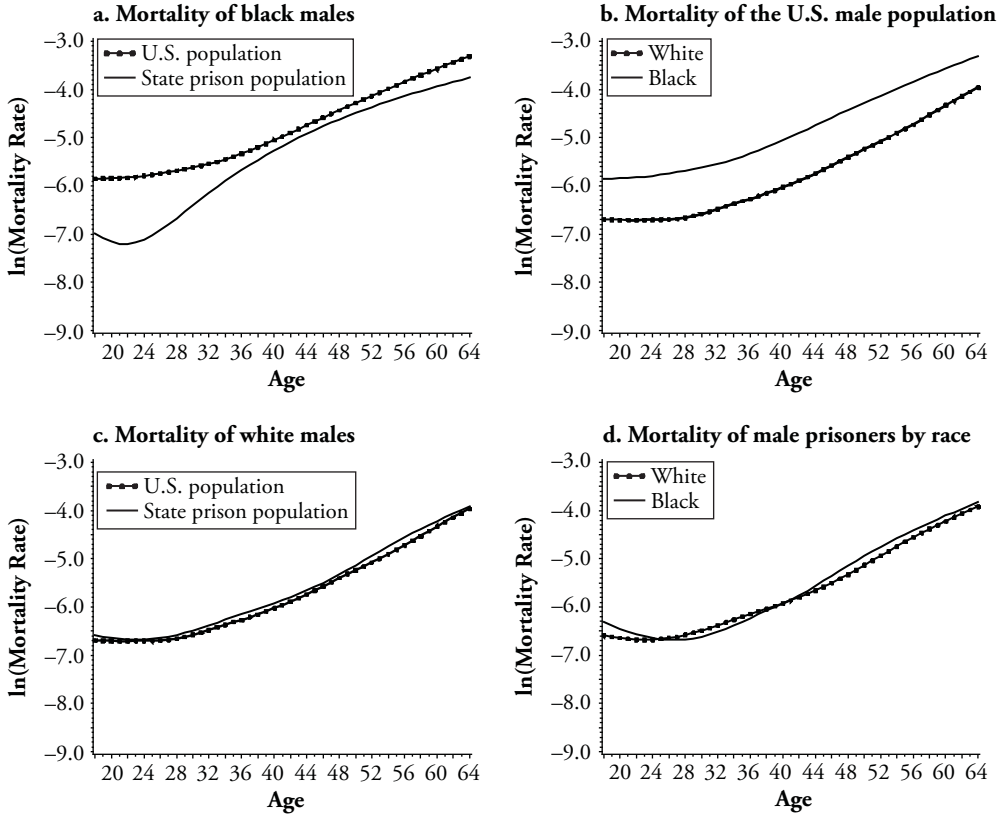
As illustrated in the bottom row of Table 1, the difference between black and white males in prison disappears for the first and last periods. Outside of prison, black males lost at least twice as many years of life as white males. The top of this table shows the contrast in the male-female difference in mortality when we look at persons imprisoned versus those not in prison. The bottom portion shows the same outcome for race, but with much more striking results. In contrast to females and white males and despite significantly increased rates of mortality in prison in general, the mortality of black males in prison decreased significantly.

Black Males Exhibit Lower Mortality in Prison

Years of life lost both inside and outside of prison for black males increased in the second study period, 1990–1992, while it decreased for every other group. This finding is in alignment with the rise in death rates among black males between 1984 and 1989 due largely to rises in human immunodeficiency virus infection and homicide (Kockanek, Maurer, and

6. Although only white and black males are compared in this part of the analysis, the overall analysis of males and females includes all racial categories. Females are not separated by race because of low sample sizes when partitioned.

Figure 1. Comparison of Male Mortality by Race and Location in United States, 1996–1998[a]



Sources: Calculations using data from Bureau of Justice Statistics, U.S. Census Bureau, and National Center for Health Statistics.

