

The Strain of Sons' Incarceration on Mothers' Health

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Abstract

Research on disadvantage across generations typically focuses on the resources that parents pass on to their children. Yet, social disadvantage might also result from the transmission of adverse experiences from children to their parents. This paper explores one such adverse experience by examining the influence of a son's incarceration on his mother's health. Using panel data from the 1979 National Longitudinal Survey of Youth and its young adult follow up ($n=2,651$ mothers; 18,390 observations), the paper shows that mothers are more likely to suffer health limitations after a son is incarcerated. A time-distributed fixed effects analysis indicates that the effect on maternal health may persist or even grow over time. Rather than a short-term shock whose effect soon diminishes, a son's incarceration is a long-term strain on mothers' health. The disproportionate incarceration of young men in disadvantaged communities is thus likely to contribute to cumulative adversity among mothers already at risk of severe hardship. More broadly, the results suggest how children's adverse experiences may influence parental well-being, producing further disadvantage across generations.

Keywords: US; health inequalities; family; incarceration; multigenerational disadvantage; longitudinal analysis

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Research on the intergenerational transmission of advantage or disadvantage typically refers to the resources that parents pass on to their children. Yet, just as parents' social and economic status affects children's well-being, children's experiences might in turn influence parental well-being. For example, having children with higher levels of education, even after accounting for one's own socioeconomic status, increases parents' life expectancy (Friedman and Mare 2014; Torssander 2013). Torssander (2013, 638) concludes that it is not just parents' social background that influences their life chances but "...that adult children's resources – the 'social foreground' – also matter for parental health and mortality."

If adult children's beneficial experiences improve their parents' health, their adverse experiences might also strain their parents' health. There is some evidence, for example, that parents are negatively affected when their adult children get divorced (Lye 1996), and mothers may experience worse health when their children face challenges during the transition to adulthood (Barr et al. 2018). In families with limited material resources, where kin are more likely to rely on each other, mothers' mental health may be especially influenced by their relationships with their adult children (Umberson 1992).

In this paper, I examine a now common adverse experience faced by poor and minority mothers in the United States: the incarceration of their sons. Over the past four decades, mass incarceration has emerged as a new threat to family life, particularly in predominantly Black and Latino communities with high rates of poverty. Most research on incarceration and family life has focused on how men's incarceration affects their partners and children (Comfort 2008; Wakefield and Wildeman 2013; Wildeman, Schnittker, and Turney 2012). However, those who go to prison and jail are not just tied to their children but also to the generation that precedes them, particularly their mothers. Young men rely heavily on their mothers for material and emotional support during the process of arrest, court proceedings, incarceration, and community return (DeVuono-Powell et al. 2015; Harding et al. 2014; Western et al. 2015). Mothers may

be at increased risk of poor health when their sons go to jail or prison due to the shame, financial strain, and family responsibility associated with sons' incarceration (Braman 2004). Moreover, the strain on mothers' health may persist or even grow over time as the stress of a son's incarceration proliferates, leading to long-term physiological effects (Glaser and Kiecolt-Glaser 2005; McEwen 1998; Pearlin et al. 2005).

The following analysis uses data from the National Longitudinal Survey of Youth 1979 to estimate the effect of a son's incarceration on maternal health limitations. Results from fixed effects models indicate that mothers are more likely to experience health limitations after their sons are incarcerated, and a time-distributed fixed effects analysis indicates that the strain on maternal health may persist for several years after a son's initial incarceration.

The present study extends research on inequality and incarceration effects in three main ways. First, whereas the traditional approach to studying multigenerational disadvantage examines the effects of parental resources on children's outcomes, this paper instead studies the consequences of children's experiences for parental well-being (cf. Barr et al. 2018; Friedman and Mare 2014; Torssander 2013). Second, largely due to data constraints, most existing estimates of the effect of kin incarceration on women's health rely on a single community study, cross-sectional data, or studies of family members other than sons (Green et al. 2006; Lee et al. 2014; Wildeman et al. 2012; cf. Goldman 2019). The following analysis uses national, longitudinal data in an attempt to identify the effect of a son's incarceration on maternal health that is distinct from related disadvantage. Third, drawing on ethnographic work on kin incarceration, this paper treats incarceration not as an isolated event but rather as a process that unfolds over time (Braman 2004; Comfort 2016; Goffman 2014). Treating incarceration as a process requires an estimation strategy that can measure the potential change in the effect of incarceration over a period of several years. This approach allows us to better understand a son's incarceration as a chronic stressor that may have varying effects on maternal health over the life course.

Although the following analysis focuses on the health of all mothers who experience their son's incarceration, not all mothers across the U.S. are equally exposed to this stressor. Because low-income Black and Latina mothers are most likely to experience a son's incarceration, the present findings have important implications for racial disparities in health, family life in contexts of high incarceration, and the intergenerational transmission of disadvantage. If the health of low-income Black and Latina women is impaired by their son's involvement with the criminal legal system, the growth of incarceration over the past four decades could intensify health disparities among American women (Wildeman and Wang 2017). Examining the influence of sons' incarceration on mothers sheds light on how adult children's adverse experiences may form an important part of their parents' "social foreground," contributing to a kind of multigenerational disadvantage that takes hold of entire families.

Background

Incarceration and Family Life

There is growing recognition that the effects of incarceration extend beyond those confined in America's jails and prisons, yet few studies have examined incarceration's influence on family members beyond partners and children. Stratification research more broadly tends to focus on the influence of parents on children rather than the effect of children on parents. The focus on partners and children reflects a narrow understanding of the family as consisting of two parents and their young children (Mare 2011; Sarkisian and Gerstel 2012; Stack and Burton 1993).

Yet, studying adult kin beyond partners may be critical to our understanding of the influence of incarceration on family life. Incarceration in America is concentrated in Black and Latino communities with high rates of poverty (Travis, Western, and Redburn 2014). Non-white adult children with low incomes are especially likely to have close ties with their parents, particularly their mothers (Silverstein, Bengtson, and Lawton 1997). Mothers play a key role in

kin networks and are often closely involved in their children's lives well into adulthood (Lye 1996; Stack and Burton 1993).

Mothers' involvement with their adult children is especially evident when those children become involved in the criminal legal system. Mothers are most likely to pay for their sons' court fines and fees, and they are often a key source of support for their adult children while they are incarcerated (Braman 2004; DeVuono-Powell et al. 2015). After prison release, mothers commonly provide housing, cash assistance, and emotional support to their adult children (Harding et al. 2014; Western et al. 2015).

Those who go to jail or prison, of course, are not just men, and their adult kin extend beyond their mothers. However, given the disproportionate rate of incarceration among young men, mothers' critical role in families – particularly those in low-income communities – and close involvement with their incarcerated sons, this paper focuses on the consequences of sons' incarceration for maternal well-being.

The Effect of Sons' Incarceration on Mothers' Health

Research on women's broader family relationships suggests that a mother's physical and mental health may be harmed after experiencing a son's incarceration. Women with an incarcerated household member, for example, have higher odds of obesity, heart attacks, and stroke (Lee et al. 2014), and women who experience the incarceration of their child's father report higher levels of depression and life dissatisfaction (Wildeman et al. 2012).

Two key studies directly test the relationship between a child's incarceration and maternal health. Using data from a longitudinal study of Black mothers in Chicago's Woodlawn community, Green et al. (2006) find that mothers with recently incarcerated adult sons displayed greater psychological distress than mothers whose sons had not been recently incarcerated. Goldman (2019) extends these findings by leveraging national survey data on mothers and their young adult children. Among mothers at age 50, those who had experienced a child's

incarceration were significantly more likely to report lower self-rated health and increased functional limitations and depressive symptoms, even after accounting for their health at age 40.

Existing studies thus suggest a negative effect of sons' incarceration on maternal health, yet pre-existing hardship and stress among mothers with incarcerated sons is likely to confound the estimation of incarceration effects. Characteristics that are associated with having a son go to jail or prison, such as having low education or being Black or Latina, are also correlated with poor health among middle-aged women (Cummings and Jackson 2008). Prior studies attempt to account for confounding by leveraging comparisons between mothers at two points in time or selecting comparison groups of mothers who are similar to those with incarcerated sons (Green et al. 2006; Goldman 2019). However, stronger tests of incarceration's effect on health require models that can estimate change within the same mothers over time (Massoglia and Pridemore 2015). Thus, the extent to which a son's incarceration might independently influence his mother's health remains unclear.

Son's Incarceration and the Stress Process

Even if we observe that a son's incarceration has a harmful effect on his mother's health, there is little understanding about the nature of this relationship over time. Direct tests of the effects of incarceration implicitly treat incarceration as an event, observing its effect on well-being at one point in time. Incarceration, however, is both an acute and chronic stressor (Massoglia and Pridemore 2015), and chronic stressors are likely to have long-term effects on well-being (Pearlin et al. 1981; Thoits 2010). From this perspective, we should treat a son's incarceration as a process that may have varying effects on maternal health over the life course.

Incarceration is not an isolated event but rather a process of extended exposure to punitive institutions over a long period of time. Those who are incarcerated themselves experience their system involvement – from arrest to confinement and integration back into society – as a source of persistent stress (Massoglia 2008; Sugie and Turney 2017; Western et

al. 2015). The effects of sons' incarceration on mothers may also be enduring as sons get into trouble, are incarcerated, return to the community, and in many cases, continue to cycle through the criminal legal system.

Even prior to their sons' confinement, mothers may experience shame, stress, and their own criminalization due to their sons' repeated exposure to surveilling institutions (Comfort 2008; Elliott and Reid 2019; Goffman 2014). In addition, young men's heavy reliance on their mothers for court fees and prison expenses is likely a source of distress for mothers, most of whom are already very poor (Braman 2004; DeVuono-Powell et al. 2015). Mothers can experience the incarceration of their sons as a deep source of loss, grow to resent other family members who withdraw support, and become socially isolated (Allen 2017; Braman 2004; Clayton et al. 2018; Coates 2015). As middle-aged mothers in the general population transition to childless households, those with incarcerated sons often continue their caretaking role as parents and grandparents, even after their sons return to the community (Harding et al. 2014; Western et al. 2015). The cycle of kin criminal legal system involvement generates family instability and may negatively affect the health of women who tend to do much of the care work within families (Comfort 2016).

Beyond the stress directly tied to their son's incarceration, mothers may also be subject to stress proliferation across the life course, in which "...serious stressors, whether in the form of an untoward event or a chronic strain within an important social role, tend to give rise to additional stressors" (Pearlin et al. 2005, 210). Given that a son's incarceration is an adverse event likely to strain a woman's role as a mother, it may lead to "interconnected hardships" as mothers proceed through midlife (Pearlin et al. 2005, 213). Similar to children with incarcerated parents, mothers with incarcerated sons may thus be subject to two dimensions of stress proliferation: the stress of incarceration that spreads from one family member to another and secondary stressors that result from incarceration, even after the period of incarceration is complete (Turney 2014).

The preceding review suggests that a son's incarceration is both a process that unfolds over time and a potential source of stress for mothers over the life course. As a result, we should consider the effects of a son's incarceration in a processual manner as well. Research on the stress process – including how stress is manifested in the body – suggests three possible over-time health trends for mothers who experience their son's incarceration.

