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Parental Imprisonment and Premature Mortality in Adulthood

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Abstract

Purpose Rising prison populations worldwide have led to an increasing body of research about the well-being of children of prisoners. Research to date has demonstrated that the consequences of parental imprisonment for children are significant and long lasting, often extending beyond the imprisonment period and into adulthood. However, research examining the association between parental imprisonment and offspring health problems and mortality is lacking. Moreover, no research to date has examined the association between parental imprisonment and premature mortality among adults.

Methods Using a Dutch multigenerational sample, this study aimed to extend existing literature by examining the link between parental imprisonment and offspring mortality up to age 65, while controlling for parental criminality.

Results Results indicated that children of imprisoned parents were significantly more likely to die prematurely than children of both non-criminal and criminal but non-imprisoned parents.

Conclusions These findings implicate that the mortality risk is not the consequence of the parental criminal behavior but is specifically related to the incarceration of the parent. Further research is required to examine the mechanisms at play for the increased risk of premature mortality for children of prisoners. This research has important implications for health-related early interventions and criminal justice policy.

Keywords Parental imprisonment · Parental incarceration · Premature mortality · Children of prisoners · Health · Criminal justice

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Introduction

The number of children with parents in prison has been steadily increasing during the last couple of decades and has never been higher in the world [14]. In 2007, for example, approximately 1.7 million American children [7] and 125,000 children from England and Wales [13] had at least one parent imprisoned, which equals 2.3 and 1% of all children under the age of 18, respectively. Moreover, it is estimated that between 8000 and 10,500 Swedish children under the age of 18 have an incarcerated parent. For the Netherlands, the country in which the current study is conducted, the number of children who experience imprisonment of their mother is estimated to be between 800 and 1200 each year [14].

Given this large and increasing prevalence of children with imprisoned parents, it is not surprising that they receive increasing attention in several scientific fields such as criminology and developmental psychology. This vast and growing body of research has shown that parental imprisonment has a negative effect on child and youth development on both the short and long term, leading researchers to refer to these children as "orphans of justice" and the "unseen victims of the prison boom" ([15], p.133). Among these adverse outcomes for children of incarcerated parents are behavioral problems [6, 22], serious and violent offending [14], and offspring's own imprisonment [3]. Moreover, several studies have studied the association between parental imprisonment and offspring mental health problems [17, 18]. A recent meta-analysis of Murray, Farrington, and Sekol [16] showed that, overall, there is a significant adverse effect of parental imprisonment on offspring antisocial behavior and, to a lesser extent, also on offspring mental health problems.

Considerably fewer studies have examined the association between parental imprisonment and offspring physical health problems (for exceptions see [10, 20]), while offspring mortality received even less attention in the literature. Although numerous studies have examined the effects of offending (e.g., [9, 19, 23]) and imprisonment (e.g., [1, 2, 4]) on criminals' own mortality risk, effects of imprisonment on mortality in the next generation have only been studied twice [24, 25]. However, these two studies only examined offspring mortality during the four months after the child's birth [24] and during the child's youth [25]. To date, no research has examined the association between parental imprisonment and premature mortality among adults. In this study, we extend the existing literature by examining the link between parental imprisonment and offspring mortality up to age 65, in a Dutch multigenerational study.

Fundamental Causes of Disease

Link and Phelan's [11, 12] fundamental causes of disease approach will be used as a theoretical framework to explain why parental imprisonment may be associated with offspring premature mortality. According to Link and Phelan [11], certain social conditions, defined as factors that involve an individual's relationships to other people, may be fundamental causes of disease. These social conditions include relationships with intimates, positions within the social and economic structure of society (e.g., race, socioeconomic status), social support, and stressful life events of a social nature (e.g., death of intimates, crime victimization). Such social conditions are viewed as a fundamental social cause of disease because they influence access to resources (e.g.,

money, knowledge, power, prestige) that can be used to avoid risks for morbidity and mortality and to minimize the consequences of disease when it occurs. Link and Phelan [12] argue that these resources can influence an individual's health in two ways. First, resources influence whether individuals have knowledge about, access to, money for, and are supported in efforts to engage in health-promoting behaviors and therefore directly impact on individuals' health behaviors. Second, resources also influence people's access to broad contexts (e.g., neighborhoods, occupations, social networks) that differ dramatically in associated profiles of risk and protective factors [12].