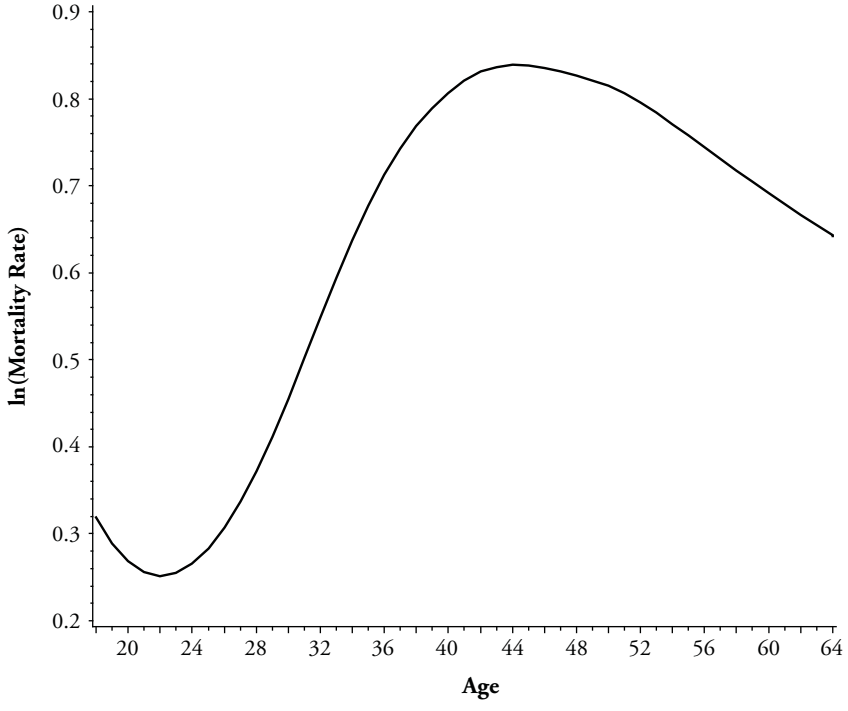
[a]These graphs reflect mortality for a sample of the U.S. population not in state correctional facilities and the U.S. population in correctional facilities. These two populations are mutually exclusive. The sample uses the 29 states that provided data to the Bureau of Justice Statistics' National Corrections Reporting Program in each period of interest.

Rosenberg 1994). Indeed, the decrease in life expectancy observed during the late 1980s for black males did not follow the expected trajectory of increasing life expectancy that white males experienced. Consequently, the years of life lost ratio for white to black males displayed a significant departure from the results in the other two periods.

Figures 1 and 2 permit a comparison of age-specific death rates and focus on age-specific differences among males in 1996–1998. In all of the study periods, mortality levels of the nonprison black male population were greater than both those of the white male non-incarcerated population and of the black prison population. In prison, the age-specific racial difference in mortality was smaller, and in the earlier period, black males had lower death rates (not displayed). Panels a–d in Figure 1 depict these two points, showing age-specific plots of log mortality by race and location.

Panel a of Figure 1 shows that, once again, black males in prison had lower levels of mortality at every age than the comparable nonprison population, and panel b shows that

Figure 2. Age-Specific Mortality Ratio for Black Males, 1996–1998



Source: Calculations using data from Bureau of Justice Statistics, U.S. Census Bureau, and National Center for Health Statistics.

white males had lower mortality than black males at every age. Panel c illustrates that the age pattern of mortality for white males in prison and the general white population were virtually identical. Panel d shows similar levels of mortality among black and white prisoners. Further examination of the age-specific mortality ratios reveals that the age-specific rates were not significantly different from 1 for white and black male prisoners or for white nonprisoners and white prisoners. That is, black males in prison saw a mortality rate that corresponds to that of white males in the nonprison population.[7]

In contrast, an examination of the ratio of age-specific rates between black male prisoners and nonprisoners reveals that most rates are significantly different from each other. Figure 2 shows the ratio of the age-specific rates for black males for the last period, 1996–1998. The curve is lowest at younger ages, where there is an initial decline until age 22. Between ages 22 and 44, the curve steeply increases, but thereafter it displays a gradual decline through age 64. Thus, the main departure of the black prison population from the U.S. black population occurred in younger years of life; it gradually disappeared in the middle ages, but increased once again in the later ages. In other words, the greatest difference in the two populations occurred when homicide rates and accidents were highest and during the ages when morbidity and mortality increase.

