

## ABSTRACT

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DOING TIME: UNDERSTANDING THE  
DYNAMIC EFFECTS OF PATERNAL  
INCARCERATION ON CHILDREN'S  
DEVELOPMENT OF AGGRESSIVE AND  
DELINQUENT BEHAVIORS

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Nearly three million children in the United States are estimated to have a parent incarcerated in a federal or state prison; countless others have experienced a mother's or father's incarceration in a prison or local jail at some point throughout childhood or adolescence. Growing evidence demonstrates that incarceration of a parent is associated with a host of undesirable child outcomes, particularly increased levels of externalizing and antisocial behaviors among boys of incarcerated fathers. Although studies of the effects of parental incarceration on child outcomes have become increasingly more rigorous, there remain several limitations in the literature. Specifically, prior research has tended to address the relationship from a static framework, by conceptualizing and operationalizing parental incarceration as a time-invariant, individual-level characteristic, rather than a time-varying event. Developmental and life-course criminology and the

notion of ‘linked lives’ suggests the utility of adopting a dynamic perspective: parent and child trajectories are inextricably intertwined, such that life events and transitions embedded in a parent’s life-course have consequences for children’s short and long term behavioral trajectories. In the current context, parental incarceration may function as a turning point that leads to elevated levels of children’s aggressive and delinquent behaviors. The purpose of this dissertation is to merge this dynamic framework with the literature on parental incarceration by examining whether father’s incarceration is associated with either between-individual differences or within-individual changes in children’s aggression and delinquency. This is accomplished using both time-invariant and time-varying measures of paternal incarceration and children’s maternally rated problem behaviors from ages 2 through 17 with data from the Rochester Youth Development and Intergenerational Studies: prospective, longitudinal studies of two generations growing up in an era of mass incarceration. Multilevel, growth curve and fixed effects models approaches are used to determine whether recent or cumulative prevalence, incidence, duration, or timing of paternal incarceration is associated with children’s aggression and delinquency. The results suggest that father’s incarceration is associated with large between-individual differences, but few statistically significant within-individual changes, in children’s aggressive and delinquent behaviors. Generally speaking, paternal incarceration may be better viewed as a risk factor for, rather than a proximal cause of, children’s problem behaviors.

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INCARCERATION ON CHILDREN'S DEVELOPMENT OF AGGRESSIVE AND  
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## **CHAPTER 1** Introduction

### *Background and Context*

America in the 21<sup>st</sup> century is situated in an era of mass incarceration. In a recent report, the National Research Council's Committee on the Causes and Consequences of High Rates of Incarceration in the United States concludes, "the growth in incarceration rates in the United States over the past 40 years is historically unprecedented and internationally unique" (2014: 2). In the early 20<sup>th</sup> century, growth in incarceration paralleled population growth (Blumstein & Cohen, 1973), at a steady rate of approximately 110 prisoners per 100,000 residents. In 1973, however, a four-decade long rise began that resulted in a 500% cumulative increase in imprisonment rates. In recent years, this trend has decelerated somewhat. For example, in 2006, the annual rate of change became negative. Furthermore, in 2009 the number of prisoners peaked at over 1.6 million prisoners serving time in state and federal correctional facilities; this was followed by three straight years of decline in the total prison population from 2010-2012 (Carson & Golinelli, 2013). Despite these changes, the United States remains an outlier compared to other nations; in addition to being ranked highest in incarceration rates, the U.S. now incarcerates a quarter of the world's prisoners, despite being only 5% its population (National Research Council [NRC], 2014).

There is now a considerable scholarly literature that addresses the various causes and consequences of the prison buildup (for a recent comprehensive overview, see NRC, 2014). In an early work, Blumstein and Beck (1999) find that the growth in incarceration was driven primarily by policy changes, rather than rising rates of crime. Despite considerable increases in incarceration rates, only two reported offense types showed an

increasing trend between 1980 and 1996 – assaults and drug offenses – both of which were likely due to changes in official response<sup>1</sup> rather than actual behavior. Instead, increased rates of arrest and formal sentencing of drug offenders, in combination with dramatic increases in the likelihood of being sent to prison and amount of time served<sup>2</sup> for all offenses, were responsible for a large portion of the growth in incarceration. These changes in the legal and judicial responses to crime were the result of much broader shifts in cultural and political forces that took place beginning in the mid-1960s. Rising crime, changes in electoral politics, and widespread public cynicism over the effectiveness of rehabilitation and social programs elevated law and order issues to a national political platform and set the stage for a more punitive, law enforcement oriented criminal justice system (Beckett, 1997; Martinson, 1974; Useem & Piehl, 2008).

Another body of literature has explored the *consequences* of mass incarceration. For the most part, research has focused on analyzing the impact of increases in incarceration on crime rates. Spelman (2000) concludes that the incapacitation effects of the prison buildup were responsible for roughly one-fourth of the crime drop of the nineties, although this number is likely to be highly variable and disagreed upon by many others (NRC, 2014). Similarly, reviews of research on the general deterrent effects of incarceration have concluded that there is little impact of increasing sentence length on

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<sup>1</sup> Blumstein and Beck believe these trends to be measurement artifacts driven by increased likelihood of the police to record domestic violence incidents as assaults and to greater law enforcement pursuit of drug offenders.

<sup>2</sup> The increased likelihood of incarceration and time served can be explained by a variety of mechanisms occurring at various points in the criminal justice process including mandatory minimums, state and federal determinate sentencing schemes, truth-in-sentencing laws, the elimination of parole boards in many states, denial of parole suitability, and increased use of parole revocation.

crime rates (Nagin, 1998), although more recent work suggests some promise for sentences that are swift, certain, and of relatively short duration (Kleiman, 2009).

In general, the literature on specific deterrence has concluded that incarceration has either a null or small criminogenic effect (Nagin, Cullen, & Jonson, 2009) on reoffending. This conclusion is also supported by the literature on the collateral consequences of incarceration. Collateral consequences refer to the unanticipated, unintended, and mostly harmful effects of imprisonment (Hagan & Dinovitzer, 1999; Mauer & Chesney-Lind, 2002), for example, on the political, social, and economic exclusion of the formerly incarcerated (Uggen & Manza, 2002; Western, 2002), the destabilizing influence on institutions such as family and community (Foster & Hagan, 2009; Lynch & Sabol, 2004), and the exacerbation of racial and socioeconomic disparities (Pettit & Western, 2004; Wakefield & Uggen, 2010). Incarceration may have a criminogenic effect for a variety of reasons. Laub and Sampson (1993) suggest that incarceration primarily serves as a negative turning point, disrupting prosocial trajectories (e.g. work, family) and reinforcing processes of cumulative disadvantage over the life course. The literature is generally supportive of these assertions. Western (2002) finds that past and current incarceration are associated with lower hourly earnings among men in the National Longitudinal Study of Youth (NLSY) between 1983 and 1998. Research with the NLSY and Fragile Families and Child Wellbeing (FFCW) study finds that incarcerated men have lower probabilities of marriage and higher likelihoods of marital dissolution, and incarcerated fathers are much less likely to be married to (or cohabiting with) their children's mothers (Western, 2006; Western, Loppo, & McLanahan, 2004).

These kinds of collateral consequences may have unique implications for individuals besides the formerly incarcerated. In recent years, children of incarcerated parents have occupied the attention of both academics and policymakers. The majority of prisoners – over half in state facilities and 60% in federal facilities – are parents to minor children. Nearly all incarcerated parents – over 90% – are fathers (Glaze & Maruschak, 2008), a reflection of the uneven demographic composition of the incarcerated population. Incarcerated fathers report having an average of 2.1 children each (Herman-Stahl & McKay, 2008). National estimates suggest that between 1.7 and 2.7 million children in the United States had a parent incarcerated in a state or federal prison in 2007 and 2008 (Glaze & Maruschak, 2008; The Pew Charitable Trusts, 2010). This translates to between 2.3% and 3.6% of minors – as many as 1 in 28 – under the age of 18. This is undoubtedly an underestimate of the number of youth impacted by parental incarceration for two reasons. First, it does not account for the population of parents incarcerated in local jails. This is not a trivial figure; roughly one-third of all incarcerated people in 2011 were imprisoned in local jails (Minton, 2013). These institutions experience a much higher *flow* of individuals – that is, entrances and exits – than prisons, meaning that local jails have much more contact with the population than state and federal institutions. Unpublished estimates suggest that the actual number of children with parents incarcerated in all correctional facilities at a given point in time is closer to 7 million (Herman-Stahl & McKay, 2008). The second reason this figure is an underestimate is that it does not account for children’s lifetime exposure to parental incarceration. Although survey data on the cumulative prevalence of parental incarceration are not available, research using life table techniques suggests that recent cohorts of youth are at much

higher risk of experiencing parental incarceration before adulthood than older cohorts. The risk is considerably higher for minority and disadvantaged youth. Wildeman (2009) estimates that roughly half of black children born to fathers lacking a high school degree experience parental incarceration by age 14. This compares to 7% of comparable white youth which, though magnitudes smaller, is still almost twice as high as the estimate for cohorts of comparable youth born earlier.

Interest in this population is long overdue not only because the number affected is large, but the potential consequences are great. Research has demonstrated that children of incarcerated parents are a particularly vulnerable segment of the population; they tend to be more disadvantaged than their peers and their circumstances are likely to worsen in the event of a parent's incarceration (Wakefield & Wildeman, 2011). Although there is some disagreement about the causal impact of parental incarceration on children's well-being (Johnson & Easterling, 2012; Murray, Farrington, & Sekol, 2012; Wildeman, Wakefield, & Turney, 2013), numerous studies have replicated the positive correlation between parental incarceration and a range of children's undesirable short- and long-term outcomes. The most consistent findings show that children of incarcerated parents have elevated levels of antisocial and externalizing behaviors such as aggression and delinquency in childhood and adulthood. A recent meta-analysis of over 40 studies estimated that parental incarceration is associated with rates of children's antisocial behavior that are roughly 10% higher than comparison children, controlling for covariates including parental criminality (Murray et al., 2012), but no effect of parental incarceration on other children's outcomes, such as mental health, school performance, or drug use. This meta-analysis also showed that neither child's nor parent's gender

moderated this effect. Although this implies that there is a universally harmful effect of parental incarceration, individual studies and narrative reviews of the literature suggest that the effects of parental incarceration are more consistently harmful in cases of *paternal* incarceration and, to a lesser extent, on sons (Turanovic, Rodriguez, & Pratt, 2012; Wildeman, 2010).

This has important implications for knowledge about the intergenerational transmission of criminal behavior, as well as the continuation of mass incarceration. Parental incarceration may act as a mechanism that facilitates intergenerational continuity in criminality. If so – and parental incarceration has a unique effect on children’s antisocial behavior – then current policies may be counterproductive for the majority of prisoners who are parents to minor children. To the extent that parental incarceration increases delinquent and criminal behavior in future generations, public safety goals underlying the original intent of sentencing policies will be eroded, adding to the already high public cost of incarceration<sup>3</sup> in the United States. On the other hand, if parental incarceration has no identifiable, unique effect on children’s antisocial behavior – that is, if it is impossible to disentangle the effect of parental incarceration from the multitude of other risk factors it is likely to be correlated with – then it may be better viewed as a risk marker for, rather than a cause of, children’s development of problem behaviors.

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<sup>3</sup> For example, the Vera Institute of Justice estimates that prisons cost states 39 billion dollars per year, roughly 5 billion over states’ estimated budgets. This amounts to an average of \$30,000 per inmate (Henrichson & Delaney, 2012).

### *Statement of Problem*

To summarize, the literature has found that parental incarceration – particularly *paternal* incarceration – is associated with elevated levels of children’s antisocial behaviors. Although the bulk of early literature suffers from limitations such as weak comparison groups and clinical samples, several more recent studies (reviewed in more detail in the next chapter) have found a positive association between parental incarceration and children’s aggression and delinquency, even when utilizing more extensive control variables and sophisticated methodological techniques.

Although high quality research on consequences of parental incarceration has increased in the last several years (Johnson & Easterling, 2012), several issues remain that limit understanding of the relationship between parental incarceration and children’s antisocial behaviors. First, the prior research has tended to adopt a static perspective by conceptualizing and measuring parental incarceration as a stable, individual-level characteristic. For example, existing research has generally operationalized parental incarceration as a binary, time-invariant measure of prevalence (i.e. participation) and then analyzed differences in outcomes between a group of children who had a parent who was incarcerated within a select reference period (e.g. ever, in the past year, after the child’s birth), to a similar group of children whose parent was not incarcerated, controlling for available covariates. Few studies have examined parental incarceration and its impact on children’s behavior from a *dynamic* perspective. A dynamic perspective places emphasis on the importance of life events and transitions embedded in longer-term developmental and life-course trajectories, and contrasts with static approaches that emphasize the primacy of between-individual differences. However parental

incarceration may be a within-individual *incident*, which varies across the life course, in addition to a between-individual *characteristic*, which varies across the population.

Viewed through this dynamic lens, parental incarceration can be thought of as a trajectory, made up of unique incidents of incarceration taking place over the life course. Trajectories may vary by the number of incidents of incarceration, and each incident of incarceration may vary by its duration. Treating parental incarceration within this dynamic framework allows research to address its time-varying and temporal dimensions – for example, durations of varying length, and in some cases, repetition of this cycle of events. There is likely to be considerable heterogeneity in these parental incarceration histories, which may be linked with heterogeneity in children’s outcomes.

A second, related limitation of prior studies is that the majority have focused on identifying between-individual differences rather than within-individual changes in children’s behavioral outcomes, and the few that do examine change tend to do so over a brief developmental period. For example, although a handful of studies have examined the effect of parental incarceration on change scores (Geller, Cooper, Garfinkel, Schwartz-Soicher, & Mincey, 2012; Wildeman, 2010) or trajectories (Murray, Loeber, & Pardini, 2012; van de Rakt, Murray, & Nieuwbeerta, 2012), the majority of them have only addressed children’s outcomes at a single point in time. This limits both the generalizability and strength of causal inference of existing studies. Criminal and antisocial behavior, as well as their antecedents, delinquency and aggression, exhibit considerable heterogeneity with age. Changes in one developmental period, such as early childhood, may not be generalizable to changes in a later developmental period, such as later adolescence. Relatedly, the effects of incarceration may be limited to temporary



changes in behavior or there may be more durable or cumulative effects. Examination of changes in antisocial behavior across a broad developmental period is useful for addressing the role of timing – when it occurs in the child’s life – as well as the temporal nature of the relationship between parental incarceration and children’s development of externalizing behaviors. In addition, examinations of within-individual change permit a stronger test of the causal effect of parental incarceration on children’s behaviors. Studies that examine between-individual differences are useful for making comparisons, however they generally cannot address change or control for unobserved differences between these two groups. This is important for addressing selection bias if there is some unmeasured – or unmeasurable – characteristic, such as criminal propensity, that explains the relationship between parental incarceration and children’s antisocial behavior. Thus, a dynamic framework can benefit understanding of both parental incarceration and children’s development of problem behaviors across childhood and adolescence.

The current research will shift the focus from identifying the net effect of parental incarceration at a single point in time, to the question of whether parental incarceration influences within-individual changes in children’s externalizing behaviors. This approach helps generate confidence that associations between parental incarceration and child problem behaviors are due to the event of parental incarceration itself (or changes that are generated by it), rather than other risk factors for children’s antisocial behavior that are likely to be associated with parent’s overall risk of incarceration, particularly parent’s antisocial behavior. This approach moves beyond a focus on between-individual differences – which addresses whether children of incarcerated parents fare worse on behavioral outcomes than those of non-incarcerated parents – to explore within-

individual change – to determine whether parental incarceration – and its dynamic dimensions – are related to both continuity and change in children’s behavior.

This dynamic perspective generates unique research questions and hypotheses regarding the effects of parental incarceration. For example, children of parents incarcerated multiple times may have more problem behaviors than children of parents incarcerated only once, particularly if “churning” into and out of institutions leads to greater family disruption and instability. On the other hand, children of parents incarcerated for longer periods of time may develop more behavior problems if they fail to receive the critical resources that parents provide to the family. Similarly, the behavioral trajectories of children whose parents are incarcerated and released prior to their birth and never re-incarcerated thereafter, may differ from trajectories of children whose parents were incarcerated during critical years such as childhood or adolescence. Although the issues of developmental timing and dosage of parental incarceration have been explored in prior research (Osborn & West, 1979), there have been few attempts to systematically examine these factors in a dynamic framework that includes time-varying measures of *both* parental incarceration and children’s development of antisocial behaviors.

#### *Goals of Current Research*

The goal of the current research is to address these limitations in the literature by examining the relationship between parental incarceration as a dynamic event (rather than static characteristic) and children’s externalizing behaviors across a broad developmental period. Because the effects of parental incarceration may differ by parent gender, and the

literature is far less conclusive regarding the impact of maternal incarceration, the current research will focus on *paternal* incarceration. Three related questions are addressed:

1) Are between-individual differences in children's externalizing behavior trajectories associated with father's incarceration? Do trajectories vary by prevalence, incidence (or frequency), duration, or timing (ever and after the child's birth) of father's incarceration?

2) Are within-individual changes in children's externalizing behaviors associated with father's recent incarceration? In other words, does recent parental incarceration lead to contemporaneous increases in children's externalizing behaviors? Do within-individual changes vary by prevalence, incidence, or duration of father's recent incarceration?

3) Are within-individual changes in children's externalizing behaviors associated with father's cumulative experience of incarceration? Do children's externalizing behavior trajectories worsen once fathers report an incarceration or with increased cumulative exposure – incidence and duration – to parental incarceration over the life course?

These research questions are addressed by examining the relationship between static and dynamic measures of father's incarceration and children's maternally-rated externalizing behaviors utilizing prospective, longitudinal data on two generations from the Rochester Youth Development Study (RYDS) and the Rochester Intergenerational Study (RIGS). The RYDS and RIGS includes extensive indicators of the occurrence, timing, and duration of incarceration, which are used to construct adult incarceration histories for a cohort of 332 fathers. In addition, RYDS includes extensive pre-incarceration covariates that help account for father's selection into incarceration. The

RIGS includes up to 12 observations of the oldest biological children of these fathers, observed from ages 2-17, which permits examination of within-individual change over a considerable developmental period and the ability to use analytic techniques to minimize (although not completely eliminate) the threat of selection bias. Together, these companion studies allow a glimpse into the relationship between paternal incarceration and children's problem behaviors through a dynamic lens.

### *Overview of Dissertation*

Chapter 2 describes three basic perspectives on the relationship between parental incarceration and children's antisocial behaviors and reviews the empirical status of research in this area, concluding with a summary of the literature and a discussion of its limitations. This is followed by a discussion of the theoretical framework that guides the present study – the developmental-life course perspective – and research questions and hypotheses for the analyses that follow. Chapter 3 reviews the data – the Rochester Youth Development Study and Rochester Intergenerational Study – the research design of these datasets, the analytic sample and structure of the data used in the current analyses, and a description of how key variables were measured. This is followed by a brief discussion of the analytic strategies employed to address each research question, followed by a discussion of some descriptive statistics for variables used in the analysis. Chapters 4-6 present the results. Chapter 4 addresses the relationship between father's incarceration and children's trajectories of aggression and delinquency throughout childhood and adolescence. Chapter 5 addresses the relationship between father's incarceration and contemporaneous *changes* in children's aggressive and delinquent behaviors. Chapter 6

addresses the relationship between father's incarceration and *cumulative* changes in children's aggression and delinquency. Chapter 7 summarizes the results, discusses their implications for policy, and concludes with limitations and directions for future research.

## CHAPTER 2 Literature Review

### *Theoretical Perspectives*

There are three broad perspectives on the relationship between paternal incarceration and children's antisocial behaviors. First, many traditional criminological theories, such as strain, control, and labeling, would predict that parental incarceration *increases* the likelihood of children's delinquency and aggression. Parental incarceration may have both a direct impact on the child, as well as an indirect impact – for example, through the remaining caregiver. At its simplest, parental incarceration is a form of family disruption, and parental absence may remove an important source of socialization and minimize the resources and contributions the parent typically provides to the child and remaining caregiver. Prior research has shown that household income and financial contributions decline during and after parental incarceration (Johnson, 2009; Geller, Garfinkel, & Western, 2011). In addition to the loss of financial support, remaining caregivers experience a loss of instrumental support (Turney, Schnittker, & Wildeman, 2012) and an increase in childcare responsibilities (Turanovic et al., 2012). Parental incarceration also removes a source of attachment, monitoring, supervision, and discipline, all of which are important factors that prevent children's delinquency, association with delinquent peers, and later involvement in antisocial behaviors such as violence, substance use, and other forms of offending (Patterson, Reid, & Dishion, 1992; Hirschi, 1969). Remaining caregivers may also experience a loss in their parenting capacities, if significant burdens are generated by their partner's absence, which disrupt their mental health and wellbeing. For example, research has shown that paternal incarceration is associated with maternal depression (Wildeman, Schnittker, & Turney,

2012), which in turn is linked with higher levels of externalizing behaviors in children (Goodman et al. 2011; Thornberry, Freeman-Gallant, & Lovegrove, 2009).

There are reasons beyond parental absence to expect that parental incarceration is harmful to children. The initial shock, stress, and uncertainty surrounding a parent's arrest and trial may be replaced by confusion, sadness, and embarrassment once a parent is incarcerated (Arditti, 2012). Furthermore, parental incarceration may set off a range of consequences that alter family structure and dynamics, including parental break up and re-partnering, and residential and school moves (Geller, Garfinkel, Cooper, & Mincey, 2009). Incarceration may also change the behavior of a parent who is incarcerated upon release, for example, by crystallizing a criminal identity, increasing the use of violent behavior (Sykes, 1958), or increasing depression (Turney, Wildeman, & Schnittker, 2012), all of which may be associated with higher levels children's delinquent behavior. All this leads to the expectation that parental incarceration will be followed by increases in children's behavior problems.

A second perspective suggests that parental incarceration will benefit children in a number of ways and thereby *decrease* the likelihood of externalizing behaviors. Several criminological theories predict that antisocial parents (who are particularly likely to be incarcerated) have a criminogenic effect on children. Differential association and social learning theories posit that association with antisocial parents – particularly when high in priority (earlier in the life), duration, frequency, and intensity – can lead to an excess of definitions favorable to antisocial behaviors (Sutherland & Cressey, 1966) or modeling and imitation of antisocial behaviors (Akers, 1998).

Antisocial parents may also transmit antisocial behavior to their children through maladaptive parenting styles. They may be more likely to use harsh or inconsistent parenting styles that are linked with children's delinquency. Patterson and colleagues, for example, argue that delinquency and peer rejection in school-age children are caused by coercive interaction styles taught to children by parents starting early in the household (Patterson, Debarshye, & Ramsey, 1989). Research has supported many of these ideas; the literature on family violence shows that children exposed to maltreatment and parent-partner violence are at risk of a range of poor psychosocial and behavioral outcomes, including aggression, delinquency, and other externalizing behaviors, as well as depressive symptoms, anxiety disorders, and internalizing behaviors (Margolin & Gordis, 2000). Consequently, incarceration may remove a harmful influence from the home, thereby reducing exposure to violence, substance use, and other disruptive and negative influences (Giordano, 2010).

Parent's antisocial behavior may also act as a moderator; Wildeman (2010) has found that the harmful effects of parental incarceration on children's aggression were diminished if fathers were involved in domestic violence. Furthermore, there is evidence that intergenerational continuity in antisocial behavior is dependent on father's residence with or contact with the child (Jaffee, Moffitt, Caspi, & Taylor, 2003; Thornberry et al., 2009) For these reasons, the absence of an antisocial parent may outweigh even the most negative consequences of his or her incarceration. Furthermore, incarceration may be a positive turning point if it connects offenders with rehabilitation (MacKenzie, 2006), labor and employment training (Bushway & Reuter, 2011), and other services, or serves as a specific deterrent; if this is the case, then the impact on families and children may be



beneficial if parents change for the better, for example by ending a substance abuse habit or become more employable.

Third, parental incarceration may have a *null* relationship with children's problem behaviors. This is particularly likely if the parent has little involvement in the child's life prior to incarceration. The high prevalence of incarceration, particularly in poor, minority communities, suggests that parental incarceration may be more or less normative; this, in combination with the fact that children often display considerable resilience in adverse circumstances, in turn suggests that there may be no appreciable causal effect of parental incarceration on children's problem behaviors. The association between parental incarceration and children's problem behaviors may also be spurious if it is driven by a shared cause; if so, parental incarceration may be no more than a marker that represents the constellation of risks for children's problem behaviors, such as parental criminality, violence, substance abuse, and mental health problems, family and neighborhood poverty and disadvantage. It is likely that at least some of the association between parental incarceration and children's antisocial behaviors is driven by these shared environmental (or genetic) risks. Because of the potential for selection bias, it is critical for research to account for as many of these covariates as possible.

These three explanations are not necessarily mutually exclusive. Parental incarceration is a complex, and oftentimes ongoing, process in the lives of children, which may be regarded ambivalently, even within the same family (Turanovic et al., 2012). The numerous consequences of parental incarceration may unfold over time and, while short and medium term impacts may be harmful, the incarceration of a particularly antisocial parent may yield positive results in the long term. Conversely, parental

incarceration may simply serve as another stepping-stone in the process of cumulative disadvantage that characterizes many disadvantaged families.

### *Empirical Findings*

The empirical literature on parental incarceration has attempted to adjudicate between these three perspectives. The intergenerational association between parent and child criminality and involvement in the justice system date back to some of the earliest empirical observations in the criminological literature. In *The English Convict*, Goring concluded that the high correlation between father's and son's imprisonment (which he failed to distinguish from criminality), as well as the stronger relationship for fathers who were incarcerated when sons were younger, was due to heredity rather than the environment (cited in Sutherland & Cressey, 1966). Although there are many studies of children of incarcerated parents, most research is characterized by relatively small, clinical samples with inadequate comparison groups and minimal statistical controls (Murray & Farrington, 2008b). The more recent availability of prospective, longitudinal data has increased the quality of the research in this area; consequently, the following review will focus on samples that use longitudinal data and quantitative analyses. In addition, because the focus of the present research study is on paternal incarceration, this review omits studies that focus exclusively on maternal incarceration<sup>4</sup>. Finally, although the literature on parental incarceration has examined many child outcomes, such as educational attainment, internalizing behaviors, and drug use, the following review will

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<sup>4</sup> Because some of the studies reviewed may have included both mothers and fathers in their samples, whereas others include only fathers, distinctions will be made throughout the text to make this clear.

focus on studies that examine general antisocial behaviors. This includes childhood aggression and externalizing behaviors, adolescent delinquency, and subsequent adult outcomes, such as criminality and arrest.

