Incarceration and Population Health in Wealthy Democracies

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ABSTRACT

This article considers how incarceration influences population health using data from 21wealthy democracies over the 1981-2005 period (*N*=370). Results provide support for a number of conclusions. First, when all 21 nations are considered, increases in the incarceration rate are associated with decreases in life expectancy at birth but no change in the infant mortality rate. Second, estimates from these models suggest that life expectancy at birth in 2005 in the United States would have been 1.5 years longer had the U.S. incarceration rate remained at the 1983 level. Third, when the U.S. is excluded, results change dramatically. Increases in the incarceration rate are no longer associated with significant decreases in life expectancy, but they are associated with decreases in the infant mortality rate. Analyses also suggest that increases in incarceration rates in wealthy nations other than the United States are associated with mortality declines for all ages until the late 20s. Taken together, results suggest that among most wealthy democracies, increases in the incarceration rate may improve population health. For the United States, on the other hand, increases in the incarceration rate likely harm population health.

The American incarceration rate is both historically and comparatively novel. Given the novelty of the American imprisonment rate, researchers have developed a keen interest in the patterning of incarceration and the effects of incarceration on the lives of marginal men and their families (Binswanger et al. 2007; Braman 2004; Comfort 2007, 2008; Massoglia 2008a; Murray and Farrington 2008; Pager 2003; Pettit and Western 2004; Schnittker and John 2007; Western 2006; Western and Wildeman 2009; Wildeman 2009a). Research in this area finds that the risk of incarceration is concentrated among marginal men and their families and that incarceration diminishes the life-chances not only of the ever-imprisoned, but also their families. Less research moves beyond the micro-level to test the effects of mass imprisonment on inequality, but existing research in this area suggests that mass imprisonment has grown inequality in the labor market, infectious disease prevalence rates, and infant mortality rates (Johnson and Raphael 2009; Massoglia 2008b; Wakefield and Uggen *Forthcoming*; Western 2006; Wildeman 2009b).

Were American imprisonment only historically novel, it would be understandable that virtually all existing research on the effects of mass imprisonment considers effects within the United States (but wee Western and Beckett 1999). Yet there are also at least two reasons to look for consequences of incarceration outside of the United States. First, since the gap between the American incarceration rate and the incarceration rates of the other most-incarcerating wealthy democracies is roughly five to one, mass incarceration may grow inequality between the United States and other wealthy democracies. Second, the largely negative effects of incarceration found in the United States may not extend to other wealthy democracies. In fact, based on differences between the United States and other wealthy democracies in the types of offenders incarcerated, the structure of the welfare state, and the financial burden of corrections, it may be reasonable to expect that while incarceration has negative effects on wellbeing in the United States, the

benefits of incarceration might even outweigh the costs in other wealthy democracies—or at the very least not be nearly as harmful for the broader population as they are in the United States.

This article addresses this gap in research by considering the effects of the incarceration rate on population health using panel data from 21 wealthy democracies. Population health is an ideal outcome for a number of reasons. First, the measures of population health considered—life expectancy at birth and the infant mortality rate—are considered excellent measures of the wellbeing of a population (Beckfield 2004; Conley and Springer 2001; Hall and Lamont 2009). Second, the health of Americans has declined relative to the residents of comparable nations in recent decades (Oeppen and Vaupel 2002). Finally, since life expectancy at birth represents the cumulative mortality experience of a population, it can easily be broken down into its constituent parts—age-specific mortality rates. Thus, this measure allows me to test at which ages incarceration has the largest effects. In testing for effects of incarceration on population health, this article not only fills a gap in the literature on the effects of mass imprisonment. It also extends discussion of the causes of the poor health of Americans relative to the residents of other wealthy democracies beyond the usual suspects: the welfare state (Conley and Springer 2001), income inequality (Wilkinson and Pickett 2009), and health behaviors (Mokdad et al. 2004).

Results from OLS regression models with country fixed effects provide support for a number of conclusions. First, when all 21 countries are considered, increases in the incarceration rate are associated with decreases in life expectancy at birth but no significant change in the infant mortality rate. Second, point estimates from these models suggest that American life expectancy at birth in 2005 would have been 1.5 years longer had the American incarceration rate remained at the 1983 level. Thus, initial models suggest that the American penal system may have contributed to the increasingly poor health of Americans over this period, relative to those

residing in comparable nations. Third, when the United States is removed from consideration, the results change notably. Increases in the incarceration rate no longer associate with decreases in life expectancy, but they do associate with decreases in the infant mortality rate. Furthermore, analyses suggest that increases in the incarceration rate in wealthy nations other than the United States are associated with mortality declines for all ages until the late 20s. Taken together, these results suggest that increases in the incarceration rate in most wealthy democracies may improve population health (or at least not harm it) and that the effects of changes in the incarceration rate on population health in America are different than they are in other wealthy democracies. They also suggest that researchers interested in between-country health inequities should focus not only on the welfare state, income inequality, and health behaviors but also other institutions.

U.S. INCARCERATION IN COMPARATIVE-HISTORICAL PERSPECTIVE

Starting in the mid-1970s, the American imprisonment rate began to increase so quickly that in only 35 years it grew from around 100 per 100,000 to around 500 per 100,000. The American incarceration rate is not only historically novel, however. When compared to the incarceration rates of other wealthy democracies, it becomes clear that the American incarceration rate is comparatively novel as well. England, which also has a high incarceration rate, incarcerates at a rate only one-fifth as high as the U.S. rate (Western 2006: 14; Figure 1). And Iceland—one of the least-incarcerating nations in the world—incarcerates at a rate only about one-seventeenth as high as the U.S. rate. Although the U.S. incarceration rate tended to be somewhat higher than those of other wealthy democracies before the prison boom began, the size of the gap between the incarceration rates of the U.S. and other wealthy democracies is a modern phenomenon.

[Insert Figure 1 about here.]

One way to highlight the comparative novelty of the American imprisonment rate is to show how the American incarceration rate changed relative to those of other wealthy democracies. Figure 1 compares the change in the American incarceration rate between 1983 and 2005 to the changes in the incarceration rates in the United Kingdom, Spain, the Netherlands, Denmark, and Austria over roughly the same period. Although each wealthy democracy was chosen because they represent the changes in incarceration in other wealthy democracies, what is most noteworthy is how extreme change in the American incarceration rate is relative to changes in other nations.[2] At the beginning of the period considered, the American incarceration rate was somewhat of an outlier, incarcerating at a rate about 2.5 times that of the United Kingdom, its closest competitor. By the end of the period, however, the American incarceration rate was around 600 per 100,000 greater than its nearest competitors. Thinking about how these inequities compare to more commonly used examples in America makes their magnitude more transparent. The relative gap in the incarceration rate between the United States and the Netherlands is comparable to the black-white gap in the risk of ever being imprisoned and ever having a parent imprisoned (Pettit and Western 2004; Western and Wildeman 2009; Wildeman 2009a).

INCARCERATION AND POPULATION HEALTH

Given vast disparities in incarceration between the United States and other wealthy democracies, incarceration may have implications for crossnational health inequities. For these inequities in incarceration to have implications for health inequities, however, incarceration would need to

[2] The United Kingdom could be grouped with Portugal, New Zealand, and Australia. Spain had a unique pattern, as it started at a very low rate of incarceration but increased to around 140 per 100,000. The pattern in the Netherlands was observed in Ireland, Greece, Sweden, France, and Italy. Denmark, which showed relative stability in the incarceration rate at a low starting rate, followed a similar pattern to the ones observed in Japan, Norway, Finland, and Switzerland. The final pattern, which was exhibited by Austria, could also be found in Canada and Germany.

influence population health. In this section, I review research on the effects of incarceration on health and wellbeing in three parts. In the first, I consider the effects of incarceration and release on the health of individuals. These are what we might consider the direct effects of incarceration on population health. Next, I review the handful of studies on the effects of mass incarceration on the health of family members, communities, and the population more broadly in America. I close by discussing how the effects of incarceration on population health outside of the U.S. may differ from effects found within the United States. Thus, analyses that assume uniform effects of incarceration on population health across wealthy democracies may underestimate the effects of mass incarceration on health inequities between the U.S. and other wealthy democracies.