Based on this theoretical framework, it can be expected that parental imprisonment is associated with increased offspring mortality for two reasons. First, there might be a causal relationship between parental imprisonment and offspring mortality. Parental imprisonment is an example of a stressful life event of a social nature and can therefore be viewed as a social condition that decreases families' access to resources. Wildeman [24] summarized previous studies that showed that families in which a parent has been incarcerated indeed have fewer resources because parental incarceration decreases the parent's earnings and labor market prospects, increases legal debts, leads to costs of keeping in touch with the incarcerated parent (e.g., making visits, sending packages), and increases risk of union dissolution. As a consequence of these reduced resources for offspring of incarcerated parents, they are at increased risk to have health problems, which can lead to premature mortality later in life. Second, the relationship between parental imprisonment and offspring mortality could also be spurious. Link and Phelan [11, 12] argue that individuals with a lower socioeconomic status, who possess fewer resources, have an increased risk for diseases and mortality. Since low socioeconomic status has also been found to be related to involvement in criminal behavior (e.g., [21]), the association between parental incarceration and offspring premature mortality might be confounded by the family's socioeconomic status.

Previous Studies

To date, there are only two studies that have examined the association between parental imprisonment and offspring mortality. These two studies focused on offspring mortality during the first four months after the child's birth [24] and during the youth of the child, up to age 20 [25]. Wildeman [24] used a large sample from the Pregnancy Risk Assessment Monitoring System, collected between 1990 and 2003 in the USA, to examine the effects of parental imprisonment on early infant mortality. The results showed a 58% increase in the odds of infant mortality among those infants of a parent who was recently incarcerated. After controlling for basic demographic characteristics and risk factors related to the pregnancy, the birth, and the immediate aftermath of the birth, this association remained significant and a 49% increase in the odds of infant mortality was found. Moreover, Wildeman [24] showed that the association between parental incarceration and infant mortality was moderated by paternal domestic violence, since the strength of this association was strongly increased among households where the father was not abusive.

The second study on this topic was conducted among all 58,848 Danish children born in 1991, who were followed up until age 20 [25]. In this study, it was shown that boys were 2.26 times more likely to die when their father was or had been incarcerated. Boys were also found to be 2.84 times more likely to die in the case of an incarcerated

mother. However, after controlling for paternal incarceration and paternal sociodemographic characteristics, the association between mortality and maternal incarceration was not significant anymore. Wildeman et al. [25] did not find any significant associations between the mortality risk of girls and paternal or maternal incarceration.

In addition to those studies that showed a link between parental incarceration and offspring mortality [24, 25], other studies have shown that children of imprisoned parents are at increased risk to have physical and mental health problems. Lee et al. [10] showed that parental imprisonment during childhood was associated with high blood cholesterol, migraines, anxiety, depression, asthma, posttraumatic stress disorder, and HIV/AIDS. Moreover, they found that children with incarcerated parents were significantly more likely to report their general health as fair or poor rather than excellent, very good, or good. Roettger and Boardman [20] examined whether parental imprisonment was associated with an increased body mass index (BMI). Their results showed that parental imprisonment is related to an increased BMI for women but not for men. Finally, several other studies examined the link between parental incarceration and offspring mental health problems. In their meta-analyses, Murray et al. [16] found significant effect sizes of parental imprisonment on mental health problems within community samples but not within clinic and court samples. Since these studies show that children of imprisoned parents are more likely than children of non-imprisoned parents to have physical or mental health problems, it can also be expected based on these studies that they are more likely to die prematurely because of their bad health.