One of the earliest studies to use prospective, longitudinal data, compared conviction records (including incarceration) of fathers and sons in the Cambridge Study in Delinquent Development (CSSD), a sample of working class males residing in South London during the early 1960s (Osborn & West, 1979). Though background characteristics were not controlled and differences were not statistically significant (the authors attribute this to low power), the analysis shows that fathers who had a custodial sentence had the highest proportion of convicted, recidivist, and persistent recidivist sons compared to sons of fathers who had a less serious conviction status. More recent research has shown that these same sons had higher rates of self-reported delinquency and violence at ages 18 and 32 (Murray and Farrington, 2005), and internalizing problems at ages 14-48 (Murray and Farrington, 2008a), even when controlling for parental criminality and other relevant background characteristics. Similar associations between parental incarceration and antisocial behavior in adolescence and adulthood have been replicated in other international samples, however most of these found that the association either weakened or disappeared once background characteristics such as parental criminality were controlled. Kinner and colleagues (2007) found that the positive, significant bivariate association between maternal reports of paternal imprisonment and child's externalizing behaviors (age 14) was explained by maternal and family characteristics in an Australian birth cohort. Murray, Janson, and Farrington (2007) used stepwise logistic regression and data from Project Metropolitan (Sweden),

finding that addition of parental incarceration to models including parental conviction did not improve prediction of children's official offending in adulthood (19-30), despite significant association at the bivariate level. Similarly, when convictions were included in analyses of the effects of paternal incarceration on children's official conviction in adulthood (18-30) using the Netherlands' Criminal Career and Life Course Study (CCLS), the magnitude of odds ratios declined (from 1.84 to 1.36), although it remained statistically significant (van de Rakt et al., 2012). On the contrary, another study using a different sample from the Netherlands found no relationship between parental imprisonment and children's conviction (Besemer, van der Geest, Murray, Bijleveld, & Farrington, 2011). As these studies demonstrate, parental incarceration is associated with children's externalizing behaviors in adolescence and official convictions in adulthood, however at least part – and in some cases all – of this association can be explained by known risk factors.

Although studies of samples outside the United States are informative, incarceration in the contemporary U.S. context is likely to be different from that of other countries and earlier time periods. One consequence of the increased use of incarceration for offenders with less severe offenses and criminal histories, is that the average prisoner in the United States may be less serious or violent; if this is the case, then parental incarceration may do more harm than good for recent cohorts of children. This is because non-violent offenders are less likely to possess the characteristics (and likely to possess fewer characteristics when they do) that put children at risk for antisocial behavior.

Research with more contemporary U.S. samples has also consistently demonstrated that parental incarceration is linked to poor child outcomes. Wilbur and

colleagues (2006) found that teachers reported more externalizing behaviors in children of incarcerated fathers in a longitudinal sample of children from urban, low-income homes. Using data from the FFCW study, Geller, Garfinkel, Cooper, and Mincey (2009), Wildeman (2010), and Geller et al. (2012) find that lifetime and recent paternal incarceration is associated with higher levels of aggression in 3- and 5-year-old boys, controlling for a range of covariates. Murray, et al. (2012) find that boys in the Pittsburgh Youth Study (PYS) had higher levels of theft following a parent's incarceration. Using the Child Development Supplement of the Panel Study in Income Dynamics' (PSID-CDS), Johnson (2009) shows that parental incarceration history is associated with worse behavioral outcomes, including externalizing behaviors. Roettger and Swisher (2011) find similar positive associations between father's history of incarceration and children's self-reported delinquency and arrest in the National Longitudinal Study of Adolescent Health (Add Health). Thus, the general conclusion from studies of samples in the U.S. – including more recent cohorts – supports the conclusion that parental incarceration has a harmful effect on children's antisocial behaviors, even controlling for covariates.

Fewer studies have addressed the role of dosage (incidence and duration) or timing (in the child's life) of parental incarceration. However, there are some noteworthy exceptions to this. In the Swedish study cited above, Murray et al. (2007) find that the number of times parents were incarcerated predicted higher rates of antisocial behavior, however, as mentioned previously, the relationship made no unique contribution apart from parental conviction. They also found that parental incarceration terms of two months or greater had an association with chronic offending in the Cambridge cohort, but incarcerations of shorter duration did not. Van de Rakt et al. (2012) find that paternal

incarcerations that last between 1 and 30 days had a significant impact on convictions in adulthood (relative to the reference category of zero incarcerations) but that those of greater than monthly duration had a null effect, perhaps because of the relative rarity of longer incarceration terms in the Netherlands.

In terms of timing, Murray and Farrington (2005) and Murray et al. (2007) find that parental incarceration elevates antisocial behavior in the CSSD, but that there is no effect if parental incarceration only occurred before the child's birth. In the Pittsburgh study, Murray, Loeber, and Pardini (2012) find no effects of the timing of incarceration within the child's life course: parental incarceration had similar associations with children's self-reported property offending, regardless of whether it occurred in early childhood (age 0-5), later childhood (age 6-10), or adolescence (age 11-16). In one of the Netherlands samples, van de Rakt et al. (2012) find that paternal incarceration occurring in childhood (age 0-12) has a stronger effect on children's probability of conviction in adulthood (18-30) than paternal imprisonment before birth or during adolescence (12-18), which the authors attribute to the traumatizing role of paternal incarceration (and separation) in early childhood. Johnson (2009) also finds a null effect of incarceration occurring prior to the child's birth, but a significant positive effect of incarceration occurring during childhood on children's externalizing behaviors.

A few studies have linked parental incarceration to within-individual change in children's antisocial behaviors. Wildeman (2010) overcomes a number of limitations from the prior literature using the FFCW, a birth cohort of nearly 5,000 children from 20 cities – the majority from unmarried families – and a range of modeling strategies, to identify the effects of paternal incarceration on children's aggression at age five. First, in

OLS regression models that include a wide range of covariates, both paternal incarceration occurring prior to age 3 and paternal incarceration occurring between ages 3 and 5 had a significant, positive relationship with boys' aggression at age five. Second, propensity score models indicated that boys of fathers incarcerated between ages 3-5 had significantly greater *increases* in their aggression change scores between ages 3 and 5 than matched boys. Third, in fixed effects models, including those restricted to the sample of ever-incarcerated fathers, recent incarceration showed similar positive and statistically significant associations with children's aggression change scores. In all analyses, models for girls were either negative or null. Geller et al. (2012) also examine paternal incarceration using increasingly more rigorous modeling strategies with the FFCW sample. Like Wildeman, they find that father's incarceration from ages 3 to 5 has a positive, statistically significant association with children's aggression at age 5 in models with extensive controls, a lagged dependent variable (age 3 aggression), and individual fixed effects. The use of change scores garners confidence that increases in aggression are due to paternal incarceration, but results are limited to a relatively short developmental period (two years in early childhood).

Murray et al. (2012) also rely on multiple rigorous modeling strategies to identify the effect of parental incarceration on boys' development of antisocial behaviors in the PYS, a sample of first and seventh grade boys attending public schools in Pittsburgh during the 1987-88 school year. Using risk set matching (a form of propensity score matching) and parents' retrospective reports of criminal justice system involvement (at the beginning of the study and again when children were ages 14 and 17) to identify years in which parental incarceration occurred, boys whose parents were incarcerated at a given

age (between ages 7-18) were matched with comparable youth whose parents had never been incarcerated (matched in the year prior to incarceration). The results showed that, in the years following parental incarceration, youth had higher rates of theft – but not marijuana use – relative to similar youth. It is not clear what effect parental incarceration would have on the aggressive or violent behaviors of youth, as data collection on violence did not begin until later in the study for the youngest cohort. Similar results were found when analyses were replicated using a fixed effects approach. Together, these two studies provide some of the strongest causal tests of the relationship between parental incarceration and children’s development of delinquency and aggression, not only because they include extensive control variables, but also because they address potential selection due to unobserved heterogeneity.

In general, three broad conclusions can be drawn regarding the literature on parental incarceration and children’s antisocial behaviors. First, the majority of studies support the perspective that parental incarceration increases antisocial behavior. There is limited evidence that these harmful effects are mitigated if fathers engaged in domestic violence. However, the conclusion that parental incarceration is beneficial does not have strong support in the empirical literature. Second, there is qualified support for the perspective that the relationship is null. There is greater evidence from international samples that third variables explain some to all of the association; although it is not clear why, this may be due to differences in the penal context – and perhaps, the incarcerated population – as well as variation in cultural norms and socio-legal policies. However, in contemporary, U.S. samples, the effect of parental incarceration and children’s antisocial behavior is robust to a variety of controls – including extensive covariates and attempts to



address unobserved heterogeneity by analyzing within-individual changes. Third, there is mixed evidence regarding the role of timing and duration. There seems to be some evidence that children of fathers whose histories of incarceration end prior to their child's birth escape some of the negative consequences compared to those whose fathers were incarcerated during their childhood or adolescence, however other studies find no differences between children of incarcerated fathers regardless of when in the life course it occurred. The findings regarding dosage are similarly mixed, with some studies finding worse outcomes for children of fathers incarcerated more frequently or for longer durations, and others finding no difference.

#### *Limitations of Existing Research*

The prior literature on parental incarceration has been limited in two primary ways. First, prior research – even when utilizing longitudinal data – has generally adopted a static view of parental incarceration, treating it as a stable, between-individual characteristic rather than a dynamic, within-individual event. Even studies that address the temporal dimensions of parental incarceration – such as its duration and frequency – primarily do so in a static framework. For example, most prior studies have used time-invariant measures of parental incarceration that simply sum the number of incidents or days of incarceration that fathers experienced in a given time period. Even studies with repeated measures of paternal incarceration – such as the FFCW – have not allowed it to vary over time in analytic models. This is changing somewhat with more recent research. For example, Murray et al. (2012) examine a time-varying measure of parental incarceration in the PYS. However, their measure only addresses first incidents of

incarceration (reported in the study) and does not distinguish between different levels of exposure to parental incarceration or temporal lags.

Relatedly, few studies have examined *within-individual change* in children's problem behaviors as a consequence of parental incarceration. Again, this is changing with the availability of prospective, longitudinal data. For example, Roettger and Swisher (2011) examine whether retrospective reports of a father's history of incarceration occurring prior to the study are linked to self-reported offending across three waves among males from the Add Health study. Similarly, van de Rakt et al. (2011) examine whether trajectories of convictions in adulthood are linked to parents' incarcerations during childhood. Others (Geller et al., 2012; Wildeman, 2010) have explored the impact of recent paternal incarceration on change scores between two time points. These analyses are a welcome change in the literature, however they are limited to between-individual examinations in trajectories or the examination of brief developmental periods.

The literature would benefit from a perspective that brings a more comprehensive, dynamic point of view to both parental incarceration and children's development of antisocial behaviors. Such an approach could address the between- and within-individual contributions made by parental incarceration to children's trajectories – and change – in antisocial behaviors. This would ensure that relationships are not limited to a short developmental period such as early childhood, or driven by between-individual differences. Furthermore, this perspective could address whether greater cumulative exposure over the life course is associated with worsening antisocial tendencies or whether recent incarceration is associated with contemporaneous changes, or discontinuities in problem behavior trajectories.

### *Theoretical Framework*

To address these limitations, the current study will examine the effects of paternal incarceration on children's trajectories of, and within-individual changes in, aggressive and delinquent behaviors from a *developmental, life-course* perspective. Criminological theory has been enriched by the development of this paradigm (Farrington, 2003; Farrington, 2005; Thornberry, 2004), as well as the many theories that fall within its purview (e.g. Laub & Sampson, 2003; Thornberry & Krohn, 2005). Developmental and life-course theories take a different approach than traditional criminological theories by explicitly acknowledging and addressing the dynamic, age-graded nature of criminal behavior and its multiple causes and consequences at various points across the life course. This perspective encourages disaggregation of individual 'criminal careers' into longitudinal sequences – or trajectories – of criminal behavior. Better understanding of individual trajectories provides the opportunity to partition the criminal career into different dimensions – such as onset and desistance – in order to identify both time-stable, inter-individual differences in patterns of behavioral development and time-varying, within-individual factors that lead to both continuity and change across the life course. These within-individual factors include role transitions and life events, such as parenthood, residential change, and institutional involvement. Further, life transitions can serve as turning points by altering trajectories, including criminal careers. Turning points can be unidirectional; whereas a positive turning point may lead to desistance (or prevent onset), a negative turning point may lead to persistence or worsening of criminal careers (Laub & Sampson, 2003). In addition, according to the principle of timing (Elder, 1994)

– the meaning of transitions and other life experiences depends on when in the life course they are experienced. On-time transitions, for example, to states of marriage and parenthood may serve as positive turning points, whereas precocious or off-time transitions such as early partnering and pregnancy may serve as negative turning points, disrupting healthy, pro-social development by reinforcing processes of cumulative disadvantage (Laub & Sampson, 1993). For example, some research has shown that certain life events that have malignant consequences when experienced in adolescence have more benign consequences when experienced only in childhood (Thornberry, 2009).

Because there may be distinct pathways that both lead to and stem from criminal behavior, the developmental-life course perspective also extends the etiology of criminal behavior prior to and beyond the adolescent years. Recognizing that delinquent and criminal behavior may be manifested differently at early developmental stages, these theories address antecedents, such as early aggression (Nagin & Tremblay, 1999), and other early risk factors that may contribute to the onset of delinquency (Moffitt, 1993). Similarly, rather than assume desistance is a function of maturation – or inevitable biological change (Gottfredson & Hirschi, 1990) – these theories explicitly address the variety of behavioral patterns that occur after the peak of criminal behavior, for example late onset, persistence, and desistance (Laub & Sampson, 2003; Maruna, 2001).

This perspective also draws on the notion of linked or interdependent lives and interlocking trajectories (Elder, 1994, 1998), themes in the life course literature which recognize that life events are experienced through social and family relationships, both affecting and being affected by the broader peer and kin networks in which lives are embedded. Consequences in one generation are particularly likely to have ramifications

for the outcomes of the next generation, as many intergenerational studies in criminology have demonstrated (Giordano, 2010; Thornberry, Freeman-Gallant, Lizotte, Krohn, & Smith, 2003).

Taken together, then, the developmental, life course perspective is well suited for the examination of the effects of paternal incarceration on children's aggression and delinquency. Father and child trajectories are particularly likely to be intertwined and, as a consequence, transitions embedded within the father's life course are likely to influence the child's own development. Paternal incarceration may be conceptualized as both a characteristic *and* a transition, with the potential to serve as either a positive or negative turning point affecting father and child. Furthermore, because incarceration is inherently temporal, possessing a discrete beginning and end, that can vary in duration from a day to a lifetime, there are likely to be unique pathways through which parental incarceration influences children's trajectories. Although difficult to measure, the impact of parental incarceration may extend prior to and beyond the actual term of incarceration, starting with arrest and conviction and lasting throughout the duration of the prison or jail sentence and release back into the community. Because incarceration is likely to be repeated (Langan & Levin, 2002), this cycle of events and associated changes may reoccur throughout the parent – and implicitly, the child's – life course.

In combination with the prior literature, developmental-life course theory suggests that children of incarcerated fathers will have trajectories of aggression and delinquency of higher magnitude than those of comparison children, and that trajectories will increase with greater exposure – that is, more frequent incidents of incarceration and longer durations – to paternal incarceration. Furthermore, paternal incarceration will lead to

within-individual increases in children's aggression and delinquency, as well as discontinuities – that is, either temporary or enduring elevations – in children's aggressive and delinquent behavior trajectories. Finally, the timing of parental incarceration should influence its consequences such that paternal incarceration experienced directly in the child's life course has more harmful consequences than those experienced indirectly or before the child's birth.

### *Research Questions and Hypotheses*

To examine these theoretical expectations, this dissertation addresses three basic research questions. First, are differences in children's trajectories externalizing and antisocial behaviors, such as aggression and delinquency, associated with father's incarceration? Do these trajectories vary by prevalence, frequency, duration, or timing of father's incarceration? This question addresses whether between-individual differences in children's behavioral trajectories can be explained by father's prior incarceration experiences.

Second, are within-individual changes in children's externalizing behaviors associated with father's recent incarcerations? In other words, does parental incarceration lead to contemporaneous increases in children's externalizing behaviors? Looked at differently, is paternal incarceration associated with temporary discontinuities or elevations in children's behavioral trajectories? Do discontinuities (or changes) vary with frequency, duration, or timing of father's recent incarceration?

Third, are within-individual changes in children's aggression and delinquency associated with father's cumulative experience of incarceration? Do children's

externalizing behaviors permanently worsen once fathers report incarceration and increase with cumulative exposure – incidence and duration – to increases in paternal incarceration over the life course?

The goal of the current study is to contribute to the evidence base on the consequences of paternal incarceration by examining the link between father's incarceration and children's antisocial behavior trajectories in a prospective, longitudinal study of two generations growing up in the modern American penal context. The analysis will shed light on both between-individual differences and within-individual changes in children's aggression and delinquency associated with paternal incarceration as both a time-invariant (person-level) status and a time-varying (person-period) event. This is accomplished by drawing on overlapping repeated measures of paternal incarceration and children's externalizing behavior trajectories across a broad developmental period.

## **CHAPTER 3** The Current Study

### *Data and Research Design*

Because research questions addressing change necessitate longitudinal data, the current study will utilize data from two prospective, longitudinal studies: the Rochester Youth Development Study (RYDS) and the Rochester Intergenerational Study (RIGS). In 1986, Rochester, New York was one of three study sites (along with Pittsburgh, Pennsylvania and Denver, Colorado) selected for the Office of Juvenile Justice and Delinquency Prevention's Program of Research on the Causes and Correlates of Delinquency (Thornberry, Huizinga, & Loeber, 2004). The original RYDS sample consisted of a cohort of 1,000 seventh and eighth grade boys and girls who were enrolled in Rochester public schools during the 1987-1988 school year. To better examine the experiences of high-risk youth and ensure adequate representation of high-risk behaviors (which have a low base-rate in the general population), males and youth from high crime neighborhoods (indicated by arrest rate of census tract of residence) were oversampled; with appropriate weighting techniques, the sample is representative of the general population of the cohort. The sample is predominantly male (73%) and ethnically diverse (68% African American, 17% Hispanic, 15% white). Initial cooperation in the study was high; 80% of parents initially selected agreed to participate and students from the same stratum replaced refusals (Thornberry, 2013).

The RYDS consists of 14 waves of data collected from the participants between 1986 and 2005, spanning the lives of respondents from roughly ages 14 to 31. The first



nine assessments (Waves 1-9 = Phase 1), through age 18<sup>5</sup>, occurred at six-month intervals. After a 3-year gap in data collection, participants were followed up with three annual assessments (Waves 10-12 = Phase 2) between ages 21 and 23. Respondents were again followed up with interviews at approximately ages 29 and 31 (Waves 13 and 14 = Phase 3). These latter interviews were supplemented by a life history calendar to cover the timing of important life events such as family formation, employment, and contact with the justice system occurring between ages 23 and 29. Retention in the study has been high – 86% at Wave 12 (age 23) and 76% at Wave 14 (age 31) – due to the use of a number of procedures to minimize attrition. For example, participants were interviewed if they left the Rochester schools or otherwise moved and as many attempts as possible were made to contact respondents as long as they did not refuse participation. Although males and disadvantaged members of the sample were less likely to be retained, differential attrition did not appear to bias the sample in any meaningful way (Thornberry, 2013).

In addition to interviews with the focal participants (second generation = G2) across their teen and young adult years, interviews with their parents (first generation = G1) were conducted for 11 of the first 12 waves, to when the adolescents were approximately 23 years old. Interview data with both G1 and G2 cover a variety of life domains, including individual, family, peer, school, and community characteristics, with a particular emphasis on the development of delinquent, criminal, and antisocial behaviors, including substance use, gang membership, and family violence. Finally,

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<sup>5</sup> These ages are averages.

interview data are augmented by administrative data from local schools, social service agencies, police departments, and the U.S. Census Bureau.

The RIGS was initiated in 1999. All original RYDS focal participants are eligible for the RIGS once they become biological parents. G2 and G3 (third generation = G3) – the oldest biological children of G2 – are eligible to enroll once the G3 turns 2 years old. In addition, another caregiver (OCG) is enrolled. For G2 males, 90% of OCGs are the G3's biological mother. Families are followed up annually once enrolled<sup>6</sup>; G2 and OCG are interviewed beginning when G3 is age 2 and G3 themselves are interviewed beginning at 8 years old. Because the RIGS and the RYDS include similar interview and official record data, the data permit exploration of continuities and discontinuities on many issues across up to three generations of family members (Thornberry et al., 2003).

### *Analytic Sample*

The sample used in the current analysis consists of 332 families who participated in the RIGS at least once through Year 12 (the latest available year), in which the G2 parent was male, and the G3 child was between the ages of 2 and 17. G2 females were dropped because they made up a smaller proportion of the RYDS (n=279) and RIGS (n=183) samples, and because the prevalence of maternal incarceration was relatively low (20% or n=38), limiting statistical power. In addition, G3 who were older than 18 were dropped because they were missing information on the dependent variable<sup>7</sup>, which is

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<sup>6</sup> Starting in Year 8, OCG reports were only available for families in which G2 was male. Starting in Year 9, parent reports are only available for minor G3. Neither of these design features affect the current analysis.

<sup>7</sup> There were actually 336 families eligible for the study, however four families had to be dropped from the analysis because they had no OCG interviews and consequently were missing information on the dependent variable.

measured with OCG reports of G3 behavior (more details on this are discussed below) and only available for G3 who are minors (i.e. age 17 or under). Figure 3.1 provides a diagram depicting how the analytic sample was derived from the original sample of RYDS males (n=721). In the first year of the RIGS, 215 families with G2 fathers (mean age = 25, range = 23-27) were enrolled with their G3 children (mean age = 5, range = 2-11). Another 107 G2 males had enrolled in RIGS by Year 12, by which point the average age of G2 fathers was 36 years old (range = 34-37) and the average age of G3 children was 12 years old (range = 2-17). Figure 3.2 shows the number of families who participated in the study (left column), as well as the cumulative sample size (right column) at each year. Because families can enter and exit the analytic sample at various points in the RIGS (for example, entering when they join the RIGS and exiting when the G3 turns 18), the panel is unbalanced – that is, there are a variable number of measurement occasions per person – a common feature of accelerated longitudinal cohort designs such as the RIGS. The panel is also unstructured – meaning there is a variable amount of time between measurement occasions – as families may periodically miss a wave of data collection, leaving gaps in their assessment schedule. Fortunately, there is little missing data across the study. Across all 12 years of available data, only 57 person-periods have missing data due to respondent or item non-response. Certain analytic strategies, such as multilevel modeling, are more accommodating for panel data that possess these features; these will be discussed in more detail below.

Because eligibility in the RIGS is determined by the child's age (i.e. families join at Year 1 or whenever G3 turns 2 years old) and attempts are made to continue following them up after they enter, families can initiate participation in the study at any point

between Years 1 and 12. The majority of G2 had begun childbearing by the time the RIGS began in 1999 (recall that the average age of G3 at Year 1 was 5 years old), therefore most respondents entered the study in its initial years. As Figure 3.3 shows, the majority of families entered the study in Year 1 (65% or  $n=215$ ) and were followed up through Year 12 (70% or  $n=241$ ). Furthermore, although a small number of families were only interviewed on one or two occasions, the vast majority of children in the sample were observed on at least three occasions. To illustrate, Figure 3.4 shows the number of observations per child, ranging from 1 to 12. The modal category ( $n=123$ ) is the maximum number of observations (i.e. 12). Furthermore, as indicated by cumulative frequency, most children have considerably more than three observations. For example, 90% of children ( $305/332$ ) are observed on at least four occasions and 75% ( $252/332$ ) are observed on eight or more. More frequent observations allow for more detailed examinations of growth (or change) processes, for example, by allowing inclusion of higher order growth parameters in trajectory models (see Chapter 4). Children in the final sample are assessed on up to 12 annual occasions for a total sample of 3,116 person-period observations.

#### *Measurement of Children's Problem Behaviors*

OCG reports of children's behaviors are used to assess children's aggressive and delinquent behaviors. Because OCG reports begin when G3 are age 2 (whereas G3 self-reports begin at age 8) and last through age 17, they provide the longest developmental period of G3 behavior available in the RIGS. As Figure 3.5 shows, the most frequent observations of children's behavior are for late childhood and early adolescence, roughly

ages 6-12. Use of G3 self-reports would truncate a large proportion of observations and minimize the total sample size. Although G2 also provide assessments of G3 behavior, they are not used for two reasons. First, use of G2 reports of incarceration and children's behaviors would lead to common reporter bias, whereby the same reporter provides information on both the independent and dependent variable. Second, for G2 who are male, OCG are almost exclusively the biological mother of G3. Mothers are generally able to provide more accurate reports of G3 behavior due to parental differences in living and childcare arrangements. In nearly all RIGS families in which the G2 is male, OCG and G3 reside together; conversely, in these same families, G2 residence with G3 is much more heterogeneous.

Although paternal incarceration is expected to impact child wellbeing in a variety of ways, the most consistent findings in the literature are for the relationship between paternal incarceration and antisocial behaviors (Murray et al. 2012). The current study will therefore focus on childhood and adolescent aggression and delinquency. Both of these outcomes are linked with serious forms of juvenile delinquency, including involvement in the juvenile justice system (Nagin & Tremblay, 1999).