The Direct Health Effects of Incarceration

Researchers have long had interest in the health effects of incarceration and release. Most research in this area has focused on the consequences of incarceration and release for mortality (Binswanger et al. 2007; Clavel, Benhamou, and Flamant 1987; Farrell and Marsden 2007; Mumola 2007; Rosen et al. 2008), but some research considers the broader health implications of incarceration (Massoglia 2008a; Massoglia and Schnittker 2009; Schnittker and John 2007). In general, research finds that individuals have lower mortality while incarcerated than those on the outside (Clavel et al. 1987; Mumola 2007) but higher risks upon release, especially immediately upon release (Binswanger et al. 2007; Farrell and Marsden 2007; Rosen et al. 2008).[3]

Unfortunately, it remains unclear based on these studies whether incarceration or release are responsible for these differences in mortality rates—in large part because prisoners are

[3] Most research has considered U.S. prisoners (Binswanger et al. 2007; Mumola 2007; Rosen et al. 2008), but research from other wealthy democracies finds similar patterns (Clavet et al. 1987; Farrell and Marsden 2007).

matched with controls only on age, race, and sex. Research on the broader health effects of having ever been incarcerated, however, suggests that incarceration may have a causal effect on mortality risk. A number of studies show, for instance, that having ever been incarcerated not only increases the risk of having infectious or stress-related diseases (Massoglia 2008a), but also increases the risk of having severe functional limitations (Schnittker and John 2007). Since these health problems are associated with elevated mortality risk, this research suggests that once prisoners have been released from penal institutions, they are likely at greater mortality risk than comparable individuals and that their status as ex-prisoners is at least partially responsible for this elevated risk. Although it is less clear whether imprisonment lowers mortality during the time that an individual is incarcerated, it could plausibly decrease mortality risk by lowering homicide- and overdose-related mortality for the duration of the imprisonment.

Unfortunately, it is difficult to generate hypotheses about the effects of incarceration on the health of a population based on these studies because it is unclear whether the mortality-reducing effects of imprisonment trump the mortality-producing effects of release from prison or vice versa *over the entire life-course*. Thus, it is difficult to know whether the total effect on population health will be positive or negative based on these studies. Nonetheless, I expect that incarceration rates will be positively associated with the mortality risks of men in their 30s and 40s. Prior research shows that recently released prisoners are at elevated mortality risk and that former prisoners have high burdens of disease (Binswanger et al. 2007; Massoglia 2008a). Because of these negative effects, former prisoners who never return to prison will be at elevated risk of mortality relative to comparable (never-imprisoned) individuals. It is difficult to know at what age men fully "age out" of crime, however, some research suggests that few continue to be criminally active after their late 30s (Laub and Sampson 2003:86). Thus, offenders released in

their 30s and 40s are unlikely to return to prison. Given negative effects of prior incarceration on health, incarceration may increase mortality among men in these ages. For younger men still in the cycle of incarceration and release, however, incarceration might diminish their mortality risk—though this has never been tested at this level of analysis. Thus, if incarceration influences population health only directly through ever-incarcerated men, then the only population-level effects should manifest themselves as diminished mortality risks among men in the most criminally active years (ages 15-29) and elevated mortality risks among men in their 30s and 40s.

Mass Incarceration and Population Health in the U.S.

Regardless of the magnitude of the effects of incarceration and release on health, if the penal system only affects population health directly through the ever-incarcerated, then it is unlikely to substantially alter population health. Since only 11 percent of American men ever go to prison (Bonczar 2003), for the penal system to have large effects on population health, incarceration would need to have effects that extend beyond these men. Little research considers such population health effects (but see Wildeman 2009b), but research on the effects of incarceration on families, communities, and populations suggest that the consequences of high incarceration rates in the United States for population health may not be limited to the ever-incarcerated.

In this section, I argue that mass imprisonment compromises population health in the United States through two primary avenues. First, and probably most importantly, incarceration compromises the health of family members both directly (via infectious disease) and indirectly (via lower rates of health insurance and higher levels of family instability and poverty). Effects might also spill out into the community, though findings in this area are tentative (Clear 2007). Second, and possibly more importantly, spending on corrections may diminish the resources

available for spending on social welfare programs that promote population health. Since welfare state spending influences population health, this tradeoff may compromise the wellbeing not only of those directly connected to prisoners or former prisoners, but also the entire population.

In considering the mechanisms through which incarceration affects population health in the United States, I begin with the direct effects of having a partner incarcerated. It should come as little surprise that having ever been imprisoned increases the risk of contracting infectious diseases given the large share of inmates with an infectious disease at prison admission and likely high rates of unprotected sex (Massoglia and Schnittker 2009; Massoglia 2008a). For those in romantic relationships with former prisoners, therefore, it is likely that being with a former prisoner increases the risk of contracting infectious diseases. Little research tests this spillover effect (but see Stuckler et al. 2008), but some research suggests that state-level incarceration rates are associated with increases in HIV/AIDS prevalence among African American women (Johnson and Raphael 2009) and that community-level incarceration rates are associated with higher prevalence rates of STIs (Thomas and Torrone 2006). Given the negative effects of contracting an infectious disease on subsequent mortality, incarceration might compromise the health of women in their 30s and 40s by increasing their risk of contracting infectious diseases.

In addition to the direct health effects of having a family member incarcerated, research also suggests a number of channels through which having a family member incarcerated could indirectly harm population health. Since incarceration substantially increases the risk of divorce and separation, for instance, incarceration could compromise the wellbeing of both the partners of incarcerated men and their children (Lopoo and Western 2005). Likewise, the negative effects of a criminal record on men's earnings (Western 2006) and probability of gaining employment (Pager 2003) suggest that having a family member incarcerated diminishes the resources families

have available to them (Geller, Garfinkel, and Western *Forthcoming*). In terms of health effects, the non-pecuniary costs of unemployment may be greater than the pecuniary ones. Since health insurance tends to be linked with employers in the United States, if incarceration harms the chances of gaining employment, then it also shrinks the probability of having health insurance.

Effects of incarceration on the wellbeing of family members need not be exclusively tied to labor market outcomes and family structure, however. Having a family member incarcerated tends to compromise family functioning (Braman 2004; Comfort 2007, 2008; Wakefield and Uggen *Forthcoming*) and has negative effects on child wellbeing and development (see the review of Murray and Farrington 2008). Though effects on the health of family members in general may be important, the effects of having a parent go to prison on children may be most acute. Research in this area suggests, for instance, that having a parent incarcerated may increase the risk of infant mortality (Wildeman 2009b) and foster care placement (Swann and Sylvester 2006).[4] Based on results from this handful of studies, therefore, it is likely that increases in the incarceration rate will increase the mortality risk of both infants and young children.

The mechanisms discussed thus far have tended to yield insight only into the health effects of being incarcerated, having a family member incarcerated, or living in a community in which incarceration is endemic. Yet mass incarceration may have important effects on the health of individuals who have not had any contact with the penal system. How could this be the case? As the American incarceration rate has grown, so also has state spending on corrections—both in absolute terms and as a percentage of expenditures (Ellwood and Guetzkow 2009). Since high incarceration rates sap resources from state and federal governments, they may diminish social spending that promotes population health. Little research considers the effects of incarceration

[4] Foster care placement is the area in which female incarceration rates matter most (Swann and Sylvester 2006), although the effects of maternal incarceration on children may also be quite large (Kruttschnitt *Forthcoming*).

on welfare state spending, but by diminishing state expenditures on public health, investment in penal institutions may compromise population health by increasing the mortality risks of older Americans and infants, for whom this public health infrastructure may be especially crucial.