Current Study

The current study adds to the existing literature on the association between parental imprisonment and offspring mortality in several ways. First, the two previous studies that investigated the association between parental imprisonment and offspring mortality only measured mortality during the first four months [24] or 20 years [25] of the children's lives and were therefore unable to study the long-term consequences of parental imprisonment. This is the first study that examines the relationship between parental imprisonment and premature mortality among adults, up to age 65. Second, these two previous studies on parental imprisonment compared children of incarcerated parents with all other children, without controlling for parental criminal behavior. As a consequence, the found associations might reflect the consequences of parental crime rather than the consequences of parental imprisonment. In this study, children of incarcerated parents will be compared with children of both non-criminal parents and criminal but non-incarcerated parents.

Third, the control groups of non-criminal and criminal but non-imprisoned parents in this study will be derived from a multigenerational sample of high-risk families that were part of the lower social strata of Dutch society around the 1900s. As a consequence of this study design, the comparison groups include children who grew up in similar disadvantaged families and were at increased risk to die prematurely. This is important because a previous study using the same dataset showed that the significant relationship between an individual's own mortality risk and criminal offending disappeared when criminals were compared with non-criminals from these families rather than with the general population [23]. Finally, the relationship between parental imprisonment and offspring mortality has only been studied among samples from the

USA [24] and Denmark [25]. It is important that these results are replicated in other countries with different criminal justice and penal systems, as well as different social welfare systems. The current study was conducted in the Netherlands, which is known for its humane prison conditions with a focus on resocialization of prisoners [3]. Moreover, the Netherlands has a particularly egalitarian society with an extensive social security system based on social insurances and supplementary income support provisions. Influences of parental incarceration under these circumstances might be different compared with, for example, the USA, which has higher incarceration rates, less humane prison conditions, and only a limited social security system.

Methods

Sample

In this study, a sample derived from the Transfive Study was used. This study contains data on individuals from five consecutive generations of Dutch families. The study started with 198 boys who were placed in a Dutch Catholic reform school between 1911 and 1914. Some boys were placed into the school because their parents could not take proper care of them, while others were placed due to concerns about their character and problem behavior. This group of 198 boys can therefore be considered as a high-risk sample in terms of criminality. All the descendants of the 198 boys were traced in Dutch municipal and genealogical records. The parents of these 198 boys are labeled generation 1 (G1) because they are the oldest generation. The 198 boys are labeled G2, while their children, grandchildren, and great-grandchildren are labeled G3, G4, and G5, respectively. From G3 onwards, official criminal records for all family members were available. At the point of data collection (December 2007), the surviving G3 sample members were on average 75 years old, the surviving G4 sample members were on average 47 years old, and surviving G5 sample members were on average 21 years old. Figure 1 summarizes the sample design.

In the current study, only data from G3 and G4 sample members are used. The G5 sample members are excluded since they were relatively young at the moment of data
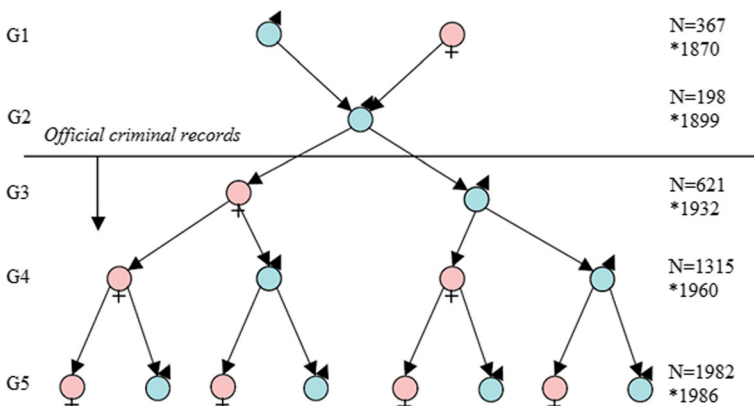