First, having a son go to jail or prison may not produce any additional strain on maternal health. The incarceration of a son is a stressor most commonly experienced by mothers already at risk of chronic stress. Individuals who have adapted to early stress exposure or those who experience ongoing background stressors may exhibit diminished reactivity to an additional stressor (Feder, Nestler, and Charney 2009; Gump and Matthews 1999). Thus, if mothers experience their son's incarceration as an acute stressor, it may not produce an additional effect on their health.

Second, a son's incarceration may produce an immediate effect on maternal health that diminishes over time. Even if mothers experience their son's incarceration as a chronic stressor, they may be able to adapt through personal coping resources or social support (Pearlin et al. 1981; Thoits 2010). In this case, the incarceration of a son might produce an immediate decline in a mother's health, but the magnitude of the effect may diminish over time.

However, the stress process paradigm suggests a third hypothesis is most plausible – that experiencing the incarceration of a son leads to a long-term strain on maternal health. Given that a son's incarceration is an extended process, potentially resulting in stress proliferation, mothers are likely to experience their son's incarceration as a chronic stressor (Pearlin et al. 1981; Pearlin et al. 2005). And given that incarceration is experienced most commonly by mothers who face multiple disadvantages, they may have fewer personal and social resources to buffer against its harmful health effects (Braman 2004; Thoits 2010).

From this perspective, having a son go to jail or prison may strain mothers' physiological capacity to respond to stress. Theories of allostatic load, for example, propose that when

individuals are forced to respond to constant threats over time, they experience “...wear and tear on the body and brain” (McEwen 1998, 37). Exposure to cumulative adversity may place individuals at risk of “weathering,” accelerated aging due to the body’s response to repeated stressors over the life course (Geronimus 1992). A number of biological pathways might account for the long-term effect of stress on health, including a weakened immune system and heightened inflammatory response, which increases the likelihood of age-related health conditions (Glaser and Kiecolt-Glaser 2005, 243). As a result, the effect of a son’s incarceration on his mother’s health may persist or grow over time.

This discussion has three main empirical implications. First, sons’ incarceration is likely to impair mothers’ health. Second, the association between sons’ incarceration and poor maternal health is likely confounded with pre-existing hardship and stress. Third, incarceration is a process both in its experience and potentially in its effects. The stress of sons’ incarceration on mothers is likely to be enduring, continuing through their sons’ system involvement and proliferating over the life course. Thus, we need empirical strategies that attempt to account for potential confounders and measure the effect of sons’ incarceration on maternal health over time.

Data and Methods

Data

Few data sources directly measure both sons’ incarceration and maternal well-being across the U.S. population. The National Longitudinal Survey of Youth 1979 (NLSY79), however, enables linkage of mothers to their sons. This paper leverages the longitudinal data linking mothers and sons to measure the effect of a son’s incarceration on maternal health over time.

The NLSY79 is a survey of 12,686 individuals aged 14 to 21 in 1979 (Bureau of Labor Statistics 2019b). The survey is meant to be representative of Black, Latino, and non-Black/non-

Latino (mostly white) youth living in households in the United States in 1979. Black and Latino youth were oversampled, which is useful for an analysis of incarceration given its concentration in Black and Latino communities. Study respondents were interviewed annually between 1979 and 1994, and every two years after 1994 until the most recent survey wave in 2016.

Beginning in 1994, the NLSY fielded a young adult survey (NLSY-YA) for all children of the NLSY79 women who had turned 15 by the survey year (Bureau of Labor Statistics 2019a). Every two years from 1994 to 2016, young adults were administered similar survey instruments to those fielded in the NLSY79. Linking the two surveys yields data on son's incarceration status and mother's health. Of the 6,283 women in the original NLSY79 sample, 3,003 have a son who was ever eligible for the NLSY-YA by 2016.

Measuring Key Variables

The key outcome variable in the following analysis is a binary measure of health limitations. Respondents who are not working are asked if their health keeps them from working for pay, and those who are working are asked if their health limits the amount or kind of work they can do. The questions on health limitations form part of the core NLSY79 survey instrument and have been administered at each wave, from 1979 to 2016.

Health limitations is a useful measure of health status in the general population. The measure captures both physical and mental health problems, such as chronic pain and psychological distress, and does not require a formal diagnosis (Hardie and Turney 2017). Health limitations is also an important indicator of overall well-being. Reporting health limitations is associated with lower potential earnings over the life course (Haveman et al. 1995), higher odds of housing insecurity (Houle and Keene 2015), and greater caretaking stress (Turney and Hardie 2018). Self-reported health measures, such as health limitations, are commonly prone to reporting bias, in which certain characteristics such as race or socioeconomic status are systematically associated with how people evaluate their own health (Ziebarth 2010). However,

fixed effects models, which rely on change in reported health status within the same individuals over time, should be less subject to reporting bias. Because health limitations is the only health outcome measured at each wave of the NLSY79, it is also ideal for panel data analyses which attempt to measure change over time.

The key explanatory variable is a measure of whether sons have ever been incarcerated by each wave. In line with recent research using the same data, I use three variables from the NLSY-YA to construct this measure (Goldman 2019). With a question about current residence, I identify sons who were interviewed while incarcerated. I also include sons who were incarcerated but unable to be interviewed, which the NLSY-YA began to report in 2004. Because sons are only interviewed every two years, these two variables might miss a substantial portion of shorter jail or prison stays and as a result, underestimate incarceration in the sample. Thus, I also code sons as incarcerated if in any wave they reported being sentenced to a correctional institution since the last interview.

The analysis also includes time-varying covariates for mothers that are likely to be associated with both maternal health and son's incarceration, including age, education, marital status, number of children, labor force participation, place of residence, geographical region, and mother's own incarceration (Chetty et al. 2016; Cummings and Jackson 2008; Parks et al. 2003; Schnittker and John 2007; Travis et al. 2014; Waldron et al. 1996). Time-invariant characteristics – including race/ethnicity at baseline, nativity, and age at first birth – are not included in the fixed effects models, yet are included in the descriptive statistics and in supplementary analyses. Appendix Table A1 describes all key variables used throughout the paper.

Sample Description

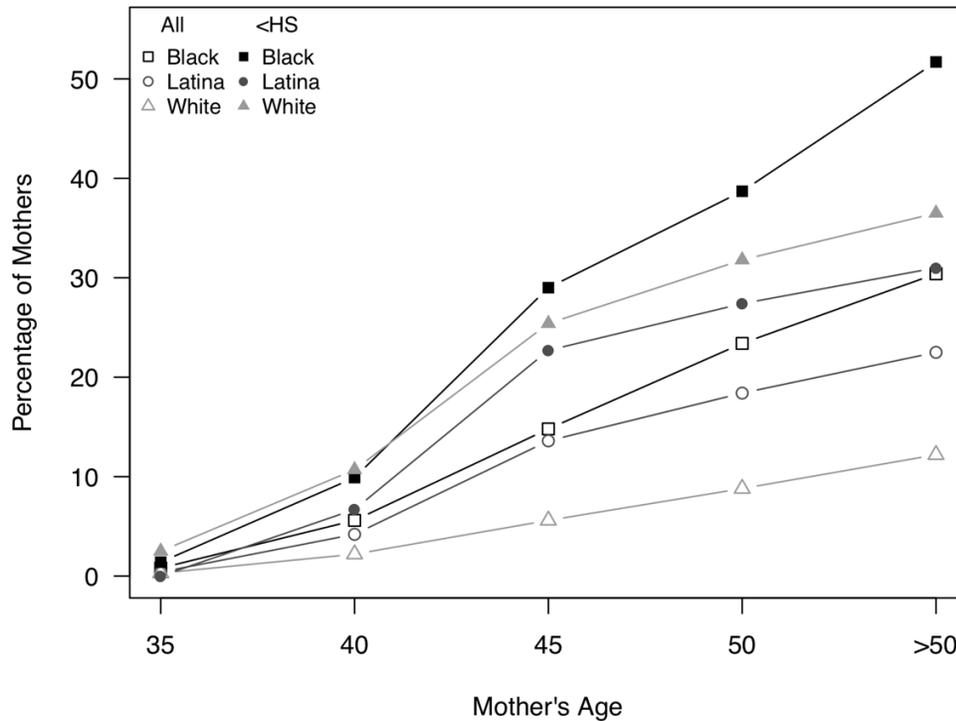
Mothers enter the analytic sample once their first son becomes eligible for the NLSY-YA. Because fixed effects models require pre- and post-treatment observations, the sample excludes 90 mothers who had already experienced their son's incarceration in the first wave of observation. After dropping observations with missing data, the following analysis uses unweighted data on 18,390 individual-year observations from 2,651 mothers over 12 survey waves between 1994 and 2016. Analyses using weighted data yield substantively identical results.

Just over 18 percent of mothers ($n = 481$) ever had a son incarcerated during the period of analysis. Though the data do not allow for exact measurement of incarceration duration, unique incarceration spells observed among sons in the analytic sample last, on average, 1.5 survey waves, representing roughly 3 years of incarceration. This estimate is similar to the average time served in state prison in the U.S. (Kaeble 2018) and aligns with prior research indicating that the NLSY is likely to capture incarceration spells longer than 12 months rather than brief jail stays (Massoglia et al. 2011).

Figure 1 displays how son's incarceration varies with maternal age, race/ethnicity, and education. The figure highlights two key patterns. First, the likelihood of ever having an incarcerated son rises sharply for mothers aged 40 to 45. The maternal age trend reflects young men's criminal legal system involvement in their late teens and early 20s. Second, experiencing a son's incarceration is deeply unequal by race and social class. By age 50, Latina and Black mothers were around twice as likely as white mothers to have had a son sent to prison or jail, and half of Black mothers who did not complete high school experienced the incarceration of a son during the study period.

Table 1 compares mean health limitations and other key variables between mothers in the analytic sample with never and ever incarcerated sons. Mothers whose sons ultimately become incarcerated are in worse health in the first year they are observed in the analytic

Figure 1. Cumulative percentage of mothers in NLSY79 with ever incarcerated son by mother's age, race/ethnicity, and education ($n = 2,651$).



Note: Unweighted data on mothers from NLSY79 linked with data on son's incarceration from NLSY-YA. >50 includes mothers between ages 51 and 59. Race/ethnicity is self-identified from the 1979 survey, and education level is measured in last wave mothers are observed in panel. Mothers are only included in estimate for each age if they were observed in analytic sample at that age.

panel, and the difference in mean health limitations between mothers with ever and never incarcerated sons grows even larger by the last wave in which they are observed. Mothers with ever incarcerated sons are more likely to identify as Black at baseline and to have had their first birth as a teenager, though these time-invariant variables are accounted for in the fixed effects models. Those in the treatment group are also slightly younger, though given that both groups of mothers are around 40 years old at panel entry, the analytic sample primarily consists of mothers proceeding through middle age. In their first wave of observation, mothers with ever incarcerated sons were also more likely to have less education, be unmarried, have more children, and have spent less time in paid employment. The differences between mothers with

Table 1. Means of key variables among mothers by son's incarceration status, NLSY79.