7. Testing was also performed for black male prisoners and white male nonprisoners. None of the age-specific rates were significantly different from each other.

Debunking the Safety Hypothesis

The findings suggest several hypotheses about these mortality differentials. The trends display a decrease in relative mortality levels between prisoners and nonprisoners and show that years of life lost were significantly higher for prisoners than for their nonprison counterparts for most of the groups studied, with the exception of black males. Lower mortality among black males could be attributed to a decline in the environmental risks—such as motor vehicle accidents and deaths related to firearms—that they would experience out of prison. Conditions in prison could simply be safer than those outside of prison for this segment of the population in particular. However, the following data analysis, which explores the impact of the absence of motor vehicle accidents and firearms on mortality, suggests that this hypothesis, which I call the "safety hypothesis," is incorrect. The method and results of the safety hypothesis analysis are detailed below. Additionally, one might consider an alternate hypothesis: prison, an environment that appears to have a detrimental health impact on most groups, is still a healthier environment than that typically experienced by black males in the nonprison population.

Prisoners do not possess guns or have exposure to motor vehicles. Thus, certain causes of death that would normally arise are not present in the prison population. Among males, deaths from accidents, homicide, and suicide rank in the top 10 causes of death for all the years of study (National Center for Health Statistics 2007). Accidents also rank in the top 10 causes of death for females (National Center for Health Statistics 2007). Deaths related to motor vehicles make up the largest share of deaths due to accidents, ranging from 54% to 59% of all accidents (U.S. Department of Health and Human Services 1992a, 1992b, 1993). Firearms were involved in 54% to 57% of all suicides and 63% to 70% of all homicides (U.S. Department of Health and Human Services 1994a, 1994b, 1995). Thus, prisoners might fare better because of their limited exposure to certain types of accidents and firearms (U.S. Department of Health and Human Services 1999, 2001a, 2001b).

I explored the validity of this safety hypothesis via two analyses. The first used the associated single decrement life table and posed the hypothetical question: how would mortality change in the nonprison population if deaths resulting from motor vehicles or firearms were removed? Let us call the hypothetical population resulting from the removal of these deaths the "safe population." The second analysis explores the expected mortality of prisoners if they were not in prison.

In Table 2, I show that removal of deaths involving firearms and motor vehicles in the nonprison population caused the years of life lost to decrease. The years of life lost for males in the resulting "safe population" was 2.861 in the first period, which is 14% less than that of the total nonprison population and 24% less than the prison population. By the last period, however, the difference between the male safe and prison populations was smaller. The former had only 9% fewer years of life lost than the latter. In contrast, removing these categories of deaths had a different impact on females' years of life lost. After these deaths were removed from the nonprison population, years of life declined by only 4%. The ratio of years of life lost in the safe population to the prison population began at 0.547 for females in the first period and rose to 0.834 by the last period of study.

The differences in mortality between the safe and total nonprison population were constant over time, even in separate comparisons by race. That is, the proportion of deaths occurring between ages 18 and 64 for which the underlying cause of death was related to a firearm or motor vehicle wavered very little from period to period.