Fig. 1 Sample design of the Transfive Study

collection and only few of them had died. Older generations (i.e., G1 and G2) were not included since the data on their criminal behavior and imprisonment were collected from different (archival) sources and thus the coverage may not be as good as the official criminal records of the later generations. G4 sample members and their parents were only included in the sample when they were at least 18 years old at the moment of data collection (December 2007) or at the moment of death. Younger G4 sample members were excluded since parental imprisonment could not be measured during their entire youth (0–18 years). Moreover, emigrated sample members were excluded as data on their offending, imprisonment, and mortality might be truncated. In addition, 16 G4 sample members were excluded because the identity of only one of their parents was known, resulting in incomplete measures for parental imprisonment and parental crime. The final sample comprises 1241 G4 children, their 457 G3 mothers, and their 462 G3 fathers.

The year of birth for G4 sample members ranged from 1924 to 1989 and they were followed up until the moment of data collection (December 2007), until the moment of death, or until age 65. Sample members were not followed up after age 65 since the focus of the current study is on premature mortality, which is defined as dying before the age of 65 [26]. The average follow-up period was 47 years.

Measures

The dependent variable in the analyses was *premature mortality* (i.e., death prior to age 65). Data on the date of death and date of birth were obtained from the Dutch population registration data. From these data, one variable was constructed that defined whether or not a sample member had died and another variable was constructed that indicated the age at the moment of death.

The main independent variable in this study is *parental imprisonment* during a child's youth. This variable was constructed using data derived from the archives of the Dutch Criminal Records Documentation Service. These data include all convictions of the sample members, as well as all sentences that were imposed. When a sample member received an unconditional prison sentence, the sentence duration and the date of sentencing were used to construct the period spent imprisoned. This period of imprisonment started at the date of sentencing and ended after the number of days that the sentence spanned was reached. By combining imprisonment periods of G3 sample members and the date of birth of their G4 children, it was possible to construct a variable indicating whether or not a G4 child experienced parental imprisonment during their youth. When either a father and/or mother was imprisoned for at least one day during the child's youth (0–18 years), the child scores 1 on *parental imprisonment*, whereas if neither parents were imprisoned during the child's youth, the child scores 0 on this variable. Those children who score 0 on parental imprisonment were divided into two control groups: 825 children with parents who were not convicted during the child's youth (0–18 years) and 300 children with parents who were convicted during the child's youth (0–18 years) but did not get a prison sentence.

In total, 116 children experienced parental imprisonment during their youth. In five cases, only the mother was imprisoned; in one case, both parents were imprisoned; and in the remaining 110 cases, the father was the imprisoned parent. Most of these children

experienced parental imprisonment once (64.7%) or twice (21.6%) during their youth, while the maximum frequency of imprisonments was 29 times. The length of prison sentences was relatively short: 46.6% of the children experienced parental imprisonment for a period shorter than a month, with a minimum of two days. Only eight children (6.9%) experienced parental imprisonment longer than a year, with a maximum of 6.58 years.

In addition to this independent variable, several control variables were included. First, the gender of the child was included as a control variable. Data on gender were derived from the Dutch population registration data. Second, the number of crimes the parents committed during the child's youth was included to control for the possibility that effects of parental imprisonment on offspring mortality are the consequence of persistent criminal behavior of the parent rather than the imprisonment itself. A distinction was also made between different types of crimes, as some types of crimes (e.g., violent crimes) are considered as more serious offenses and are therefore more likely to lead to imprisonment. These types of crimes are as follows: violent offenses, property offenses, traffic offenses, public order offenses, and other offenses (e.g., drug offenses, weapons offenses, crimes under military law). Third, the age of the mother and father at the birth of the child and the marital status of the parents (i.e., married or divorced) were included as control variables. Only five children had parents who were never married. Because of the small size of this group, this group was combined with the group of divorced parents. Finally, the family size, indicated by the number of children within a household, was also used as a control variable.