	Never Incarcerated	Ever Incarcerated
<i>Outcome variable</i>		
Health limitations, first wave	.12	.16
Health limitations, wave pre-incarceration	NA	.23
Health limitations, last wave	.26	.46
<i>Time-invariant characteristics</i>		
Race/Ethnicity		
Black	.26	.46
Latina	.19	.22
White/Other	.56	.32
Born outside U.S.	.07	.06
Age at first birth		
Less than 20	.30	.56
20 to 24	.33	.35
25 or older	.37	.09
<i>Time-varying covariates</i>		
Age (years)	41.53	37.33
Education		
Less than high school	.09	.25
High school (ref)	.42	.49
Some college	.27	.20
College or more	.22	.06
Married	.64	.44
No. of children	2.49	3.14
Avg. weeks worked	36.78	29.91
Place of residence		
Central city	.24	.29
Suburb (ref)	.53	.39
Central city unknown	.09	.17
Rural	.15	.16
Geographical region		
Northeast (ref)	.16	.11
North central	.25	.22
South	.41	.47
West	.19	.20
Ever incarcerated	.01	.02
No. of individuals	2170	481

Note: Unweighted data on mothers from NLSY79 linked with data on son's incarceration from NLSY-YA. Son's incarceration status is measured in last wave mothers are observed in panel. Statistics for covariates are reported for first wave mothers are observed in panel, and statistics for health limitations are reported for both first and last waves mothers are observed in panel. For mothers with ever incarcerated sons, health limitations is also reported for wave prior to son's incarceration. The sample size is slightly smaller ($n=440$) because not all mothers were observed in wave immediately prior to their son's incarceration.

and without ever incarcerated sons motivate an analytic approach that can estimate change within the same mothers over time and account for time-varying covariates.

Analytic Approach

A key challenge to identifying the effect of sons' incarceration on mothers is the severe hardship that mothers may face even if their sons did not go to prison or jail. Unobserved features of mothers may be associated with both having an incarcerated son and having poor health, and estimates from the models predicting health may be biased.

In an experimental framework, consider mothers with incarcerated sons as forming the treatment group ($T = 1$) and mothers with sons who are not incarcerated as forming the control group ($T = 0$). Ideally, to identify the causal effect of having a son incarcerated on a mother's health, we would compare the health of a mother i at time t when $T = 1$ to the health of a mother i at time t when $T = 0$. Yet, because a son cannot be simultaneously incarcerated and not incarcerated, it is impossible to observe the counterfactual.

The following analysis estimates the effect of sons' incarceration on mothers' health with fixed effects models that exploit variation within the same mothers over time. Because we observe mothers and sons every two years, we can compare a mother's health when her son has been incarcerated to her health prior to her son's incarceration. This approach thus accounts for time-invariant unobserved characteristics of mothers (such as a propensity to poor health or lack of social support) that may bias the estimated effect of having a son incarcerated on one's health.

The analysis fits two models predicting health limitations. Though health limitations is a dichotomous variable, I estimate linear probability models because logit models exclude observations with no change in the outcome variable (Allison 2009). I use robust standard errors to adjust for the inherent heteroskedasticity in linear probability models.

First, I estimate a fixed effects model that compares a mother's average probability of health limitations when her son is currently or previously incarcerated to a mother's average probability of health limitations in the years prior to her son's incarceration. More formally, for mother i in survey year t , we can write the model,

$$H_{it} = \beta_0 + \beta_1 S_{it} + \mathbf{X}'_{it} \beta_2 + \gamma_t + \alpha_i + \epsilon_{it}, \quad (1)$$

where H_{it} is a binary measure of health limitations, $S_{it} = 1$ if a mother has a son incarcerated in year t or earlier and $S_{it} = 0$ otherwise, \mathbf{X}'_{it} is a vector of time-varying mother characteristics, γ_t is a year fixed effect, α_i is a mother fixed effect, and ϵ_{it} is an error term. Year fixed effects remove any underlying aggregate trend in health status. To break the collinearity between maternal age and survey year, the year variable collapses every two survey years (Wooldridge 2013).

The conventional fixed effects model treats a son's incarceration as a single event and estimates a mother's average probability of health limitations across all of the years after she experiences the event. However, if incarceration is a process that affects maternal health over a period of several years, we need a method that accounts for changes in its effect over time. Thus, I also estimate a time-distributed fixed effects (TDFE) model which shows how a mother's predicted probability of health limitations changes over time relative to her son's incarceration. When a given treatment is conceived as a process, rather than a single event, the TDFE model is more appropriate than conventional fixed effects approaches (Dougherty 2006). This model adapts equation (1) and can be formally expressed,

$$H_{it} = \beta_0 + \sum_{p=-6}^6 \lambda_p S_{it}^p + \mathbf{X}'_{it} \beta_2 + \gamma_t + \alpha_i + \epsilon_{it}, \quad (2)$$

where p is the number of years since a son's incarceration if positive or prior to a son's incarceration if negative, and the superscripted S_{it}^p indicates an incarceration estimate for each $p = -6, \dots, 6$. The earliest pre-incarceration observation is at $p = -22$ for mothers in 1994 whose

sons are not incarcerated until 2016. The maximum number of years we observe after a son's incarceration is $p = 20$ for mothers in 2016 whose sons were first incarcerated in 1996. Though a mother's health may begin to be affected in the years immediately prior to her son's initial incarceration, we would not expect to observe an effect several waves prior to incarceration. For this reason, and because there are few observations at the tails, I collapse years -22 to -6 (the reference period) and years 6 to 20.

With this formulation, we can estimate the change in a mother's health four and two years prior to her son's incarceration, in the year her son is first incarcerated, two years following his incarceration, four years following, and six or more years later. The TDFE model thus tests whether (1) there is any significant change in a mother's health after her son is incarcerated, (2) there is an immediate effect that diminishes over time, or (3) the effect on a mother's health is persistent or cumulative, increasing as more years pass since her son is first incarcerated.

Because we only observe son's incarceration every two years, the timing of son's incarceration is not entirely precise. A son first observed as incarcerated in year t , for example, may have been incarcerated nearly two years prior (just after year $t - 2$) or just before his interview in year t . Still, the timing estimate is as precise as possible given the available data and offers important insight into the effect of a son's incarceration on maternal health over an extended period.

The fixed effects models that use a mother as her own control offer a key advantage over cross-sectional analyses that compare the health of mothers with and without incarcerated sons at a given point in time. Still, these models are not without limitations. First, conventional fixed effects models may be subject to bias when those in the treatment group do not merely exhibit different levels of a given outcome but also different trends in that outcome over time. Appendix B provides further discussion and analysis of this potential limitation. In addition, although the models account for several time-varying characteristics, there may be unobserved

confounders that change over time (such as a son's involvement in abusive behavior) that are correlated with whether a son becomes incarcerated and his mother's health limitations, potentially biasing estimates away from zero. Appendix C reports results from models that control for several different young adult children's behaviors and a proxy measure of paternal incarceration that could also influence maternal health. Lastly, though the TDFE analysis extends existing research by measuring the effect of incarceration over time, it does not illuminate the mechanisms for this over-time change, if any. In the discussion, I propose several plausible mechanisms and suggest avenues for future research.

Results

Fixed Effects Models of Health Limitations

The following section presents results from fixed effects models predicting the change in health limitations among mothers after their sons have been incarcerated. Table 2 reports results from the model in equation (1). After accounting for time-varying covariates, age, and year fixed effects (Model 1b), a mother's probability of health limitations is five percentage points higher, on average, in the years following her son's incarceration than in the years prior to her son's incarceration. However, it is possible that the effect is not constant across all years but rather changes over time. A TDFE model can account for this possibility by estimating the over-time change in the effect of a son's incarceration.

Figure 2 reports the parameter estimates from the TDFE model in equation (2). These results support the hypothesis that a son's incarceration has a cumulative effect on maternal health over time. Two and four years prior to a son's incarceration, mothers do not experience any change in the probability of health limitations compared to earlier years. We see a slight increase in a mother's probability of health limitations in the year her son is first incarcerated, though it is not statistically significantly different from zero. Two and four years following a son's incarceration, a mother's predicted probability of health limitations increases by around four

Table 2. Fixed effects regression estimates of the effect of son's incarceration on health limitations among mothers, NLSY79 1994-2016.

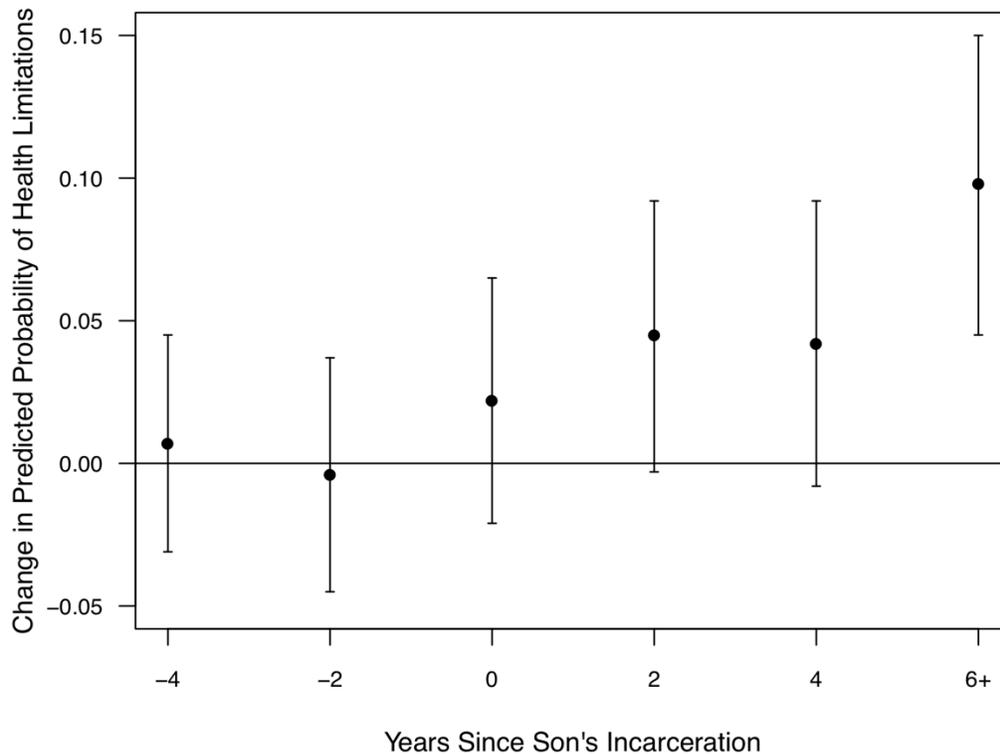
	(1a)	(1b)
Son ever incarcerated	.054*** (.016)	.054*** (.016)
Age	.003 (.011)	.009 (.011)
Age-squared	.076 (.114)	.014 (.115)
Education		
Less than high school		-.088* (.041)
Some college		-.055* (.024)
BA or more		-.073* (.036)
Married		-.011 (.011)
No. of children		-.007 (.020)
Avg. weeks worked		-.007*** (.001)
Place of residence		
Rural		-.022 (.015)
Central city		.009 (.011)
Central city unknown		.014 (.018)
Geographical region		
North central		-.072 (.057)
South		-.051 (.045)
West		-.046 (.052)
Ever incarcerated		-.192 (.136)
Constant	.189*** (.023)	.536*** (.079)
R^2 within individuals	.065	.081
No. of observations	18390	18390
No. of individuals	2651	2651

* $p < .05$ ** $p < .01$ *** $p < .001$ (two-tailed tests)

Note: Unweighted data on mothers from NLSY79 linked with data on son's incarceration from NLSY-YA. Estimated coefficients from linear probability models. Standard errors are in parentheses and adjusted for clustering at the individual level. Age centered at sample mean. Age-squared multiplied by 1000 in order to display a significant digit. Models also include year fixed effects with baseline year 1994-1996. The constant reported is the average value of the individual fixed effects.

percentage points ($p < 0.1$). Maternal health appears to significantly worsen over time. In the period six or more years following a son's incarceration, a mother's predicted probability of health limitations is 10 percentage points higher than in the years prior to her son's incarceration, net of any decline in health associated with aging.