The ratio of years of life lost between the safe and prison population, however, was very different for white and black males. In the first period, white males had a ratio of 0.647, while black males had a ratio of 1.535. After removing deaths due to accidents and firearms, the mortality of white males in the prison population converged closer to their safe counterparts, while black males' mortality diverged. Moreover, in every period, the ratio of

Table 2. Years of Life Lost Between Ages 18 and 65 in the U.S. Population When Excluding Deaths Due to Firearms and Motor Vehicles[a]

Demographic Indicator	Prison	U.S.	U.S.[b]	U.S.[b]:U.S. Ratio	U.S.[b]:Prison Ratio
Males					
1985–1987	3.760	3.325	2.861	0.860**	0.761**
1990–1992	3.278	3.291	2.795	0.849**	0.792**
1996–1998	2.712	2.879	2.475	0.860**	0.913**
Females					
1985–1987	2.871	1.630	1.570	0.963**	0.547**
1990–1992	2.195	1.558	1.500	0.963**	0.683**
1996–1998	1.727	1.489	1.440	0.967**	0.834**
White Males					
1985–1987	4.003	3.032	2.589	0.853**	0.647**
1990–1992	3.146	2.956	2.529	0.856**	0.804**
1996–1998	2.850	2.597	2.244	0.864**	0.787**
Black Males					
1985–1987	3.787	6.527	5.814	0.891**	1.535**
1990–1992	4.060	6.921	5.883	0.850**	1.449**
1996–1998	3.068	6.024	5.209	0.865**	1.698**

Sources: Calculations using data from Bureau of Justice Statistics, U.S. Census Bureau, and National Center for Health Statistics.

[a]The maximum number of years of life lived or lost between ages 18 and 65 is 47. The calculations use the 29 states that reported deaths in state correctional facilities for each of the periods studied. The calculation for years lost in prison uses death data over the three-year period specified. The estimate of years lost for the total enumerated population uses data from the middle year in the period. See the text for further details.

[b]U.S. refers to the safe population, or the U.S. population without mortality associated with firearms and motor vehicles.

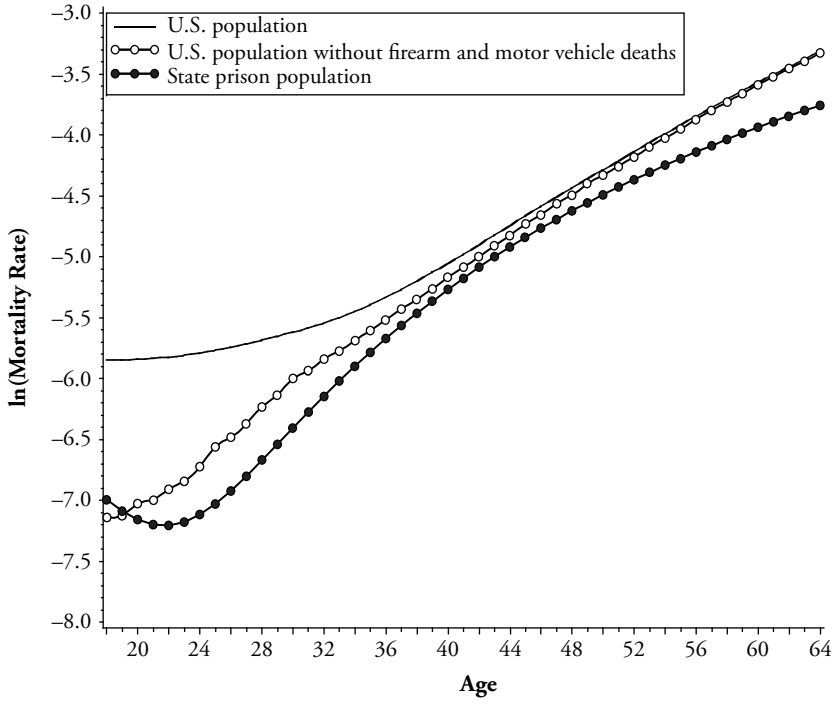
**Ratio is significantly different from 1 ($p < .01$).

years of life lost in the black male safe versus prison population was greater than 1. Even when deaths from firearms and motor vehicle accidents were removed from the nonprison population, black male prisoners experienced a life expectancy benefit inside prison that the outside population did not.