Analyses

The analyses start with comparing the mortality rates of children from the three different groups: children with non-criminal parents, children with criminal but non-imprisoned parents, and children with imprisoned parents. Odds ratios were calculated to indicate the mortality risk. These mortality rates will also be compared with the mortality rate of all Dutch individuals born in 1960 (i.e., the average year of birth of G4 sample members), to indicate the extent to which sample members were at increased risk to die prematurely.[1] Next, Cox regression models were estimated to predict the mortality risk of the children. In these multivariate models, two groups of children were included as dummy variables together with the control variables. Multiple children from the same families are included in the sample. As a consequence, the assumption of independent observations in the Cox regression analyses is violated, which without an appropriate correction would result in underestimated standard errors. Robust standard errors were computed to correct for this clustering within families. Moreover, an additional analysis will be performed in which offspring offending is included as a possible mediating variable. This is a possible mediator because it has been shown that parental imprisonment is related to an individual's offending risk [14] and that this offending risk is associated with mortality risk (e.g., [9, 19, 23]).

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[1] Using all Dutch individuals born in 1942 as a control group would have made it possible to compare until age 65 (i.e., the age until a death is considered premature, according to the World Health Organization). However, as only a few G4 sample members from the Transfive Study were measured up to age 65, this would make it difficult to make comparisons at older ages.

Results

Descriptive Statistics

Table 1 presents the descriptive statistics of all variables in the analyses. Among all 1241 children in the sample, 46 (3.7%) had died before the moment of data collection. The average age of death was 43.25 years old, with a range of 18.81–60.17. The majority of children (66.5%) had parents who were not convicted during their youth, 24.2% of the children had parents who were convicted during their youth but not imprisoned, and the remaining 9.4% of the children had experienced parental imprisonment during their youth. Both children with non-criminal parents and children with imprisoned parents were on average born in 1959, while the average birth year for children with criminal parents was 1960. These birth years did not differ significantly from each other.

Approximately half of the children were male. The number of crimes committed by parents during the youth of their children was highly right-skewed, with outliers of 35 property offenses and 23 traffic offenses. To control for such outliers, the maximum number of parental offenses was set at 10 for each type of offense. The parents most

Table 1 Descriptive statistics

Variables	Min.	Max.	Mean	Std. dev.
Premature mortality	0	1	3.7%	
Age at death	18.81	60.17	43.25	12.03
Type of parents				
Non-criminal parents	0	1	66.5%	
Criminal parents	0	1	24.2%	
Imprisoned parents	0	1	9.4%	
Control variables				
Gender (1 = male)	0	1	50.9%	
No. parental offenses during youth:				
Violent offenses	0	7	0.12	0.52
Property offenses	0	10	0.29	0.93
Traffic offenses	0	10	0.23	0.85
Public order offenses	0	7	0.05	0.37
Other offenses	0	5	0.17	0.59
Age mother at birth	16.41	44.35	27.22	5.46
Age father at birth	13.98	55.26	30.43	6.14
Marital status parents				
Married	0	1	75.5%	
Divorced	0	1	24.5%	
Family size	1	15	3.88	2.37
No. offspring offenses	0	10	1.29	2.59

$N = 1241$

often committed property offenses (0.29) and traffic offenses (0.23) during the youth of their children. Moreover, children were on average born when their mother was 27.22 years old and their father was 30.43 years old. Approximately three quarters of the parents remained married, and the average number of children in each household was 3.88. In addition, the number of crimes committed by the child was highly right-skewed, with a maximum of 108. Again, the maximum was set at 10 offenses, which resulted in an average offense rate of 1.29.