Figure 2. Change in predicted probability of health limitations among mothers by time since son's incarceration, NLSY79 1994-2016 ($n = 18,390$).



Note: Estimated coefficients from linear probability models predicting health limitations with individual mother fixed effects. The reference period is 6+ years prior to son's incarceration. Model includes controls for age, age-squared, education, marital status, number of children, average weeks worked, place of residence, geographical region, mother's own incarceration and year fixed effects. Standard errors are adjusted for clustering at the individual level. Bars represent 95% confidence intervals around the parameter estimates.

Results from the TDFE model support findings from ethnographic work describing how a mother's health is strained with increased exposure to the criminal legal system. A son's initial

entry into jail or prison might have an immediate effect on his mother's health, and the effect may grow over time as her son serves his sentence, returns to the community, and perhaps becomes reincarcerated. Beyond the stress directly associated with a son's incarceration, the experience may also lead to secondary stressors which take a significant toll on a mother's health over time. From this perspective, rather than a short-term shock, the stress of a son's incarceration develops over several years, contributing to strained health among mothers as they age through midlife.

Supplementary Analyses

The main analysis reports the average effect of a single treatment – whether a son has ever been incarcerated – on maternal health. Due to the small sample size and the intensive data requirements of fixed effects models, reporting main effects for a single treatment maximizes the statistical power of the data and allows for the implementation of a time-distributed fixed effects model, which advances existing research by showing how the effect of a son's incarceration on maternal health varies over time.

It is possible, however, that the effect of a child's incarceration on maternal health varies based on characteristics of the mother or the nature of a child's incarceration. Supplemental analyses address this possibility by considering the heterogeneous effects of a son's incarceration (Appendix D1), the heterogeneous treatment of a son's incarceration (Appendix D2), and the effect of a daughter's incarceration (Appendix D3). These analyses produce three suggestive takeaways: (1) the effect of a son's incarceration on maternal health is largest for Black and Latina mothers and mothers with higher levels of education; (2) the effect of a son's incarceration on maternal health does not significantly differ when using alternate measures of the treatment, including whether a mother has had a son incarcerated in multiple waves or has had multiple sons incarcerated; and (3) experiencing a daughter's incarceration does not produce the same detrimental effect on maternal health. Although these models extend the

main analysis, they also rely on limited statistical power, and thus the results should be interpreted with caution.

Appendix E also includes results from a falsification exercise, which compares findings from the TDFE model for mothers who experience their son's incarceration to a control group of mothers who are similar on key variables. Because mothers whose sons become incarcerated may have distinct health trajectories, the falsification exercise is meant to test whether mothers from similar backgrounds experience the same long-term health decline, even in the absence of a son's incarceration. The results show that matched control mothers do not exhibit worsening health over time in response to a hypothetical stressor, providing further evidence for the long-term strain of a son's incarceration on maternal health.

Discussion

The results presented here suggest that mothers are significantly more likely to experience health limitations after their sons go to jail or prison. These findings extend prior research indicating worse physical and mental health among mothers whose young adult children have been incarcerated (Goldman 2019; Green et al. 2006) and women with incarcerated household members (Lee et al. 2014). The results also build on recent evidence that Black adolescents' stressful experiences, including arrest and broader criminalization, strain their mothers' well-being (Barr et al. 2018; Elliott and Reid 2019).

It is possible that mothers with incarcerated sons would experience poor health even in the absence of incarceration. Middle-aged women with low socioeconomic status are already at risk of experiencing severe hardship (Willson et al. 2007). The fixed effects analyses presented here attempt to account for a mother's risk of poor health by comparing her health in the years following her son's incarceration to her health in the years prior to her son's incarceration.

This paper also indicates that the detrimental effect on health may grow over time, perhaps due to mothers' continued exposure to the criminal legal system, the stress of their

sons' transition back into the community, and the stressors resulting from a son's incarceration that may proliferate as mothers proceed through midlife. This finding lends evidence to theories of allostatic load and weathering, which point to the physical and mental strain that individuals experience in response to chronic stressors over the life course (Geronimus 1992; McEwen 1998). Mothers' experience of health limitations may have serious consequences for their subsequent well-being, including substantial future earnings loss and housing insecurity (Haveman et al. 1995; Houle and Keene 2015). Perhaps most importantly, the physiological toll resulting from a son's incarceration and its accompanying stressors could lead to premature aging and mortality among mothers exposed to significant hardship (Glaser and Kiecolt-Glaser 2005).

The findings thus have implications for racial disparities in health, the consequences of incarceration for family life, and multigenerational disadvantage more broadly. Black women have the lowest levels of self-reported health in the United States and experience a decline in health at earlier ages than white women (Cummings and Jackson 2008; Geronimus et al. 2006). The present analysis shows that Black mothers, especially those with low levels of education, disproportionately experience the incarceration of a son, and their health is likely strained as a result. Research on stress and health shows that "...differential exposure to stressful experiences is one of the central ways that gender, racial-ethnic, marital status, and social class inequalities in health are produced (Thoits 2010, S44)." Given the present findings, the mass incarceration of young men may serve as an "insult to health" among Black mothers already at risk of hardship (Geronimus 1992, 211). This paper thus builds on work urging us to consider the expansion of the criminal legal system over the past four decades as a critical social factor contributing to health disparities between Black and white women in America (Comfort 2016; Lee and Wildeman 2013; Lee et al. 2015; Wildeman and Wang 2017).

When men go to prison, it is often the women left behind who are tasked with providing support (Braman 2004; Clayton et al. 2018; Comfort 2016; Goffman 2014; Harding et al. 2014;

Western et al. 2015). The results presented here suggest that the extensive reach of the criminal legal system may contribute to greater health limitations among women as they proceed through midlife, when they are likely still caring for children and working to support their families. If that is the case, the strained health that results from a son's incarceration may also influence the well-being of children already at risk of disadvantage, limit middle-aged mothers' participation in the labor force, and potentially reduce their opportunities to build wealth (Hardie and Turney 2017; Haveman et al. 1995; Houle and Keene 2015). The effects of incarceration are thus likely to ripple through family networks, increasing disadvantage among those already at risk of severe hardship (Turney 2014). From this perspective, exploring the effect of sons' incarceration on maternal health extends our understanding of multigenerational disadvantage.

The findings motivate three considerations for future research. First, our narrow conception of the family as consisting of parents and their young children may limit our understanding of the full effects of mass incarceration. Data collection should take into account extended kin who may be connected to those in jail or prison, and future analyses should consider older generations, in addition to younger, when measuring the effects of incarceration (cf. Comfort 2007; Lee and Wildeman 2013; Lee et al. 2015). Though it is not possible with the NLSY79 data structure, future research might also consider how fathers' well-being is affected when their children are incarcerated. Indeed, this extension may help to explain how a son's incarceration influences maternal health.

Second, the present analysis indicates that experiencing the incarceration of a son harms a mother's health and that this effect may persist or even grow over time. However, it does not test for mechanisms that might account for this relationship. Existing research suggests a number of plausible mediators that could explain why a son's incarceration strains his mother's health, including stigma or social isolation, increased care-taking of grandchildren, and the financial strain that occurs both when sons are confined and when they return to the community (Braman 2004; Clayton et al. 2018; Comfort 2008; DeVuono-Powell et al. 2015;

Goldman 2019; Green et al. 2006; Harding et al. 2014; Western et al. 2015). The process of incarceration is dynamic and closely tied to the transition to adulthood, as young men seek work or establish families. Analyses that employ alternate methods may be better suited to identify mechanisms and explore the dynamic process of incarceration, and would make a significant contribution to research and policy.

Lastly, this paper treats the incarceration of a son as a homogenous stressor and identifies the average effect of this stressor on maternal health. It is likely, however, that both the nature of incarceration and a mother's response to the stressor vary across several dimensions, including race, class, and region (Travis et al. 2014). Future research might explore variation in the type or intensity of sons' criminal legal system contact and the extent to which the effect of this contact is moderated by mothers' demographic characteristics or social context. (Though Appendix D begins to explore this variation, by examining heterogeneity in the experience and effect of incarceration, a lack of statistical power limits the conclusions we are able to draw.)

Research on the children of those involved with the criminal legal system has demonstrated how the effects of incarceration are carried over into younger generations. The present study shows how young men's incarceration may also influence mothers as they age through the life course. Mass incarceration has taken hold of entire families, compounding hardship among those most at risk of adversity. More broadly, studying the influence of sons' adverse experiences on mothers illuminates the multigenerational character of disadvantage. Social disadvantage is not just produced by the transmission of resources from parents to children but also by the transmission of experiences from children to their parents.

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ONLINE APPENDIX

Appendix A. Additional Tables

Table A1. Variables used in analysis of mother's health limitations on son's incarceration, NLSY79.

Variable	Description
<i>Outcome variable</i>	
Health limitations	A variable indicating whether mother answered yes to one of three questions: health prevents working for pay or health limits kind/amount of work one can do.
<i>Explanatory variable</i>	
Son ever incarcerated	An indicator variable for whether mother had experienced the incarceration of a son by a given wave. Incarceration includes sons who were interviewed or located in jail or prison and those who self-reported being sentenced to a correctional institution.
<i>Time-invariant characteristics</i>	
Race/Ethnicity	Collapses self-identified measure of mother's racial or ethnic origin from 1979 baseline survey into three categories: Black, Latina, or White/Other (mostly European origin; ref).
Born outside U.S.	A variable measured in 1979 baseline survey indicating whether mother was born outside of the United States.
Age at first birth	A categorical variable measuring whether mother experienced first birth as a teenager (less than 20), a young adult (ages 20 to 24), or later (25 or older; ref).
<i>Time-varying covariates</i>	
Age	A continuous measure of mother's age in years. Analysis also includes a quadratic age term.
Education	A categorical variable indicating highest level of education based on years of schooling: less than high school (<12), high school (12; ref), some college (13-15), or college or more (>=16).
Married	An indicator variable for whether mother reported being married. Does not include cohabitation.
Number of children	A continuous variable measuring number of children ever born to mother.
Average weeks worked	A measure of the cumulative mean of weeks per year mother spent in paid employment up to current survey wave (ranges from 0 to 52).
Place of residence	A categorical variable based on mother's address: central city indicates residence in core part of standard metropolitan statistical area (SMSA). Suburb (ref) indicates residence in SMSA but not central city, central city unknown indicates residence in SMSA but place in SMSA is unknown, and rural indicates residence outside of SMSA. Excludes those not currently residing in U.S.
Geographical region	A categorical variable based on mother's address: Northeast (ref), North central, South, or West. See NLSY79 documentation for specific states in each region (Bureau of Labor Statistics 2019b).
Ever incarcerated	An indicator variable for whether mother was ever interviewed or located in jail or prison.