Taken together, research suggests that the comparatively and historically novel rates of incarceration in the U.S. are likely to compromise population wellbeing. Since life expectancy at birth provides a simple measure of population wellbeing, therefore, we might expect that the incarceration rate would be negatively associated with life expectancy at birth in the United States. Likewise, we might expect incarceration rates to be associated with elevated infant mortality rates, which some research already suggests to be the case (Wildeman 2009b). We might also suggest given the negative effects of having a partner incarcerated on health that increases in the incarceration rate would be associated with increases in the mortality rates of the women who have partners returning from prison—roughly in the 30-49 age group. Existing research also suggests, albeit more tentatively, that if increases in incarceration correspond with divestment of funds from public health spending, it would be reasonable to expect high rates of incarceration to have substantial effects on the health and mortality risk of older individuals and infants. There may, however, also be some protective effects of incarceration on mortality risk. Specifically, we might expect incarceration to diminish mortality risk among men ages 15-29.

Incarceration and Population Health in Other Wealthy Democracies

Research on the consequences of mass incarceration for population health in the United States suggests that mass incarceration is likely to both diminish life expectancy at birth for the total population and increase the infant mortality rate. In this section, I suggest that it may be incorrect to assume that increases in the incarceration rate should also compromise population health in

other wealthy democracies. I suggest that this is the case because of differences between the United States and other wealthy democracies in (1) the types of offenders who are incarcerated, (2) the structure of the welfare state and its implications for those coming into contact with the penal system, and (3) the public costs associated with maintaining prisons and jails. Possibly most importantly, I suggest that the benefits of incarceration for population health may outweigh the costs (or be about the same) in wealthy democracies other than the United States.

Typical accounts of the causes of the prison boom in America suggest that a punitive turn in criminal justice imposing long sentences on those involved in the drug trade, drug abuse, and public order offenses played an important role in growing the American penal population (Western and Wildeman 2009). Given that many of these laws were distinctively American—in that many of these offenses would have drawn only fines in other wealthy democracies—we might expect that a higher proportion of American prisoners and former prisoners were imprisoned only for nonviolent crimes than in any other wealthy democracy in the world. Were the social consequences of removing violent and nonviolent offenders from society about the same, crossnational differences in the distribution of violent tendencies would do little to affect the social costs of incarceration. Some research suggests, however, that the effects of having a nonviolent offender removed from families may be much greater than the effects of having a violent offender removed. Research on the effects of paternal incarceration on child wellbeing suggests, for instance, that it is only when the father was neither abusive nor incarcerated for a violent crime that his absence compromises child wellbeing (Wildeman *Forthcoming*). Likewise, it is only when the father was not abusive to the mother that his absence increases the risk of infant death (Wildeman 2009b). Since it is only in the U.S. that nonviolent offenders are incarcerated at very high rates, this finding suggests that the spillover effects of incarceration on

family life may be exclusively (or primarily) a U.S. phenomenon since fathers who enter prison in low-incarceration countries may be sufficiently antisocial to harm their children. Since imprisoning men also diminishes their fertility (Pettit and Sykes 2009), increases in the incarceration rate in countries that primarily incarcerate violent offenders could not only directly decrease infant mortality rates via removing these fathers from the household, but also indirectly diminish the infant mortality rate by diminishing the number of high-risk infants born.

Crossnational differences in the traits of prisoners may not only matter for small children, however. Another example of how incarceration could promote population health applies to men in the most criminally active years. Much research on crime suggests that there is a small pool of young men who are responsible for the lion's share of violent crime. Likewise, previous research suggests that most homicides take place between individuals who are similar in their race, age, and other demographic characteristics (Papachristos 2009). Thus, increases in the incarceration rate in nations that primarily incarcerate violent offenders are likely to decrease the mortality rates of young men substantially—thereby improving population health. Paradoxically, removing such men from the streets likely diminishes not only the mortality risk of other men in their age range, but also their own mortality risk since they are also at elevated risk of homicide.

Thus far, discussion in this section has focused on how incarceration may promote population health in wealthy democracies other than the United States. In addition to ways in which incarceration might improve population health in wealthy democracies, there are also a number of ways in which incarceration may harm population health less in wealthy democracies other than the United States than it does in the United States. Possibly most importantly, the effects of incarceration may be less detrimental in countries other than the United States because their more expansive welfare states provide a better buffer for the family members of former

prisoners—in addition to prisoners themselves. In other wealthy democracies, for instance, the incarceration of a family member is unlikely to push families as deep into poverty as it would in the United States—and even less likely to cause loss of health insurance. By buffering the negative effects of incarceration on families, therefore, the expansive welfare states of most other wealthy democracies may diminish the effects of incarceration on population health more broadly. This is not to say that incarceration should have no negative effects on the ever-imprisoned in other wealthy democracies, however. To the degree that having ever been incarcerated increases subsequent mortality risk in ways that cannot easily be addressed by broad welfare policies, incarceration should increase the mortality risk of the ever-imprisoned.

A final reason that the consequences of incarceration for population health in other wealthy democracies may be smaller than they are in the United States is because of how much less state money is spent on corrections in those nations. As Ellwood and Guetzkow (2009) have elegantly noted, increases in the American incarceration have come a high price—specifically, the increasing share of state budgets spent on corrections. Although the effects of these changes in state spending on corrections have not contributed to a huge change in the amount states spend on public goods such as welfare and public health infrastructure, the costs of maintaining the American correctional system dwarfs the costs of maintaining any other correctional system in the world. Thus, the complex system of budgetary trade-offs caused by mass imprisonment in the United States is unlikely to pose a problem for other wealthy democracies, leaving them more money to budget for public goods that promote population health.

Taken together, this research suggests that in wealthy democracies other than the United States, we might expect increases in the incarceration rate to promote population health. And should they not help population health, we might expect them to have little to no effect on

population health. The specific ages at which we might expect incarceration to diminish mortality are among infants, young children, and men in the most criminally active ages—roughly 15-29. Although I expect former prisoners (and their romantic partners) in other nations to also experience lower mortality rates than they do in the United States, it is likely that having ever been incarcerated will still substantially increase post-release mortality rates.

DATA AND ANALYTIC STRATEGY

Data

Unbalanced panel data covering the years 1981-2005 (*N*=370) are used to test the association between incarceration and population health. All 21 countries included were founding members of the OECD or wealthy democracies at the beginning of the period (see Table A1 for countries and years included). Data were drawn from various administrative sources (see Table A2).

Dependent Variables. I use three sets of dependent variables: Measures of life expectancy at birth, infant mortality rates, and age-specific mortality rates. Life expectancy at birth provides an overview of the health of a population (see especially Hall and Lamont 2009; see also Beckfield 2004). Since the associations between incarceration and health may vary by sex, I consider not only total life expectancy, but also male and female life expectancies. The infant mortality rate is an indicator of the health of women of childbearing age and their infants (Conley and Springer 2001). Some research proposes that the postneonatal mortality rate is more sensitive to macro-level shifts than is the neonatal mortality rate (LaVeist 1992), so I also predict neonatal and postneonatal mortality rates. The final dependent variables are age-specific mortality rates. I break age-specific mortality rates into five-year age groups (to 65-69), with the exception of considering 0-1 and 1-4 as separate categories. I consider age-specific effects of

incarceration on mortality because it allows me to (1) detect implausible effects of incarceration on mortality rates and (2) isolate age-specific variations in the mortality effects of incarceration.