Table 2 shows the premature mortality rate of the children with different types of parents. In total, 3.7% of the children in the sample had died prematurely. In comparison, the mortality rate among all Dutch individuals born in 1960 is 2.4%. The odds of children in the sample dying prematurely were 56% higher than the general population (odds ratio = 1.56) and can therefore be considered a high-risk sample of premature mortality. Among the 825 children with non-criminal parents, 26 (3.2%) had died prematurely. This percentage was slightly higher among children of criminal parents: 12 out of 300 (4.0%) children in this group had died prematurely. The highest percentage of premature mortality was found among the children with imprisoned parents, with 8 out of 116 (6.9%) having died before age 65. Odds ratios were computed to indicate the risk of premature mortality for children of imprisoned parents compared to that of children of non-criminal (odds ratio = 2.28) and criminal parents (odds ratio = 1.78). Thus, children of imprisoned parents are 2.28 and 1.78 times as likely to die before age 65 than children of non-criminal and criminal parents, respectively.

Next, three Cox regression models were estimated. Table 3 shows the results of these analyses. In model 1, only the three groups of parents were included as predictors, with non-criminal parents as a reference category. The results show that children of imprisoned parents were at significantly higher risk to die prematurely than children with non-criminal parents, with a hazard ratio of 2.23 (95% CI 1.07–4.66). No significant differences were found between children of criminal parents and non-criminal parents. In model 2, the control variables were added to the model. This did not lead to other conclusions. Rather, the hazard ratio for children of imprisoned parents increased to 3.81 (95% CI 1.48–9.84). Moreover, there were no significant effects for the control variables, except for family size, with children from larger families being more likely to die prematurely. In model 3, the analyses were repeated using the group with criminal parents as a reference category, to test whether children with criminal parents and children with imprisoned parents differed significantly in their mortality risk. These analyses showed a significant difference between these two groups, with a hazard ratio of 2.64 (95% CI 1.12–6.26). Children of imprisoned parents were, thus, significantly

Table 2 Mortality risk by type of parent

Type of parent	Premature mortality: N (%)
Non-criminal ($N = 825$)	26 (3.2%)
Criminal ($N = 300$)	12 (4.0%)
Imprisoned ($N = 116$)	8 (6.9%)
Total ($N = 1241$)	46 (3.7%)

Table 3 Cox regression models predicting offspring premature mortality

| Variable	Model 1		Model 2		Model 3	
	Hazard ratio	Robust S.E.	Hazard ratio	Robust S.E.	Hazard ratio	Robust S.E.
Type of parent						
Non-criminal	Ref.		Ref.		0.69	0.29
Criminal	1.29	0.48	1.44	0.60	Ref.	
Imprisoned	2.23	0.84*	3.81	1.84**	2.64	1.16*
Control variables						
Gender (1 = male)			1.08	0.32	1.08	0.32
Parental offenses:						
Violent offenses			0.85	0.29	0.85	0.29
Property offenses			0.89	0.11	0.89	0.11
Traffic offenses			0.57	0.20	0.57	0.20
Public order offenses			0.81	0.48	0.81	0.48
Other offenses			1.05	0.17	1.05	0.17
Age mother at birth			1.00	0.05	1.00	0.05
Age father at birth			1.01	0.04	1.01	0.04
Parents married			0.92	0.34	0.92	0.34
Family size			1.08	0.05*	1.08	0.05*

$N = 1241$

*$p < .05$; **$p < .01$ (one-sided)

more likely to die prematurely than children of both non-criminal and criminal parents. An additional analysis was carried out to test whether offspring's own offending mediated the relationship between parental incarceration and offspring mortality, but no significant association between own offending and mortality was found.

Figure 2 shows the hazard functions of children from the different groups of parents, based on the Cox regression analyses in model 2 from Table 3. At age 18, all sample members were alive, but from that age onwards, the hazard of children of imprisoned parents increased most rapidly. Their hazard is higher than that of children with criminal or non-criminal parents at every age. From age 45 onwards, the differences between the groups become larger, but these results should be interpreted with some caution as the number of children in the sample decreases rapidly when the age at moment of data collection increases.