Appendix B. Models with Group-Specific Slopes

The fixed effects models reported in Table 2 account for unobserved time-constant variables that might otherwise bias the estimated effect of a son's incarceration on his mother's health. These models thus control for different baseline levels of health limitations among treated mothers (those whose sons become incarcerated) and untreated mothers (those whose sons are not incarcerated). However, conventional fixed effects models do not account for the possibility that treated and untreated mothers may not just have different levels of a given outcome variable, but different trends in that outcome over time (Brüderl and Ludwig 2013). In the case presented here, results from a conventional fixed effects model may be biased if mothers whose sons become incarcerated would have exhibited distinct health trajectories over time, independent of the treatment.

It is reasonable to expect that mothers whose sons become incarcerated may have distinct health trajectories, even prior to their son's incarceration, given their sociodemographic traits. Mothers with incarcerated sons are disproportionately Black and Latina and have lower levels of education than mothers without incarcerated sons. The health of mothers with these attributes is likely to decline at a faster rate over the life course relative to mothers from more advantaged groups (Geronimus 1992; Geronimus et al. 2006). If this were the case, results from conventional fixed effects models may be upwardly biased because although these models account for different health levels among treated mothers, they do not account for different health trends over time.

To address this potential source of bias, I implemented mother fixed effects models that estimate group-specific slopes. Extending conventional FE models, these models allow for different baseline health trajectories among mothers by controlling for the interaction

between age and a given sociodemographic group.² This supplementary analysis estimates unique slopes for groups defined by (1) race/ethnicity, (2) education level at age 25, and (3) race/ethnicity by education level at age 25. In addition to the predictor (son's incarceration) and covariates included in the main model, these models also estimate interaction effects between age, age-squared, and the specified sociodemographic group. (Because race/ethnicity and education at age 25 are time invariant, the model does not estimate main effects for each group.)

Table B1 reports results from the main fixed effects model (also reported in Table 2) and three supplementary models (one for each sociodemographic group). Even after accounting for different baseline health trajectories over time, the substantive takeaway is the same as in the conventional FE analysis: experiencing the incarceration of a son may be detrimental for a mother's health, increasing her probability of health limitations by around five percentage points, on average.³

² Recent scholarship suggests extending this approach even further by allowing for a different time trend in the outcome for each individual. These models, called fixed effect individual specific (FEIS) models, estimate a unique slope for each individual, in addition to the unique intercept that is estimated with conventional FE approaches. See Brüderl and Ludwig (2013) for an explanation of FEIS models and Ludwig and Brüderl (2018) for an application to the marriage wage premium. Other scholarship, however, notes key limitations of the FEIS approach. Including individual-specific time trends in a fixed effects model is very data intensive and may absorb "...variation that is in actuality due to the treatment effect" (Meer and West 2015, 514). In additional analyses, I implemented a FEIS model, estimating a unique age-health trajectory for each mother in the analysis. The FEIS model produced results that are not significantly different from zero at conventional statistical levels. Although this could indicate that there is no additional effect of having a son incarcerated on a mother's health after accounting for her baseline health trajectory, it could also be the case that estimating a slope for each individual absorbs some of the treatment effect itself. Given the uncertainty around FEIS models, I do not report the results here, though they are available upon request.

³ I also implemented a model with a group defined by mother's academic achievement (using AFQT tertiles) and found the effect of a son's incarceration to also be around 5 percentage points. However, I do not include this model in Table B1 because missing data on the AFQT variable reduces the analytic sample by around 700 observations.

Table B1. Fixed effects regression estimates with group-specific slopes of the effect of son's incarceration on health limitations among mothers, NLSY79 1994-2016.

	Main Model	Race x Age	Education x Age	Race/Education x Age
Son ever incarcerated	.054*** (.016)	.051** (.016)	.049** (.016)	.047** (.016)
Age	.009 (.011)	.009 (.014)	-.002 (.018)	-.012 (.031)
Age-squared	.014 (.115)	.002 (.144)	.171 (.188)	.268 (.340)
Education				
Less than high school	-.088* (.041)	-.085* (.041)	-.056 (.043)	-.055 (.044)
Some college	-.055* (.024)	-.056* (.025)	-.062* (.025)	-.063* (.025)
BA or more	-.073* (.036)	-.074* (.036)	-.070 (.036)	-.072* (.036)
Married	-.011 (.011)	-.011 (.011)	-.010 (.011)	-.010 (.011)
No. of children	-.007 (.020)	-.009 (.020)	-.007 (.020)	-.008 (.020)
Avg. weeks worked	-.007*** (.001)	-.007*** (.001)	-.007*** (.001)	-.007*** (.001)
Place of residence				
Rural	-.022 (.015)	-.023 (.015)	-.021 (.015)	-.022 (.015)
Central city	.009 (.011)	.009 (.011)	.009 (.011)	.009 (.011)
Central city unknown	.014 (.018)	.015 (.018)	.013 (.018)	.015 (.018)
Geographical region				
North central	-.072 (.057)	-.070 (.057)	-.066 (.058)	-.064 (.058)
South	-.051 (.045)	-.050 (.045)	-.050 (.047)	-.048 (.047)
West	-.046 (.052)	-.046 (.052)	-.044 (.054)	-.044 (.054)
Ever incarcerated	-.192 (.136)	-.188 (.135)	-.190 (.134)	-.190 (.135)
Constant	.536*** (.079)	.541*** (.079)	.535*** (.079)	.537*** (.080)
<i>R</i> ² within individuals	.081	.082	.084	.085
No. of observations	18390	18390	18390	18390
No. of individuals	2651	2651	2651	2651

p*<.05 *p*<.01 ****p*<.001 (two-tailed tests)

Note: Unweighted data on mothers from NLSY79 linked with data on their son's incarceration from NLSY-YA. Estimated coefficients from linear probability models. Standard errors are in parentheses and are adjusted for clustering at the individual level. Age centered at sample mean. Age-squared multiplied by 1000 in order to display a significant digit. Models also include year fixed effects with baseline year 1994-1996. The constant reported is the average value of the individual fixed effects. In addition, the group-specific slope models include interaction terms between age, age-squared, and the specified sociodemographic group (race, education, or race/education).

Appendix C. Accounting for Key Omitted Variables

An important advantage of the fixed effects models in the main analysis is that they account for unobserved time-invariant traits of mothers that may be related to both their health and whether they experience their son's incarceration. However, unobserved time-varying characteristics associated with a son's incarceration and maternal health may still bias estimates away from zero. The following analyses attempt to account for key variables omitted from the main analysis: young adult children's behavior and the incarceration of young adult children's fathers.

Appendix C1. Young Adult Children's Behavior

We might expect that young adult sons who go to jail or prison may have experienced additional hardship or engaged in harmful behaviors that could influence their mothers' health even if they did not come into contact with the criminal justice system (Barr et al. 2018; Sugie and Turney 2017). Although I am unable to fully observe young adult children's behavior, I attempt to address this potential limitation by controlling for a number of children's behaviors (separate from institutional sanctions) that may influence maternal health.

Drawing on prior research that measures the effect of young adults' criminal justice contact on their own mental health (Sugie and Turney 2017), the following analyses control for measures of young adult children's health (including substance use) and delinquency that may be associated with both a mother's health and whether she experiences her son's incarceration. Using the NLSY-YA, I identified a number of variables related to young adult health and delinquency that were asked at each wave of nearly the entire young adult sample. The supplementary analyses presented here consider eight measures: whether a mother had a young adult child at each wave who had ever (1) received help for an emotional, behavioral, or family problem; (2) been suspected to have depression, based on a cutoff score of 8 on the CES-D 7-item scale (Levine 2013); (3) experienced problems after drinking alcohol, including

getting into an argument, having trouble with friends/family/neighbors, and skipping school or work; (4) used hard drugs, including cocaine, crack, heroin; (5) gotten into a fight at school or work; (6) skipped a full day of school or work without a real excuse; (7) stolen something worth \$50 or more; and (8) hit or seriously threatened to hit someone. Though the variables used to construct each measure were asked at every wave, sample sizes vary due to missing data.

Table C1 presents results from eight pairs of supplementary models estimating the effect of a son's incarceration on maternal health limitations. For each young adult behavior, the table includes the estimate from the main FE model (see Table 2) using the sample complete on the given measure and the estimate from a model that adds a control for the given measure.

Though the estimates vary slightly depending on which control variable is included, the substantive result is the same. Even after accounting for a number of young adult children's health and delinquent behaviors that might influence maternal health, mothers experience roughly a 5 percentage point increase in the probability of health limitations after their son's incarceration.

Table C1. Fixed effects regression estimates of the effect of son's incarceration on health limitations among mothers with controls for young adult children behaviors, NLSY79 1994-2016.

	Main Model	Controlling for Behavior
YA ever received help for problem (<i>n</i> = 2637; 18066) Son ever incarcerated	.052** (.016)	.053*** (.016)
YA ever potentially depressed (<i>n</i> = 2640; 17196) Son ever incarcerated	.056*** (.016)	.056*** (.016)
YA ever had problems after drinking (<i>n</i> = 2641; 17736) Son ever incarcerated	.045** (.016)	.046** (.016)
YA ever used hard drugs (<i>n</i> = 2644; 17997) Son ever incarcerated	.052** (.016)	.054*** (.016)
YA ever got into physical fight (<i>n</i> = 2576; 16887) Son ever incarcerated	.052** (.016)	.051** (.016)
YA ever skipped school or work (<i>n</i> = 2577; 16996) Son ever incarcerated	.053** (.016)	.052** (.016)
YA ever stole something >\$50 (<i>n</i> = 2575; 16712) Son ever incarcerated	.048** (.016)	.046** (.016)
YA ever hit or threatened to hit someone (<i>n</i> = 2575; 16954) Son ever incarcerated	.054** (.016)	.053** (.016)

p*<.05 *p*<.01 ****p*<.001 (two-tailed tests)

Note: Unweighted data on mothers from NLSY79 linked with data on their son's incarceration from NLSY-YA. Estimated coefficients from linear probability models. Standard errors are in parentheses and are adjusted for clustering at the individual level. Models also control for age, age-squared, year fixed effects, and the following characteristics of mothers: education, marital status, number of children, average weeks worked, place of residence, geographical region, and ever incarcerated. Sample size varies for each YA behavior; *n*(individuals) and *n*(observations) are included in parentheses after each control variable.