Explanatory Variable. The explanatory variable is the incarceration rate in the previous year and is measured per 1,000 individuals in the population. So if life expectancy at birth in 1990 is the dependent variable, then the 1989 incarceration rate is the explanatory variable. By using the incarceration rate in the previous year to predict population health in the current year, I provide insight only into the *immediate* effects of incarceration on population health. Future research should also consider the long-term effects of incarceration on population health. I use the incarceration rate, which measures the rate at which individuals are detained in prisons or jails, rather than the imprisonment rate, which measures prison detainment. I chose this broader measure because it is easier to compare across nations than the imprisonment rate. Results seem unlikely to change much were the imprisonment rate used instead of the incarceration rate.

As Figure 1 showed, the American incarceration rate is an outlier. Taking the log of the incarceration rate could diminish the influence of the American incarceration rate on the results. Unfortunately, taking log of the incarceration rate would also make it more difficult to interpret the results since I am interested not in the effects of a relative increase in the incarceration rate but an absolute increase in the incarceration rate. Furthermore, one goal of this analysis is to demonstrate how distinct the associations between incarceration and population health are in the United States relative to those in other wealthy democracies, so I want to highlight (not hide) the influence of the United States on the results. Thus, I do not log the incarceration rate.

Control Variables. This analysis also includes a host of controls. These include the total fertility rate, the percent of the population aged 65 or older, per capita GDP, the unemployment

rate, public expenditures on health, and total social expenditures.[5] All analyses also include controls for the year (which has been centered) and a quadratic term for year in order to account for the somewhat dramatic secular improvements in population health over this period.[6]

In addition to these standard controls, the analyses also control for income inequality and the homicide rate. Income inequality is included because it is associated with the imprisonment rate and the health and wellbeing of a population (Wilkinson and Pickett 2009:496). Until recently, data on income inequality were limited, making it difficult to control for income inequality in models using repeated observations on countries without losing many observations. However, a new dataset called the SWIID provides information on income inequality for all of the country-years included in this analysis (Solt 2009). Although the procedures used to generate these estimates have limitations, estimates for the country-years I consider are likely reliable (Solt 2009:238).[7] Changes in the incarceration rate do not correspond closely with changes in the crime rate in the United States over this period (Western and Wildeman 2009), but I still include one control for crime—the homicide rate. I do so for a number of reasons. First, homicide is both a crime and a cause of death. Thus, it is may be associated with both the dependent and explanatory variables. Second, although incarceration and crime rates may not co-vary in the United States over time, some research suggests a substantial association between incarceration and homicide rates in other countries (Nadanovsky and Cunha-Cruz 2009). Finally, the homicide rate is the only measure of crime unlikely to be defined differently depending on the country.

For descriptive statistics for dependent, explanatory, and control variables, see Table 1.

[5] Many similar analyses also control for percent urban, but I do not use this measure because of how highly urbanized most of these countries were and how little change there was in the percent urban over this time period.
[6] Results did not change notably when year fixed effects were included in the model, so I opted for using only 2 degrees of freedom (for the linear and quadratic year terms) rather than 24 (for the year dummy variables).
[7] This is especially the case since the Luxembourg Income Study (LIS) estimates of the Gini, which have long been considered the gold standard in this area of research, form the backbone of the SWIID estimates (Solt 2009).

[Insert Table 1 about here.]

Analytic Strategy

I rely on an OLS regression model with country fixed effects and clustered standard errors to test the hypotheses presented earlier in this paper. This model is appropriate because it controls for stable (yet unobserved) traits of countries possibly associated with both incarceration rates and population health. In crossnational analyses, unobserved heterogeneity is one of the most serious threats to causal inference, so including fixed effects improves the reliability of results.[8] At least two other difficulties stem from the use of such panel data, however: (1) the clustering of observations on countries; and (2) serial correlation. Since failing to deal with either of these difficulties results in biased standard errors, I use clustered errors. This method adjusts standard errors to account for clustering of observations on countries without assuming an AR(1) process. In panel datasets around the size used for this analysis, this method is considered preferable to using an AR(1) adjustment, which can substantially bias standard errors—even if the serial correlation is AR(1), which it rarely is (Bertrand, Duflo, and Mullainathan 2004:272).

In the first stage of the analysis, I predict six different measures of population health, three related to life expectancy at birth—total, male, and female life expectancy at birth—and three related to the infant mortality rate—total, neonatal, and postneonatal—using all 21 countries (Table 2). The goal in this stage of the analysis is to consider how incarceration rates associate with population health in the full sample while controlling for country fixed effects and

[8] Although a GLS model with random (and fixed) effects would have improved efficiency, I did not use that model because Hausman tests revealed significant differences between the GLS and OLS estimates. Since the efficiency gained from using random effects is preferable to fixed effects only when it does not significantly alter the coefficients (Halaby 2004; see also Beckfield 2006), I use the OLS regression model with fixed effects. Nonetheless, estimated effects of incarceration were comparable in the GLS models with fixed and random effects.

the full range of covariates discussed. Based on point estimates derived from these models, predictions are then made about how different the health of Americans would be if the American incarceration rate were not such an outlier (Table 3; Figure 2). In the second stage of the analysis, the United States is omitted (Table 4), making it possible to consider what the effect of the incarceration rate on population health is when the United States is excluded.[9]

In the final stage of the analysis, I use the same modeling strategy but predict age-specific mortality rates (Table 5). Some of these models include the United States; others exclude it. Considering age-specific effects of incarceration is important for two reasons. First, it allows me to test for implausible effects. For instance, no research suggests that incarceration rates should increase the mortality rates of young men (age 15-29), so if models suggest that incarceration rates are positively associated with higher mortality risk among those men, effects would seem implausible. This would suggest that the relationship between the incarceration rate and population health was likely spurious—even if models to that point had suggested a causal relationship between the two. Since these are the years in which men are most criminally active, finding incarceration rates to be associated with significant increases in mortality in that range might also suggest that it was crime rather than incarceration that was driving any association. Second, it allows me to consider whether effects are largest at the youngest or oldest ages, and how these effects differ when the United States is included or excluded from the analysis.

RESULTS

[9] In preliminary models, I included an interaction between the United States and the incarceration rate. In general, results from those models provided support for the hypothesis that the effects of incarceration different significantly in the United States than the other wealthy democracies considered here. In the interest of providing a less complex summary of the results for the other wealthy democracies, I ultimately decided to drop the United States from those analyses rather than including an interaction. These analyses are available upon request from the author.

Results from Models Predicting Population Health in the Full Sample

In Table 2, I present estimates of the association between the incarceration rate and six measures of population health in 21 wealthy democracies over the 1981-2005 period. Each of the models controls for country fixed effects and other covariates likely associated with the incarceration rate and population health. In the first three models, the outcomes considered are total, male, and female life expectancy at birth. In each of these models, the incarceration rate is associated with significant declines (at the .01 and .001 levels) in life expectancy at birth. The magnitude of the association is largest for female life expectancy, which is likely due to the greater life expectancy of men than women (Table 1). According to these estimates, each additional prisoner per 1,000 population decreases life expectancy at birth between .29 and .35 years. Results from these three models provide initial support for the negative effects of incarceration on population health.

[Insert Table 2 about here.]

The final three models in Table 2 consider the association between the incarceration rate and the infant, neonatal, and postneonatal mortality rates. Prior research on the United States finds a positive association between the imprisonment rate and the infant mortality rate (Wildeman 2009b), but the association between the incarceration rate and the infant mortality rate is nonsignificant in the current analysis. Based on these models, there is no evidence that the incarceration rate affects the infant mortality rate in the same way in other nations as it does in the United States. In supplementary models, I included an interaction between the dummy variable for the United States and the incarceration rate, finding a statistically significant interaction large enough that it confirmed the harmful effects of incarceration on infant mortality.

Based on estimates from models presented in Table 2, we might expect growth in the American incarceration rate over this period to explain some of the declining life expectancy at

birth of Americans relative to those from other wealthy democracies. We would not expect that the prison boom played much of a role in the elevated mortality risk of American infants relative to infants born in comparable nations, however. In Table 3, I use estimates from Table 2 to consider how different population health would have been in America in 2005 had the American incarceration rate remained at the 1983[10] level or decreased to the sample mean incarceration rate rather than increasing to its 2005 level. All estimates are derived holding all other values at their 2005 levels in America and varying only the incarceration rate. This is a simple way to consider the counterfactual scenario in which the prison boom had not happened.