Childhood aggression and delinquency are measured through OCG reports from the Achenbach Child Behavior Checklist (CBCL). The CBCL has been used frequently in the literature on children's development and has been shown to meet various criteria of validity and reliability (Achenbach, 1991; Achenbach et al., 1987). For example, intraclass correlation coefficients (ICC) for inter-interviewer and test-retest reliabilities were approximately .90 for externalizing behavior scores, which also showed high correlation (.86-.88) with similar scales measuring conduct disorders. Furthermore,

externalizing behavior scores were able to discriminate between clinically referred and non-referred children (Achenbach, 1991).

Two schedules of interview questions are available based on the age of the child: toddler, for children ages 2-3, and youth, for children ages 4 and older<sup>8</sup>. The aggression subscale<sup>9</sup> is available for toddlers and youth, whereas the delinquency subscale is available for youth only. OCG are asked to rate on a 3-point (0-2) scale how often in the last six months (never = 0, sometimes = 1, often = 2) it was true that G3 engaged in a variety of externalizing behaviors. For youth, the 20 items in the aggression subscale include behaviors such as arguing, getting into fights, demanding attention, destroying things, disobedience, irritability and sudden mood changes. The delinquent behavior subscale contains 13 items and includes behaviors such as truancy, drug use, vandalizing, stealing, setting fires, and running away from home. For toddlers, the aggression subscale contains 15 items, some of which are similar to the youth aggression items (e.g. demands things immediately), but others of which are better suited for 2-3 year olds (e.g. easily frustrated, hits others). Each scale is an average of the items, provided at least 80% of items were non-missing; fewer than 10 observations were missing at any given year for a total of 57 missing observations on the CBCL across all twelve years of available data.

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<sup>8</sup> Individual items are included in Appendix A.

<sup>9</sup> Together, the aggression and delinquency subscales make up an externalizing scale. Each subscale was analyzed as a separate outcome because they exhibit somewhat different trends with age. Because of similarities between the externalizing scale and the aggression subscale, analyses with the externalizing scale were dropped.

### *Measurement of Father's Incarceration*

There are several available measures of incarceration in both the original study (RYDS) and the intergenerational follow-up (RIGS). Interview data from several waves of these two sources are combined to create multiple measures of fathers' incarceration history, which are then linked with children's trajectories of aggression and delinquency. Dates of each incarceration incident are used to determine their timing relative to G3 date of birth, as well as measurement of G3 externalizing behaviors (i.e. OCG interview dates), and – when direct reports are not available – to estimate duration of incarceration. Below is a brief overview of what interview data are collected to create these measures, followed by a description of measures constructed for later analyses.

G2 self-reports of incarceration began in Phase 2 (Waves 10-12) of the RYDS, when they were between 20 and 22 years old (range=19-24). Because Phase 2 of the RYDS occurred prior to the RIGS, measures of paternal incarceration come before all observations of G3, although not necessarily before G3 had been born. At Wave 10, the survey instrument asked G2 to report whether they had been incarcerated since the date of their last interview (DOLI), the number of times incarcerated during this period, and the month and year each incident of incarceration started and ended. If respondents were already incarcerated, they completed a correctional interview, in which they were asked to report the month and year they came to the facility, the month and year they expected to be released, and whether they had any other reported incarcerations since DOLI (and if so – how many and when). Waves 11 and 12 ask similar questions, however questions about timing (i.e. month/year of start and release for each incident of incarceration) are

replaced by questions asking respondents to report the number of days they were incarcerated. Because the reference periods for Waves 11 and 12 were approximately one year, random start dates were generated for each incident of incarceration using a random date function in SAS<sup>10</sup> to approximate the timing of incarceration; end dates were simply the random start dates plus the number of days of each reported incarceration. Duration was estimated for Wave 10 by substituting the first of the month for each reported start and end date and taking the difference; if the same month/year were reported for start and release, duration was conservatively set to equal 1.

Similar questions were included in interview schedules for the RIGS (when fathers were between the ages of 25 and 36) beginning in Year 2 (data on incarcerations derived from correctional interviews is available starting in Year 1). All interview schedules include direct information on timing and duration (in days) of incarceration incidents. Correctional interviews are not available starting in Year 8, however, incarcerations that were reported at prior years but in which expected release dates extend beyond Year 8 interview dates are retained.

Based on this information, several measures of paternal incarceration were created from both the RYDS and RIGS. Together, these measures can be combined with child outcomes and other covariates to construct a person-period dataset to address individual change. Although complete measures of father's incarceration history and

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<sup>10</sup> This was accomplished by first identifying the earliest and latest potential dates of exposure based on the date and location of prior and contemporaneous interviews. If prior interviews occurred in the community then the earliest possible date of incarceration was the day after the prior interview date; conversely if the prior interview occurred in an institution, then the day after expected release was used. Similarly, if the current interview occurred in the community, then the latest possible incarceration start date was the date of interview minus the total reported number of days incarcerated (a sum of the duration of each reported incident), whereas if the current interview occurred in a correctional facility, then the latest possible start date was the date of reported incarceration minus the total reported number of days incarcerated.



children's problem behaviors would have been ideal, this was not feasible. Incidents reported in Phase 2 of the RYDS do not include corresponding observations of children's behaviors because they occurred prior to the start of the intergenerational study; thus, it is not possible to determine whether children born to young fathers were influenced (at least, immediately) by these early incidents of incarceration. On the other hand, it is possible to link children's subsequently observed behaviors (from the RIGS) to their fathers earlier incidents of incarceration (reported in the RYDS) to determine whether parental incarceration in early adulthood is associated with between-individual differences in children's trajectories. In addition, the RIGS provides up to 12 years of observations of both father's incarceration *and* children's externalizing behaviors, which permits examination of within-individual changes associated with ongoing incidents of paternal incarceration. To address these different questions, two sets of *time-invariant* parental incarceration measures are created from RYDS self-reports and two sets of *time-varying* parental incarceration measures are created from RIGS self-reports. Each set includes a binary measure of the prevalence of incarceration, an ordinal measure of frequency of incarceration incidents, and a measure of duration of incarceration (this was measured on multiple scales and will be discussed in more detail separately). Dates of incarceration and children's dates of birth were used to determine timing of incarceration in the child's life.

Although similar, there are important conceptual distinctions between these different variables; to a limited extent, the analysis is able to parse out the differential effects of father's incarceration versus detention. For example, prevalence assesses whether the father was incarcerated (and may have been released), regardless of the

number and duration of incidents. Incidence (or frequency) only captures the occurrence of one or more unique incidents of incarceration without regard to the length of duration; this measure provides a measure of the father's transition into a custodial sentence, and therefore the more immediate impact. Duration is better able to capture the effects of the length of father's detention (and absence) on children's delinquency and aggression.

#### *Time-Invariant Incarceration Variables*

The two sets of time-invariant measures are based on data from the RYDS and include incidents of incarceration occurring when G2 were approximately 18-22<sup>11</sup> years old. The first set of time-invariant measures is based on all incidents of incarceration occurring during this period of emerging adulthood. *Prevalence of paternal incarceration* is a binary indicator of whether or not fathers reported an incarceration at any point during Phase 2. *Incidence of paternal incarceration* is an ordinal indicator of the number of incidents of incarceration that fathers reported during Phase 2. *Duration of paternal incarceration* is also an ordinal measure that is the number of days of the longest incident of incarceration of all incidents reported across the three waves. Because of the positive skew of the distribution for this variable and because total days incarcerated may not have an additive (i.e. linear) relationship with children's behavior scores, the natural log is used for this measure. In addition, a measure of the *proportion of time incarcerated* is also included to address the total exposure to incarceration. To construct this measure, the total days of all reported incidents of incarceration were summed to create a measure of

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<sup>11</sup> These numbers represent the average age of G2 at Waves 9-12, but due to age heterogeneity within the G2 cohort, the range is between 16-24 years old.

the total days incarcerated and then divided by the number of days in the reference period.

The second set of time-invariant measures was created only for incarcerations that occurred *after the child's date of birth*, to address the importance of timing of incarceration. Because dates of incarceration for Waves 11 and 12 were randomly assigned, there is an additional source of measurement error in these variables that is attributable to misclassifying incidents of incarceration as prior to or after child's birth. However, there were only five G3 children born between Waves 10-11 and whose fathers' reported incarceration dates at Wave 11 had to be randomly created and four G2 whose G3 child was born between 11-12 and whose reported incarceration dates at Wave 12 had to be randomly generated. Like previous measures, there is a binary measure of whether *prevalence of paternal incarceration after child's birth*, ordinal measures of *incidence of paternal incarceration after child's birth*, *duration of paternal incarceration after child's birth* (natural log), and *proportion of time incarcerated after child birth*.

#### *Time-Varying Incarceration Variables*

Two sets of time-varying measures were constructed using data from the RIGS, when fathers were between the ages of 25 and 36. To facilitate understanding of how these variables were coded, Figure 3.6 displays the incarceration history of an example G2 whose G3 child was observed from age 7-17. The first set of time-varying measures indicates whether fathers were incarcerated at all between current and prior (DOLI) interview dates. *Recent prevalence paternal incarceration* is a binary measure of whether the father reported an incarceration date that occurred between the OCG current and prior

interview date (DOLI). If fathers were incarcerated at any point between the current and previous interview dates (based on OCG), this variable was coded 1. *Recent incidence of paternal incarceration* is an indicator of the number of unique incidents of incarceration reported by the father. If fathers were incarcerated throughout multiple years – for example, the father whose incarceration history is reported in Figure 3.6 was incarcerated from Years 2-6 – only the first year he reported an incident is included. *Recent duration of paternal incarceration* is a continuous measure of the number of days fathers were incarcerated divided by the number of days between interview dates that can range from 0 (was not incarcerated) to 1 (incarcerated the entire time)<sup>12</sup>; this variable is similar to the *proportion of time* incarcerated measure reported earlier.

The second set of time-varying measures captures the cumulative exposure to parental incarceration across the intergenerational study. *Cumulative prevalence of paternal incarceration* is a binary measure that switches to and remains at one once fathers report an incarceration in the RIGS. *Cumulative incidence of paternal incarceration* is a similar variable, but increases each time a father reports a new incident of incarceration. *Cumulative duration of paternal incarceration* is a sum of the total days fathers report being incarcerated divided by total days since start of the study and is similar to the *proportion of time* measure reported earlier.

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<sup>12</sup> Like time-invariant duration measures, other specifications of duration were explored including an absolute measure, its natural log, and categorical versions.

### *Measurement of Covariates*

Several pre-incarceration, time-invariant characteristics are included in models to address selection bias. Because *high school drop-out* is highly correlated with incarceration and poverty, the latter of which is also likely to contribute to children's disadvantage in ways that may impact their behavioral trajectories, models include an indicator of whether or not fathers ever reported dropping out of school during Phase 1 of the original RYDS (Waves 2-9).

In addition, two measures of fathers' pre-incarceration antisocial behavior, both of which are potential causes of children's aggression and delinquency that are highly correlated with incarceration, are included: fathers' adolescent drug use and violence. These measures are taken from Wave 9. *Drug use* is scored one if fathers reported marijuana use, inhalants, hallucinogens, cocaine, crack, heroin, PCP, tranquilizers, uppers, or downers at Wave 9, when fathers were roughly age 18. *Violence*, taken from the same wave, is scored one if fathers reported attacking someone with a weapon, gang fight, robbery, rape, other assault, or throwing things at people. Father's early child-bearing is captured with a binary indicator of *teen parenthood*, scored one if G3 child was born prior to age 20. Finally, demographic indicators of father's *racial-ethnic identity*, *child gender*, and *child age* are also included.

### *Analytic Plan*

The analysis will proceed in three stages. To address the first research question – does paternal incarceration differentiate between children's trajectories of aggression and delinquency? – G3's aggressive and delinquent behavior trajectories are examined as a

function of G2's incarceration experiences reported during Phase 2 of the RYDS. This is accomplished by using a multilevel modeling approach with random effects<sup>13</sup>. Multilevel models are used frequently to address research questions concerning ecological and hierarchical processes, for example, when individuals are nested within higher order units such as neighborhoods, counties, or schools (Johnson, 2010; Snijders & Bosker, 1999), as well as to analyze change or growth, for example when repeated measures are nested within individuals (Holt, 2008; Raudenbush, 2001). The analyses will also address whether incidence, duration, or timing of incarceration is associated with variation in children's trajectories of aggression and delinquency.

The second research question – what is the effect of recent paternal incarceration on children's change in aggression and delinquency? – will examine the effects of time-varying measures of recent paternal incarceration on within-individual changes in children's aggression and delinquency, using two analytic approaches. First, multilevel models with random effects are used to address whether father's incarceration is associated with a discontinuity – that is, a temporary elevation – in children's trajectories of aggression and delinquency. This approach uses person-mean centering, which disaggregates between- and within-individual variation in time-varying covariates (Curran & Bauer, 2011; Hoffman & Stawski, 2009), in order to address whether period-specific deviations from person-level means lead to within-individual changes in outcome variables. Second, a fixed effects approach is used to remove stable, between-individual differences in order to address whether recent incarceration is associated within-

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<sup>13</sup> These are sometimes referred to as mixed models, hierarchical linear models, and growth curve models (Raudenbush, 2001).

individual change. Similarities and differences between these two approaches have been identified by Phillips and Greenburg (2008) and are discussed in more detail in Chapter 5. Like earlier analyses, special attention is paid to the incidence and duration of incarceration in the child's life.

Finally, the third research question – what is the effect of exposure to paternal incarceration accumulated over time on within-individual changes in children's aggression and delinquency? – utilizes time-varying, cumulative measures of paternal incarceration – prevalence, frequency, and duration – in a fixed-effects model. More details on these models are discussed in Chapters 5 and 6.

### *Descriptive Statistics*

Table 3.1 provides descriptive statistics for all measures included in the current analyses. Outcome variables have almost complete data. Children's aggressive behavior scores have a mean of .56 (S.D.=.37, range=0-2) and delinquent behaviors scores have a mean of .19 (S.D.=.18, range=0-1.73), across all measurement occasions. Figures 3.7-3.10, which plot individual trajectories of aggression and delinquency against child's age, show that aggressive behaviors tend to decline across childhood and adolescence and delinquent behaviors are essentially flat prior to adolescence but begin to increase around age 12. They also suggest wide between-individual variation in both the level and rate of change of individual trajectories.

Like the original RYDS sample, the majority of G2 in the analytic sample identify as a racial or ethnic minority; two thirds of the sample identify as African American and 17% identify as Hispanic. The sample is split equally by child gender. Children are on

average 9 years old across all 12 years of data collection, although this ranges from 2-17. At Wave 9, about one third of fathers had reported dropping out of high school at least once since Wave 2<sup>14</sup>. About 17% of fathers reported engaging in violence and 25% of fathers reported drug use at Wave 9. Finally, 35% of fathers are teen parents.

*Prevalence* Paternal incarceration is common in the analytic sample; just over half of fathers reported an incarceration in either the RYDS or RIGS. Slightly more fathers reported an incarceration during the RYDS (38%) than the RIGS (35%). About 20% of fathers were incarcerated *after* their child's birth, when children were up to 7 years old at their father's last incident of incarceration (mean=.57, S.D.=1.35). Fathers reported a recent incarceration in 13% of person-periods and a cumulative prevalence of incarceration in 32% of person-periods during the RIGS.

*Incidence* In the RYDS, times incarcerated ranges from 0 to 6, with a mean of .77 (S.D.=1.24) and .39 (S.D.=.89) for all incidents and those occurring after G3 birth, respectively. In the RIGS, G2 reported up to three incidents of incarceration in a given period and up to six incidents across the whole study.

*Duration* During the RYDS, the average longest incident of incarceration fathers reported was 70, however this measure varies considerably (S.D.=205.19, range=0-1,461). Fathers reported an average longest incident of incarceration of 35 total days after child's birth (S.D.=147.01, range=0-1,461). On average, fathers reported being incarcerated for .02-.05 of their time in total and after their child's birth. During the RIGS, recent absolute duration (not reported) ranges from 1 to over 1,000 (mean=26.12)

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<sup>14</sup> This variable does not account for individuals who re-enrolled after dropping out and is therefore a conservative measure of high-school drop-out. Conversely, it also does not account for respondents who were enrolled at Wave 9 but eventually dropped out of school.



and the number of days of reported incarceration since entering the sample ranges from 1 to over 4,000 (mean=174). Because both of these measures are skewed, additional measures of the proportion of time incarcerated since DOLI and since entrance into the RIGS are also included (mean = .07 and .08, respectively).

### *Comparison of RIGS Fathers with RYDS Males*

Table 3.2 compares the means of key variables between members of the analytic sample and the original RYDS males. RIGS fathers are similar to the original RYDS males in terms of their demographic characteristics, teen parenthood<sup>15</sup>, and involvement in violence. RIGS fathers were more likely to have reported dropping out of school at any point between Waves 2-9, as well as drug use at Wave 9. In addition, they were almost twice as likely to be incarcerated (38% versus 22%), to have been incarcerated more times (.77 versus .40) and for more total days (90 versus 50) during early adulthood. RIGS fathers may have greater criminal justice involvement than the original study members because their early child-bearing patterns distinguish them from other sample members. It is thus, important to keep in mind that analytic sample may not be generalizable to the original population from which it was drawn.

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<sup>15</sup> This is not the same measure of teen parenthood that is used in analyses, which is based on G3 date of birth. By definition, non-RIGS participants do not have G3 whose date of birth can be calculated. Instead, a measure of “precocious parenthood” at Wave 9 is used to indicate childbearing that occurs prior to age 20. Because many respondents were not yet 20 at Wave 9, this is a fairly conservative measure of teen parenthood (e.g. 15% report precocious parenthood at Wave 9 whereas 33% report a G3 date of birth prior to age 20).

*Comparison of RIGS Fathers by Incarceration Histories*

Table 3.3 compares means of key variables between fathers based on their incarceration histories. Fathers who reported having been incarcerated differed from those who were never incarcerated in several ways. They are more likely to have reported involvement in violence at Wave 9 and to have dropped out of school at any point between Waves 2-9. Fathers who were incarcerated after their child's birth were more likely to be African American, to have reported drug use at Wave 9, as well as to have had their children before the age of 20. This is consistent with prior research on characteristics of incarcerated fathers (Herman-Stahl and McKay, 2008) and underscores the importance of addressing confounders.

## **CHAPTER 4** Between-Individual Differences in Child Aggression and Delinquency Trajectories by Paternal Incarceration

This chapter answers the first research question addressed in this dissertation: *is father's incarceration associated with between-individual differences in children's aggressive and delinquent behavior trajectories across childhood and adolescence?*

These analyses rely on time-invariant measures of father's incarceration occurring prior to the start of the RIGS, when children's outcomes were first observed. Given the hypotheses stated in the previous chapter, it is expected that the prevalence, frequency, and duration of incarceration will be positively associated with children's trajectories of aggression and delinquency. Furthermore, if timing is important, as suggested by developmental, life course theories, then the coefficients for measures of paternal incarceration occurring after the child's birth should be larger than those in models that don't take account of timing.

To create child behavior trajectories, maternal assessments of children's aggressive and delinquent behaviors are modeled as a function of a set of child-specific random intercepts and slopes, in addition to a set of fixed parameters representing father's incarceration experiences in early adulthood, the child's gender, and a set of pre-incarceration father characteristics to account for his selection into incarceration. All models were estimated with full information maximum likelihood using PROC MIXED in SAS (Singer, 1998).

*Developmental Change in Children's Aggression and Delinquency*

In multilevel modeling it is standard to first examine an *unconditional means model*<sup>16</sup> (Singer & Willett, 2003), which reveals the relative proportion of variance in aggressive or delinquent behaviors that is allocated within-individuals (i.e. over time) and between-individuals. This is accomplished by estimating a model with no predictors (other than a random intercept) where  $y_{it}$  is the aggressive or delinquent behavior score for child  $i$  at age  $t$ ,  $\gamma_{00}$  is the average aggressive or delinquent behavior score across all children at all ages,  $\zeta_{0i}$  is a random, child-specific intercept  $\sim N(0, \sigma_0^2)$ , and  $\varepsilon_{it}$  is a within-individual residual for child  $i$  at age  $t \sim N(0, \sigma_\varepsilon^2)$ :

$$y_{it} = \gamma_{00} + \zeta_{0i} + \varepsilon_{it}$$

The output, reported in Column A of Tables 4.1 and 4.2, includes two level-1 parameters, which are referred to as random effects, and one level-2 parameter, which are referred to as fixed effect. Level-1 parameters ( $\zeta_{0i}, \varepsilon_{it}$ ), are considered random effects because they are not directly estimated, however they can be described by their variance and covariance components. These include  $\sigma_\varepsilon^2$ , the variance of the within-individual residual  $\varepsilon_{it}$ , and  $\sigma_0^2$ , the variance of the between-individual residual  $\zeta_{0i}$ . Variance components are used to construct an ICC, which indicates the proportion of variance allocated between individuals relative to total variance (the sum of between-individual and within-individual variance). For aggressive and delinquent behaviors, 50% to 55% of variation is attributable to between-individual differences, with the remaining variation occurring within-individuals. Thus, there is adequate between- and within-individual

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<sup>16</sup> This is sometimes called an empty model and is equivalent to a *random effects ANOVA* (Snijders & Bosker, 1999).

heterogeneity in children's externalizing behaviors, which could be explained by either a level-1 or level-2 covariate.

The unconditional means model can be modified by adding covariates. Singer and Willett (2003) recommend starting with an *unconditional growth model* by adding an indicator of time to the level-1 equation. For these analyses, child's age at the time of the OCG interview is used as an indicator of time, denoted by  $X_{it}$ . In addition, higher-order terms can be added to accommodate changes in the rate of growth. Columns B and C show level-1 and level-2 parameters once linear and quadratic terms for child's age are added to the equation. Adding predictor variables changes the meaning of the intercept to the average problem behavior score across individuals at age zero (Biesanz, Deeb-Sossa, Bollen, Papadakis, & Curran, 2004). The coefficients indicate that behavior scores decline at a rate of .0681 each year for aggression and .0250 each year for delinquency, but that change decelerates for both problem behaviors as children grow older. It is noteworthy that for delinquency, the linear term for child's age is positive (Column B) until a quadratic term is added. Likelihood ratio tests favor the more restrictive models, so both terms are retained.

Adding random effects to the level-1 slope coefficients modifies the level-2 equation, allowing each individual's trajectory to have both a unique intercept and rate of change. Columns D and E add these random parameters for child's age and age squared. Likelihood ratio tests also favor these more restrictive models so random slopes are also retained. The top panel of Tables 4.1 and 4.2 reveals the variance and covariance parameters for these random effects. Single-parameter hypothesis tests reject the null

hypotheses that variance and covariance parameters are equal to zero<sup>17</sup>, in support of the notion that there is individual variation in both individual intercepts and slopes. Within-individual residuals ( $\sigma_{\epsilon}^2$ ) also decline with the addition of these parameters, an indicator of improved model fit. For aggression, deviance statistics, BIC, and AIC scores also improve (get smaller) with the addition of each parameter. On the other hand, additional parameters appear to worsen the fit in models for delinquency; despite this, likelihood ratio tests favor these more restrictive models (McCoach & Black, 2008).

All measures of paternal incarceration examined in this chapter are time-invariant and therefore added to level-2 equations. Consequently, paternal incarceration may influence children's trajectories through any of the three level-1 parameters (child-specific random intercepts and random coefficients for age and age<sup>2</sup>). For example, children of incarcerated fathers may have externalizing behavior trajectories of higher magnitude but equivalent slope to children of non-incarcerated fathers. On the other hand, paternal incarceration may influence the rate of change of children's trajectories of aggression and delinquency. If this is the case, the prior literature suggests that their slopes would either increase or decrease more rapidly than children of non-incarcerated fathers.

Adding paternal incarceration to the model allows the random intercept to vary as a function of paternal incarceration. To address whether slopes vary as a function of parental incarceration, a cross-level interaction that is the product of child's age and paternal incarceration is also added to the model. For all measures of paternal

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<sup>17</sup> Although it is possible to specify various covariance structures – for example, compound symmetry constrains covariance parameters to be equal to zero – all models include unstructured covariance parameters, a more flexible approach.

incarceration, the following model is estimated, where  $\gamma_{10}$  is the average linear rate of change in problem behavior scores,  $\gamma_{20}$  is the average quadratic rate of change in problem behavior scores,  $\zeta_{1i}$  is an individual-specific deviation from the average linear rate of change for child  $i$  and is  $\sim N(0, \sigma_1^2)$ ,  $\zeta_{2i}$  an individual-specific deviation from the average quadratic rate of change for child  $i$  and is  $\sim N(0, \sigma_2^2)$ ,  $\gamma_{01}Inc_i$  is the regression of the random intercept on father's incarceration and represents the average contribution to the intercept of fathers' incarceration status,  $\Sigma\gamma_{0k}C_i$  is the regression of the random intercept on a set of  $k$  covariates and represents the average contribution to the intercept of covariate  $k$ ,  $\gamma_{11}Inc_iX_{it}$  is regression of the random linear term on fathers' incarceration and represents the average contribution to the linear rate of change conditional of fathers' incarceration status, and  $\gamma_{21}Inc_iX_{it}^2$  is regression of the random quadratic term on fathers' incarceration and represents the average contribution to the quadratic rate of change of fathers' incarceration status:

$$y_{it} = \gamma_{00} + \gamma_{10}X_{it} + \gamma_{20}X_{it}^2 + \gamma_{01}Inc_i + \gamma_{11}Inc_iX_{it} + \gamma_{21}Inc_iX_{it}^2 + \Sigma\gamma_{0k}C_i + \zeta_{0i} + \zeta_{1i}X_{it} + \zeta_{2i}X_{it}^2 + \varepsilon_{it}$$

The results from multilevel models for aggression and delinquency are presented in Tables 4.3-4.12 and are discussed below. Column headings in the top row indicate the specific indicator of father's incarceration that is being examined: prevalence, incidence, a log transformed measure of duration (the longest reported incident), and a proportion of total time the father was incarcerated (the sum of all incidents). Sub-headings indicate the specification of the model; each measure of incarceration is added to the model first without covariates (Column A), second with covariates (Column B), third with cross-level interactions, but without covariates (Column C), and fourth with cross-level

interactions and covariates (Column D). Results are presented for paternal incarceration, regardless of whether it occurred before or after child's birth, followed by paternal incarceration occurring after the child's birth.