Appendix C2. Paternal Incarceration

Another important variable omitted from the main analyses is paternal incarceration – whether the young adult’s father was ever incarcerated in jail or prison. Existing research finds that paternal incarceration may increase the likelihood that a son has contact with the criminal justice system (Foster and Hagan 2015; Turney 2017) and harm maternal well-being (Wildeman et al. 2012). Given the likelihood that paternal incarceration is positively associated with both the explanatory and outcome variables in the main analysis, its omission from the fixed effects models may lead us to overestimate the effect of son’s incarceration on maternal health.

Because the NLSY79 and NLSY-YA do not systematically measure the incarceration of mothers’ partners or young adults’ fathers over time, I am unable to confidently account for paternal incarceration in the main analysis. However, in the following supplementary analysis, I use a proxy measure for paternal incarceration to try to test whether the harmful effect of a son’s incarceration on maternal health is partly due to a father’s incarceration.

Beginning in 2006, the NLSY-YA added a module on catastrophic events to the health section of the young adult questionnaire. This module includes the following question: “Since you were ten years old, has an adult member of your household (other than yourself), that is someone who was living in the same household as you at the time, been sent to jail or prison?” (Bureau of Labor Statistics 2019a). If respondents answer “yes,” they are asked the relationship of that person and their age when that person was sent to jail or prison (if the person was incarcerated multiple times, they are asked their age at the first and most recent times). Starting in 2008, if YA respondents have already answered this series of questions, they are asked about household member incarceration since the last interview rather than since they were 10 years old.

I used this series of questions to construct variables indicating whether each YA respondent reported experiencing their father’s incarceration (if residing in the same household)

at each wave between 2006 and 2016. Using the age questions and data on birth year, I then constructed variables indicating each age and year at which a respondent reported having their father sent to jail or prison. To match the biennial structure of the NLSY-YA data and the survey waves included in the analysis, I then created variables indicating whether a young adult had ever reported that their father was incarcerated by each wave between 1994 and 2016. Linking the young adults to their mothers yields a variable indicating whether the mother experienced the incarceration of any young adult child's father by each wave in the panel data. By 2016, according to this proxy measure of paternal incarceration, around 6% of mothers in the analytic sample had experienced the incarceration of a young adult's father who was residing with the child at the time of his incarceration.

Given the limitations to constructing this measure of paternal incarceration, it should be interpreted with great caution. First, though the analysis begins in 1994, the question about household member incarceration is first asked in 2006. Paternal incarceration measured prior to 2006 is thus based on young adults' retrospective accounts of whether their father was incarcerated at an earlier date. Second, the question specifically asks young adults about household member incarceration since they were 10 years old. Though a significant proportion of young adult respondents report ages when their father was sent to jail or prison prior to turning 10 years old, the measure is likely to miss a substantial portion of paternal incarceration that occurred when young adult respondents were young children. Third, given that the measure is constructed from a question about household member incarceration, it only captures incarceration for fathers who were residing in the same household as their children at the time of the father's incarceration. Just under half of fathers sent to jail or prison reside with their children prior to incarceration, and nonresidence is especially common for fathers from more disadvantaged groups (Glaze and Maruschak 2010; Turney and Wildeman 2013). As a result, paternal incarceration is likely further underestimated, particularly for young adults from more marginalized families. Still, given these limitations, the measure of paternal incarceration used in

the supplementary analysis leverages the available data as best as possible and accounts for at least some of the paternal incarceration (including its approximate timing) experienced by young adults and their mothers in the sample.

Table C2 presents results from fixed effects models estimating the effect of a son's incarceration on maternal health limitations. The table includes the estimate from the main FE model (Table 2) using the sample with complete data on the measure of paternal incarceration and the estimate from a model that adds a control variable for whether the mother had ever experienced the incarceration of a child's father. The results indicate that even after accounting for paternal incarceration, mothers experience around a 5 percentage point increase in the probability of health limitations after their son is incarcerated. This supplementary analysis increases our confidence that the harmful effect of a son's incarceration on his mother's health is not mainly due instead to the effect of a father's incarceration. However, more systematic data on paternal incarceration – starting from a child's birth and for fathers who do not reside with their children – would be critical for more definitively answering this question in future research.

Table C2. Fixed effects regression estimates of the effect of son's incarceration on health limitations among mothers, controlling for incarceration of young adult's father, NLSY79 1994-2016.

	Main model	With paternal incarceration
Son ever incarcerated	.049** (.016)	.049** (.016)
YA dad ever incarcerated		-.011 (.051)
Age	.009 (.011)	.009 (.011)
Age-squared	.012 (.115)	.012 (.115)
Education		
Less than high school	-.086* (.041)	-.086* (.041)
Some college	-.056* (.024)	-.056* (.024)
BA or more	-.078* (.036)	-.078* (.036)
Married	-.011 (.011)	-.011 (.011)
No. of children	-.008 (.020)	-.008 (.020)
Avg. weeks worked	-.007*** (.001)	-.007*** (.001)
Place of residence		
Rural	-.021 (.015)	-.021 (.015)
Central city	.009 (.011)	.009 (.011)
Central city unknown	.012 (.018)	.012 (.018)
Geographical region		
North central	-.069 (.058)	-.069 (.058)
South	-.053 (.046)	-.053 (.046)
West	-.050 (.053)	-.049 (.053)
Ever incarcerated	-.215 (.132)	-.215 (.132)
Constant	.535*** (.080)	.535*** (.079)
<i>R</i> ² within individuals	.079	.079
No. of observations	18229	18229
No. of individuals	2607	2607

p*<.05 *p*<.01 ****p*<.001 (two-tailed tests)

Note: Unweighted data on mothers from NLSY79 linked with data on their son's incarceration from NLSY-YA. Estimated coefficients from linear probability models. Standard errors are in parentheses and are adjusted for clustering at the individual level. Age centered at sample mean. Age-squared multiplied by 1000 in order to display a significant digit. Models also include year fixed effects with baseline year 1994-1996. The constant reported is the average value of the individual fixed effects. Analysis restricted to observations with non-missing data on paternal incarceration variable.

Appendix D. Supplementary Analyses

The main analysis reports the average effect of a single treatment – whether a son has ever been incarcerated – on maternal health. Due to the small sample size and the intensive data requirements of fixed effects models, reporting main effects for a single treatment maximizes the statistical power of the data and allows for the implementation of a time-distributed fixed effects model, which advances existing research by showing how the effect of a son’s incarceration on maternal health varies over time.

It is possible, however, that the effect of a child’s incarceration on maternal health varies based on characteristics of the mother or the nature of a child’s incarceration. The following analyses address this possibility by considering the heterogeneous effects of a son’s incarceration (Appendix D1), the heterogeneous treatment of a son’s incarceration (Appendix D2), and the effect of a daughter’s incarceration (Appendix D3). Although these models extend the main analysis, they also rely on limited statistical power, and thus the results should be interpreted with caution.

Appendix D1. Heterogeneous Effects of Son’s Incarceration

Most research on the consequences of kin incarceration estimates the average effect of having a family member incarcerated on a range of outcomes related to well-being. Recent scholarship, however, has begun to consider how the effect might vary based on one’s likelihood of experiencing the stressor of kin incarceration. For example, Turney (2017) finds that children with lower risks of being exposed to paternal incarceration experience more negative consequences when their fathers are incarcerated than children with a higher risk of exposure.

Mothers from disadvantaged groups, including Black and Latina mothers and those with low levels of education, are at highest risk of experiencing the incarceration of a son. It is unclear, however, whether the effect of a son’s incarceration on maternal health varies with the risk of exposure to the stressor. In order to begin to understand how the effect might vary by maternal characteristics, the following tables present estimates of the effect of a son’s incarceration on mothers’ health limitations separately by race/ethnicity and education level.

Table D1.1 presents results from the main FE model (Table 2) as well as the estimated effect of a son’s incarceration on maternal health limitations separately for Black, Latina, and white mothers. Mother’s race/ethnicity is a self-identified measure from the 1979 baseline survey.

The estimated coefficients for mothers from each racial/ethnic group suggest that the effect of a son’s incarceration is larger for Black and Latina mothers than for white mothers. However, the coefficients are not statistically significantly different from each other (Black v. white: $p=.13$; Latina v. white: $p=.24$).⁴ Thus, although the estimated probability of health limitations is higher for Black and Latina mothers than for white mothers, we cannot conclude based on these data that these mothers experience a greater decline in their health after their sons are incarcerated. Regardless of whether the health effects of experiencing a son’s incarceration differ significantly by maternal race/ethnicity, it is important to note that the prevalence of the stressor varies dramatically – Black and Latina mothers are much more likely to experience a son’s incarceration than white mothers (Haskins and Lee 2016; see Figure 1).

⁴ Throughout the supplementary analyses, I use the following formula recommended by Paternoster et al. (1998) to test the equality of coefficients between models: $Z = \frac{b_{1(group1)} - b_{1(group2)}}{\sqrt{SEb_{1(group1)}^2 + SEb_{1(group2)}^2}}$, in which b_1 refers to the estimated effect of a son’s incarceration on maternal health and each group refers to the different groups for whom regression coefficients are being tested (e.g. Black v. white or Latina v. white). This formula assumes that the covariance of the parameter estimates is zero and that the error variance is the same across groups.

Table D1.2 presents results from the main FE model (Table 2) as well as the estimated effect of a son's incarceration on maternal health limitations separately by mothers' education level. Mothers are divided into three groups based on their education level at age 25: less than a high school education, no more than a high school degree, and more than a high school education.

The results suggest that mothers with more education experience a larger health penalty after their sons are incarcerated. Mothers with more than a high school education experience nearly a 9 percentage point increase in the probability of health limitations after their son's incarceration, whereas mothers with less than a high school education do not experience a significant change in their health after a son is incarcerated. The difference between the two groups is marginally statistically significant ($p=.05$). The effect for mothers with no more than a high school education is not statistically significantly different from the effect for mothers with lower ($p=.11$) or higher ($p=.46$) education.

The preliminary findings presented here align with recent scholarship suggesting that a stressful event is most harmful for those for whom the event is the least prevalent, perhaps due to the unexpected nature of the event or a stronger associated stigma (Brand and Thomas 2014; Brand et al. 2019; Turney 2017). However, future research should aim to replicate these analyses with larger sample sizes, allowing for more statistical power to test differences between groups, and with a variety of health measures that are not directly tied to one's ability to work.

Table D1.1. Fixed effects regression estimates of the effect of son's incarceration on health limitations among mothers by race/ethnicity, NLSY79 1994-2016.