[Insert Table 3 about here.]

Results from Table 3 suggest that American life expectancy at birth, but not infant mortality, would have changed substantially had the American prison boom not taken place. According to Table 3, total life expectancy at birth would have been 1.5 and 2.0 years longer had the American incarceration rate stayed at its 1983 level or dropped to the mean incarceration rate. This is not a large percentage increase, but it is substantively important (and large) nonetheless. Over the 1983-2005 period, American life expectancy at birth increased from 74.6 to 77.8 years at birth—an increase of 3.2 years. According to results from Table 2, American life expectancy would have increased an additional 47 percent over this period had the incarceration rate remained at the 1983 level. Furthermore, results for male and female life expectancy are similar, suggesting comparable gains for men and women had the prison boom not happened. Results also suggest that the American infant and postneonatal (although not neonatal) mortality rates would have been somewhat lower in the absence of the prison boom, though those predictions are based on estimated effects that are not statistically different from zero.

[10] I use the 1983 American incarceration rate instead of the 1981 rate because the United States was not included in the models shown in Table 2 until 1983. (See Table A1 for a list of years in which each country was included.)

How does the change in American life expectancy at birth under this counterfactual scenario compare to those in other wealthy democracies? In Figure 2, I present estimates of life expectancy at birth over the 1983-2005 period for four countries that experienced relatively large increases in the incarceration rate based on (1) the actual increase in the incarceration rate over that period and (2) the counterfactual scenario in which the incarceration rate did not increase. Results show that it is only in the United States that changes in the incarceration rate could have substantially diminished the life expectancy gains over this period. In the other countries shown, the observed and counterfactual estimates were nearly identical. Thus, regardless of the level of significance of the incarceration rate in models presented in Table 2, it is only in the U.S. that these significant effects may have a substantial impact on population health.

[Insert Figure 2 about here.]

Results from Models That Exclude the United States

Results from Table 2, which included all 21 countries, showed that the incarceration rate is negatively associated with life expectancy at birth but not significantly associated with the infant mortality rate. Furthermore, applying these point estimates to a counterfactual scenario in which the American incarceration rate had not increased to its current level suggests that the average American could expect to live about 1.5 years longer had the prison boom not taken place. Since the American incarceration rate is such an outlier, however, results from these models may have been heavily influenced by the American incarceration rate to the point that they may not accurately reflect the relationship between the incarceration rate and population health for the other countries in the sample. This is problematic not only because it suggests that the model

may be misspecified, but also because the effects of incarceration on population health in the United States may differ significantly from their effects in the other countries considered.

In order to address these limitations, I present the same series of models shown in Table 2 but exclude the United States from the analysis. The first three models in Table 4 show how the incarceration rate is associated with life expectancy at birth. In each of these models, the relationship between the incarceration rate and life expectancy at birth is positive, although nonsignificant. These nonsignificant results are substantively interesting because models in Table 2 suggested effects that not only went in the other direction but were also statistically significant. Thus, based on results from the first three models of Table 4, it appears that life expectancy is at worst not harmed (and at best helped) by increases in the incarceration rate in the 20 countries considered in the analysis. This differs not only from findings shown in Table 2, but also from macro-level studies considering the relationship between incarceration and population health in the United States (Johnson and Raphael 2009; Wildeman 2009b). Thus, these results suggest that effects in the U.S. in previous models overwhelmed the effects in all other nations, for which the effects of incarceration on population health are not damaging.

[Insert Table 4 about here.]

In the final three models of Table 4, I present estimates of the effects of the incarceration rate on the infant, neonatal, and postneonatal mortality rates, again with the United States excluded. Results from these three models suggest that the incarceration rate is negatively and significantly associated with both the total infant mortality rate and the postneonatal infant mortality rate (but not the neonatal mortality rate). These results suggest that increases in the incarceration rate may decrease postneonatal and total infant mortality. This finding again differs from what was demonstrated in the models including the United States, where the incarceration

rate was positively (but not statistically significantly) related to the infant mortality rate. According to results from these models, each additional prisoner decreases the infant mortality rate by 1.75 infant deaths.[11] Thus, the protective effects of increases in the incarceration rate on the infant mortality rate in little-incarcerating countries appear to be quite substantial.

Age-Specific Effects of Incarceration on Mortality

Results thus far suggest that incarceration seems to harm population health when the U.S. is included and help it when the U.S. is excluded. In Table 5, I consider age-specific effects of incarceration of mortality. Results from the full sample suggest that any mortality-increasing effects of incarceration are concentrated at the older ages (30+) for both men and women. The ages at which the effects appear to be greatest are in the 30s, 40s, and from the late 50s on. It is likely that effects in the 30-49 age range are mostly attributable to the elevated mortality risks of prisoners (Binswanger et al. 2007) and their partners (Johnson and Raphael 2009). At the older ages, it is plausible that some excess mortality associated with increases in the incarceration rate is due to divestment of funding from programs that promote public health in order to cover the substantial costs of imprisoning a larger share of the population. It is also worth mentioning that at no age was the incarceration rate negatively and significantly associated with mortality risk. Thus, at no age did incarceration actually promote population health in the full sample.

[Insert Table 5 about here.]

[11] On first glance, these results may seem implausibly large. I suggest that, although large, they are not implausibly so because the total number of individuals who cycle through the penal system in any year is greater than the incarceration rate. Thus, to the degree that the incarceration rate is a proxy for the total number of people incarcerated in any given year, it will sometimes provide estimates that appear to be implausibly large.

Given substantial differences in results between Tables 2 and 4, it is not surprising that results in the last three models in Table 5, which exclude the United States, differ substantially from the first three models, which included it. In the last three models of Table 5, three findings merit attention. First, increases in the incarceration rate appear to decrease the mortality risk of all children under the age of five. This finding meshes well with the hypothesized protective effects of increases in the incarceration rate on the mortality risk of the young in most wealthy democracies. A second pattern has to do with the mortality of males—and, to a lesser degree, females—in their late teens and early 20s. According to results shown in Table 5, the incarceration rate was negatively and significantly associated with mortality rates among males ages 15 to 24. This again provides support for the hypothesis that increases in the incarceration rate may be protective for the young males most at risk of being a homicide victim.

A final pattern that merits attention is the elevated mortality risk among men ages 35 to 44. Although not surprising, this pattern bears mentioning for two reasons. First, it suggests that the mortality-increasing effects of having ever been incarcerated can likely not be undone by having a strong welfare state, suggesting that a more concerted effort to reduce the mortality costs of having ever been incarcerated may be needed not just in the United States, but also in other wealthy democracies. Second, this pattern suggests how different the mortality patterns are when the United States is removed from the analysis. When the United States was included in the analysis, the incarceration rate was only associated with increases in age-specific mortality risks. In models not including the U.S., however, the only time that the incarceration rate was associated with elevated mortality risk for men or women was among men in the 35-49 age group. Thus, while analyses including the United States suggest that incarceration harms population health, analyses excluding the United States showed negative effects on population

health in only two age groups—and only for men. This suggests that the potentially negative effects of incarceration on population health are likely to be felt only in the United States.

It is also worth mentioning in closing this section that results never suggested effects that would immediately seem implausible. Since the most plausible argument for spuriousness would suggest that crime rates (rather than incarceration rates) were the real cause of any effects on population health, we might have expected to see incarceration rates be associated with increases in population-level mortality rates at the most criminally actives ages—the 15-29 age groups. None of the models predicting age-specific mortality rates showed a positive association between incarceration and mortality at those ages, suggesting that spuriousness is not driving the relationship—or at least that high rates of crime are unlikely driving the observed associations.