The age-specific death rates of black males in the first and last periods further support the presence of a safety impact in prison. Figure 3 displays age-specific death rates for black males in prison, black males not in prison, and the black male safety population. As mentioned in the previous section, nonprisoner mortality in the black male population is greater than prisoner mortality at every age between 18 and 64. The curve for the safe population intersects with the curve for the prison population at younger ages and then gradually diverges, suggesting that in the younger years, a large proportion of the decrease in mortality is from limited exposure to vehicles and firearms. The proportion of deaths due to motor vehicles or firearms declines as age increases, lessening the distance between the safe and total nonprisoner curves.

Thus far, in the description of my results, I have used the nonprison population as the central comparison. My study also examined the protection of prison walls and used the life table to examine potential mortality by adding deaths due to firearms and motor vehicle accidents to the prison population's existing death count. Let us call this segment

Figure 3. Comparison of Black Male Mortality Under Various Conditions, 1996–1998



Sources: Calculations using data from Bureau of Justice Statistics, U.S. Census Bureau, and National Center for Health Statistics.

the "at-risk" population.[8] As one might expect, the relative difference between the at-risk population and nonprison population was significant for most groups, but the opposite was true for black males. The ratio between the at-risk and prison populations was less than 1 for black males in each period. This finding suggests once again that the lower mortality experienced by black male prisoners results not only, or even primarily, from the prison's protective shield.

Socioeconomic Status and Mortality Rates in Prison

How does the mortality of prisoners compare with that of other socioeconomic categories? This section answers that question using data from 1996–1998, combined with Molla, Madans, and Wagener's (2004) data addressing socioeconomic differentials in 1998. Table 3 presents the mortality of males and females between the ages 25 and 64 by educational attainment. It describes the educational attainment of prisoners prior to their current admission into prison using data from the 1997 Survey of Inmates in State and

8. The assumption that prisoners have the same proportion of deaths due to firearms and motor vehicle accidents as nonprisoners most likely underestimates years of life lost for the at-risk population, given their especially high exposure to these risks; nevertheless, it provides a starting point.

Table 3. Educational Attainment of Prisoners, and Years of Life Lost Between Ages 25 and 64 by Educational Attainment: Late 1990s

	Male	Female
Educational Attainment of Prison Population (1997)[a] (%)		
0–8 years	20.3	17.7
9–12 years	68.5	67.9
13+ years	11.2	14.4
Years of Life Lost		
Prisoners (1996–1998)	2.340 [2.326, 2.354]	1.515 [1.459, 1.572]
U.S. population by years of schooling (1998)		
0–8 years	3.591 [3.570, 3.612]	1.952 [1.938, 1.965]
9–12 years	3.473 [3.470, 3.477]	1.821 [1.819, 1.822]
13+ years	1.397 [1.395, 1.398]	0.887 [0.885, 0.888]

Note: Numbers in brackets are the 99% confidence intervals for the point estimates.

Sources: 1996–1998 calculations using data from Bureau of Justice Statistics, U.S. Census Bureau, and National Center for Health Statistics; 1998 calculations for years of schooling use data from Molla, Madans, and Wagener (2004).

[a]Educational attainment refers to years of schooling prior to prison admission. High school graduates and GED recipients are included in the 9–12 years category. The data for this portion of the table utilize the Survey of Inmates in State and Federal Correctional Facilities, 1997. This survey restricts the population to those housed in state correctional facilities.

Federal Correctional Facilities.[9] Table 3 divides the last completed year of education into three categories that are consistent with Molla et al.'s study: 0–8, 9–12, and 13 or more years of schooling. Those with a GED or high school diploma were included in the 9–12 years of schooling category. As Table 3 shows, the majority of prisoners attained this level of schooling prior to their current admission.[10] Table 3 also shows that only 11% of males and 14% of females in state correctional facilities had postsecondary education.

The next set of rows describes years of life lost for prisoners during the last period, 1996–1998, and for those in the U.S. population in 1998. The table partitions the latter (prisoners excluded) by years of schooling and provides 99% confidence intervals in brackets beneath the point estimates. The mortality of those with little schooling differs only slightly from those with 9–12 years of schooling. Males with 0–8 years of schooling lost 3.591 years of life, and those with 9–12 years of schooling lost 3.473 years. This difference is larger for females; those with 0–8 years of schooling lost 7.2% more years of life than females with 9–12 years of schooling.