	Full Sample	Black	Latina	White/Other
Son ever incarcerated	.054*** (.016)	.070** (.023)	.064* (.032)	.015 (.027)
Age	.009 (.011)	-.008 (.019)	.035 (.021)	.008 (.017)
Age-squared	.014 (.115)	.110 (.120)	-.245 (.218)	.005 (.178)
Education				
Less than high school	-.088* (.041)	-.086 (.054)	-.171* (.079)	-.006 (.085)
Some college	-.055* (.024)	-.073* (.028)	-.064 (.045)	-.036 (.050)
BA or more	-.073* (.036)	-.066 (.057)	-.135* (.059)	-.063 (.058)
Married	-.011 (.011)	-.003 (.018)	-.024 (.025)	-.008 (.018)
No. of children	-.007 (.020)	-.029 (.029)	.028 (.044)	-.005 (.035)
Avg. weeks worked	-.007*** (.001)	-.006*** (.001)	-.007*** (.002)	-.007*** (.001)
Place of residence				
Rural	-.022 (.015)	-.052 (.031)	.045 (.044)	-.026 (.019)
Central city	.009 (.011)	.002 (.018)	.006 (.021)	.022 (.019)
Central city unknown	.014 (.018)	.035 (.029)	.016 (.035)	-.009 (.029)
Geographical region				
North central	-.072 (.057)	-.017 (.093)	-.177 (.150)	-.075 (.094)
South	-.051 (.045)	-.008 (.063)	-.103 (.075)	-.052 (.091)
West	-.046 (.052)	-.010 (.097)	-.093 (.096)	-.048 (.089)
Ever incarcerated	-.192 (.136)	-.049 (.036)	-	-.266 (.201)
Constant	.536*** (.079)	.570*** (.119)	.514** (.176)	.510*** (.131)
R^2 within individuals	.081	.092	.100	.070
No. of observations	18390	5918	3649	8823
No. of individuals	2651	783	508	1360

* $p < .05$ ** $p < .01$ *** $p < .001$ (two-tailed tests)

Note: Unweighted data on mothers from NLSY79 linked with data on their son's incarceration from NLSY-YA. Estimated coefficients from linear probability models. Standard errors are in parentheses and are adjusted for clustering at the individual level. Age centered at sample mean. Age-squared multiplied by 1000 in order to display a significant digit. Models also include year fixed effects with baseline year 1994-1996. The constant reported is the average value of the individual fixed effects.

Table D1.2. Fixed effects regression estimates of the effect of son's incarceration on health limitations among mothers by education level, NLSY79 1994-2016.

	Full Sample	<High School	High School	>High School
Son ever incarcerated	.054*** (.016)	.001 (.028)	.058** (.022)	.088** (.034)
Age	.009 (.011)	.027 (.025)	.011 (.015)	-.030 (.020)
Age-squared	.014 (.115)	-.163 (.267)	-.021 (.156)	.404 (.203)
Education				
Less than high school	-.088* (.041)	-.064 (.044)		
Some college	-.055* (.024)	-.149* (.060)	-.037 (.027)	-.023 (.046)
BA or more	-.073* (.036)	-.136 (.147)	-.073 (.041)	
Married	-.011 (.011)	-.032 (.026)	.002 (.016)	-.008 (.019)
No. of children	-.007 (.020)	.038 (.045)	-.003 (.026)	-.088** (.028)
Avg. weeks worked	-.007*** (.001)	-.006*** (.001)	-.007*** (.001)	-.006*** (.002)
Place of residence				
Rural	-.022 (.015)	-.063 (.034)	-.012 (.020)	.000 (.028)
Central city	.009 (.011)	-.017 (.024)	.009 (.017)	.025 (.018)
Central city unknown	.014 (.018)	.024 (.039)	-.012 (.027)	.047 (.026)
Geographical region				
North central	-.072 (.057)	-.156 (.141)	-.119 (.084)	.073 (.072)
South	-.051 (.045)	-.227* (.102)	-.048 (.058)	.097 (.072)
West	-.046 (.052)	-.181 (.128)	-.062 (.077)	.074 (.073)
Ever incarcerated	-.192 (.136)	.164*** (.024)	-.309 (.177)	-.060** (.021)
Constant	.536*** (.079)	.608** (.192)	.539*** (.099)	.448*** (.131)
R^2 within individuals	.081	.116	.086	.057
No. of observations	18390	3746	9078	5566
No. of individuals	2651	464	1247	940

* $p < .05$ ** $p < .01$ *** $p < .001$ (two-tailed tests)

Note: Unweighted data on mothers from NLSY79 linked with data on their son's incarceration from NLSY-YA. Estimated coefficients from linear probability models. Standard errors are in parentheses and are adjusted for clustering at the individual level. Age centered at sample mean. Age-squared multiplied by 1000 in order to display a significant digit. Models also include year fixed effects with baseline year 1994-1996. The constant reported is the average value of the individual fixed effects. Time-constant measure of mother's education (used to create groups) is measured when mothers are age 25. Models also include time-varying measure of education as mothers may complete additional years of schooling during the period of analysis.

Appendix D2. Heterogeneous Treatment of Son's Incarceration

In the main analysis, mothers are considered to have experienced the treatment if, in a given wave, at least one of their sons has ever been incarcerated. A son's incarceration is thus treated as a homogenous stressor. Most studies on the effects of one's own incarceration or the incarceration of a family member treat incarceration in a similar manner (e.g. Lee et al. 2014; Massoglia 2008; Western 2002). Panel surveys such as the Fragile Families and Child Wellbeing Study and NLSY79 also allow scholars to measure the timing or recency of incarceration. The present paper, for example, leverages the NLSY79 panel data to estimate how the effect of a son's incarceration varies over time.

The effect of incarceration may also vary along dimensions such as sentence length or number of incarceration spells. However, measuring these dimensions has proved challenging due to data limitations. The Fragile Families survey asks mothers about the duration of a father's incarceration, but due to missing data, few papers use it in the main analysis (e.g. Turney and Wildeman 2013; Wildeman et al. 2012). Using the NLSY79, scholars have attempted to approximate the duration of incarceration using a count of the interview waves in which a respondent was incarcerated (e.g. Maroto 2015; Massoglia et al. 2011; Schnittker and John 2007). Still, this measure cannot distinguish between someone who is incarcerated for several consecutive short spells and someone who is incarcerated continuously for a period of time.

In the following analyses, I consider two different measures of son's incarceration, beyond whether a son was ever incarcerated. Similar to prior papers using the NLSY79, I approximate the duration of incarceration with a measure of the number of waves in which a mother has ever had a son incarcerated by each wave. In addition, I approximate the intensity of a mother's exposure to the treatment with a measure of the number of sons a mother has ever had incarcerated by each wave.

Table D2.1 compares the results from the main FE model (Table 2) to a model that uses the number of waves a son has been incarcerated as the treatment variable. Due to limited observations in which mothers have sons incarcerated for multiple waves, the number of waves is collapsed into one, two, and three or more waves, and the analysis is restricted to mothers observed in at least three waves. The estimated coefficients for two ($p=.36$) and three or more waves ($p=.37$) are not statistically significantly different from the estimated coefficient for one wave. Thus, although the coefficients are slightly larger for mothers who have experienced their son's incarceration in multiple waves, we cannot conclude that there is a significant relationship between incarceration duration and maternal health based on the available data. These results align with prior research suggesting that any exposure to incarceration is a better predictor of later health than the duration of incarceration (Massoglia 2008; Schnittker and John 2007).

Table D2.2 compares the results from the main FE model (Table 2) to a model that uses the number of sons that a mother has ever had incarcerated as the treatment variable. Due to limited observations in which mothers have had multiple sons incarcerated, the variable collapses all observations in which mothers have had more than one son incarcerated. The results show that having multiple sons ever incarcerated is not statistically significantly different than having one son ever incarcerated ($p=.69$). The magnitude of the coefficient for multiple sons is slightly larger, but we do not have enough information to conclude that mothers with multiple sons ever incarcerated experience significantly worse health than mothers with one son ever incarcerated.

Table D2.1. Fixed effects regression estimates of the effect of son's incarceration and number of waves son incarcerated on health limitations among mothers, NLSY79 1994-2016.

	Any wave	Number of waves
Son ever incarcerated	.054*** (.016)	
One wave		.045** (.015)
Two waves		.073** (.027)
Three or more waves		.077* (.033)
Age	.009 (.011)	.008 (.011)
Age-squared	.016 (.115)	.023 (.115)
Education		
Less than high school	-.088* (.041)	-.086* (.041)
Some college	-.055* (.024)	-.054* (.024)
BA or more	-.073* (.036)	-.071* (.036)
Married	-.010 (.011)	-.011 (.011)
No. of children	-.006 (.020)	-.006 (.020)
Avg. weeks worked	-.007*** (.001)	-.007*** (.001)
Place of residence		
Rural	-.022 (.015)	-.022 (.015)
Central city	.008 (.011)	.008 (.011)
Central city unknown	.013 (.018)	.013 (.018)
Geographical region		
North central	-.071 (.057)	-.072 (.057)
South	-.051 (.045)	-.049 (.045)
West	-.046 (.052)	-.046 (.052)
Ever incarcerated	-.192 (.136)	-.195 (.134)
Constant	.540*** (.079)	.537*** (.079)
R^2 within individuals	.082	.082
No. of observations	17975	17975
No. of individuals	2368	2368

* $p < .05$ ** $p < .01$ *** $p < .001$ (two-tailed tests)

Note: Unweighted data on mothers from NLSY79 linked with data on son's incarceration from NLSY-YA. Estimated coefficients from linear probability models. Standard errors are in parentheses and adjusted for clustering at individual level. Age centered at sample mean. Age-squared multiplied by 1000 in order to display a significant digit. Models also include year fixed effects with baseline year 1994-1996. The constant reported is the average value of the individual fixed effects. Analysis restricted to mothers observed in at least three waves in panel.

Table D2.2. Fixed effects regression estimates of the effect of son's incarceration and number of sons incarcerated on health limitations among mothers, NLSY79 1994-2016.

	Any son	Number of sons
Son ever incarcerated	.047*	
	(.024)	
One son		.045
		(.023)
Two or more sons		.065
		(.046)
Age	.016	.0157
	(.021)	(.021)
Age-squared	-.053	-.050
	(.214)	(.215)
Education		
Less than high school	-.101	-.100
	(.062)	(.063)
Some college	-.122**	-.122**
	(.038)	(.038)
BA or more	-.136*	-.135*
	(.061)	(.061)
Married	-.025	-.026
	(.022)	(.021)
No. of children	.010	.009
	(.104)	(.103)
Avg. weeks worked	-.008***	-.008***
	(.001)	(.001)
Place of residence		
Rural	.006	.006
	(.026)	(.026)
Central city	.017	.018
	(.020)	(.020)
Central city unknown	.027	.028
	(.029)	(.029)
Geographical region		
North central	-.150	-.150
	(.109)	(.109)
South	-.174	-.174
	(.098)	(.098)
West	-.160	-.159
	(.105)	(.104)
Ever incarcerated	-.329	-.332
	(.190)	(.189)
Constant	.626	.625
	(.361)	(.360)
R^2 within individuals	.093	.094
No. of observations	6339	6339
No. of individuals	1088	1088

* $p < .05$ ** $p < .01$ *** $p < .001$ (two-tailed tests)

Note: Unweighted data on mothers from NLSY79 linked with data on their son's incarceration from NLSY-YA. Estimated coefficients from linear probability models. Standard errors are in parentheses and are adjusted for clustering at the individual level. Age centered at sample mean. Age-squared multiplied by 1000 in order to display a significant digit. Models also include year fixed effects with baseline year 1994-1996. The constant reported is the average value of the individual fixed effects. Analysis restricted to observations in which mothers have at least two sons in young adult sample.