DISCUSSION, IMPLICATIONS, AND LIMITATIONS

Results from a series of OLS regression models with country fixed effects yield interesting insight into crossnational variation in the effects of incarceration on population health. Models that included the U.S., which undoubtedly had substantial influence on the results given that its unusually high incarceration rate and change in that rate were both strong outliers, suggested that incarceration was negatively associated with life expectancy, but not infant mortality. Furthermore, models predicting age-specific mortality rates suggested that the incarceration rate was not significantly and negatively related to mortality risk in any age group and the incarceration rate appeared to have the most detrimental effects on the mortality risk of older adults, especially those around the age of permanent prison release (35-49) and for whom public investments in health are most likely to decrease mortality risk (50+). The magnitude of the effects on life expectancy suggest that had the American incarceration rate remained at the 1981

level, American life expectancy at birth would have been about 1.5 years longer in 2005. Such an increase would have eliminated much of the divergence in life expectancy between the U.S. and other comparable nations that occurred over this period. Taken together, results from models including the U.S. suggest that incarceration rates may compromise population health and that it is only in the U.S. that changes in the incarceration rate are substantial enough that these statistically significant effects may have substantial effects on population health.

When the United States was excluded from the analysis, however, the findings changed dramatically. After removing the United States from the analysis, the association between the incarceration rate and life expectancy at birth is no longer statistically significant, suggesting that the broad, negative effects of incarceration on population health may presently be restricted to the United States. Possibly even more intriguing, increases in the incarceration rate in these models were associated with decreases in both the infant mortality rate and the mortality rates of all children under the age of five. Furthermore, results suggest that increases in the incarceration rate may diminish the mortality of those males in the most criminally-active years (15-29). Taken together, these results suggest that increases in the incarceration rate may have broadly positive effects on population health outside of the United States. They also suggest that the effects of incarceration on population health in the United States may differ substantially from the effects in the other 20 countries considered in these analyses.[12] The finding that incarceration does not harm population health outside of the United States has another important implication. Since analyses show that incarceration harms population health within the United States, the finding that incarceration does little to harm population health (or may even help it) suggests that

[12] Models including an interaction between the incarceration rate and a dummy for the United States generally confirm this statement. For further discussion of these results or to see tables, contact the author.

the effects of mass incarceration on health inequities between the United States and all other wealthy democracies are likely even larger than the predictions shown in Figure 2.

Thus, results tended to suggest that the effects of incarceration on population health in the United States were quite different than its effects in other wealthy democracies. This is not to say that effects were totally incomparable, however. Both models including the full range of countries and excluding the United States showed that increases in incarceration rates were associated with elevated mortality risks among men who were roughly the age at which individuals who have been released from prison are unlikely to return—between the ages of 35 and 49. Since studies both in the United States and other countries have shown that prison release is associated with elevated mortality risk both immediately following release and many years into the future (Binswanger et al. 2007; Clavel et al. 1987; Farrell and Marsden 2007; Rosen et al. 2008), this finding does not come as a tremendous surprise. Possibly most importantly, this finding suggests that no matter what the incarceration regime, individuals who are released from prison are likely to experience higher mortality risks than they would have experienced had they never been incarcerated. In fact, the magnitude of these effects appears to be substantial enough that even in rarely-incarcerating nations, they can be detected at the macro-level. This finding is especially intriguing because it suggests that even in nations with a strong social safety net, having ever been incarcerated still increases subsequent mortality risk.

Although these findings are provocative, and this study is the first of its kind, it is limited in a number of ways. Probably the most serious concerns are endogeneity bias and spuriousness. I have dealt with endogeneity by including fixed effects and spuriousness by looking for implausible effects, but it is possible that both alternative explanations could be contributing to the findings. Some research considering the effects of incarceration on crime has used exogenous

shocks to deal with these obstacles (Drago, Galbiati, and Vertova 2009; Levitt 1996), but using such natural experiments is nearly impossible with such a large sample of countries. Another concern is that the incarceration rate may not have been the best possible measure of the size and change in the criminal justice system. A more appropriate measure might have been the share of the population having ever been imprisoned, for instance. Nonetheless, most such variables are either unavailable or impossible to calculate using the available data, making these concerns difficult to avoid. A final limitation is that a small sample of countries and years was included, making it impossible to tell if effects of incarceration vary by level of development.

Despite these important limitations, the findings presented here nonetheless have a number of important implications for how we think about the consequences of the penal system for health—both within the United States and throughout the rest of the developed world. On the most basic level, they suggest that incarceration compromises population health in the United States. They also suggest, however, that in the 20 other wealthy democracies considered here, increases in the incarceration rate may promote population health—or at least not harm it. For many who study the deleterious effects of mass imprisonment on society, this conclusion will likely be quite unpopular. Nonetheless, it bears mentioning since it suggests, as do recent analyses of the crime-incarceration relationship (Johnson and Raphael 2006), that incarceration has non-negligible benefits. This is the first time this possibility has been tested in regards to health, however, so future work should continue testing this hypothesis rigorously.

In addition to considering this research question, future research should also consider a number of other questions. Possibly most importantly, more research should consider the effects of incarceration on population health—and inequality in population health—in the United States. Some research considers this topic (Johnson and Raphael 2009; Swann and Sylvester 2006;

Wildeman 2009b), but more research is needed in this area. More work on wealthy nations that incarcerate little and less developed or transitional nations that incarcerate a great deal also merit attention, although many of the less developed (but heavily incarcerating) nations (such as Malta, some of the former Soviet republics, and South Africa) may lack the high-quality measures of population health over a long period of time needed to provide rigorous empirical tests. Finally, research should provide more tests of the effects of the incarceration rates on those other than the men and women who enter prison walls. Without demonstrating that having a family member imprisoned or living in a high-incarceration community are detrimental to one's health, it remains unclear whether macro-level results presented here are identifying a causal relationship between incarceration and population health. Whether future research considers these questions or other ones, the effects demonstrated here—when coupled with the astonishingly high rates of incarceration in America—suggest that this form of American distinctiveness merits attention.

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Table 1. Descriptive Statistics

Variable	Mean	(SD)	Min	Max
Dependent Variables				
Total Life Expectancy at Birth (in Years)	77.5	(1.7)	73.6	81.8
Male Life Expectancy at Birth (in Years)	74.4	(1.8)	70.2	78.4
Female Life Expectancy at Birth (in Years)	80.5	(1.6)	76.4	85.2
Infant Mortality Rate (per 1,000)	6.0	(1.8)	3.0	11.4
Neonatal Mortality Rate (per 1,000)	3.8	(1.1)	1.6	7.3
Postneonatal Mortality Rate (per 1,000)	2.2	(0.9)	0.8	6.3
Explanatory Variable				
Incarceration Rate in Previous Year (per 1,000)	1.1	(1.2)	0.3	7.3
Control Variables				
Total Fertility Rate	1.7	(0.2)	1.2	2.4
Percent of the Population 65+	14.3	(2.2)	9.6	19.3
Per Capita GDP in 2000 Dollars (Logged)	10.1	(0.2)	9.5	10.7
Unemployment Rate	7.5	(4.0)	0.5	23.9
Per Capita Public Health Care Expenditures in 2000 Dollars (Logged)	7.4	(0.3)	6.5	8.0
Per Capita Social Expenditures in 2000 Dollars (Logged)	8.5	(0.3)	7.5	9.2
Income Inequality (Gini)	28.9	(4.2)	20.9	37.8
Homicide Rate (per 100,000)	2.0	(1.7)	0.2	9.8
Year	1995.2	(5.7)	1981	2005

Sources: See Table A2. (*N*=370)

Table 2. Results from OLS Regression Models with Country Fixed Effects, 1981-2005