The magnitude of the mortality difference between those with 9–12 years of schooling and those with postsecondary education is considerably larger, however. Between ages 25 and 64, males who had postsecondary education lost 1.397 years of life, compared with their counterparts with 9–12 years of education who lost 2.5 times more years of life. Females with 9–12 years of schooling lost 1.821 years of life, while those with postsecondary

9. This analysis is restricted to inmates in state correctional facilities.

10. Additional investigation determined that 44% of persons in a state correctional facility had not obtained their high school diploma (or GED) before their current admission.

education lost 0.887 years of life between ages 25 and 64. Based on the educational composition of prisoners prior to admission in prison and the number of years lost by educational attainment in the U.S. population, I estimated an expected value for the number of years lost in the prison population between ages 25 and 64. The estimate is simply the sum of the educational-specific product of years of life lost and the composition of the prison population. Thus, the expected number of years lost for male prisoners is 3.264 years, 40% greater than the actual value. For females, the observed number of years lost is 13% higher than the expected value. Hence, the expected mortality of prisoners is actually higher than that experienced in prison, underlining the need to disentangle the components (e.g., access to health care and basic nutrition) of this widely used proxy in mortality analyses.

SUMMARY AND CONCLUSION

In this article, I examined age-adjusted mortality levels by race and sex in U.S. state correctional facilities from 1985 to 1998. Using life-table methods, I estimated the mortality of prison populations by sex, race, and socioeconomic status. The analyses revealed several important findings. First, prison was relatively more detrimental for females than for males. However, the relative difference between mortality of males and females was smaller in prison than in the nonprison population. Second, the relative difference in mortality between those in and outside of prison narrowed over time. Though this trend held for both men and women, the difference declined more for men, while for women the number of years lost in prison remained significantly greater than the years lost in the nonprison population. Third, significant race differences emerged. For black males at every age, death rates were higher for the population outside of prison compared with their same-race counterparts in prison. In prison, there was little or no mortality difference between white and black males. Fourth, removing deaths from firearms and motor vehicles in the nonprison population narrowed, but did not eliminate, the differential between black male prisoners and nonprisoners. Although the ratio between the mortality of prisoners and nonprisoners approached 1 for all groups, it was consistently less than 1 for black males. Moreover, over time, this ratio moved closer to zero.

The sex-specific mortality ratios between the prison and nonprison populations investigated in this article resemble the sex ratios of the standardized death rates of nuns and monks in Gajewski and Poznanska's (2008) study. The sex ratio of years of life lost for the prison population ranged from 1.31 to 1.57, and the sex ratio of years of life lost for the U.S. nonprison population ranged from 1.93 to 2.04 in the three study periods. Similarly, Gajewski and Poznanska's expected standardized mortality sex ratio based on the urban Polish population was 2.05, while their observed standardized mortality sex ratio was 1.69 between nuns and monks. The monks and nuns had joined a community with a distinct way of life that they expected to continue for the rest of their lives. Thus, these mortality findings most likely reflect death while still members of a community that shared similar values and lifestyles, much like persons who died while members of the prison community.

Basic Healthcare in Prison

Despite better provision of services that target healthcare needs of prisoners (Anno 2004), many enter prison with diseases or contract diseases because of the prison environment. Several scholars have documented intraprison spread of diseases, including tuberculosis, HIV, hepatitis B virus, and hepatitis C virus (Horsburgh et al. 1990; Koehler 1994; Krebs and Simmons 2002; Macalino et al. 2004; Mahon 1996; Mutter 1994). Of the state prisoners who died between 2001 and 2004, a physician or medical staff evaluated 94.1%, 93.3% received some type of medication, and 20.1% were provided surgical services (Mumola 2007). Given that the expected length of stay in prison was 2.26 years in 1997 (Patterson and Preston 2008) and mortality levels in prison were equal to or lower across race, age, and place, it seems likely that the risk of death is not solely related to early prevention but

also to immediate access to nutrition and health care. This does not mean that diseases are not contracted. Rather, if an inmate contracts a disease while in prison, there is usually health care available to provide treatment. I would hypothesize that the availability of this treatment in prison accounts, at least in part, for the decreased mortality rate of black males inside of prison in comparison to black males outside of prison.