Given hypotheses presented in the previous chapter, we should expect a positive association between all measures of paternal incarceration (prevalence, incidence, and duration) and children's problem behaviors. Coefficients for cross-level interactions should also be positive, indicating that children of incarcerated fathers experience more gradual decline or increase in their aggressive behavior scores with age. Finally, coefficients that use variables sensitive to the timing of incarceration in child's life (i.e. after his or her birth) should also be positively related to children's trajectories of aggression and delinquency; if timing is important, then these coefficients should be of larger magnitude and statistical significance<sup>18</sup> than those of variables that are insensitive to timing.

### *Paternal Incarceration and Children's Aggression*

*Prevalence* Models examining the effect of prevalence of paternal incarceration, regardless of timing in the child's life, are presented in the left panel of Table 4.3.

Column A indicates that prevalence of paternal incarceration has a positive, but only marginally significant association with children's aggression but, as Column B

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<sup>18</sup> Alternatively, one could address whether paternal incarceration after child's birth is associated with greater problem behaviors relative to those who were only incarcerated prior to their child's birth. Supplemental analyses with this smaller sample of ever-incarcerated fathers (n=128) indicated that incarceration after child's birth (relative to any incarceration) is generally not associated with differences in children's trajectories of aggression and delinquency. This could be due to lower statistical power, or insignificant differences between fathers who persist in being incarcerated after their child's birth relative to all who experience incarceration.



demonstrates, that association disappears once covariates are added to the model. The coefficients for paternal incarceration, age x paternal incarceration, and age<sup>2</sup> x paternal incarceration are all indistinguishable from zero before (Column C) and after (Column D) covariates are included in models, indicating that children's slopes do not vary by prevalence of paternal incarceration. Of level-2 covariates, only teen parenthood is significantly associated with children's trajectories of aggression, with the coefficient indicating that children of teen fathers have aggressive behavior trajectories that are .076 greater than trajectories of children whose fathers delayed their parenthood.

*Incidence* Models examining the effect of incidence (or frequency) of paternal incarceration, regardless of timing in the child's life, are presented in the right panel of Table 4.3. Incidence of paternal incarceration is unrelated to child's aggression in models without (Column A) and with (Column B) covariates. Furthermore, incidence of paternal incarceration and its interaction with age and age<sup>2</sup> are insignificant in models both prior to (Column C) and after (Column D) addition of covariates. In other words, neither the magnitude nor the slope of trajectories of child aggression are influenced by incidence of paternal incarceration. As before, only father's early childbearing is linked with children's aggressive behavior trajectories, with this variable associated with trajectories that are .0762 greater than youth whose fathers delay childbearing.

*Duration* Models examining the effect of duration of paternal incarceration regardless of timing in the child's life, are presented in Table 4.4. Two measures of duration are examined: the natural log of the total days of father's longest reported incarceration (models presented in left panel) and the proportion of time fathers were incarcerated (models presented in right panel). The coefficient for duration of longest

incarceration (natural log), presented in Column A, shows a positive, statistically significant association with child's aggression. The same coefficient, although reduced in magnitude from .0215 to .0192 (about 10%), remains statistically significant after the addition of covariates. Column C adds cross-level interactions. All three indicators of duration of paternal incarceration are statistically significant. The coefficients for paternal incarceration and its interaction with age<sup>2</sup> are both positive and statistically significant (.1042, .0026), however the interaction between duration of longest incarceration and age is negative. This indicates that children's aggression trajectories decline more steeply as their father's longest duration of incarceration increases<sup>19</sup>.

Models including the proportion of time the father was incarcerated in total are presented in the right panel of the Table 4.4. Column A indicates that this measure is unrelated to child's aggression prior to inclusion of covariates. Adding covariates (Column B), cross-level interactions (Column C), and both covariates and cross-level interactions (Column D) do not alter this conclusion. For all duration models, only G2 teenage fatherhood is associated with children's aggression.

#### *Paternal Incarceration after Child's Birth and Children's Aggression*

*Prevalence* Similar models are estimated to determine whether father's prevalence, incidence and duration of incarceration after child's birth are associated with children's aggression. We would expect a stronger relationship for these measures that only capture the prevalence, incidence, and duration of paternal incarceration after child's

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<sup>19</sup> Likelihood ratio tests favor these more restrictive models. All likelihood ratio tests (and other fit statistics) were calculated using the mixed\_fit SAS macro developed by Ene, Smiley, and Bell (2013).

birth. The left panel of Table 4.5 addresses whether prevalence of paternal incarceration in the child's life is associated with children's levels of aggression. Column A indicates that prevalence of paternal incarceration after child's birth has a significant positive relationship with children's levels of aggression. Column B shows that this relationship disappears once covariates are included. No coefficients are significant in models with cross-level interactions (Column C and D).

*Incidence* The right panel of Table 4.5 addresses whether incidence of paternal incarceration after the child's birth is associated with child's aggression. The coefficient for incidence of incarceration in the child's life is significantly associated with child's aggression in the model presented in Column A, however this association becomes statistically indistinguishable from zero in the same model once covariates are included (Column B). Columns C and D indicate that neither paternal incarceration nor its interaction with either age term are significantly related to aggression.

*Duration* Table 4.6 presents models examining whether either measure of duration of incarceration in the child's life is associated with child's trajectories of aggression. Column A in the left panel shows that the natural log of the total days of the longest incident of incarceration that fathers report taking place after their child's birth has a marginal association with children's level of aggression. This association disappears once covariates are added (Column B). Models with cross-level interactions (Column C) indicate that paternal incarceration is positively associated with children's aggression, however interactions with age and age<sup>2</sup> are only significant at marginal

levels<sup>20</sup>. These associations decline in models with covariates (Column D), such that paternal incarceration is only marginally associated with children's aggression and cross-level interactions are statistically indistinguishable from zero.

The right panel of Table 4.6 presents similar models with the proportion of total time fathers were incarcerated in their child's life. The total proportion of time fathers were incarcerated in the child's life is unrelated to child's aggression in all four models prior to (Column A) and after (Column B) inclusion of covariates, as well as in models including cross-level interactions (Columns C and D). As earlier, father's teen parenthood is the only covariate associated with children's aggression, with children of teen fathers experiencing aggression trajectories .0365 higher than children of fathers who delay parenthood.

*Timing – Child's Age at Incarceration* Table 4.7 addresses whether the child's age at the time of father's incarceration (the last incarceration if there were multiple incidents that occurred in his/her life) is associated with children's trajectories of aggression. These models were re-estimated for the small sample of children whose fathers were incarcerated after their birth (n=73). Child's age at incarceration has a significant positive association with child's levels of aggression (Column A); the magnitude of the coefficient declines but remains statistically significant after covariates are included (Column B). This coefficient indicates that levels of children's trajectories of aggression increase directly with the child's age at incarceration. In other words,

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<sup>20</sup> If the interaction with age<sup>2</sup> is dropped then neither the main effect of longest duration or its interaction with age is significantly associated with delinquency.

children exposed to paternal incarceration at later ages have worse trajectories of aggression than those exposed at younger ages.

Models with cross-level interactions are presented in Columns C and D. In models without covariates (Column C), the coefficient for child's age at paternal incarceration is not statistically significant; however, cross-level interaction with age and age<sup>2</sup> are both statistically significant. The positive coefficient for child's age x child's age at paternal incarceration indicates that the slope of children's aggression trajectories declines as the child's age at incarceration increases; conversely, the negative coefficient for child's age<sup>2</sup> x child's age at paternal incarceration that *change* in the rate of change slows down as children grow older. These relationships persist after covariates are added (Column D).<sup>21</sup> To summarize, few indicators of paternal incarceration were associated with between-individual differences in children's trajectories of aggression. There is some indication that duration of incarceration differentiates children's aggression trajectories; the natural log of the longest incident of incarceration (in days) was associated with aggression. Despite this, neither prevalence nor incidence of incarceration – in total and after child's birth – distinguished between children's trajectories of aggression.

### *Paternal Incarceration and Children's Delinquency*

*Prevalence* The left panel of Table 4.8 presents the results for models examining the effect of prevalence of paternal incarceration, regardless of timing relative to child's date of birth, on children's delinquency. Column A indicates that prevalence of paternal

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<sup>21</sup> Likelihood ratio tests favor these more restrictive models over those without interactions.

incarceration has a significant, positive association with child's delinquency. Column B shows that this relationship remains significant, though declines its magnitude (roughly 20%), after addition of covariates. Columns C and D indicate that cross-level interactions make no significant contribution to the explanation of children's delinquency. Thus, father's incarceration is associated with children's trajectories of delinquency that are .0366 higher – but of equivalent slope – than comparable children whose fathers were not incarcerated.

*Incidence* The right panel of Table 4.8 shows the results for models examining the effect of incidence of incarceration on child's delinquency. Column A shows that incidence of incarceration has a significant, positive association between child's delinquency. Adding covariates weakens the magnitude of the association (about 20%) but it remains statistically significant. Each incident of incarceration is associated with a .0128 increase in children's levels of delinquency trajectories. Models C and D indicate that slopes do not vary as a function of father's incidence of incarceration.

*Duration* Models in Table 4.9 explore the role of father's duration of incarceration on child's delinquency. The left panel shows the effect of the natural log of the total days of father's longest incident of incarceration on child's delinquency. Although this measure is significantly associated with child's levels of delinquency in models without covariates (Column A), the association is indistinguishable from zero once covariates are included (Column B). Models with cross-level interactions make no contributions to explaining children's delinquency (Column C and D).

The right panel in Table 4.9 shows the relationship between the proportion of time fathers were incarcerated in total and children's delinquency. The model presented in

Column A demonstrates that this variable has a significant association with children's levels of delinquency, however the model presented in Column B indicates that this association declines to marginal significance once covariates are included. Models with cross-level interactions indicate that neither interaction term is significantly associated with child's aggression (Column C and D); furthermore, although the main effect of paternal incarceration is large and statistically significant in models without covariates (Column C), the coefficient declines to marginal significance once covariates are included (Column D)<sup>22</sup>.

#### *Paternal Incarceration after Child's Birth and Children's Delinquency*

*Prevalence* The effects of father's prevalence of incarceration after child's birth on children's delinquency are explored in models presented in the left panel of Table 4.10. The model presented in Column A indicates that prevalence of paternal incarceration after child's birth is positively associated with child's delinquency trajectories, however the same coefficient is only marginally significant in this model once covariates are included (Column B). Models with cross-level interactions indicate that the interaction between paternal incarceration and child's age is only marginally related to child's aggression, although both the main effect of paternal incarceration and its interaction with age<sup>2</sup> are statistically significant; likelihood ratio tests indicated that the additional parameters in these more restrictive models made no significant contribution to the explanation of delinquency.

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<sup>22</sup> Although the marginal significance of the coefficient for duration of incarceration (proportion of total exposure) makes this point moot – likelihood ratio tests favored the less restrictive models (without cross-level interactions).

*Incidence* Models exploring the effects of father's incidence of incarceration after child's birth are presented in the right panel of Table 4.10. Father's incidence of incarceration after child's birth is associated with higher trajectories of child delinquency (Column A). Adding covariates reduces the magnitude, but not the significance, of this association from .0306 to .0193 (36%). Models with cross-level interactions indicate that the rate of change in children's delinquency varies as a function of the number of incidents of incarceration occurring after his or her birth. The negative coefficient for the interaction between paternal incarceration and child age indicates that paternal incarceration declines at a steeper rate as the number of incidents of incarceration increases, whereas the positive coefficient for the interaction between paternal incarceration and child age<sup>2</sup> indicates that the rate of change decelerates at a greater rate with increasing incidence of paternal incarceration in the child's life (Column C). These coefficients remain statistically significant, and only the main effect of paternal incarceration declines in size, once covariates are included in this model (Column D). Likelihood ratio tests favor these more restrictive models therefore cross-level interactions are retained. In other words, both the level and rate of change in delinquency trajectories vary as a function of father's incidence of incarceration in his child's life.

*Duration* Results for the effects of duration of incarceration after child's birth on trajectories of child delinquency are included in Table 4.11. The left panel indicates the relationship between the natural log of father's longest reported incident of incarceration in the child's lifetime and child delinquency. The model presented in Column A indicates that this variable has a marginal association with child's delinquency, however it is indistinguishable from zero once accounting for covariates (Column B). All three



indicators of duration of paternal incarceration are insignificant in models with cross-level interactions (Columns C and D).

The right panel of Table 4.11 addresses whether paternal incarceration is associated with the proportion of time fathers were incarcerated in total after their child's birth. This variable was unrelated to children's trajectories of delinquency in both models A and B. Once cross-level interactions are added, the main effect of paternal incarceration is only marginally related to child delinquency, whereas the interaction with both age and age<sup>2</sup> are no different than zero (Column C); all three indicators of the proportion of childhood exposure to paternal incarceration are insignificant in models including covariates (Column D).

*Timing – Child's Age at Incarceration* To address whether the child's age at father's incarceration (the last incident if there were multiple in his or her life), Table 4.12 presents models addressing whether this variable is related to trajectories of child delinquency for the smaller sample of children (n=73) whose fathers were incarcerated after their birth. This variable has a statistically significant, positive association with child delinquency (Column A), that declines (by 12%) but remains statistically significant after covariates are included in the model (Column B). Models with cross-level interactions make no substantive contribution to the explanation of children's delinquency (Column C and D).

### *Summary of Results*

To summarize, there is weak evidence that paternal incarceration is associated with between-individual differences in children's trajectories of aggression and

somewhat stronger evidence that paternal incarceration is associated with between-individual differences in children's trajectories of delinquency. For aggression, the effects of paternal incarceration are significant only in models that include the natural log of the father's longest incident of incarceration. There may be a tipping point – or critical threshold – when the effects of paternal incarceration are significantly associated with children's aggression trajectories however supplemental analyses did not reveal any clear cutpoints.

There is much greater evidence that between-individual differences in delinquency are attributable to paternal incarceration. Delinquency appears to worsen with greater levels of exposure to increased incidents – but not duration – of incarceration. It may be that the disruptions associated with paternal incarceration and release – rather than the father's detention itself – explain the harmful effects of paternal incarceration.

There is mixed evidence regarding the importance of timing. In general, the models were less consistent when only addressing prevalence, incidence, and duration of incarceration after the child's birth. For example, only incidence of incarceration in the child's lifetime was consistently associated with trajectories of delinquency. This could be due to lower statistical power – only 20% of fathers were incarcerated after their children were born in Phase 2 of the RYDS. Or it may be due to the greater susceptibility of these indicators to measurement error (see Chapter 3). Because of this, additional models were therefore estimated for the smaller sample of families in which the father reported an incarceration after the child's birth (n=73), in order to determine whether there is a relationship between the child's age at incarceration (last incarceration if there

were multiple incidents) and their later trajectories of aggression and delinquency (Tables 4.11 and 4.12). Results indicated that the child's age at father's incarceration has a statistically significant and positive association with both aggression and delinquency. One way to interpret this result could be that older children experience greater disadvantage by their father's incarceration than younger children. Alternatively, older children may be exposed to greater amounts of paternal incarceration than younger children, or they may face unique disadvantages relative to children whose parents delayed childbearing. To address these possibilities, measures of incidence and duration of incarceration, as well as a continuous measure of the father's age at child's birth, were included in models, however substantive results remained the same.

The analyses explored in the present chapter have addressed whether between-individual differences in aggression and delinquency are linked with father's prior incarceration experiences. The results indicate qualified support for the perspective that paternal incarceration has a harmful effect on children's antisocial behaviors. In the next two chapters, analyses explore whether within-individual changes are associated with father's recent incarceration. The results are more able to address whether paternal incarceration serves a causal role – rather than acting as a risk marker – in the development of children's antisocial behaviors. This is done by removing time-stable, between-individual differences and addressing within-individual change associated with the time-varying effects of paternal incarceration. Although additional time-varying confounders are not included – limiting the ability of the present study to make strong causal inferences – the following analyses provide a more rigorous causal test than many previous studies.

## **Chapter 5** Recent Paternal Incarceration and Within-Individual Changes in Children's Aggression and Delinquency

The analyses in this chapter address the second research question explored in this dissertation: *what effect does recent paternal incarceration have on within-individual changes in aggression and delinquency?* To address this question, time-varying measures of recent paternal incarceration (see left-hand panel in Figure 3.6) are added to the level-1 portion of the multilevel model. The addition of time-varying covariates allows modeling of discontinuous change (McCoach & Kanaskin, 2010; Singer & Willett, 2003). If our hypotheses are correct, then recent paternal incarceration should be positively related to within-individual increases in children's aggression and delinquency scores. These increases would resemble a discontinuity – or elevation – in the child's trajectory.

Because time-varying covariates are composed of both between and within-individual variation (Curran & Bauer, 2011), all indicators of paternal incarceration are *person-mean centered*. Person-mean centering (or group-mean centering) is accomplished by a) calculating the mean of the time-varying covariate for each child, and b) taking its deviation from the mean (Allison, 2009; Curran & Bauer, 2011; Hoffman & Stawski, 2009; Osgood, 2009). Substituting the mean and deviate for the original time-varying covariate decomposes it into within- and between-individual effects. This is useful for addressing whether paternal incarceration is associated with *change* in children's problem behaviors. In the fixed effects regression literature, person-mean centering is discussed as a hybrid approach between random and fixed effects approaches (Allison, 2005, 2009). The multilevel models that were estimated in the previous chapter are considered random effects models because they model individual heterogeneity as a

set of individual-specific random variables ( $\zeta_{0i} + \zeta_{1i}X_{it} + \zeta_{2i}X_{it}^2$ ). In addition to assumptions about the distribution of random variables (i.e. normality, mean of zero, constant variance), random effects models assume that random variables are not correlated with other variables – both measured and unmeasured – in the right-hand side of the equation. If this assumption is correct, then random effects models produce efficient and unbiased estimates. If this assumption is incorrect, for example, if there is unobserved heterogeneity between individuals that is correlated with predictor variables, then estimates from random effects models are subject to bias.

Fixed effects models, on the other hand, model individual heterogeneity with a set of individual-specific parameters. Unlike the random effects approach, correlations between individual-specific effects and other predictor variables are permitted (and can be modeled explicitly). Although fixed effects models require more power and are therefore less efficient than random effects models (e.g. estimates in fixed effects models tend to have high standard errors), they overcome issues with bias by controlling for both observed and unobserved between-individual heterogeneity. Allison (2005, 2009) considers person-mean centering to be a more flexible approach because, like random effects models, this method allows estimation of the effects of time-invariant predictors<sup>23</sup> as well as inclusion of random coefficients in the level-1 equation. However, like the fixed effects approach, person-mean centering removes between-individual sources of variation from time-varying covariates. The two methods do this in slightly different

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<sup>23</sup> Because fixed-effects approaches remove between-individual variation, they cannot estimate the coefficients for time-invariant covariates. This is actually a strength of the method because removing between-individual variation – both measured and unmeasured – obviates the estimation of individual differences (e.g. gender, race).

ways; whereas fixed effects models difference out between-individual variation, person-mean centering disaggregates between-individual variation into a separate estimator (the person-level mean). For comparison, both person-mean centered models and fixed effects models are estimated to address the impact of paternal incarceration on within-individual changes in children’s aggression and delinquency. Because fixed effects models examine within-individual change and difference out between-individual variation, they require all subjects to have at least two observations of outcome variables; consequently, 13 families are dropped from these models, with a resulting sample of 319 children observed from age 2 through 17 and 308 children observed from age 4 through 17. Relatedly, time-invariant covariates (which by nature do not change) are necessarily dropped from fixed effects equations. The multilevel model is reported below:

(5.1)

$$y_{it} = \gamma_{00} + \gamma_{10}X_{it} + \gamma_{20}X_{it}^2 + \gamma_{30}(Inc_{it} - \overline{Inc}_i) + \gamma_{40}\overline{Inc}_i + \Sigma\gamma_{0k}C_i + \zeta_{0i} + \zeta_{1i}X_{it} + \zeta_{2i}X_{it}^2 + \varepsilon_{it}$$

Fixed effects models can include both individual- and time-specific fixed effects. Individual differences are captured through individual-level dummy variables (the fixed effects). In the following models, time-specific fixed effects,  $\mu_k$ , refer to the *year* of the study rather than child’s age because models also include continuous, time-varying measure of child’s age and age-squared<sup>24</sup>. The most restrictive models include both individual- and time-specific fixed effects:

(5.2)

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<sup>24</sup> Although dummy variables for child’s age could also be used to structure the time-series of the panel, this is a less restrictive – and more difficult to interpret – specification.

$$y_{it} = \mu_k + \beta_1 X_{it} + \beta_2 X_{it}^2 + \beta_3 Inc_{it} + \alpha_i + \varepsilon_{it}$$

Results are presented in the following order: first, for models with year-specific fixed effects, second, for models with child-specific fixed effects, third, for models with two-way (child- and year- specific) fixed effects, and finally, for random effects, multilevel models in which time-varying measures of paternal incarceration are person-mean centered. As in the previous chapter, random effects models are estimated with SAS PROC MIXED and include random intercepts and slopes<sup>25</sup>. Fixed effects models are estimated with SAS PROC PANEL<sup>26</sup>. Because the temporal order of incidents of parental incarceration may follow children's behavior problems, lagged models were explored whereby children's behavior problems were lagged forward one temporal period (i.e. paternal incarceration occurring in Year 1 was linked to CBCL assessments occurring at Year 2); substantive results remain virtually the same, therefore they are not presented.

*Recent Paternal Incarceration and Within-Individual Change in Children's Aggression*

*Prevalence* Table 5.1 presents the results of models examining the effects of prevalence of recent paternal incarceration on children's aggression. Models with year fixed effects indicate that, within a given year, recent paternal incarceration is associated with a positive, statistically significant relationship with children's aggressive behavior scores. Conversely, models with child fixed effects show that recent paternal incarceration is unrelated to children's within-individual change in aggression. Models

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<sup>25</sup> Because measures of paternal incarceration are included in the level-1 equation and are allowed to vary over time, it would be possible to allow the coefficients for paternal incarceration to vary as well. However there is no substantive justification for doing this.

<sup>26</sup> This procedure is an update to PROC TSCSREG.

with two-way fixed effects replicate the same substantive conclusion as those with only child fixed effects. Finally, multilevel, random effects models in which prevalence of recent paternal incarceration is disaggregated into between- and within-individual sources of variation, show a positive and statistically significant between-individual effect of prevalence of paternal incarceration, but a within-individual effect that is statistically indistinguishable from zero.

*Incidence* Table 5.2 shows models examining the relationship between incidence of recent paternal incarceration and children's aggression. The model with year fixed effects indicates that incidence of recent paternal incarceration has a positive statistically significant association with children's aggression within a given year. The model with child fixed effects shows a null relationship between incidence of recent paternal incarceration and child aggression. The same result holds in models with two-way fixed effects. Finally, multilevel, random effects models indicate that there is a significant, positive between-individual effect, and a null within-individual effect, of incidence of recent incarceration.

*Duration* Table 5.3 shows the relationship between the duration of recent paternal incarceration, measured as a proportion of time incarcerated between the prior and current interview dates, and children's aggression. Like both prevalence and incidence of incarceration, the relationship between duration of recent paternal incarceration and children's aggression has a positive, statistically significant association with children's delinquency in models with year fixed effects. Duration of incarceration is not statistically different than zero in models with child fixed effects and two-way fixed effects. Random effects models indicate that neither the between-individual nor within-



individual effects of father's duration of recent incarceration are associated with child's delinquency.

*Timing* Table 5.4 presents year, child, and two-way fixed effects models for the timing of recent prevalence, incidence, and duration of paternal incarceration in the child's life. The age of the child at the time of paternal incarceration was grouped into three categories: incarceration in early childhood (age 2-6), late childhood (7-11), and adolescence (12-17). These categorical variables were entered into fixed effects models (incarceration in early childhood was the reference category) to address whether the effects of incarceration vary with the child's age.

The left column of the top panel (Panel A) indicates that only recent prevalence of paternal incarceration in late childhood has a positive and statistically significant relationship (.0839) with children's aggression in models with year fixed effects. Conversely, neither recent prevalence of paternal incarceration in late childhood or adolescence is related to children's aggression in models with child or two-way fixed effects.

Similarly, the left column of the center panel (Panel B) indicates that recent incidence of paternal incarceration in late childhood has a positive and statistically significant relationship (.0721) with children's aggression in models with year fixed effects; however recent neither incidence of paternal incarceration in late childhood or adolescence is associated with children's aggression in models with child or two-way fixed effects.

Finally, the left column of the bottom panel (Panel C) indicates that recent duration of paternal incarceration in late childhood has a positive and statistically

significant relationship (.1098) with children's aggression. Like the previous two sets of results, neither indicator of recent duration of paternal incarceration is associated with children's aggression in models with child or two-way fixed effects.

*Recent Paternal Incarceration and Within-Individual Change in Children's Delinquency*

*Prevalence* Models for delinquency are presented in Tables 5.5-5.8. The first column in Table 5.5 shows that, in models with year fixed effects only, prevalence of recent paternal incarceration has a significant, positive association with child's delinquency. The next model, which includes child fixed effects only, indicates that there is no within-individual effect of prevalence of paternal incarceration. The final model, which includes both child and year fixed effects replicates this association. Finally, the random effects model with person-mean centering show that there is a positive, statistically significant between-person effect and a null within-person effect of prevalence of recent paternal incarceration.

*Incidence* The same pattern is evident in Table 5.6, which shows the relationship between incidence of incarceration and child delinquency. The first model, which includes only year fixed effects, shows that incidence of incarceration is only marginally associated with child's delinquency. The next two models, show that incidence of incarceration is unrelated to delinquency. Finally, the random effects multilevel model indicates that incidence of incarceration has a positive, statistically significant between-person effect and a null within-person effect on child's delinquency.

*Duration* Table 5.7 shows the relationship between duration of incarceration and child delinquency. Models with year fixed effects show that duration of incarceration has

a positive and statistically significant association with child's delinquency of .0352. This relationship becomes non-significant in models with child and two-way fixed effects.