	Life Expectancy at Birth			Infant Mortality Rate		
Covariate	M1 (Total)	M2 (Male)	M3 (Female)	M4 (Total)	M5 (Neonatal)	M6 (Postneontal)
Incarceration Rate	-.32***	-.29**	-.35***	.14	-.11	.24
Total Fertility Rate	-.27	-.01	-.48	.31	.19	.13
Percent of the Population 65+	.04	-.07	.13**	.06	-.06	.12
Per Capita GDP	-.13	-.59	.29	2.38*	.84	1.54
Unemployment Rate	.03*	.03#	.04*	.02	.03	-.01
Public Health Care Expenditures	.91	.66	1.18#	-1.19	.66	-1.86*
Social Expenditures	-.02	-.26	.24	-1.45	-2.15*	.70
Income Inequality	.03	.03	.03	-.12#	-.12**	.01
Homicide Rate	-.06	-.07	-.04	-.05	-.06	.01
Year	.21**	.27***	.15*	-.25***	-.06*	-.19***
$Year^2$	.00**	.00**	.00#	.01*	.00	.00*
Intercept	71.89***	78.17***	65.66***	5.30	12.69	-7.39
R^2	.98	.98	.97	.92	.90	.88
N	370	370	370	370	370	370

Notes: Significance levels are as follows: *** <.001; ** <.01; * <.05; #<.10. All t-tests are two-sided. Standard errors are adjusted to account for clustering of observations on countries. Standard errors are omitted to conserve space.

Table 3. Predicted Life Expectancy at Birth (Total, Male, and Female) and Infant Mortality Rate (Neonatal and Postneonatal) in the U.S. at Three Incarceration Levels

	2005 U.S. Incarceration	1983 U.S. Incarceration	Sample Mean Incarceration
Total Life Expectancy	78.1	79.6	80.1
Male Life Expectancy	75.6	77.0	77.4
Female Life Expectancy	80.6	82.2	82.7
Infant Mortality	6.2	5.6	5.4
Neonatal Mortality	4.2	4.7	4.9
Postneonatal Mortality	2.0	0.8	0.5

Note: All other measures are held at their 2005 values in the United States.

Table 4. Results from OLS Regression Models with Country Fixed Effects for all Countries except the United States, 1981-2005

	Life Expectancy at Birth			Infant Mortality Rate		
Covariate	M1 (Total)	M2 (Male)	M3 (Female)	M4 (Total)	M5 (Neonatal)	M6 (Postneontal)
Incarceration Rate	.20	.19	.18	-1.75**	-.70	-1.05*
Total Fertility Rate	-.21	.05	-.45	-.04	.11	-.15
Percent of the Population 65+	.02	-.09	.11**	.10	-.05	.15*
Per Capita GDP	-.07	-.53	.37	2.02#	.72	1.30#
Unemployment Rate	.04**	.04**	.05*	-.02	.02	-.04
Public Health Care Expenditures	1.11#	.85	1.38*	-1.94	.45	-2.38**
Social Expenditures	-.19	-.41	.07	-.74	-1.94*	1.20
Income Inequality	.02	.02	.02	-.09	-.11**	.02
Homicide Rate	-.10	-.11#	-.10	.08	-.00	.07
Year	.21**	.27***	.15***	-.25***	-.06*	-.19***
$Year^2$	.00*	.00**	.00	.01**	.00	.00**
Intercept	70.99***	77.29***	64.76***	9.54	13.97#	-4.44
R^2	.98	.98	.97	.93	.88	.89
N	347	347	347	347	347	347

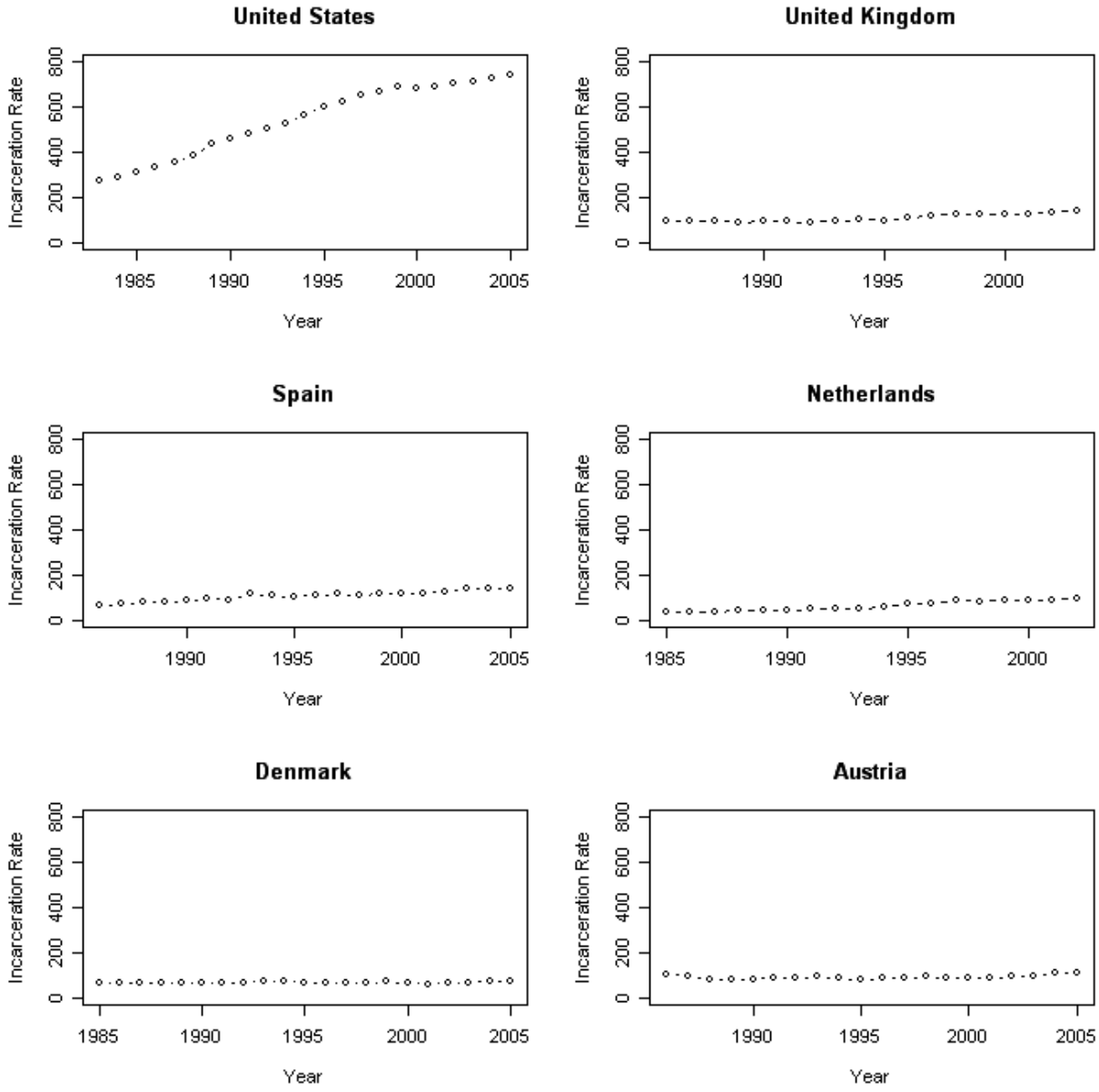
Notes: Significance levels are as follows: *** <.001; ** <.01; * <.05; #<.10. All t-tests are two-sided. Standard errors are adjusted to account for clustering of observations on countries. Standard errors are omitted to conserve space.

Table 5. Age-Specific Effects of Incarceration Rates on Mortality Rates from OLS Regression Models with Country Fixed Effects, 1981-2005 (*N*=370 for full, 347 without the U.S.)