Finally, the assumption of proportional hazards was tested for the Cox regression models using Schoenfield residuals. For the total model, the assumption of proportional hazards was met ($\chi 2(12) = 17.35$, $p = .14$), indicating that the log hazard-ratio function is constant over time. However, the assumption was not met for all individual covariates. The largest violation of this assumption was found for family size ($\chi 2(1) = 8.38$, $p < .005$), and the results regarding family size should therefore be interpreted with caution. Because of this violation of the assumption of proportional hazards, models 2 and 3 were estimated again excluding family size as a covariate. The results of these additional analyses were comparable to those shown in Table 3, with only significant
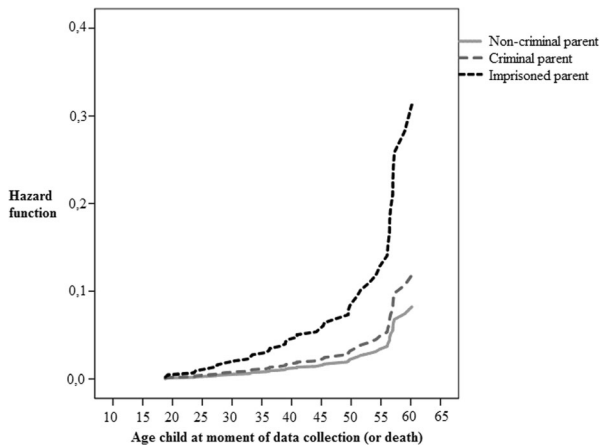
Fig. 2 Hazard functions by type of parent

hazard ratios for imprisoned parents (hazard ratio = 4.56, $p < .001$ and hazard ratio = 2.98, $p < .05$, in models 2 and 3, respectively). Moreover, in these new analyses, the assumption of proportional hazards was met, both for the total model ($\chi 2(11) = 7.89$, $p = .72$) and for all variables separately.

Conclusion and Discussion

This study examined the relationship between parental incarceration during a child's youth (i.e., age 0–18 year) and the child's premature mortality during adulthood (i.e., age 18–65 years). A Dutch, multigenerational study was used in which children of non-criminal, criminal, and incarcerated parents were followed up, on average, until age 47. In line with previous studies that found an association between parental imprisonment and offspring mortality up to age four months [24] and age 20 years [25], this study found that children of imprisoned parents were also significantly more likely to die during adulthood than children of non-imprisoned parents. Importantly, the results also showed that children of imprisoned parents were significantly more likely to die prematurely compared to children of criminal but non-imprisoned parents. This implicates that the mortality risk is not the consequence of the parental criminal behavior but is specifically related to the incarceration of the parent.

The mechanisms through which parental imprisonment is related to offspring mortality could not be examined in this study, as the available data lack detailed information on relevant factors. According to Link and Phelan's [11, 12] fundamental social causes of disease perspective, parental imprisonment would reduce families' access to resources (e.g., money, knowledge, power, prestige) that can be used to avoid risks for morbidity and mortality. In order to directly test this hypothesis, future research should include longitudinal measurements of such resources (e.g., family income) and examine whether reductions in these resources appear after parental imprisonment and whether these reduced resources are consequently related to

offspring mortality. The inclusion of measures of the causes of death in future research could also give some insight in the possible mechanisms. If children of imprisoned parents die relatively often as the consequence of suicide, for example, it can be expected that mental health problems play an important role in the relationship between parental incarceration and offspring mortality. Moreover, if dying because of an overdose or in an accident after driving under influence is a prevalent cause of death among these children, it can be argued that alcohol and drug abuse is an important explaining mechanism.