Like earlier models, the random effects model for recent duration of paternal incarceration indicates that there is a positive, statistically significant between-individual, but a null within-individual effect, of paternal incarceration.

*Timing* Table 5.8 addresses whether the timing of recent prevalence, incidence, and duration of paternal incarceration in the child's life is associated with varying effects on children's delinquent behaviors. The left column of the top panel (Panel A) indicates that – as with children's aggression – incarceration in late childhood has a positive, statistically significant association (.0528) with children's delinquency in models with year fixed effects, however, this association disappears once child and two-way fixed effects are included in models.

The left column of the center panel (Panel B) indicates that recent incidence of paternal incarceration in late childhood has a positive, statistically significant association (.0512) with delinquency in models with year fixed effects. When child fixed effects are added, the association drops in magnitude (.0240) and is only marginally significant. Furthermore, incarceration in adolescence has the opposite – that is, a negative – relationship with children's delinquency (-.0270), however is significant at only marginal levels. When both child and year fixed effects are included in models, the association between recent incidence of paternal incarceration becomes null, however the inverse relationship between recent incidence of paternal incarceration in adolescence remains marginally significant (-.0263).

The bottom panel of Table 5.8 (Panel C) indicates that recent duration of paternal incarceration in late childhood is associated with a positive, statistically significant relationship (.0671) with children's delinquency in models with year fixed effects. This relationship remains significant in models with child (.0451) and two-way (.0466) fixed effects.

### *Summary of Results*

These analyses suggest that paternal incarceration has a positive, between-person relationship but a null, within-person relationship with children's aggression and delinquency. This suggests that the link between paternal incarceration and childhood aggression and delinquency is primarily due to unobserved differences associated with paternal incarceration. These results cast doubt on causal interpretations of the relationship between father's incarceration and children's development of antisocial behavior. Although this was not a comprehensive causal analysis, models addressing within-individual change generally did not find a statistically significant effect of recent prevalence, incidence, or duration of paternal incarceration.

There is some indication that the effect of paternal incarceration may vary according to the developmental stage when it is experienced, with more consistent harmful effects of paternal incarceration occurring in late childhood (age 7-11). Recent duration of paternal incarceration in late childhood was positively and significantly related to children's delinquency in models addressing within-individual change. Because there are more observations of children in this developmental stage (see Figure 3.5), there may be more statistical power to detect an effect. Conversely, late childhood may be an

age when consequences of paternal incarceration are more salient and behavioral differences among children are beginning to emerge.

Although recent paternal incarceration mostly does not appear to be associated with changes in problem behaviors, these results strongly suggest that paternal incarceration as an individual-level status is a risk marker for children's development of both aggressive and delinquent behaviors. This is also supported by results reported in the previous chapter, in which father's incarceration in early adulthood was found to elevate the likelihood of children's development of trajectories of externalizing (particularly delinquent) behaviors. The results reported in these models suggest that father's continued incarceration in later adulthood (ages 25-36) also has a strong between-person effect on children's aggression and delinquency, however within-individual changes in children's aggression and delinquency are unexplained by changes in father's incarceration status. In the next chapter, fixed effects models explore the relationship between children's cumulative exposure to paternal incarceration and their externalizing behaviors.

## Chapter 6 Cumulative Paternal Incarceration and Within-Individual Changes in Aggression and Delinquency

The analyses in this chapter address the third and final research question explored in this dissertation: *what effect does cumulative prevalence, incidence, and duration of paternal incarceration have on within-individual changes in aggression and delinquency?* To address this question, the effects of time-varying measures of cumulative experiences of paternal incarceration (see right-hand panel in Figure 3.6) are examined using fixed effects models similar to those in the previous chapter. As a reminder, cumulative prevalence measures are coded 0 until the father reports an incarceration and are coded 1 thereafter; cumulative incidence measures are similarly coded 0 but permanently increase in value each time fathers report a new incident of incarceration at any point through the RIGS; cumulative duration measures sum the total days of all incidents of incarceration and divide them by total exposure time. Although time-varying measures can be used in multilevel-growth models, such as in those reported in the previous chapter (McCoach & Kanaskin, 2010; Singer & Willett, 2003), person-mean centering fails to yield the best estimates of between- and individual- effects when time-varying covariates are correlated with time (Curran & Bauer, 2011)<sup>27</sup>. Because the time-varying covariates analyzed in this chapter are cumulative, they will have a tendency to increase in value as children age; examination of descriptive statistics

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<sup>27</sup> Curran and Bauer (2011) demonstrate this using simulation models. The rare exception in which person-mean centering produces unbiased results when TVCs are related to time is when data are balanced and structured. Unfortunately, this is not the case with most panel datasets, including the RIGS. Curran and Bauer recommend an alternative to group-mean centering for applications in which TVCs are correlated with time. This alternative approach involves *grand*-mean centering time, regressing the TVC on time within each individual, and using OLS residuals to estimate within-individual effects and intercepts to estimate between-individual effects (2011). Unfortunately, this approach has not been tested for binary or ordinal distributions of TVCs.

confirms significant, positive relationship between child's age and all three cumulative measures. Consequently, multilevel, random effects models with person-mean centered time-varying covariates were dropped from this chapter. Like the fixed effects results presented in the prior chapter, results are presented first for models that include only year fixed effects, second for models that only include child fixed effects, and third for models that include two-way (child and year) fixed effects (see Equation 5.2). As stated previously, children's aggression and delinquency are expected to increase permanently once fathers report an incarceration, as well as to increase with greater exposure – both incidence and duration – of paternal incarceration over the life course.

*Cumulative Paternal Incarceration and Within-Individual Change in Children's Aggression*

*Prevalence* Models examining the effect of all three cumulative indicators of paternal incarceration are presented in Table 6.1. Prevalence of cumulative paternal incarceration (Panel A) has only a marginal association with child's aggression in the model with fixed effects for study year. Substituting, child fixed effects in place of year fixed effects shows that the cumulative prevalence of paternal incarceration has a negative relationship with children's aggression, indicating that children of fathers who have ever reported an incarceration (in the RIGS) have significantly lower aggression scores. This association disappears in the next model, which includes two-way fixed effects.

*Incidence* The relationship between cumulative incidence of paternal incarceration and children's aggression is displayed in the next panel (Panel B) of Table

6.1. The model with year fixed effects indicates that the number of incidents of paternal incarceration that the child experiences cumulatively has a significant, positive association with aggression within a given study year. This association disappears in the next model, which includes only child fixed effects. The same finding persists in the third model, which includes two-way fixed effects.

*Duration* The relationship between cumulative duration of paternal incarceration and child's aggression is displayed in the final panel (Panel C) in Table 6.1. The model with year fixed effects shows that duration of paternal incarceration has a large, positive, and statistically significant association with child's aggression. In the next model, with child fixed effects only, the p-value for this coefficient drops below conventional levels. This remains unchanged in models with two-way fixed effects.

*Timing* Table 6.2 shows the effects of timing of cumulative prevalence, incidence, and duration of paternal incarceration on children's aggression. As in the previous chapter, variables indicate the cumulative prevalence, incidence, and duration of incarceration by G3's developmental stage: early childhood (age 2-6), late childhood (7-11), and adolescence (12-17). The top panel of this table (Panel A) shows that cumulative prevalence of paternal incarceration in late childhood and adolescence has no relationship with children's aggression in models with year, child, or two-way fixed effects.

The left column of the center panel (Panel B) indicates that, in models with year fixed effects, cumulative incidence of paternal incarceration in late childhood has a positive but only marginally significant association (.0223), whereas cumulative incidence of paternal incarceration in adolescence has a positive, statistically significant



association (.0247) with children's aggression. Both of these associations disappear in models with child and two-way fixed effects.

Finally, the left column of the bottom panel (Panel C) of Table 6.2 indicates that cumulative duration of paternal incarceration in late childhood has a positive and statistically significant association (.1206) with children's aggression. Although this association disappears in models with child fixed effects only, it becomes marginally significant in models with two-way fixed effects (.0821).

#### *Cumulative Paternal Incarceration and Within-Individual Change in Children's Delinquency*

*Prevalence* The results for models exploring the relationship between cumulative prevalence, incidence, and duration of paternal incarceration and child's delinquency are shown in Table 6.3. In the first model of the top panel (Panel A), which includes year fixed effects only, cumulative prevalence of paternal incarceration has a significant, positive relationship with delinquency. In the next model, in which child fixed effects replace year fixed effects, cumulative prevalence of paternal incarceration has a negative, but statistically insignificant relationship with delinquency. The coefficient for cumulative prevalence of paternal incarceration remains insignificant in models with two-way fixed effects.

*Incidence* In the next panel of Table 6.3 (Panel B), models explore the effects of cumulative incidence of paternal incarceration on children's delinquency. The effects of cumulative incidence of paternal incarceration are positive and statistically significant, indicating that a one unit change in cumulative incidence is associated with a .0118

higher delinquent behavior score in models with year fixed effects. In the next model, which substitutes child for year fixed effects, this coefficient is negative and indistinguishable from zero. The final model, with two-way fixed effects, shows a similar null association between the cumulative incidence of paternal incarceration and within-individual change in delinquency.

*Duration* The final models, exploring the effects of the cumulative duration of paternal incarceration on children's delinquency, are presented in the bottom panel (Panel C) of Table 6.3. Cumulative duration of incarceration has a positive and statistically significant association with children's delinquency scores when year fixed effects are included. The next model shows that this coefficient remains positive, but only marginally significant in models with child fixed effects. In models with two-way fixed effects, cumulative duration of paternal incarceration is once again statistically significant. Thus, children's delinquency increases with increased exposure to paternal incarceration across childhood and adolescence.

*Timing* Table 6.4 shows results of models addressing the role of timing of cumulative prevalence, incidence, and duration of paternal incarceration and children's delinquency. The left column of the top panel (Panel A) indicates that cumulative prevalence of paternal incarceration in late childhood has a positive, statistically significant relationship (.0256) with children's delinquency in models with year fixed effects. This relationship disappears in models with child and two-way fixed effects. However, cumulative prevalence of paternal incarceration in adolescence has an inverse relationship with delinquency in models with child (-.0270) and two-way (-.0252) fixed effects.

The left column of the center panel (Panel B) of Table 6.4 indicates that both cumulative incidence of paternal incarceration in late childhood and adolescence has a positive, statistically significant association (.0175 and .0099, respectively) with delinquency in models with year fixed effects. Both of these associations disappear when child fixed effects are added to the model. In models with two-way fixed effects, cumulative incidence of paternal incarceration in late childhood has a positive, but only marginally significant association with delinquency.

Finally, the bottom panel (Panel C) of Table 6.4 shows the effect of cumulative duration of paternal incarceration and delinquency by developmental stage. In models with year fixed effects (left column), cumulative duration of paternal incarceration in late childhood has a positive, statistically significant association (.0673) with delinquency. This association declines somewhat in models with child (center column of right panel) and two-way (right column of right panel) fixed effects, but remains statistically significant (.0495 and .0540, respectively).

### *Summary of Results*

With the exception of cumulative duration, there does not appear to be a relationship between cumulative exposure to paternal incarceration – whether measured as prevalence, incidence, or duration – and within-individual increases in children’s aggressive and delinquent behaviors. There is some indication that children who experience parental incarceration have lower long-term levels of aggressive behaviors, but this association disappears once time series (i.e. year) effects are removed. Like results in the previous chapter, these results indicate that paternal incarceration serves as

a between-individual risk marker for children's problem behaviors, but there is less evidence that parental incarceration on average leads to changes in children's problem behaviors.

On the other hand, there is some indication that this effect varies according to the child's developmental stage. In particular, cumulative prevalence of incarceration in adolescence has a negative association with delinquency in models addressing within-individual change. Furthermore, cumulative duration of incarceration in late childhood has a positive, statistically significant association with delinquency similar models. This may be due to differences in statistical power or actual behavioral differences related to children's cumulative experiences of paternal incarceration by developmental stage.

## **Chapter 7 Conclusion**

Over the last 40 years, the United States has increasingly become an outlier on the world stage according to nearly every available metric regarding the size and growth of its correctional population. With uncertain crime reduction benefits – and those benefits coming at great cost – many scholars, academics, and increasingly, policymakers have questioned whether maintenance of the policies that have led to the prison buildup is a sound use of public resources. One contributing factor to this change in outlook is the recognition, particularly over the last 15 years (Hagan & Dinovitzer, 1999; Sampson, 2011) that mass incarceration imposes collateral damages on society, ranging from the immediate impacts on physical, mental, and behavioral health of the incarcerated to the long-term impacts on socioeconomic mobility, family reunification, and civic participation of the formerly incarcerated. These have rippling consequences for the families and communities from which the incarcerated come and to which they eventually return.

There is a growing literature that documents the harmful impacts of paternal incarceration – particularly, paternal incarceration – on the wellbeing of children. Children of incarcerated fathers are found to be at risk of a number of undesirable outcomes, including internalizing and externalizing behaviors, delinquency, drug use, criminal justice involvement, educational failure, and homelessness. In general, the empirical literature has found that the most consistent consequences of paternal incarceration are children's increased involvement in antisocial behaviors. These consequences may exact considerable damages when scaled up; nearly 1 in 28 children is

estimated to have a parent incarcerated in a prison or jail, the majority of whom are fathers.

To many, paternal incarceration represents a critical link in the intergenerational chain of criminal behavior. The majority of the empirical literature has supported the perspective that incarceration has a criminogenic effect on children. Several studies have found that there are positive associations between father's incarceration and children's aggressive behaviors in childhood (Geller et al., 2012), delinquency in adolescence (Murray et al., 2012), and arrest and conviction in adulthood (Roettger & Swisher, 2011; van de Rakt et al., 2012), even when including statistical controls and utilizing analytic techniques that minimize the effects of unobserved heterogeneity (e.g. propensity scores or fixed effects models).

Conversely, others have argued that paternal incarceration may come as a relief to children, with the incarceration of an antisocial parent ensuring healthy development and disruption of intergenerational continuity in criminality. Removal of antisocial fathers from the household may insulate children from environmental risks (Jaffee et al., 2003; Thornberry, et al., 2009), such as deviant role models (Akers, 1998), parenting styles that are harsh or inconsistent (Patterson et al., 1998), or other strains that are associated with having an antisocial parent.

Skeptics of both perspectives argue instead that paternal incarceration has no unique effect on children's behavior, particularly given the range of other risks faced by these children. There are a number of alternative explanations for the positive correlation between paternal incarceration and children's antisocial behavior. For example, shared genetic and environmental risks may drive the direct association between parent

incarceration and child delinquency. Families experiencing paternal incarceration are exposed to a plethora of risk factors, including residence in neighborhoods of extreme concentrated disadvantage, families characterized by unemployment and resource deprivation, fragile family structures, and exposure to violence, drug use, and poor health – all factors that are linked to children’s development of externalizing behavior problems.

The existing literature has made a substantial contribution to our understanding of the collateral consequences of paternal incarceration, yet limitations still remain. In a systematic review and meta-analysis, Murray et al. (2012) point out that the majority of studies have failed to use rigorous research designs; few<sup>28</sup> examine *change* in children’s behavioral outcomes before and after parental incarceration and many do not account for important third variables, such as parent criminality. This has changed, particularly in the last few years, as several high-quality studies have emerged from prospective, longitudinal samples such as the PYS (Murray et al., 2012) and the FFCW (Geller et al., 2011, Wildeman, 2010). Despite these welcome additions to the literature, research has tended to conceptualize paternal incarceration as an individual characteristic and measure it as a static, time-invariant variable, rather than a dynamic, time-varying incident. Few have taken a comprehensive longitudinal approach by examining repeated measures of paternal incarceration and change in children’s behavioral outcomes across a broad developmental range.

Yet developmental, life course theories of criminology have underscored the importance of examining developmental trajectories – time-ordered sequences – of

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<sup>28</sup> Out of 40 studies, Murray et al. identify three (from four samples) that examine change and 13 that account for parental criminality.

criminal behaviors across early development and the later adult life course, as well as the importance of transitions – life events and age-graded role changes – embedded within these trajectories, at explaining variation in criminality both between individuals as well as over the life course. The notion of linked lives – that individual trajectories are embedded within social and familial networks – indicates that transitions in one person’s life course may serve as turning points in another’s. Because parent’s trajectories are particularly likely to be intertwined with their children’s, paternal incarceration is expected to have consequences – both direct and indirect – for children’s outcomes.

The present analyses have drawn on the conceptual framework of developmental, life-course criminology by suggesting the importance of studying the interlocking nature of fathers’ trajectories of incarceration and children’s trajectories of problem behaviors across a long-term developmental period. This was done through the use of repeated measures of paternal incarceration and children’s aggressive behaviors across the first 12 years of the Rochester Intergenerational Study. Although it was not possible to construct complete histories of father’s incarceration in their child’s lives, the analyses presented a comprehensive assessment of this issue in two studies. First, during emerging adulthood measures of father’s incarceration and incarceration after their child’s birth taken from the original Rochester Youth Development Study were used to examine whether they were related to children’s externalizing trajectories. Second, later adult measures of father’s incarceration were incorporated from the Rochester Intergenerational Study to examine whether they were associated with recent or cumulative within-individual changes in aggression and delinquency.



This dissertation addressed three basic research questions. First, does prevalence, incidence, and/or duration of paternal incarceration in emerging adulthood (ever and after their child's birth) distinguish between children's trajectories of aggression and delinquency across childhood and adolescence? Second, does recent prevalence, incidence, and duration of paternal incarceration lead to within-individual changes in children's aggression and delinquency? Finally, does cumulative prevalence, incidence, and duration of paternal incarceration lead to within-individual changes in children's aggression and delinquency?

Together, the prior literature on paternal incarceration, in combination with the theoretical expectations derived from developmental-life course criminology, suggests that paternal incarceration should lead to both between-individual differences in children's long-term trajectories of aggression and delinquency and within-individual changes in these same behaviors across childhood and adolescence. It was anticipated that children's trajectories of aggression and delinquency would be significantly higher if fathers were incarcerated beforehand, and would increase directly with the incidence and duration of incarceration, particularly if occurring after the child's birth. In addition, recent and cumulative paternal incarceration were expected to lead to increases in delinquency and aggression. Models addressing within-individual change provide much stronger tests of the causal claims regarding the effects of paternal incarceration.

### *Summary and Discussion of Findings*

The results of analyses from the previous three chapters can be summarized as follows. Paternal incarceration is associated with between-individual differences in

children's delinquency and, to a lesser extent, aggression, and within-individual increases in delinquency as children are exposed to greater cumulative durations of paternal incarceration across childhood and adolescence. In between-individual trajectory models (Chapter 4), the prevalence and incidence of paternal incarceration was associated with higher trajectories of children's delinquency. In addition, children of fathers who are incarcerated for relatively longer durations of incarceration are at increased risk of developing above average trajectories of aggression. For the most part, it does not seem to matter whether incarceration occurred before or after the child was born (perhaps because of low statistical power), although the child's age at father's incarceration had a significant, direct effect on both aggressive and delinquent behavior trajectories for the small sample of children whose fathers were incarcerated during their early childhoods. Although this could be attributed to unobserved differences related to early childbearing, this suggests that the more directly the child experiences the father's incarceration, the worse are its consequences (e.g. Johnson, 2009; Osborn and West, 1979). In within-individual, fixed effects models with cumulative, time-varying measures of paternal incarceration (Chapter 6), the proportion of time in which children were exposed to periods of incarceration across development was associated with significantly higher delinquency scores. In other words, children with the greatest exposure to parental incarceration – or absence due to parental incarceration – are at greatest risk of developing problem behaviors.

These analyses shed light on theoretical perspectives discussed earlier. First, there is little evidence in favor of the perspective that paternal incarceration provides a net benefit to children by reducing their involvement in aggression and delinquency. There is

some evidence in favor of the perspective that paternal incarceration has a criminogenic effect on children's externalizing behaviors, particularly delinquency. For the most part, however, paternal incarceration acts as a risk marker rather than a cause of increased behavior problems. This provides more support for the perspective that parental incarceration has a null effect on children's antisocial behavior. For example, time-varying, proximal indicators of paternal incarceration (Chapter 5) had no association on within-individual changes in children's aggressive or delinquent behaviors. Rather, associations between paternal incarceration and children's problem behaviors are attributable to unobserved heterogeneity between children based on father's average incarceration status. These families are likely to possess a number of characteristics that elevate the likelihood of children's aggression and delinquency, including residence in economically deprived neighborhoods, poverty, and exposure to family instability, drug use, violence, and crime. Once these various unknown sources of unobserved heterogeneity were removed – in models using child fixed effects and person-mean centered, time-varying covariates – within-person estimates of paternal incarceration were found to be unrelated to children's problem behaviors. There are likely to be great challenges to disentangling the unique effects of paternal incarceration from myriad other disadvantages faced by this population.

These analyses also provide some support for the notion that there is heterogeneity in father's paternal incarceration histories that is linked to the developmental course of children's behavioral trajectories, as well as the importance of addressing paternal incarceration from a developmental, life-course perspective and in particular for examining the cumulative effects of paternal incarceration over a broad

developmental period. For example, although recent prevalence, incidence, and duration of paternal incarceration are unrelated to within-individual changes in antisocial behavior, the cumulative measures of father's duration of incarceration were related to within-individual increases in delinquency across childhood and adolescence. Surprisingly, the cumulative incidence measure did not have the same effect on either delinquency or aggression. This provides some support for the idea that longer periods of incarceration are more consequential than shorter, but more frequent incidents over the life-course. It may be that absences of greater duration limit father's prospects for family reunification and economic solvency thereby weakening contributions and leading to the accumulation of disadvantage and risk within the child's early life course.

#### *Limitations and Future Directions*

The present study is not without limitations. First, maternal ratings of children's behaviors may be subject to bias because mothers of children whose fathers are incarcerated may differ systematically from those of children whose fathers are not incarcerated. As discussed in Chapter 2, caregivers of these children are more likely to be single parents and may experience depression (cite) and declines in instrumental support (cite) as a consequence of incarceration, which may impede their abilities to accurately rate their children's behavior problems. Thus, differences in mother's attitudes to their children's behavior may be misinterpreted as changes in actual behavior. Future research should replicate the current analyses with alternative sources of children's behavior, such as the child's self-reports, official indicators of criminal justice involvement (e.g. arrest), or additional reporters (e.g. teachers). All of these are subject to different sources of

measurement error, therefore triangulation among different sources is necessary. Relatedly, paternal incarceration is based on father's self-reports, which is also subject to measurement error. Misreporting due to poor memory, dishonesty, or other sources of contamination is a common source of error with self-report measures. Although administrative data are no panacea, future research should examine whether measures with official reports of paternal incarceration reveal the same findings.

The current analysis also could not address maternal incarceration given the relatively small female sample size and low prevalence of maternal incarceration in the Rochester studies. Yet maternal incarceration is a growing and potentially more problematic issue than paternal incarceration. Maternal incarceration rates – and female incarceration rates more generally – have increased at a faster rate than paternal/male incarceration rates (Carson & Golinelli, 2013). Furthermore, incarcerated women are much more likely to have children and their children are more likely to come from single-parent homes than the children of incarcerated men (Glaze & Maruschak, 2008). The fates of mothers and children are more likely to be intertwined than those of fathers and children, particularly given that children are much more likely to reside with and be cared for by mothers than fathers; it is no surprise that children of incarcerated mothers are more likely to be placed in foster care or to have their children reside with extended kin (Johnson & Waldfogel, 2002). Although a meta-analysis (Murray et al., 2012) did not identify any moderator effects for parent gender, this may be because maternal incarceration has been studied less frequently in the quantitative literature, because of its considerably lower prevalence (less than 10% of incarcerated parents are mothers). There is some evidence to suggest that similar harmful effects are found for maternal

incarceration; Huebner and Gustafson (2007), for example, find that children of incarcerated mothers in the NLSY 1979 were more likely to be involved in the justice system as adults. On the other hand, qualitative research by Turanovic et al. (2012) suggests that maternal incarceration may actually be beneficial to children because the children who reside with incarcerated mothers are subject to more antisocial influences than children of incarcerated fathers (see also work by Giordano, 2010). Recent quantitative research with the FFCW also suggests that the effects of maternal incarceration may be more complex than those of paternal incarceration (Turney & Wildeman, 2014).

The present study has also only addressed the ‘average treatment effect’ of parental incarceration, however there may be heterogeneity in this effect based on a variety of factors, such as father characteristics, family structure, and the father-child relationship context. For example, Wildeman (2010) found that the harmful impact of paternal incarceration was eliminated if fathers were involved in domestic violence. Research also suggests that father’s residence and relationship with children prior to incarceration may condition the effect of paternal incarceration. Geller et al. (2012) find evidence that paternal incarceration has a greater impact on children’s aggression levels if the father resided with the child prior to his incarceration, although paternal incarceration is still harmful when fathers and children do not reside together. Similarly, two older studies suggest that residence and relationship quality moderate the effects of paternal incarceration. Fritsch and Burkhead (1981) found that parents who lived with their children prior to their incarceration were more likely to report behavioral problems (70% versus 53%). Morris (1967) argues that the extent of children’s suffering is dependent on

the father's relationship with the child prior to the incarceration (e.g. whether or not the child was a victim of the father's abuse) or the effect of the incarceration on child's the mother. Future research is necessary to uncover these and other potential moderators. In particular, research should specifically examine whether paternal incarceration is associated with varying effects based on paternal involvement in intimate partner violence and father's residence or supervisory status over the child.

The results also come from a cohort initially drawn from a single city and therefore may not be generalizable to the broader U.S. population. Furthermore, participants of the RIGS were shown to differ from the original RYDS sample (followed up through Phase 2) in a number of ways, including their higher likelihood of incarceration in early adulthood and their greater frequency and duration of institutional involvement. The reasons for these differences are likely attributable to the eligibility criteria of the RIGS and the fact that the majority of participants experienced early parenthood, a known correlate of antisocial behavior. Because this sample is at higher-risk of antisocial behavior than typical samples, the results may underestimate the effect of paternal incarceration. Relatedly, the parent generation is generalizable to those who have had children since the study began (and parents were between 25 and 36) and the child generation is generalizable to oldest biological children. Oldest biological children may systematically differ from other children in a number of ways; for example, they are more likely to have been born to younger parents and less likely to reside with their fathers. Because of this, they may be at risk of a range of other negative consequences such as single-parent households, household poverty and financial strain, and transitions in family structure. This makes it more difficult to disentangle the unique effects of

paternal incarceration from other pre-existing differences. Thus, results with this sample may be more conservative than those from other samples.