There are at least two explanations for lower mortality in prison. One is selectivity, which is the main critique of prior studies of cloistered populations. Incarcerated persons are probably different from those not incarcerated in a number of ways. Thus, it is possible that the results simply show that persons who go to prison have similar backgrounds, resulting in smaller differentials by race and sex in mortality among prisoners than nonprisoners. Although this explanation is certainly possible, the lack of significant differences in the age-specific death rates for males by race and location suggests that the findings likely are not due to selectivity only.

Another possibility is that certain features in the prison environment diminish the inequities that usually differentiate racial groups. That is, the prison population represents people who are subjected to a similar regime and afforded the same opportunities for nutrition, access to health care, and protection from external sources of mortality differences (i.e., firearms and motor vehicles). Although the study's design limits the ability to make causal claims, the lack of significant differences in age-specific death rates for males by race and location suggests that diminished inequities do not result at least partially from equal access to resources.

These findings should be considered in light of several limitations. Because the age distribution of the 29 states may not perfectly match the age distribution obtained from inmate surveys, the rates could be under- or overestimated. I accounted for this type of error by smoothing the curve of age-specific death rates with nonparametric functions. Another limitation relates to the racial/ethnic categories available in existing data sets. I included the mortality profiles for persons of Hispanic origin, separating them by race but not ethnicity, which likely biased death rates for whites. Finally, this analysis did not estimate mortality of federal prisoners, who violated federal rather than state or local laws; there may be systematic differences in their mortality levels.[11]

Future Studies

The prison experience clearly extends beyond a prison's walls: diseases contracted during prison and the social stigma of incarceration affect prisoners' future socioeconomic and health outcomes once outside (Binswanger et al. 2007; Bushway 2004; Massoglia 2008; Olivares, Burton, and Cullen 1996; Pager 2003; Schnittker and John 2007). Therefore, future studies should include other important offender, offense,[12] and social covariates, as well as the cause of death. These types of analyses will build on findings from this study and help to illuminate the pathways and interventions necessary to reduce the health inequalities that passage of time alone will not diminish.

From these results, scholars and policymakers could reach the conclusion that because mortality is lower in prison, we help people, especially African Americans, when we incarcerate them. However, I caution against such an interpretation because studies on prison morbidity suggest that prisoners are at risk for more diseases before, during, and after interaction with the criminal justice system. Although they may not die from the disease

11. To date, the detailed mortality characteristics of the federal prison population have often been overlooked because federal inmates make up only 12.5% (midyear 2007) of the correctional population (Sabol and Couture 2008). A sensitivity analysis of how the results might have changed if federal facilities were included can be found online in Appendix B on *Demography*'s Web site. The overall results do not change.

12. Years of life lost did not differ significantly between persons sentenced for a violent crime and those sentenced for a nonviolent crime (results not shown). Sample size limited further disaggregation, which might produce different findings. This is something for future research to consider.

in prison due to the provision of healthcare services, they certainly have higher risks of dying once released (Binswanger et al. 2007; Massoglia 2008; Schnittker and John 2007). Furthermore, being contained in a place with no control over one's life, and where there is a high likelihood of victimization, does not suggest that people are better off. In contrast, what the findings do suggest is that even in hostile environments such as prison, there is potential to greatly reduce racial and sex disparities in mortality. Such findings speak to the depth of deprivation some groups suffer in U.S. society—a place with such deprivation that prison, in some cases, is a lesser enemy in life.

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