	Full Sample			All Countries Except the U.S.		
Age	All	Male	Female	All	Male	Female
<1	.000131	.000149	.000143	-.001861**	-.002329**	-.001423**
1-4	.000006	-.000010	.000007	-.000083**	-.000107**	-.000048#
5-9	.000002	.000004	.000010	-.000028	-.000040	-.000011
10-14	- .000002	.000011	-.000007	-.000043#	-.000021	-.000060#
15-19	.000025	.000044	-.000002	-.000120**	-.000210**	-.000003
20-24	.000021	.000024	.000009	-.000199*	-.000316**	-.000048
25-29	.000010	-.000003	.000015	-.000021	-.000022	-.000024
30-34	.000027	.000004	.000037**	.000173*	.000298*	.000027
35-39	.000084**	.000069	.000090***	.000243**	.000372**	.000094
40-44	.000151***	.000180**	.000118***	.000202**	.000360**	.000052
45-49	.000135***	.000155**	.000102***	-.000066	-.000003	-.000077
50-54	.000118	.000204*	.000021	-.000287	-.000123	-.000311
55-59	.000202*	.000299**	.000080	-.000373	-.000107	-.000387
60-64	.000457**	.000638**	.000253*	-.000225	-.000079	-.000161
65-69	.000752***	.000854*	.000654***	-.000520	-.000786	-.000203

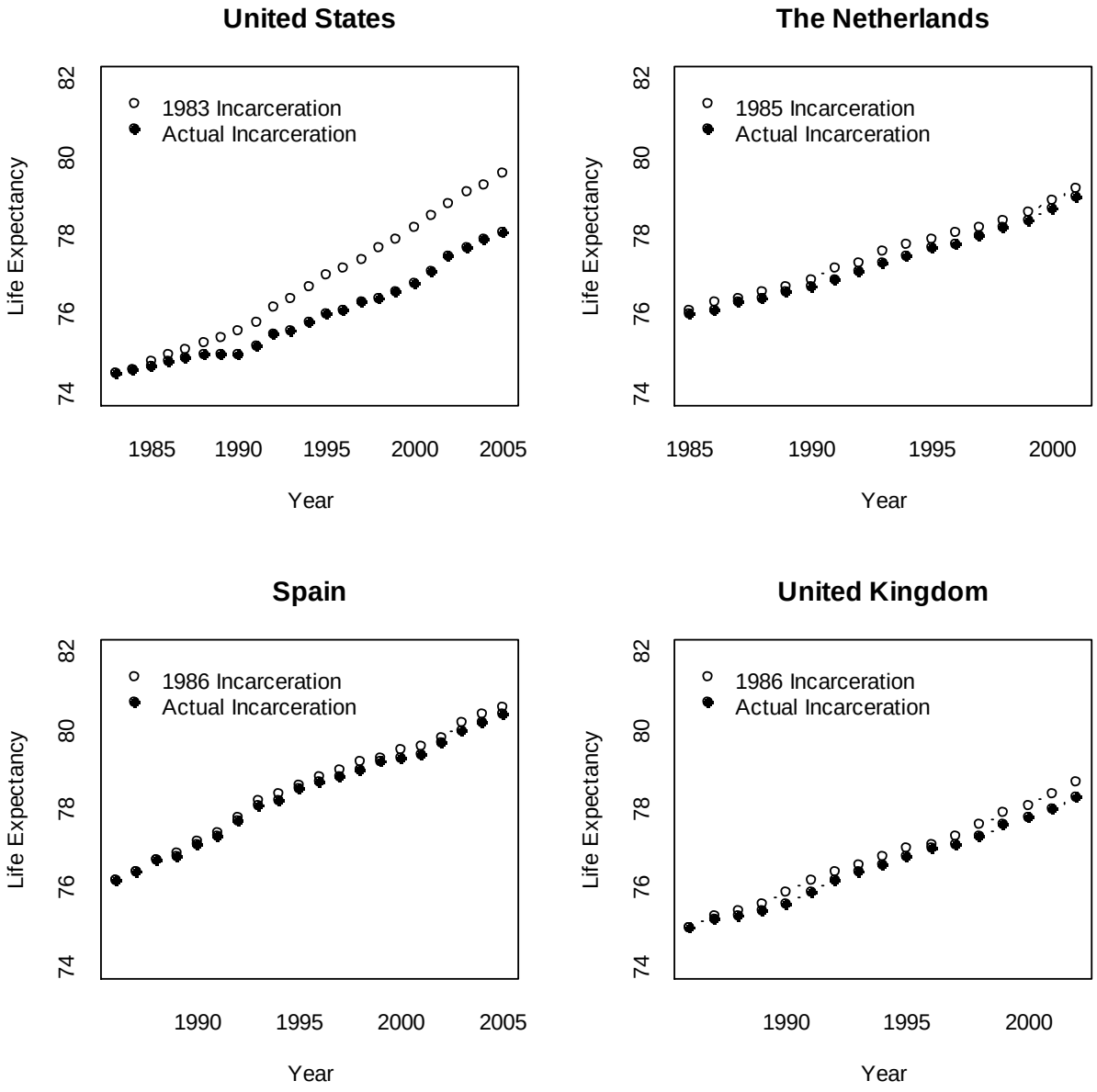
Notes: All models include the same controls as those shown in Tables 2 and 4. Coefficients for control variables are omitted to conserve space. Significance levels are as follows: *** <.001; ** <.01; * <.05; #<.10. All t-tests are two-sided. Standard errors are adjusted to account for clustering of observations on countries. Standard errors are omitted to conserve space.

Figure 1. Changes in the Incarceration Rate in Six Wealthy Democracies, 1983-2005



Sources: See Table A2.

Figure 2. Predicted Life Expectancy Based on Zero and Actual Change in Incarceration in Four Wealthy Democracies Experiencing Large Increases in Incarceration, 1983-2005



Note: Predictions based on estimates from Model 1 in Table 2.

Table A1. Availability of data by Country and Year (* = Data Available)

Country	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Australia						*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Austria						*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Belgium															*	*									
Canada	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Denmark					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Finland					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
France					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Germany											*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Ireland						*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Italy								*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Japan						*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*			
Luxembourg															*	*	*	*	*	*	*	*	*		
Netherlands					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*			
New Zealand					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Norway										*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Portugal										*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Spain						*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Sweden					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Switzerland										*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
United Kingdom						*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
United States	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Table A2. Data Sources by Variable

Variable	Sources
Total Life Expectancy	OECD Health Data ECO-SANTE
Male Life Expectancy	OECD Health Data ECO-SANTE
Female Life Expectancy	OECD Health Data ECO-SANTE
Infant Mortality Rate	OECD Health Data ECO-SANTE
Neonatal Mortality Rate	OECD Health Data ECO-SANTE
Postneonatal Mortality Rate	OECD Health Data ECO-SANTE
Age-Specific Mortality Rates	Human Mortality Database
Incarceration Rate[a]	United Nations Survey on Crime Trends and the Operations of Criminal Justice Systems, the Council of Europe, the European Sourcebook of Criminal Justice, Eurostat, Australian Institute of Criminology, Asian Pacific Conference of Correctional Administrators, U.S. Bureau of Justice Statistics, Statistics Canada
Total Fertility Rate	OECD Health Data ECO-SANTE
Population 65+	OECD Health Data ECO-SANTE
GDP	OECD Health Data ECO-SANTE
Unemployment Rate	OECD Health Data ECO-SANTE
Public Health Expenditures	OECD Health Data ECO-SANTE
Social Expenditures	OECD Health Data ECO-SANTE
Income Inequality	SWIID Database
Homicide Rate	United Nations Survey on Crime Trends and the Operations of Criminal Justice Systems, the European Sourcebook of Criminal Justice, Statistics Canada

[a] In some cases, multiple sources had calculated the incarceration rate independently. The rates from different sources were not always identical (often because they were collected at different times of the year), but the correlation between various sources was always around .99. Since the correlation between these rates was always so high, the rate chosen has little effect on the results. For further information or to see robustness checks, contact the author.