Finally, the analyses in the current study rely on observational data, therefore conclusions regarding causality should be interpreted cautiously. Although the methods used in the current study permit stronger conclusions regarding causality than many previous studies of the effects of paternal incarceration, there are many ways in which the analysis could be strengthened to identify the unique causal effect of paternal incarceration. For example, although the analyses addressed and minimized the effects of time-stable, between-individual differences, they did not explore the effects of other time-varying factors than child's age and paternal incarceration. More importantly, the literature would benefit from experimental evaluations of the effects of paternal incarceration on children's antisocial behavior. Well-designed randomized-control trials can better address whether there are differences in the effects of custodial versus non-custodial sentences, or short versus long sentences, on children's problem behaviors. These evaluations are necessary to understand the collateral consequences of incarceration more broadly; however, children's outcomes should be included in evaluations of the effects of different sentencing schemes to determine whether they are consistent with results from observational studies.

### *Policy Implications*

Addressing the consequences of incarceration on families and, specifically, children, is an important endeavor, particularly given the impressive growth in lifetime risks of incarceration for recent cohorts of men from the least advantaged segments of the



population (Bonczar, 2003). The rise in paternal incarceration has coincided with a multitude of other socioeconomic trends that have resulted in decreasing resources to children born into the lowest socioeconomic strata (McLanahan, 2004). Consequently, this population should be of continued interest to policymakers concerned with child wellbeing, and those who are interested in interrupting the intergenerational cycle of criminality and institutional involvement.

Limitations aside, the results from the previous analyses have several policy implications. First, they suggest that reducing paternal incarceration alone will do little to prevent children's development of delinquency and aggression. For the most part, within-individual effects of recent and cumulative prevalence, incidence, and duration of paternal incarceration had a null relationship with children's aggression and delinquent behavior scores. This is contrary to expectations derived from the prior literature, particularly the literature on collateral consequences of mass incarceration. These results do not suggest that paternal incarceration is beneficial for families or that current levels of incarceration should be maintained. Rather, they indicate that there are large differences among families based on whether they have ever experienced paternal incarceration. These between-individual differences are difficult – if not impossible – to disentangle from unique incidents of incarceration. Many of these differences may precede the incarceration experience. The literature is only now beginning to articulate the kind of information necessary to generate relevant policy implications (Sampson, 2011).

Second, there are marked between-individual differences in children's aggression and delinquency based on father's incarceration status; these differences should not be

understated. Trajectory models indicate that prevalence, incidence, and duration of incarceration act as risk markers for children's delinquent and aggressive behaviors. Paternal incarceration may serve as a valuable risk marker through which to target evidence-based interventions to the child and family; in other words, the incarceration of a father may serve as a potential point of intervention through which necessary services to high-risk and vulnerable families and children can be provided. There are now several rigorous evaluations in the prevention science literature that have demonstrated the efficacy of a number of programs at reducing children's undesirable outcomes<sup>29</sup>. For example, Functional Family Therapy (Alexander et al., 1998) is a family-based, therapeutic intervention that reduces problem behaviors by improving parenting skills, family communication, and supportive parent-child relationships. Many school-and community-based programs, as well as those targeting multiple domains, such as Multisystemic Therapy (Henggeler, 2011), have also been found effective at reducing children's problem behaviors. Because incarceration is concentrated in known demographic groups and geographic communities, primary prevention programs that provide services to entire populations may also be usefully implemented. Replication and modification of these prevention and intervention programs to address the specific needs of children of incarcerated fathers, as well as their caregivers, would be a useful avenue for policymakers. It is assuring, however, that these programs have been found to be effective in multiple, rigorous evaluations with diverse populations. Finally, many have

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<sup>29</sup> Blueprints for Healthy Youth Development, Promising Practices Network, CrimeSolutions.gov, and the Campbell Collaboration are all sources of information on evidence-based practices.

been found to be cost-effective (Aos, Phipps, Barnoski, & Lieb, 2001), particularly given the high costs of crime and the administration of the justice system.

Third, there is some indication that longer durations of incarceration are associated with harmful child outcomes. Cumulative exposure to greater periods of paternal incarceration is directly associated with increases in delinquency. Unfortunately, increased sentence lengths are responsible for a large share of the prison buildup of the last few decades, due to policies such as mandatory minimum sentencing. On the other hand, there is less evidence that the incidence of incarceration is associated with increases in problem behaviors. This is consistent with recent research and commentary advocating shorter custodial sentences as a more effective and efficient allocation of criminal justice resources (Kleiman, 2009). Future research should continue to explore this idea in more detail to determine whether it extends to the collateral consequences of parental incarceration.

There is currently a momentum within the academic and policy worlds that is built around reducing incarceration levels in the United States; this “de-carceration” movement has the potential to be more successful if paired with a comprehensive strategy to improve family and child wellbeing. Employment of evidence-based programs and policies has the potential to minimize damages experienced by families characterized by criminal justice system involvement, institutionalization, and the range of associated risk factors.

## *Conclusions*

Despite limitations, the present study has made a number of contributions to the literature on parental incarceration. First, it has drawn on a more comprehensive history of paternal incarceration that allowed the construction of measures of the occurrence and dosage of incarceration (i.e. prevalence, incidence, and duration) over the father's life course and their child's development during childhood and adolescence. The availability of repeated measures of paternal incarceration and child's aggressive and delinquent behaviors have allowed analyses to address whether there are between-individual differences in children's trajectories, as well as within-individual changes, associated with father's incarceration. Finally, the availability of pre-incarceration control variables, including parental criminality, as well as analytic methods for removing unobserved heterogeneity, have minimized the threat of selection bias.

Interrupting intergenerational continuities in problem behaviors and improving the wellbeing of children, particularly those from the most disadvantaged segments of American society, is a valuable goal for public policy. Although it remains to be seen whether future work will replicate these findings, the present study has indicated that paternal incarceration is a risk factor, though not a unique cause, of children's problem behaviors. More work is necessary to uncover the common causes of father's institutional involvement and children's aggression and delinquency in order to develop services and policies tailored to the needs of these at-risk families. Continued study of the linked lives of fathers and children growing up in an era of mass incarceration will provide a much-needed foundation for the development of policies to ensure brighter prospects for the next generation.

## FIGURES

Figure 3.1: Research Design and Sample Characteristics

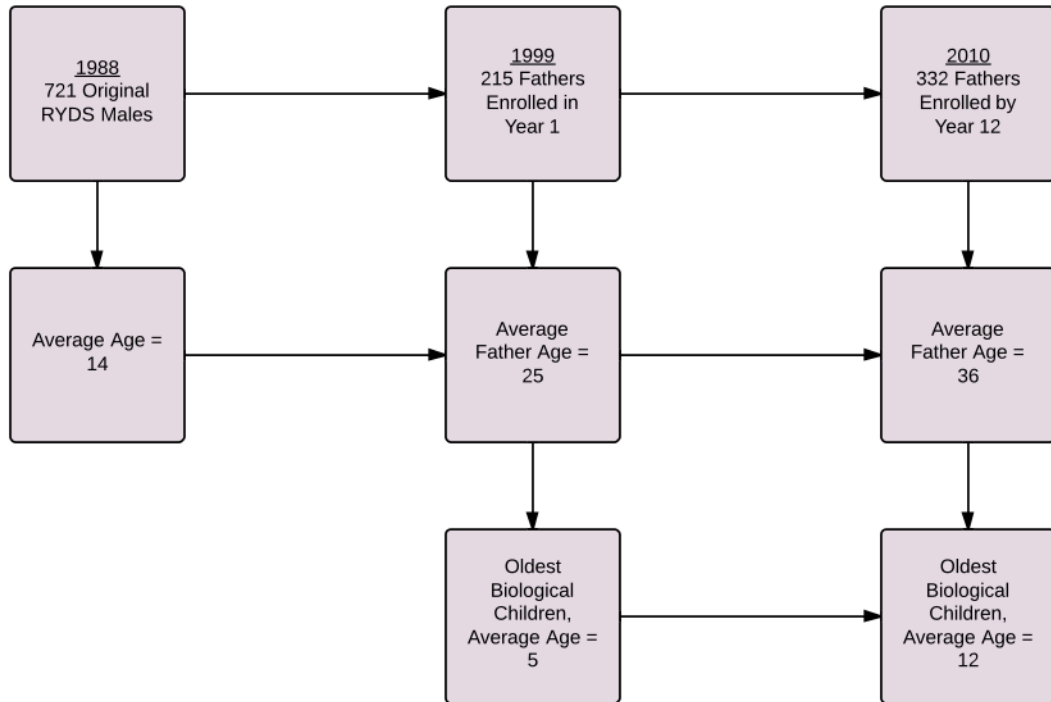


Figure 3.2: Sample Size, By Year and Cumulative

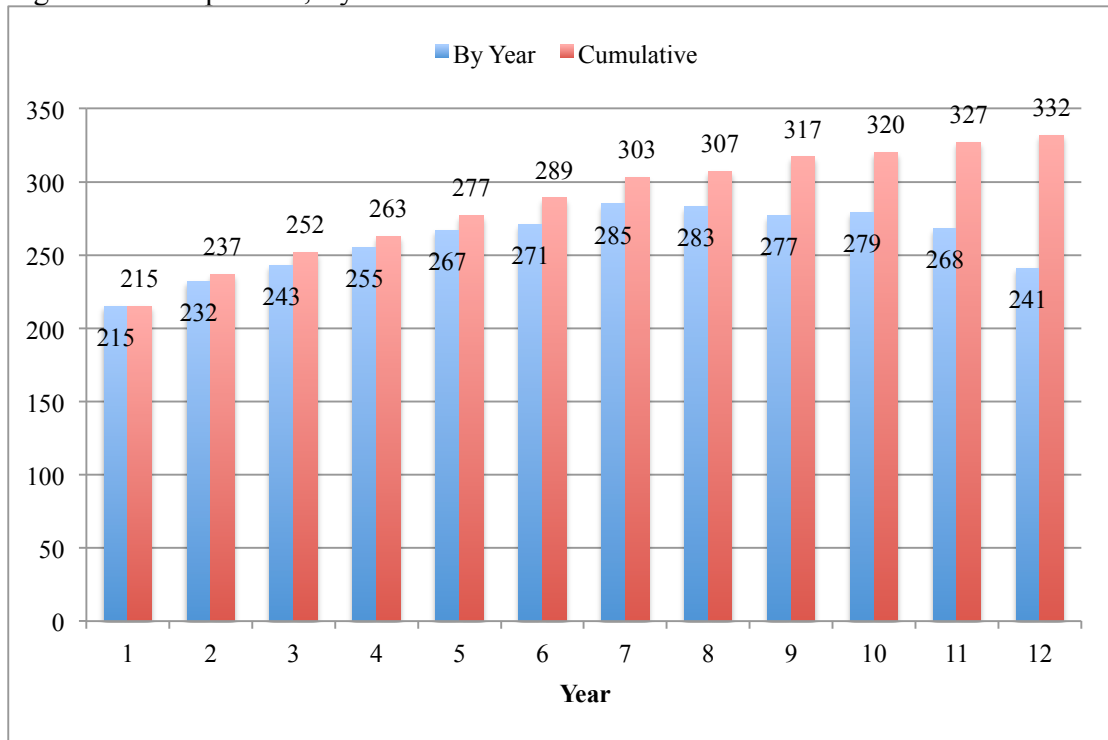


Figure 3.3: First and Last Year in RIGS

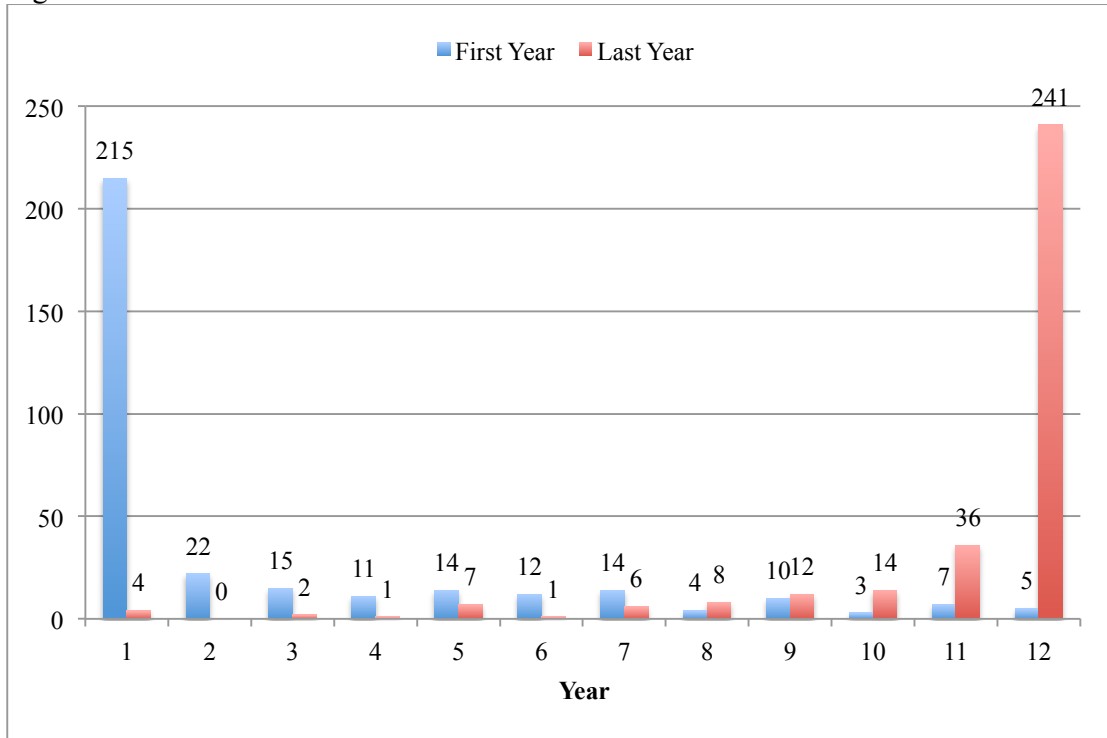


Figure 3.4: Number of Observations per Child, By Year and Cumulative

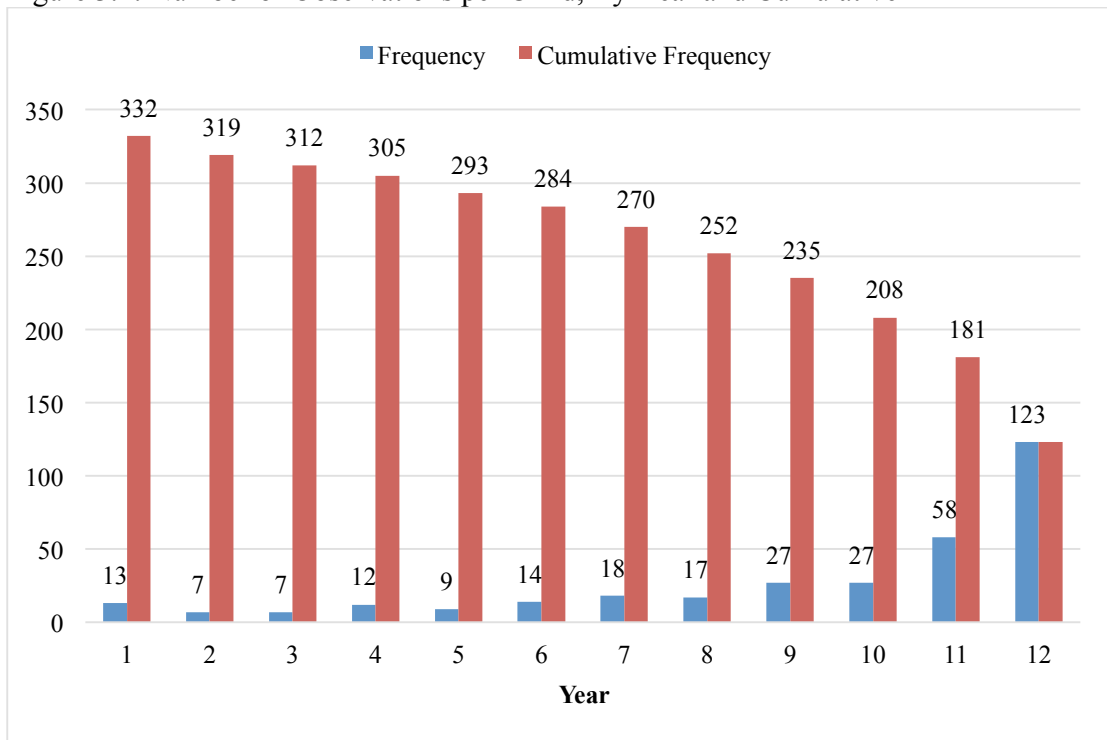


Figure 3.5: Number of Observations by Child Age

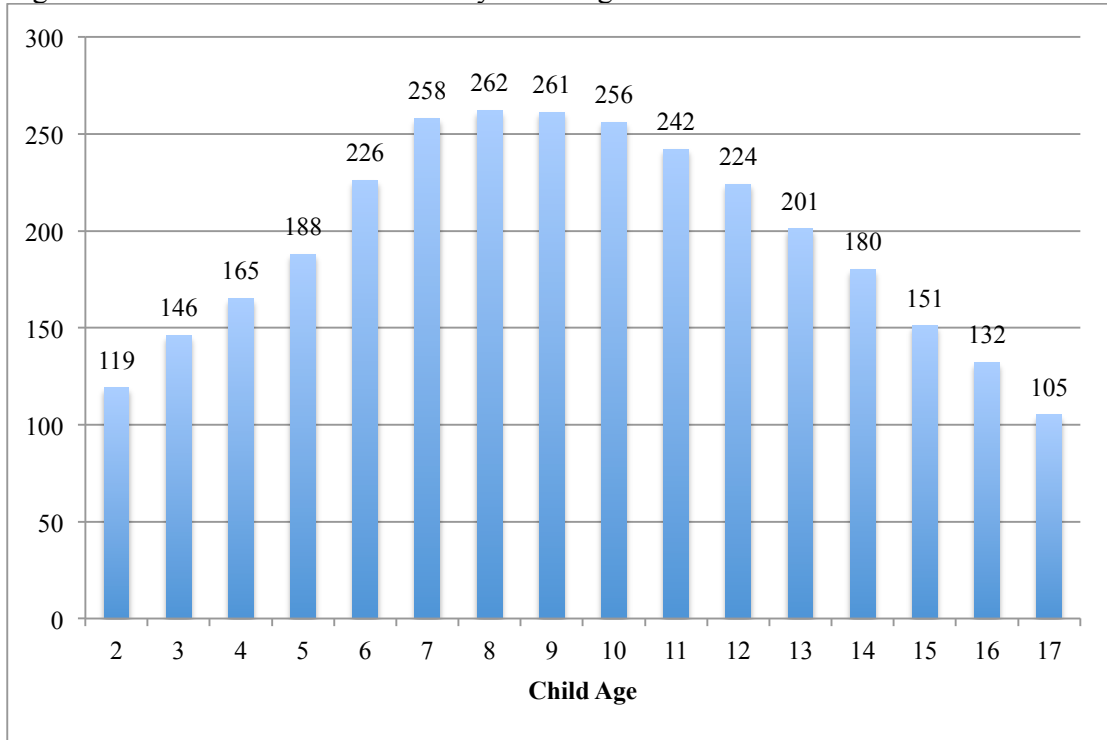


Figure 3.6: Coding of Time-Varying Measures of Parental Incarceration

Year	Child Age	Recent Incarceration			Cumulative Incarceration		
		Prevalence	Incidence	Duration	Prevalence	Incidence	Duration
2	5	1	1	0.31	1	1	0.31
3	6	1	0	1.00	1	1	0.60
4	7	1	0	1.00	1	1	0.73
5	8	1	0	1.00	1	1	0.81
6	9	1	0	0.14	1	1	0.65
7	10	0	0	0.00	1	1	0.51
8	11	0	0	0.00	1	1	0.46
9	12	0	0	0.00	1	1	0.38
10	13	1	1	.10	1	2	0.44
11	14	0	0	0.00	1	2	0.34
12	15	0	0	0.00	1	2	0.29

Figure 3.7: Spaghetti Plot, Individual Aggression Trajectories

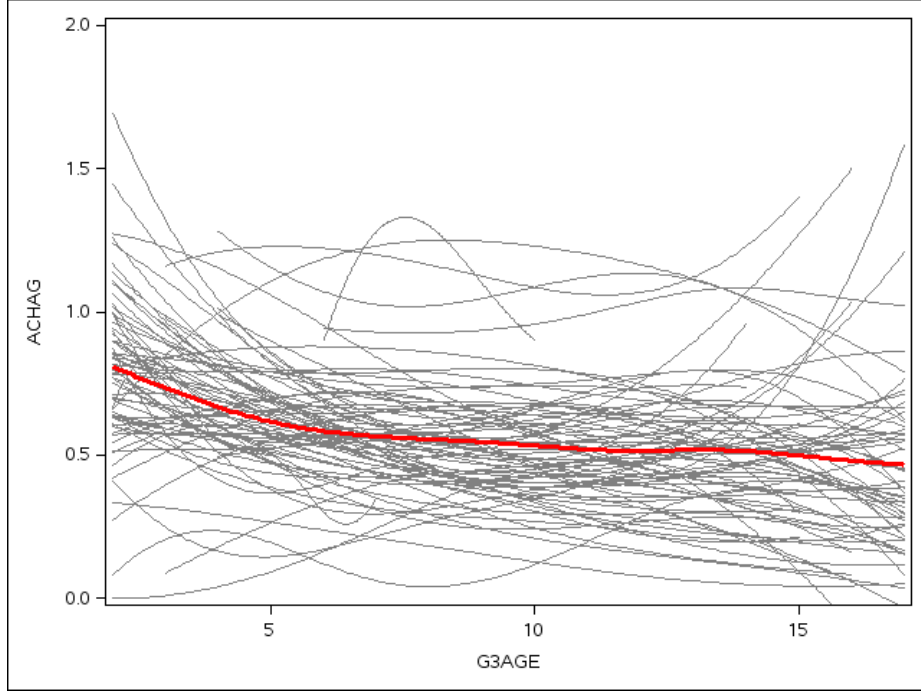


Figure 3.8: Fitted Lines, Individual Aggression Trajectories

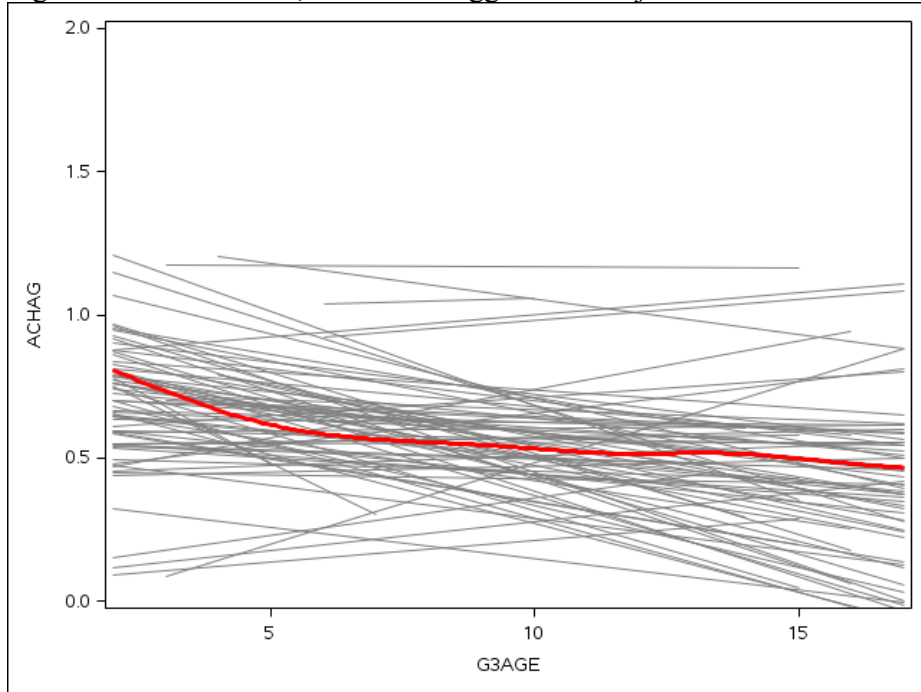




Figure 3.9: Spaghetti Plot, Individual Delinquency Trajectories

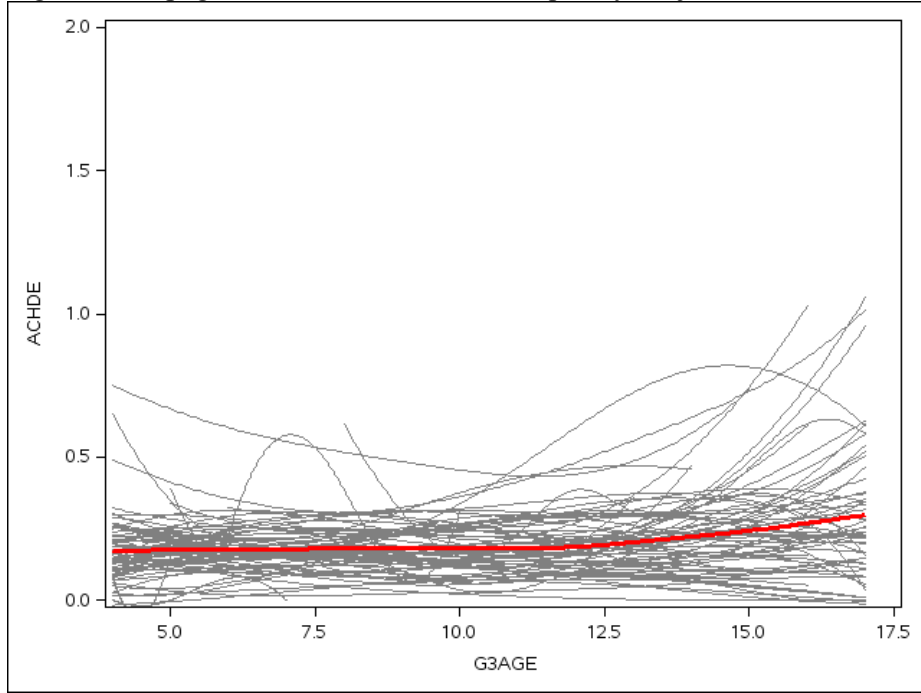
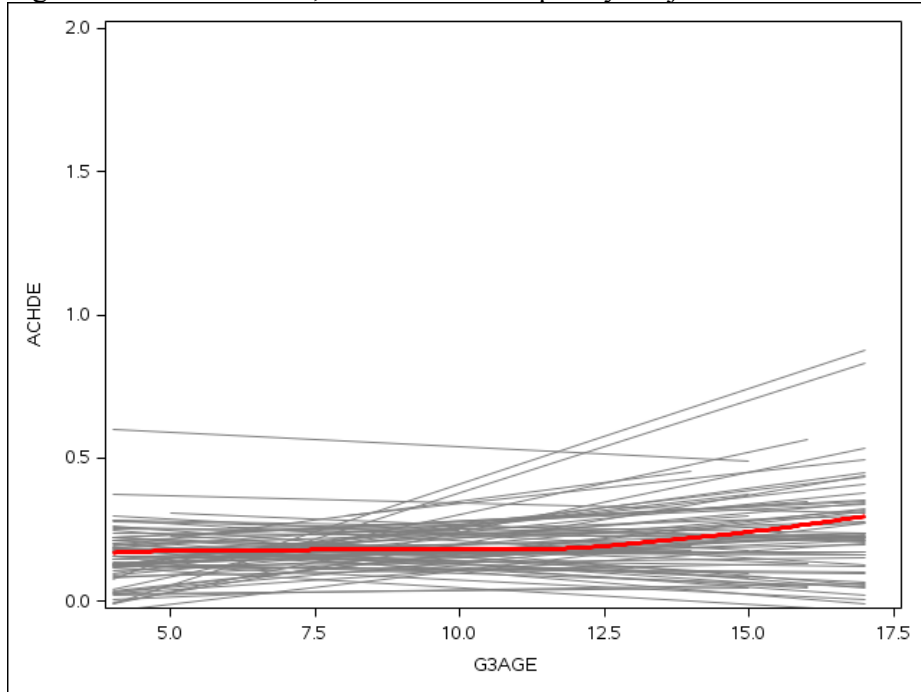