Appendix D3. Effect of Having a Daughter Incarcerated

The final supplementary analysis departs from prior analyses by using a daughter's incarceration, rather than a son's incarceration, as the key explanatory variable in models predicting maternal health limitations. This is a preliminary assessment because this event is very unusual in the lives of mothers in the sample. In addition, there is likely a great deal of heterogeneity in the experience of a daughter's incarceration due to the distinct nature of women's incarceration, in which women are incarcerated for shorter periods of time and are more likely than men to go to jail or prison for drug offenses rather than violent crimes (Leverentz 2014; Western 2018).

For the following analysis, I replicated the approach used in the main analysis, but instead of restricting the sample to mothers with young adult sons, I restricted the sample to mothers with young adult daughters. The daughter analysis uses 18,453 individual-year observations from 2,622 unique mothers over 12 waves of survey data from 1994 to 2016. During the period of analysis, just over 7 percent of mothers ($n=191$) ever experienced a daughter's incarceration. In accordance with national trends, experiencing the incarceration of a daughter is significantly less likely than experiencing the incarceration of a son (Travis et al. 2014).

Table D3 replicates the fixed effects models from Table 2 in the main analysis on the sample of mothers with young adult daughters to estimate the effect of a daughter's incarceration on maternal health. The results show that there is no statistically significant effect of having a daughter ever incarcerated on a mother's probability of health limitations. However, given that the event is very unusual and that there is likely a great deal of heterogeneity in the

experience, it is difficult to make a conclusive assessment of the effect of a daughter's incarceration on maternal health. Future research would benefit from a larger sample of daughters and mothers in order to provide a stronger test of the relationship.

Table D3. Fixed effects regression estimates of the effect of daughter's incarceration on health limitations among mothers, NLSY79 1994-2016.

	(1a)	(1b)
Daughter ever incarcerated	-.003 (.025)	-.002 (.024)
Age	.009 (.011)	.015 (.011)
Age-squared	.021 (.112)	-.034 (.112)
Education		
Less than high school		.008 (.033)
Some college		-.036 (.027)
BA or more		-.053 (.037)
Married		.016 (.012)
No. of children		-.020 (.023)
Avg. weeks worked		-.007*** (.001)
Place of residence		
Rural		-.024 (.014)
Central city		.006 (.011)
Central city unknown		.007 (.018)
Geographical region		
North central		-.088 (.056)
South		-.056 (.044)
West		-.055 (.054)
Ever incarcerated		.158 (.180)
Constant	.214*** (.024)	.566*** (.086)
R^2 within individuals	.058	.072
No. of observations	18453	18453
No. of individuals	2622	2622

* $p < .05$ ** $p < .01$ *** $p < .001$ (two-tailed tests)

Note: Unweighted data on mothers from NLSY79 linked with data on their daughter's incarceration from NLSY-YA. Estimated coefficients from linear probability models. Standard errors are in parentheses and are adjusted for clustering at the individual level. Age centered at sample mean. Age-squared multiplied by 1000 in order to display a significant digit. Models also include year fixed effects with baseline year 1994-1996. The constant reported is the average value of the individual fixed effects. Analysis restricted to mothers with at least one daughter in NLSY-YA sample.

Appendix E. Falsification Exercise with Matched Control Mothers

The findings presented in the main analysis indicate that mothers' health worsens over time after experiencing the incarceration of a son. We might expect, however, that mothers' probability of health limitations would naturally increase as they age. The TDFE model accounts for the association between age and health by controlling for age and by exploiting variation in the timing of son's incarceration among mothers who have experienced the treatment. However, to further explore whether age effects may be misspecified in some way, I conduct a falsification test by creating a control group of mothers who are similar to those whose sons have been incarcerated but who have not experienced the treatment themselves (see Killewald and Lundberg 2017 for a similar application).

To construct a matched control group, I use Coarsened Exact Matching (CEM) to match mothers on age, as well as the variables that most strongly predict the likelihood of experiencing the incarceration of a son: race/ethnicity, education, and age at first birth (King and Nielsen 2019). All matching variables are time-invariant and measured prior to when mothers are at risk of experiencing the treatment. Within CEM strata, I match treated mothers to control mothers who did not experience the incarceration of a son but who are similar on key variables. Table E1 shows covariate balance between treated and matched control groups in terms of demography and social background. I then assign mothers in the control group a hypothetical year of son's first incarceration by using the actual timing of the treated mothers to whom they are matched.

Because the falsification test relies on matching pre-treatment, we can only estimate the effect for mothers who are completely observed on time invariant pre-treatment variables included in the matching analysis. In addition, as with the main TDFE model, the estimated timing of incarceration relies on data observed every two years. Estimates become less precise as we move further from the year of son's (hypothetical) incarceration because there are few observations at the tails of the distribution. Despite these limitations, the falsification test is a useful exercise for testing the hypothesized effect of son's incarceration on health for a group of

mothers who are similar to treated mothers but who do not experience the treatment themselves.

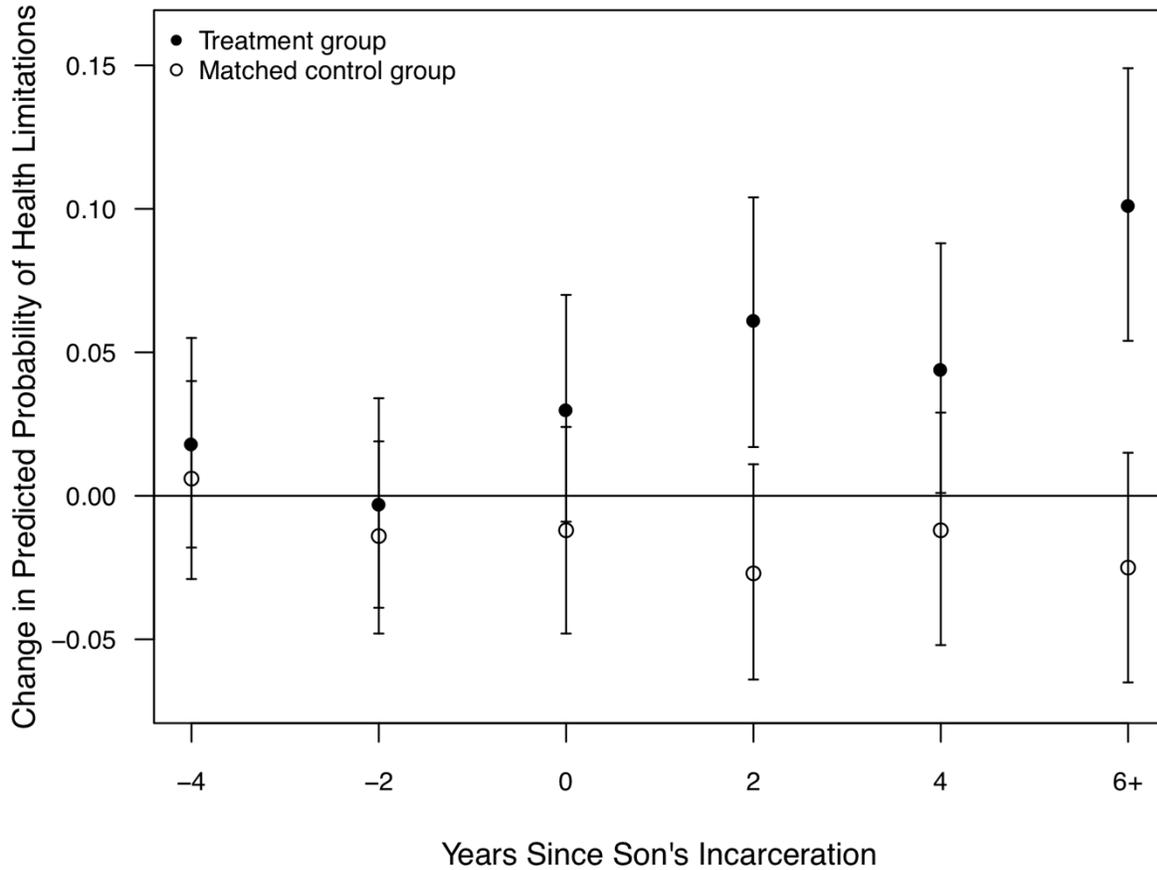
Figure E1 displays the parameter estimates from the TDFE model for both mothers in the treatment group and those in the matched control group. Four years prior to the treatment event, health status of the treatment and control groups is nearly equal. However, whereas mothers whose sons were incarcerated experience an increased probability of health limitations over time, mothers in the control group do not exhibit the same trend. The parameter estimates for the control group are never significantly larger than zero. By the period six or more years following their son's hypothetical incarceration, their probability of health limitations is roughly the same as the years prior to their son's hypothetical incarceration. This is a marked difference from mothers in the treatment group who exhibit worsening health over time.

Table E1. Means of key background variables among treated mothers with incarcerated sons and matched control group, NLSY79.

	Treated	Control
Age in 1979	17.53	17.53
Father's education		
Never knew father	.03	.03
Education unknown	.16	.15
Less than high school	.48	.50
High school	.27	.23
Some college	.04	.04
BA or more	.03	.05
Mother's education		
Never knew mother	.00	.00
Education unknown	.05	.07
Less than high school	.60	.60
High school	.30	.27
Some college	.04	.05
BA or more	.01	.02
Lived with both parents, age 14	.53	.52
Place of residence, age 14		
Town or city	.79	.82
Country, not farm	.17	.15
Farm or ranch	.04	.03
AFQT score	26.29	26.15
Race/Ethnicity		
Black	.46	.46
Latina	.21	.21
White/Other	.33	.33
Born outside U.S.	.06	.08
Own education, age 25		
Less than high school	.32	.32
High school	.50	.50
Some college	.15	.15
BA or more	.02	.02
Age at first birth		
Less than 20	.56	.56
20 to 24	.36	.36
25 or older	.08	.08
Ever incarcerated	.01	.01
Total (<i>n</i>)	428	428

Note: All differences between mothers in the treated and control groups are statistically insignificant at the $p < .05$ level. Treated and control mothers are matched exactly on age, race/ethnicity, own education, and age at first birth.

Figure E1. Change in predicted probability of health limitations among treated and matched control mothers by time since son's incarceration, NLSY79 1994-2016 ($n = 16,211$).



Note: Estimated coefficients from linear probability models predicting health limitations with individual mother fixed effects. Control mothers are matched to treated mothers and assigned the same (hypothetical) timing of son's incarceration. The reference period is 6 or more years prior to son's incarceration. Model includes controls for age, age-squared, education, marital status, number of children, average weeks worked, place of residence, geographical region, mother's own incarceration and year fixed effects. Standard errors are adjusted for clustering at the individual level. To compare effects between groups, bars represent 83.5% confidence intervals around the parameter estimates (Knol, Pestman, and Grobbee 2011).

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