Previous studies also showed that the relationship between parental incarceration and offspring mortality is moderated by paternal domestic violence [24] and the gender of parent and child [25]. It was not possible to test whether these factors also moderate the association between parental incarceration and offspring mortality among adults, in this study. Measurements of paternal domestic violence were not available in the data, while the sample size of the current study is too small to distinguish between gender-specific relationships. The data, for example, only included six children that were exposed to maternal imprisonment during their youth rather than paternal imprisonment. As these moderating influences could not be studied, it should be kept in mind that the found associations are possibly stronger among certain groups within the sample than among others.

Among the control variables included in the analyses, only family size (i.e., number of children in the household) was significantly associated with premature mortality. Children with more siblings were shown to be at greater risk of dying prematurely. A similar result was found by Hart and Smith [8] among a group of 5765 men. The number of siblings in their study was positively associated with the risk of dying due to coronary heart disease, lung cancer, stomach cancer, respiratory disease, and all causes of death combined. Hart and Smith [8], however, also showed that the number of siblings is related to adverse socioeconomic measures (e.g., low social class, downwardly social mobility, deprivation, school dropout) and that adjusting for these measures explained the relationship between household size and all causes of death, except for stomach cancer. It is possible that the measure of family size in the current study is also an indicator of low socioeconomic status and the relationship with premature mortality might indicate that those from a lower socioeconomic background are more likely to die prematurely. However, it is important to note that the assumption of proportional hazards was not met for the variable family size, and these results should therefore be interpreted with some caution.

Unfortunately, the available data did not make it possible to include more direct indicators of socioeconomic status (e.g., income, educational level, employment). Instead, the control groups in this study were derived from a multigenerational sample of high-risk families, including siblings and cousins of the imprisoned parents. By using this study design, the control groups included children who grew up in similar disadvantaged families. Our analyses showed that children in these control groups were also more likely to die prematurely than children from the general Dutch population and, thus, also constituted a high-risk group for premature mortality. However, as our analyses do not control for all possible confounders, the found relationships could be spurious rather than causal and should therefore be interpreted with caution. An approach that future studies could use to exclude environmental and genetic confounders, and better test the causality of the relationship between parental incarceration

and offspring mortality, is a discordant sibling/twin design. In such models, child mortality of imprisoned parents would be compared with the mortality of the children of their non-imprisoned twin/sibling [5]. The use of this approach was not possible in the current study, as the Transfive Study only includes the siblings of G3 sample members but not of their partners. Because the imprisoned parent in many cases was the partner of the G3 sample member, the discordant sibling design would result in a too small sample of families with discordant siblings.

Although the results of this study make an important contribution to the existing literature on the adverse effects of parental imprisonment, it also has its limitations. First, as discussed above, the found associations are not necessarily causal relationships and should therefore not be interpreted as such. Second, a sample at high-risk for criminal involvement was used in this study, and the results might therefore not be generalizable to the general population. Moreover, the generalizability of the results is limited as it focuses on parental imprisonment during the youth of children who were born, on average, in 1960. In the Netherlands, incarceration rates were very low during the 1960s and 1970s. This might imply that, in these decades, imprisoned parents were more serious offenders than those imprisoned in more recent decades [3]. Moreover, prison conditions and possibilities to visit imprisoned parents might have changed over time, which limits the generalizability of the results to more contemporary populations. On the other hand, the use of an older sample of imprisoned parents is inevitable when focusing on the long-term consequences of parental imprisonment. A third limitation is that a dichotomous variable is used to indicate parental incarceration, while there is much more heterogeneity within the population of prisoners in terms of incarceration length, number of imprisonments, and the type of offenses they were imprisoned for. Future studies should also take into account this heterogeneity when studying the relationship between parental imprisonment and offspring mortality.

Overall, this study highlights important implications for the risks of children of prisoners that should be considered. In particular, more attention needs to be given to assess for possible physical or mental health problems among these children. Moreover, the criminal justice system should take into account the adverse effects of imprisonment for children when sentencing parents. These children are a vulnerable group and early intervention is critical to prevent negative outcomes throughout development.

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