Figure 3.10: Fitted Lines, Individual Delinquency Trajectories



TABLES

Table 3.1: Descriptive Statistics

Variable	N	Mean	Std Dev	Range
Level 1				
Prevalence of Paternal Incarceration (RYDS)	332	.38	.49	0-1
Incidence of Paternal Incarceration (RYDS)	332	.77	1.24	0-6
Duration of Paternal Incarceration (RYDS)	330	.05	.15	1
Proportion of Time Incarcerated (RYDS)	332	71.01	201.19	0-1461
Prevalence of Paternal Incarceration After Child's Birth (RYDS)	332	.22	.41	0-1
Incidence of Paternal Incarceration After Child's Birth (RYDS)	332	.39	.89	0-6
Duration of Paternal Incarceration After Child's Birth (RYDS)	332	36.05	147.01	0-1461
Proportion of Time Incarcerated After Child's Birth (RYDS)	332	.02	.10	0-1
Child's Age at (Last) Father's Incarceration	332	.57	1.35	0-7.02
Child Male	332	.48	.50	0-1
Father Teen Parent	332	.35	.48	0-1
Father's Violence in Early Adulthood	329	.17	.38	0-1
Father's Drug Use in Early Adulthood	329	.26	.44	0-1
Father Ever Dropout of High School	329	.32	.47	0-1
Father African American	332	.66	.47	0-1
Father Hispanic	332	.17	.38	0-1
Level 2				
Child Age	3116	9.33	4.04	2-17
Aggressive Behaviors	3060	.56	.37	0-2
Delinquent Behaviors	2794	.19	.18	0-2
Recent Prevalence of Paternal Incarceration (RIGS)	3116	.13	.34	0-1
Recent Incidence of Paternal Incarceration (RIGS)	3116	.08	.30	0-3
Recent Duration of Paternal Incarceration (RIGS)	3116	.07	.23	0-1
Cumulative Prevalence of Paternal Incarceration (RIGS)	3116	.32	.46	0-1
Cumulative Incidence of Paternal Incarceration (RIGS)	3116	.53	.97	0-6
Cumulative Duration of Paternal Incarceration (RIGS)	3116	.08	.21	0-1

Table 3.2: Comparison of RIGS Fathers with Original RYDS Males

	RYDS Males (n=729)	RIGS Fathers (n=332)
Incarcerated (n=729)	.22 (.42)	.38 (.48)***
Times Incarcerated (n=729)	.40 (.93)	.77 (1.24) ***
Days Incarcerated (n=729)	52.56 (228.39)	89.89 (259.79) ***
Teen Parent (n=601)	.14 (.35)	.15 (.36)
Violence (n=638)	.15 (.35)	.17 (.38)
Drug Use (n=637)	.18 (.39)	.26 (.44)*
HS Dropout (n=637)	.22 (.42)	.32 (.47)**
African American (n=729)	.61 (.49)	.66 (.47)
Hispanic (n=729)	.19 (.39)	.17 (.38)

Table 3.3: Comparison of RIGS Fathers by Incarceration History

Father Characteristics	Never Incarcerated (n=163)	Before G3 Only (n=55) <sup>1</sup>	After G3 Birth (n=114) <sup>2</sup>	Difference <sup>3</sup>
Teen Parent (n=601)	.26 (.44)	.11 (.31)*	.61 (.49)***	.0001
Violence (n=638)	.07 (.26)	.20 (.41)*	.29 (.46)***	N.S.
Drug Use (n=637)	.15 (.36)	.18 (.39)	.45 (.50)***	.0001
HS Dropout (n=637)	.15 (.36)	.46 (.50)***	.49 (.50)***	N.S.
African American (n=729)	.59 (.49)	.65 (.48)	.77 (.42)**	N.S.
Hispanic (n=729)	.18 (.39)	.16 (.37)	.16 (.37)	N.S.

<sup>+</sup>p<.10, \*p<.05, \*\*p<.01, \*\*\*p<.001

- <sup>1</sup> Differences are relative to never incarcerated fathers.  
<sup>2</sup> Differences are relative to never incarcerated fathers.  
<sup>3</sup> Differences refer to fathers incarcerated only before child's birth and fathers incarcerated after child's birth.

Table 4.1: Unconditional Means and Growth Models, Children's Aggression from 2-17 (n=332, 3,060)

	Random Effects				
	A	B	C	D	E
Var( $\zeta_{0t}$ ) = $\sigma_1^2$	.0751 (.0016)***	.0775 (.0066)***	.0794 (.0068)***	.1622 (.0169)***	.1936 (.0312)***
Cov( $\zeta_{0t}$ , $\zeta_{1t}$ )	--	--	--	-.0086 (.0012)***	-.0292 (.0064)***
Var( $\zeta_{1t}$ ) = $\sigma_1^2$	--	--	--	.0009 (.0001)***	.0083 (.0083)***
Cov( $\zeta_{2t}$ , $\zeta_{0t}$ )	--	--	--	--	.0012 (.0003)***
Cov( $\zeta_{2t}$ , $\zeta_{1t}$ )	--	--	--	--	-.0004 (.0001)***
Var( $\zeta_{2t}$ ) = $\sigma_2^2$	--	--	--	--	.00002 (.000004)***
Var( $\epsilon_{1t}$ ) = $\sigma_2^2$	.0591 (.0016)***	.0530 (.0014)***	.0513 (.0014)***	.0413 (.0012)***	.0385 (.0011)***
Fixed Effects					
Intercept	.5720 (.0159)***	.7731 (.0197)***	.9512 (.0276)***	.9865 (.0348)***	.9517 (.0358)***
Child Age	--	-.0227 (.0013)***	-.0681 (.0051)***	-.0763 (.0061)***	-.0713 (.0077)***
Child Age <sup>2</sup>	--	--	.0024 (.0002)***	.0028 (.0003)***	.0027 (.0004)***
Fit Statistics					
Deviance Statistic	843.3	551.4	468.2	216.0	143.1
AIC	849.3	559.4	478.2	230.0	163.1
BIC	860.7	574.6	497.2	256.6	201.2

<sup>†</sup>p<.10, \*p<.05, \*\*p<.01, \*\*\*p<.001

Table 4.2: Unconditional Means & Growth Models, Children's Delinquency from 2-17 (n=317, 2794)

	Random Effects				
	A	B	C	D	E
Var ( $\zeta_{0i}$ ) = $\sigma_1^2$	.0166 (.0015)***	.0160 (.0014)***	.0163 (.0015)***	.0353 (.0045)***	.0791 (.0163)***
Cov ( $\zeta_{0i}, \zeta_{1i}$ )	--	--	--	-.0028 (.0004)***	-.0147 (.0033)***
Var ( $\zeta_{1i}$ ) = $\sigma_1^2$	--	--	--	.0003 (.00004)***	.0034 (.0007)***
Cov ( $\zeta_{2i}, \zeta_{0i}$ )	--	--	--	--	.0008 (.0002)***
Cov ( $\zeta_{2i}, \zeta_{1i}$ )	--	--	--	--	-.0002 (.00003)***
Var ( $\zeta_{2i}$ ) = $\sigma_2^2$	--	--	--	--	.00001 (.000002)***
Var ( $\epsilon_{it}$ ) = $\sigma_2^2$	.0165 (.0005)***	.0164 (.0005)***	.0161 (.0005)***	.0128 (.0004)***	.0118 (.0004)***
Fixed Effects					
Intercept	.1909 (.0077)***	.1574 (.0107)***	.2862 (.0205)***	.2929 (.0230)***	.2915 (.0249)***
Child Age	--	.0035 (.0008)***	-.0250 (.0039)***	-.0275 (.0044)***	-.0259 (.0053)***
Child Age <sup>2</sup>	--	--	.0014 (.0002)***	.0016 (.0002)***	.0014 (.0003)***
Fit Statistics					
Deviance Statistic	-2834.8	-2855.0	-2908.4	-3198.0	-3309.4
AIC	-2828.8	-2847.0	-2898.4	-3184.0	-3289.4
BIC	-2817.5	-2831.9	-2879.6	-3157.6	-3251.8

<sup>†</sup>p<.10, \*p<.05, \*\*p<.01, \*\*\*p<.001

Table 4.3: Father's Prevalence and Incidence of Incarceration and Children's Trajectories of Aggression

	I. Prevalence of Incarceration				II. Incidence of Incarceration			
	A	B	C	D	A	B	C	D
Intercept	.9313 (.0373)***	.9174 (.0525)***	.9101 (.0441)***	.8926 (.0577)***	.9384 (.0367)***	.9191 (.0525)***	.9230 (.0413)***	.9016 (.0558)***
Child's Age	-.0717 (.0077)***	-.0735 (.0077)***	-.0657 (.0097)***	-.0668 (.0098)***	-.0716 (.0077)***	-.0735 (.0077)***	-.0676 (.0090)***	-.0692 (.0091)***
Child's Age <sup>2</sup>	.0027 (.0004)***	.0027 (.0004)***	.0024 (.0005)***	.0024 (.0005)***	.0027 (.0004)***	.0027 (.0004)***	.0025 (.0005)***	.0025 (.0005)***
Incarceration	.0591 (.0325) <sup>+</sup>	.0428 (.0364)	.1167 (.0746)	.1092 (.0767)	.0196 (.0128)	.0151 (.0142)	.0419 (.0307)	.0414 (.0323)
Incarceration x Child's Age	--	--	-.0154 (.0158)	-.0174 (.0159)	--	--	-.0053 (.0064)	-.0061 (.0066)
Incarceration x Child's Age <sup>2</sup>	--	--	.0008 (.0008)	.0009 (.0008)	--	--	.0003 (.0003)	.0003 (.0003)
Child Male	--	.0350 (.0319)	--	.0356 (.0319)	--	.0354 (.0319)	--	.0358 (.0320)
Teen Parent	--	.0760 (.0358)*	--	.0771 (.0358)*	--	.0753 (.0359)*	--	.0762 (.0359)*
Violence	--	-.0176 (.0475)	--	-.0173 (.0475)	--	-.0149 (.0473)	--	-.0151 (.0473)
Drug Use	--	-.0120 (.0410)	--	-.0114 (.0410)	--	-.0147 (.0414)	--	-.0139 (.0414)
HS Dropout	--	.0417 (.0378)	--	.0422 (.0378)	--	.0492 (.0363)	--	.0493 (.0363)
African American	--	-.0242 (.0460)	--	-.0245 (.0460)	--	-.0221 (.0459)	--	-.0229 (.0459)
Hispanic	--	-.0070 (.0573)	--	-.0075 (.0574)	--	-.0083 (.0574)	--	-.0096 (.0574)
Deviance Statistic	139.9	140.0	138.9	138.7	140.8	140.2	140.1	139.4
AIC	161.9	176.0	164.9	178.7	162.8	176.2	166.1	179.4
BIC	203.7	244.3	214.3	254.7	204.7	244.5	215.6	255.3

All models include random intercepts and random coefficients for linear and quadratic age terms; <sup>+</sup>p<.10, \*p<.05, \*\*p<.01, \*\*\*p<.001

Table 4.4: Father's Duration of Incarceration and Children's Trajectories of Aggression

	I. Duration – Natural Log of Longest Incident				II. Duration – Proportion of Time Incarcerated			
	A	B	C	D	A	B	C	D
Intercept	.9151 (.0372)***	.8982 (.0529)***	.9085 (.0375)***	.8886 (.0534)***	.9491 (.0364)***	.9199 (.0526)***	.9414 (.0378)***	.9115 (.0536)***
Child's Age	-.0661 (.0078)***	-.0688 (.0079)***	-.0632 (.0079)***	-.0653 (.0080)***	-.0711 (.0077)***	-.0735 (.0077)***	-.0706 (.0082)***	-.0729 (.0081)***
Child's Age <sup>2</sup>	.0025 (.0004)***	.0026 (.0004)***	.0023 (.0004)***	.0023 (.0004)***	.0027 (.0004)***	.0027 (.0004)***	.0027 (.0004)***	.0028 (.0004)***
Incarceration	.0215 (.0064)***	.0192 (.0066)**	.1042 (.0268)***	.1024 (.0270)***	.0623 (.1079)	.0259 (.1133)	.2526 (.2585)	.2217 (.2588)
Incarceration x Child's Age	--	--	-.0315 (.0104)**	-.0304 (.0105)**	--	--	-.0176 (.0537)	-.0210 (.0532)
Incarceration x Child's Age <sup>2</sup>	--	--	.0026 (.0010)**	.0024 (.0010)*	--	--	-.0002 (.0027)	-.00003 (.0026)
Child Male	--	.0356 (.0318)	--	.0368 (.0318)	--	.0379 (.0320)	--	.0387 (.0320)
Teen Parent	--	.0698 (.0359)+	--	.0748 (.0361)*	--	.0782 (.0358)*	--	.0777 (.0358)*
Violence	--	-.0147 (.0470)	--	-.0162 (.0469)	--	-.0112 (.0480)	--	-.0099 (.0479)
Drug Use	--	-.0122 (.0409)	--	-.0135 (.0409)	--	-.0082 (.0410)	--	-.0083 (.0410)
HS Dropout	--	.0476 (.0357)	--	.0442 (.0358)	--	.0555 (.0359)	--	.0553 (.0359)
African American	--	-.0219 (.0457)	--	-.0221 (.0456)	--	-.0186 (.0459)	--	-.0179 (.0458)
Hispanic	--	-.0074 (.0573)	--	-.0053 (.0573)	--	-.0064 (.0575)	--	-.0079 (.0574)
Deviance Statistic	132.0	132.9	121.9	122.7	151.8	141.3	149.1	138.8
AIC	154.0	168.9	147.9	162.7	173.8	177.3	175.1	178.8
BIC	195.8	237.3	197.4	238.6	215.5	245.6	224.5	254.7

All models include random intercepts and random coefficients for linear and quadratic age terms; <sup>+</sup>p<.10, \*p<.05, \*\*p<.01, \*\*\*p<.001

Table 4.5: Father's Prevalence and Incidence of Incarceration After Child's Birth and Children's Trajectories of Aggression

	I. Prevalence of Incarceration				II. Incidence of Incarceration			
	A	B	C	D	A	B	C	D
Intercept	.9386 (.0360)***	.9271 (.0527)***	.9331 (.0382)***	.9216 (.0543)***	.9406 (.0359)***	.9255 (.0526)***	.9455 (.0376)***	.9308 (.0537)***
Child's Age	-.0723 (.0077)***	-.0736 (.0077)***	-.0721 (.0085)***	-.0730 (.0086)***	-.0723 (.0077)***	-.0736 (.0077)***	-.0744 (.0083)***	-.0755 (.0083)***
Child's Age <sup>2</sup>	.0027 (.0004)***	.0027 (.0004)***	.0028 (.0004)***	.0028 (.0004)***	.0027 (.0004)***	.0027 (.0004)***	.0029 (.0004)***	.0029 (.0004)***
Incarceration	.0903 (.0383)*	.0614 (.0451)	.1568 (.1071)	.1322 (.1113)	.0454 (.0177)*	.0320 (.0201)	.0353 (.0549)	.0220 (.0567)
Incarceration x Child's Age	--	--	-.0095 (.0209)	-.0108 (.0211)	--	--	.0040 (.0104)	.0038 (.0105)
Incarceration x Child's Age <sup>2</sup>	--	--	.0002 (.0010)	.0003 (.0010)	--	--	-.0002 (.0005)	-.0002 (.0005)
Child Male	--	.0347 (.0320)	--	.0343 (.0319)	--	.0320 (.0320)	--	.0317 (.0320)
Teen Parent	--	.0630 (.0374) <sup>+</sup>	--	.0619 (.0374) <sup>+</sup>	--	.0597 (.0375)	--	.0586 (.0375)
Violence	--	-.0163 (.0472)	--	-.0168 (.0472)	--	-.0103 (.0469)	--	-.0103 (.0469)
Drug Use	--	-.0197 (.0418)	--	-.0201 (.0418)	--	-.0226 (.0419)	--	-.0231 (.0419)
HS Dropout	--	.0449 (.0366)	--	.0454 (.0366)	--	.0489 (.0358)	--	.0486 (.0358)
African American	--	-.0250 (.0460)	--	-.0255 (.0460)	--	-.0209 (.0457)	--	-.0211 (.0457)
Hispanic	--	-.0058 (.0573)	--	-.0071 (.0574)	--	-.0027 (.0574)	--	-.0032 (.0574)
Deviance Statistic	137.6	139.5	136.8	138.7	136.7	138.8	136.1	138.4
AIC	159.6	175.5	162.8	178.7	158.7	174.8	162.1	178.4
BIC	201.5	243.8	212.2	254.6	200.5	243.2	211.5	254.3

All models include random intercepts and random coefficients for linear and quadratic age terms; <sup>+</sup>p<.10, \*p<.05, \*\*p<.01, \*\*\*p<.001



Table 4.6: Father's Duration of Incarceration After Child's Birth and Children's Trajectories of Aggression

	I. Duration – Natural Log of Longest Incident				II. Duration – Proportion of Time Incarcerated			
	A	B	C	D	A	B	C	D
Intercept	.9408 (.0363)***	.9171 (.0727)***	.9366 (.0363)***	.9159 (.0526)***	.9518 (.0362)***	.9154 (.0528)	.9547 (.0368)***	.9196 (.0531)***
Child's Age	-.0701 (.0077)***	-.0727 (.0078)***	-.0685 (.0077)***	-.0710 (.0078)***	-.0711 (.0078)***	-.0735 (.0077)	-.0729 (.0079)***	-.0751 (.0079)***
Child's Age <sup>2</sup>	.0027 (.0004)***	.0027 (.0004)***	.0025 (.0004)***	.0026 (.0004)***	.0027 (.0004)***	.0027 (.0004)***	.0028 (.0004)***	.0029 (.0004)***
Incarceration	.0140 (.0081)+	.0094 (.0084)	.1384 (.0697)*	.1216 (.0738)+	.0138 (.1597)	-.1236 (.1719)	.0459 (.5887)	-.1219 (.5926)
Incarceration x Child's Age	--	--	-.0389 (.0208)+	-.0336 (.0217)	--	--	.0339 (.1059)	.0352 (.1054)
Incarceration x Child's Age <sup>2</sup>	--	--	.0029 (.0016)+	.0024 (.0016)	--	--	-.0029 (.0047)	-.0029 (.0046)
Child Male	--	.0373 (.0319)	--	.0366 (.0318)	--	.0416 (.0321)	--	.0409 (.0321)
Teen Parent	--	.0735 (.0361)*	--	.0717 (.0362)*	--	.0832 (.0365)*	--	.0815 (.0365)*
Violence	--	-.0104 (.0471)	--	-.0129 (.0470)	--	-.0047 (.0474)	--	-.0055 (.0474)
Drug Use	--	-.0106 (.0410)	--	-.0145 (.0410)	--	-.0038 (.0413)	--	-.0039 (.0412)
HS Dropout	--	.0540 (.0357)	--	.0509 (.0357)	--	.0595 (.0358)+	--	.0591 (.0358)+
African American	--	-.0199 (.0457)	--	-.0213 (.0456)	--	-.0154 (.0458)	--	-.0156 (.0458)
Hispanic	--	-.0067 (.0574)	--	-.0052 (.0573)	--	-.0098 (.0576)	--	-.0104 (.0575)
Deviance Statistic	140.2	140.1	137.7	137.7	152.1	140.8	149.7	138.8
AIC	162.2	176.1	177.7	177.7	174.1	176.8	175.7	179.1
BIC	204.1	244.4	253.7	253.7	215.8	245.2	225.1	254.8

All models include random intercepts and random coefficients for linear and quadratic age terms; +p<.10, \*p<.05, \*\*p<.01, \*\*\*p<.001

Table 4.7: Child's Age at Father's Incarceration and Children's Trajectories of Aggression

	A	B	C	D
Intercept	.9290 (.1346)***	1.062 (.2624)***	1.279 (.1961)***	1.415 (.2780)***
Child's Age	-.0826 (.0220)***	-.0821 (.0225)***	-.1492 (.0345)***	-.1492 (.0354)***
Child's Age <sup>2</sup>	.0030 (.0009)**	.0030 (.0009)**	.0060 (.0015)***	.0059 (.0016)***
Child's Age at Incarceration	.0666 (.0203)**	.0597 (.0250)*	-.1127 (.0838)	-.1205 (.0877)
Age at Incarceration x Child's Age	--	--	.0327 (.0140)*	.0324 (.0143)*
Age at Incarceration x Child's Age <sup>2</sup>	--	--	-.0014 (.0006)*	-.0014 (.0006)*
Child Male	--	.0402 (.0731)	--	.0394 (.0729)
Teen Parent	--	-.0168 (.0949)	--	-.0131 (.0946)
Violence	--	-.0418 (.0853)	--	-.0405 (.0852)
Drug Use	--	.0209 (.0795)	--	.0211 (.0793)
HS Dropout	--	.1078 (.0744)	--	.1055 (.0743)
African American	--	-.1825 (.1789)	--	-.1768 (.1784)
Hispanic	--	-.2788 (.1930)	--	-.2736 (.1925)
Deviance Statistic	137.3	129.8	132.4	125.1
AIC	159.3	165.8	158.4	165.1
BIC	184.5	206.8	188.1	210.6

All models include random intercepts and random coefficients for linear and quadratic age terms  
<sup>+</sup>p<.10, \*p<.05, \*\*p<.01, \*\*\*p<.001

Table 4.8: Father's Prevalence and Incidence of Incarceration and Children's Trajectories of Delinquency

	I. Prevalence of Incarceration				II. Incidence of Incarceration			
	A	B	C	D	A	B	C	D
Intercept	.2757 (.0253)***	.2570 (.0301)***	.2653 (.0320)***	.2445 (.0359)***	.2815 (.0252)***	.2584 (.0301)***	.2712 (.0295)***	.2447 (.0338)
Child's Age	-.0264 (.0053)***	-.0295 (.0054)***	-.0233 (.0069)***	-.0258 (.0070)***	-.0264 (.0053)***	-.0295 (.0054)***	-.0229 (.0063)***	-.0251 (.0064)
Child's Age <sup>2</sup>	.0014 (.0003)***	.0015 (.0003)***	.0012 (.0004)**	.0013 (.0004)***	.0014 (.0003)***	.0015 (.0003)***	.0012 (.0003)***	.0012 (.0003)
Incarceration	.0461 (.0144)**	.0366 (.0157)*	.0681 (.0510)	.0634 (.0515)	.0156 (.0057)**	.0128 (.0062)*	.0251 (.0204)	.0264 (.0214)
Incarceration x Child's Age	--	--	-.0067 (.0107)	-.0080 (.0108)	--	--	-.0035 (.0042)	-.0046 (.0044)
Incarceration x Child's Age <sup>2</sup>	--	--	.0004 (.0006)	.0005 (.0006)	--	--	.0003 (.0002)	.0003 (.0002)
Child Male	--	.0377 (.0138)**	--	.0378 (.0138)**	--	.0382 (.0138)**	--	.0383 (.0138)**
Teen Parent	--	.0572 (.0152)***	--	.0572 (.0152)***	--	.0564 (.0152)***	--	.0564 (.0152)***
Violence	--	-.0125 (.0206)	--	-.0124 (.0206)	--	-.0102 (.0206)	--	-.0100 (.0206)
Drug Use	--	-.0025 (.0177)	--	-.0026 (.0177)	--	-.0049 (.0179)	--	-.0050 (.0179)
HS Dropout	--	.0061 (.0162)	--	.0060 (.0162)	--	.0129 (.0155)	--	.0129 (.0155)
African American	--	.0013 (.0202)	--	.0014 (.0202)	--	.0032 (.0202)	--	.0033 (.0202)
Hispanic	--	-.0037 (.0251)	--	-.0036 (.0251)	--	-.0047 (.0251)	--	-.0045 (.0251)
Deviance Statistic	-3319.5	-3282.4	-3320.7	-3283.9	-3316.7	-3281.3	-3320.4	-3285.7
AIC	-3297.5	-3246.4	-3294.7	-3243.9	-3294.7	-3245.3	-3294.4	-3245.7
BIC	-3256.2	-3178.9	-3245.8	-3168.9	-3253.3	-3177.8	-3245.5	-3170.7

All models include random intercepts and random coefficients for linear and quadratic age terms; <sup>+</sup>p<.10, \*p<.05, \*\*p<.01, \*\*\*p<.001

Table 4.9: Father's Duration of Incarceration and Children's Trajectories of Delinquency

	I. Duration – Natural Log of Longest Incident				II. Duration – Proportion of Time Incarcerated			
	A	B	C	D	A	B	C	D
Intercept	.2783 (.0252)***	.2535 (.0302)***	.2814 (.0259)***	.2520 (.0309)***	.2900 (.0251)***	.2618 (.0300)***	.2778 (.0264)***	.2494 (.0311)***
Child's Age	-.0244 (.0053)***	-.0283 (.0054)***	-.0250 (.0055)***	-.0277 (.0056)***	-.0267 (.0053)***	-.0295 (.0054)***	-.0240 (.0056)***	-.0267 (.0057)***
Child's Age <sup>2</sup>	.0014 (.0003)***	.0015 (.0003)***	.0014 (.0003)***	.0015 (.0003)***	.0014 (.0003)***	.0015 (.0003)***	.0013 (.0003)***	.0014 (.0003)***
Incarceration	.0090 (.0039)*	.0064 (.0040)	.0205 (.0388)	.0308 (.0418)	.1115 (.0480)*	.0864 (.0496)+	.3404 (.1707)*	.3223 (.1695)+
Incarceration x Child's Age	--	--	-.0056 (.0117)	-.0075 (.0124)	--	--	-.0493 (.0350)	-.0210 (.0350)
Incarceration x Child's Age <sup>2</sup>	--	--	.0006 (.0009)	.0005 (.0009)	--	--	.0025 (.0018)	.0025 (.0018)
Child Male	--	.0396 (.0138)**	--	.0394 (.0138)**	--	.0378 (.0138)**	--	.0380 (.0138)**
Teen Parent	--	.0558 (.0154)***	--	.0555 (.0155)***	--	.0586 (.0152)***	--	.0587 (.0152)***
Violence	--	-.0061 (.0205)	--	-.0066 (.0205)	--	-.0120 (.0209)	--	-.0121 (.0208)
Drug Use	--	-.0005 (.0177)	--	-.0010 (.0177)	--	-.0015 (.0177)	--	-.0016 (.0177)
HS Dropout	--	.0161 (.0154)	--	.0156 (.0155)	--	.0151 (.0154)	--	.0151 (.0154)
African American	--	.0054 (.0202)	--	.0050 (.0202)	--	.0032 (.0202)	--	.0031 (.0202)
Hispanic	--	-.0038 (.0252)	--	-.0036 (.0252)	--	-.0032 (.0251)	--	-.0036 (.0251)
Deviance Statistic	-3314.6	-3279.5	-3315.8	-3279.9	-3253.5	-3280.0	-3255.5	-3282.2
AIC	-3292.6	-3243.5	-3289.8	-3239.9	-3231.5	-3244.0	-3229.5	-3242.2
BIC	-3250.8	-3175.2	-3240.4	-3164.0	-3189.8	-3175.7	-3180.1	-3166.2

All models include random intercepts and random coefficients for linear and quadratic age terms; <sup>+</sup>p<.10, \*p<.05, \*\*p<.01, \*\*\*p<.001

Table 4.10: Father's Incarceration After Child's Birth and Children's Trajectories of Delinquency

	I. Prevalence of Incarceration				II. Incidence of Incarceration			
	A	B	C	D	A	B	C	D
Intercept	.2838 (.0248)***	.2637 (.0302)***	.2583 (.0279)***	.2377 (.0327)***	.2852 (.0248)***	.2628 (.0301)***	.2597 (.0269)***	.2372 (.0318)***
Child's Age	-.0271 (.0053)***	-.0296 (.0054)***	-.0208 (.0061)***	-.0231 (.0062)***	-.0272 (.0053)***	-.0296 (.0054)***	-.0205 (.0058)***	-.0229 (.0059)***
Child's Age <sup>2</sup>	.0014 (.0003)***	.0016 (.0003)***	.0011 (.0003)***	.0012 (.0003)***	.0015 (.0003)***	.0016 (.0003)***	.0011 (.0003)***	.0012 (.0003)***
Incarceration	.0590 (.0167)***	.0359 (.0193) <sup>+</sup>	.1661 (.0638)**	.1465 (.0651)*	.0306 (.0077)***	.0193 (.0086)*	.0872 (.0318)**	.0766 (.0324)*
Incarceration x Child's Age	--	--	-.0241 (.0127) <sup>+</sup>	-.0250 (.0129) <sup>+</sup>	--	--	-.0133 (.0061)*	-.0135 (.0062)*
Incarceration x Child's Age <sup>2</sup>	--	--	.0013 (.0006)*	.0013 (.0006)*	--	--	.0007 (.0003)*	.0007 (.0003)*
Child Male	--	.0383 (.0138)**	--	.0385 (.0138)**	--	.0365 (.0138)**	--	.0366 (.0139)**
Teen Parent	--	.0502 (.0159)**	--	.0503 (.0160)**	--	.0479 (.0160)**	--	.0479 (.0160)**
Violence	--	-.0089 (.0206)	--	-.0093 (.0206)	--	-.0052 (.0204)	--	-.0054 (.0204)
Drug Use	--	-.0059 (.0181)	--	-.0060 (.0181)	--	-.0082 (.0181)	--	-.0085 (.0181)
HS Dropout	--	.0119 (.0158)	--	.0122 (.0158)	--	.0143 (.0154)	--	.0144 (.0154)
African American	--	.0023 (.0203)	--	.0024 (.0203)	--	.0050 (.0202)	--	.0050 (.0202)
Hispanic	--	-.0039 (.0252)	--	-.0040 (.0252)	--	-.0017 (.0251)	--	-.0018 (.0252)
Deviance Statistic	-3321.6	-3280.5	-3325.7	-3284.7	-3324.6	-3282.0	-3331.5	-3289.0
AIC	-3299.6	-3244.5	-3299.7	-3244.7	-3302.6	-3246.0	-3305.5	-3249.0
BIC	-3258.3	-3177.0	-3250.8	-3169.7	-3261.2	-3178.5	-3256.6	-3174.0

All models include random intercepts, linear age, and quadratic age terms; <sup>+</sup>p<10, \*p<.05, \*\*p<.01, \*\*\*p<.001

Table 4.11: Father's Duration of Incarceration After Child's Birth and Children's Trajectories of Delinquency

	I. Duration – Natural Log of Longest Incident				II. Duration – Proportion of Time Incarcerated			
	A	B	C	D	A	B	C	D
Intercept	.2846 (.0250)***	.2576 (.0301)***	.2829 (.0254)***	.2543 (.0304)***	.2938 (.0251)***	.2589 (.0302)***	.2842 (.0257)***	.2499 (.0307)***
Child's Age	-.0253 (.0052)***	-.0290 (.0054)***	-.0247 (.0054)***	-.02771 (.0055)***	-.0268 (.0053)***	-.0295 (.0054)***	-.0245 (.0055)***	-.0273 (.0055)***
Child's Age <sup>2</sup>	.0014 (.0003)***	.0015 (.0003)***	.0013 (.0003)***	.0014 (.0003)***	.0014 (.0003)***	.0015 (.0003)***	.0013 (.0003)***	.0014 (.0003)***
Incarceration	.0081 (.0043)+	.0046 (.0045)	.0645 (.0473)	.0729 (.0513)	.0926 (.0701)	-.0157 (.0740)	.5573 (.3324)+	.4212 (.3316)
Incarceration x Child's Age	--	--	-.0188 (.0136)	-.0197 (.0146)	--	--	-.0940 (.0611)	-.0894 (.0609)
Incarceration x Child's Age <sup>2</sup>	--	--	.0015 (.0010)	.0014 (.0010)	--	--	.0046 (.0029)	.0044 (.0028)
Child Male	--	.0400 (.0138)**	--	.0397 (.0138)**	--	.0409 (.0140)**	--	.0410 (.0140)**
Teen Parent	--	.0565 (.0154)***	--	.0555 (.0155)***	--	.0595 (.0156)***	--	.0593 (.0156)***
Violence	--	-.0050 (.0205)	--	-.0060 (.0205)	--	-.0039 (.0207)	--	-.0041 (.0207)
Drug Use	--	-.0004 (.0178)	--	-.0016 (.0178)	--	.0016 (.0179)	--	.0014 (.0179)
HS Dropout	--	.0173 (.0154)	--	.0165 (.0154)	--	.0190 (.0155)	--	.0189 (.0155)
African American	--	.0058 (.0203)	--	.0051 (.0202)	--	.0070 (.0203)	--	.0067 (.0203)
Hispanic	--	-.0039 (.0252)	--	-.0035 (.0252)	--	-.0045 (.0253)	--	-.0047 (.0253)
Deviance Statistic	-3312.8	-3278.1	-3315.5	-3279.9	-3250.0	-3277.1	-3252.5	-3279.5
AIC	-3290.8	-3242.1	-3289.5	-3239.9	-3228.0	-3241.1	-3226.5	-3239.5
BIC	-3248.9	-3173.7	-3240.0	-3164.0	-3186.2	-3172.8	-3177.2	-3163.6

All models include random intercepts and random coefficients for linear and quadratic age terms; +p<.10, \*p<.05, \*\*p<.01, \*\*\*p<.001

Table 4.12: Child's Age at Incarceration and Children's Trajectories of Delinquency

	A	B	C	D
Intercept	.3455 (.0651)***	.3617 (.0955)***	.3743 (.1052)***	.4092 (.1279)**
Child's Age	-.0493 (.0123)***	-.0513 (.0126)***	-.0502 (.0209)*	-.0554 (.0213)**
Child's Age <sup>2</sup>	.0025 (.0006)***	.0026 (.0006)***	.0023 (.0010)*	.0025 (.0011)*
Child's Age at Incarceration	.0413 (.0082)***	.0362 (.0099)**	.0131 (.0462)	-.0013 (.0477)
Child's Age at Incarceration x Child's Age	--	--	.0031 (.0084)	.0047 (.0084)
Child's Age at Incarceration x Child's Age <sup>2</sup>	--	--	-.00002 (.0004)	-.00008 (.0004)
Child Male	--	.0302 (.0283)	--	.0312 (.0280)
Teen Parent	--	.0135 (.0365)	--	.0181 (.0362)
Violence	--	-.0086 (.0332)	--	-.0086 (.0328)
Drug Use	--	.0250 (.0307)	--	.0228 (.0304)
HS Dropout	--	.0144 (.0287)	--	.0123 (.0284)
African American	--	-.0304 (.0680)	--	-.0315 (.0670)
Hispanic	--	-.0807 (.0735)	--	-.0808 (.0724)
Deviance Statistic	-649.7	-367.1	-651.8	-639.3
AIC	-627.7	-601.1	-625.8	-599.3
BIC	-602.6	-560.1	-596.0	-553.8

All models include random intercepts and random coefficients for linear and quadratic age terms

<sup>+</sup>p<.10, \*p<.05, \*\*p<.01, \*\*\*p<.001

Table 5.1: Recent Prevalence of Paternal Incarceration and Children's Aggression, Fixed and Random Effects Models

	Year Fixed Effects	Child Fixed Effects	2-Way Fixed Effects	Random Effects
Intercept	.7618 (.0419)***	.8555 (.0757)***	-.0763 (.4602)	.9198 (.0525)***
Child's Age	-.0494 (.0077)***	-.0721 (.0052)***	.0051 (.0355)	-.0736 (.0077)***
Child's Age <sup>2</sup>	.0021 (.0004)***	.0025 (.0003)***	.0022 (.0003)***	.0027 (.0004)***
Incarceration	.0532 (.0194)**	.0022 (.0164)	.0027 (.0165)	--
Incarceration Between Effect	--	--	--	.1527 (.0757)*
Incarceration Within Effect	--	--	--	-.0037 (.0158)
Child Male	--	--	--	.0370 (.0317)
Teen Parent	--	--	--	.0717 (.0357)*
Violence	--	--	--	-.0203 (.0471)
Drug Use	--	--	--	-.0088 (.0407)
HS Dropout	--	--	--	.0386 (.0365)
African American	--	--	--	-.0275 (.0457)
Hispanic	--	--	--	-.0078 (.0572)
Deviance Statistic	--	--	--	137.3
AIC				175.3
BIC				247.4

All multilevel models include random intercepts and random coefficients for linear and quadratic age terms  
<sup>+</sup>p<.10, \*p<.05, \*\*p<.01, \*\*\*p<.001



Table 5.2: Recent Incidence of Paternal Incarceration and Children's Aggression, Fixed and Random Effects Models

	Year Fixed Effects	Child Fixed Effects	2-Way Fixed Effects	Random Effects
Intercept	.7573 (.0418)***	.8543 (.0750)***	-.0723 (.4605)	.9160 (.0525)***
Child's Age	-.0486 (.0077)***	-.0720 (.0052)***	.0049 (.0355)	-.0737 (.0077)***
Child's Age <sup>2</sup>	.0020 (.0004)***	.0025 (.0003)***	.0022 (.0003)***	.0027 (.0004)***
Incarceration	.0446 (.0219)*	.0083 (.0151)	.0039 (.0151)	--
Incarceration Between Effect	--	--	--	.2503 (.1250)*
Incarceration Within Effect	--	--	--	-.0045 (.0138)
Child Male	--	--	--	.0392 (.0317)
Teen Parent	--	--	--	.0737 (.0356)*
Violence	--	--	--	-.0230 (.0472)
Drug Use	--	--	--	-.0110 (.0407)
HS Dropout	--	--	--	.0409 (.0362)
African American	--	--	--	-.0246 (.0456)
Hispanic	--	--	--	-.0038 (.0572)
Deviance Statistic	--	--	--	137.3
AIC				175.3
BIC				247.4

All multilevel models include random intercepts and random coefficients for linear and quadratic age terms

+p<.10, \*p<.05, \*\*p<.01, \*\*\*p<.001

Table 5.3: Recent Duration of Paternal Incarceration and Children's Aggression, Fixed and Random Effects Models

	Year Fixed Effects	Child Fixed Effects	2-Way Fixed Effects	Random Effects
Intercept	.7611 (.0419)***	.8526 (.0756)***	-.0766 (.4602)	.9205 (.0525)***
Child's Age	-.0490 (.0077)***	-.0721 (.0052)***	.0049 (.0355)	-.0738 (.0077)***
Child's Age <sup>2</sup>	.0020 (.0004)***	.0025 (.0003)***	.0022 (.0003)***	.0028 (.0004)***
Incarceration	.0669 (.0284)*	.0108 (.0262)	.0146 (.0262)	--
Incarceration Between Effect	--	--	--	.0149 (.1026)
Incarceration Within Effect	--	--	--	.0189 (.0270)
Child Male	--	--	--	.0368 (.0318)
Teen Parent	--	--	--	.0744 (.0358)*
Violence	--	--	--	-.0154 (.0471)
Drug Use	--	--	--	-.0076 (.0408)
HS Dropout	--	--	--	.0464 (.0362)
African American	--	--	--	-.0271 (.0457)
Hispanic	--	--	--	-.0073 (.0573)
Deviance Statistic	--	--	--	138.8
AIC				176.8
BIC				248.9

All multilevel models include random intercepts and random coefficients for linear and quadratic age terms

+p<.10, \*p<.05, \*\*p<.01, \*\*\*p<.001

Table 5.4: Timing of Recent Paternal Incarceration and Children's Aggression, Fixed Effects Models

A) Recent Prevalence of Paternal Incarceration			
	Year FE	Child FE	2-Way
Intercept	.7724 .0422***	.8553 .0750***	-.1151 .4605
Child's Age	-.0516 .0079***	-.0723 .0053***	.0079 .0355
Child's Age <sup>2</sup>	.0022 .0004***	.0025 .0003***	.0022 .0003***
Incarceration in Late Childhood	.0839 .0308**	.0080 .0224	.0069 .0225
Incarceration in Adolescence	.0473 .0347	-.0060 .0257	-.0030 .0257
B) Recent Incidence of Paternal Incarceration			
	Year FE	Child FE	2-Way
Intercept	.7639 .0421***	.8565 .0749***	-.1097 .4603
Child's Age	-.0499 .0078***	-.0722 .0052***	.0078 .0355
Child's Age <sup>2</sup>	.0021 .0004***	.0025 .0003***	.0022 .0003***
Incarceration in Late Childhood	.0721 .0363*	.0102 .0247	.0036 .0247
Incarceration in Adolescence	.0384 .0421	.0013 .0283	.0048 .0282
C) Recent Duration of Paternal Incarceration			
	Year FE	Child FE	2-Way
Intercept	.7676 .0421***	.8523 .0749***	-.1183 .4604
Child's Age	-.0503 .0078***	-.0728 .0052***	.0074 .0355
Child's Age <sup>2</sup>	.0021 .0004***	.0025 .0003***	.0027 .0003***
Incarceration in Late Childhood	.1098 .0454*	.0429 .0340	.0465 .0339
Incarceration in Adolescence	.0646 .0526	.0098 .0399	.0158 .0400

<sup>+</sup>p<.10, \*p<.05, \*\*p<.01, \*\*\*p<.001

Table 5.5: Recent Prevalence of Paternal Incarceration and Children's Delinquency, Fixed and Random Effects Models

	Year Fixed Effects	Child Fixed Effects	2-Way Fixed Effects	Random Effects
Intercept	.1649 (.0296)***	.2044 (.0494)***	-.4173 (.2782)***	.2603 (.0300)***
Child's Age	-.0150 (.0056)**	-.0275 (.0040)***	.02313 (.0216)	-.0296 (.0053)***
Child's Age <sup>2</sup>	.0013 (.0003)***	.0014 (.0002)***	.0014 (.0002)***	.0015 (.0003)***
Incarceration	.0274 (.0099)**	.0015 (.0095)	.0015 (.0096)	--
Incarceration Between Effect	--	--	--	.1138 (.0328)***
Incarceration Within Effect	--	--	--	-.0098 (.0091)
Child Male	--	--	--	.0393 (.0136)**
Teen Parent	--	--	--	.0529 (.0151)***
Violence	--	--	--	-.0128 (.0204)
Drug Use	--	--	--	-.0002 (.0175)
HS Dropout	--	--	--	.0047 (.0156)
African American	--	--	--	.0001 (.0201)
Hispanic	--	--	--	-.0049 (.0249)
Deviance Statistic	--	--	--	-3289.8
AIC	--	--	--	-3251.8
BIC	--	--	--	-3179.7

All multilevel models include random intercepts and random coefficients for linear and quadratic age terms

+p<.10, \*p<.05, \*\*p<.01, \*\*\*p<.001

Table 5.6: Recent Incidence of Paternal Incarceration and Children's Delinquency, Fixed and Random Effects Models

	Year Fixed Effects	Child Fixed Effects	2-Way Fixed Effects	Random Effects
Intercept	.1630 (.0297)***	.2045 (.0488)***	-.4164 (.2783)***	.2586 (.0300)***
Child's Age	-.0147 (.0056)**	-.0275 (.0040)***	.0231 (.0216)	-.0298 (.0053)***
Child's Age <sup>2</sup>	.0013 (.0003)***	.0014 (.0002)***	.0014 (.0002)***	.0016 (.0003)***
Incarceration	.0217 (.0114) <sup>+</sup>	.0029 (.0089)	.0011 (.0090)	--
Incarceration Between Effect	--	--	--	.1691 (.0057)**
Incarceration Within Effect	--	--	--	-.0019 (.0080)
Child Male	--	--	--	.0406 (.0137)**
Teen Parent	--	--	--	.0556 (.0151)***
Violence	--	--	--	-.0144 (.0205)
Drug Use	--	--	--	-.0017 (.0175)
HS Dropout	--	--	--	.0076 (.0156)
African American	--	--	--	.0020 (.0201)
Hispanic	--	--	--	-.0028 (.0250)
Deviance Statistic	--	--	--	-3285.9
AIC	--	--	--	-3247.9
BIC	--	--	--	-3175.8

All multilevel models include random intercepts and random coefficients for linear and quadratic age terms

<sup>+</sup>p<.10, \*p<.05, \*\*p<.01, \*\*\*p<.001

Table 5.7: Recent Duration of Paternal Incarceration and Children's Delinquency, Fixed and Random Effects Models

	Year Fixed Effects	Child Fixed Effects	2-Way Fixed Effects	Random Effects
Intercept	.1632 (.0296)***	.1974 (.0493)***	-.4156 (.2781)***	.2610 (.0300)***
Child's Age	-.0146 (.0056)**	-.0274 (.0040)***	.0226 (.0216)	-.0296 (.0053)***
Child's Age <sup>2</sup>	.0013 (.0003)***	.0014 (.0002)***	.0014 (.0002)***	.0015 (.0003)***
Incarceration	.0352 (.0144)*	.0153 (.0150)	.0163 (.0150)	--
Incarceration Between Effect	--	--	--	.1340 (.0451)**
Incarceration Within Effect	--	--	--	-.0063 (.0154)
Child Male	--	--	--	.0389 (.0137)**
Teen Parent	--	--	--	.0543 (.0151)***
Violence	--	--	--	-.0097 (.0204)
Drug Use	--	--	--	.0009 (.0175)
HS Dropout	--	--	--	.0088 (.0155)
African American	--	--	--	.0028 (.0201)
Hispanic	--	--	--	-.0049 (.0250)
Deviance Statistic	--	--	--	-3285.8
AIC	--	--	--	-3247.8
BIC	--	--	--	-3175.6

All multilevel models include random intercepts and random coefficients for linear and quadratic age terms

+p<.10, \*p<.05, \*\*p<.01, \*\*\*p<.001

Table 5.8: Timing of Recent Paternal Incarceration and Children's Delinquency, Fixed Effects Models

A) Recent Prevalence of Paternal Incarceration			
	Year FE	Child FE	2-Way
Intercept	.1771 .0299***	.2014 .0486***	-.4360 .2781
Child's Age	-.0178 .0056**	-.0283 .0040***	.0233 .0216
Child's Age <sup>2</sup>	.0014 .0003***	.0015 .0002***	.0014 .0002***
Incarceration in Late Childhood	.0528 .0154***	.0184 .0127	.0184 .0127
Incarceration in Adolescence	.0124 .0173	-.0210 .0144	-.0208 .0145

B) Recent Incidence of Paternal Incarceration			
	Year FE	Child FE	2-Way
Intercept	.1705 .0298***	.2046 .0486***	-.4044 .2780
Child's Age	-.0164 .0056**	-.0281 .0040***	.0214 .0216
Child's Age <sup>2</sup>	.0014 .0003***	.0015 .0002***	.0014 .0002***
Incarceration in Late Childhood	.0512 .0181**	.0240 .0139+	.0218 .0139
Incarceration in Adolescence	.0030 .0210	-.0270 .0158+	-.0263 .0158+

C) Recent Duration of Paternal Incarceration			
	Year FE	Child FE	2-Way
Intercept	.1716 .0298***	.2001 .0486***	-.4373 .2780
Child's Age	-.0165 .0056**	-.0286 .0040***	.0231 .0216
Child's Age <sup>2</sup>	.0014 .0003***	.0015 .0002***	.0014 .0002***
Incarceration in Late Childhood	.0671 .0227**	.0450 .0191*	.0466 .0191*
Incarceration in Adolescence	.0117 .0262	-.0165 .0224	-.0154 .0224

<sup>+</sup>p<.10, \*p<.05, \*\*p<.01, \*\*\*p<.001

Table 6.1: Cumulative Paternal Incarceration and Children's Aggression, Fixed Effects Models

A) Cumulative Prevalence of Paternal Incarceration			
	Year FE	Child FE	2-Way
Intercept	.7591 (.0419)***	.8860 (.0759)***	-.0587 (.4602)
Child's Age	-.0488 (.0775)***	-.0709 (.0052)***	.0057 (.0355)
Child's Age <sup>2</sup>	.0020 (.0004)***	.0025 (.0003)***	.0022 (.0003)***
Incarceration	.0260 (.0147) <sup>+</sup>	-.0457 (.0209)*	-.0296 (.0216)
B) Cumulative Incidence of Paternal Incarceration			
	Year FE	Child FE	2-Way
Intercept	.7587 (.0418)***	.8700 (.0757)***	-.0689 (.4604)
Child's Age	-.0488 (.0077)***	-.0718 (.0052)***	.0053 (.0355)
Child's Age <sup>2</sup>	.0020 (.0004)***	.0025 (.0003)***	.0022 (.0003)***
Incarceration	.0243 (.0070)***	-.0101 (.0091)	-.0052 (.0091)
C) Cumulative Duration of Paternal Incarceration			
	Year FE	Child FE	2-Way
Intercept	.7611 (.0419)***	.8549 (.0756)***	-.0799 (.4602)
Child's Age	-.0492 (.0077)***	-.0721 (.0052)***	.0050 (.0355)
Child's Age <sup>2</sup>	.0020 (.0004)***	.0025 (.0003)***	.0022 (.0003)***
Incarceration	.0786 (.0319)*	.0121 (.0605)	.0362 (.0609)***

<sup>+</sup>p<.10, \*p<.05, \*\*p<.01, \*\*\*p<.001



Table 6.2: Cumulative Paternal Incarceration and Timing of Children's Aggression, Fixed Effects Models

A) Cumulative Prevalence of Paternal Incarceration			
	Year FE	Child FE	2-Way
Intercept	.7638	.8585	-.1141
	.0424***	.0749***	.4602
Child's Age	-.0500	-.0724	.0076
	.0081***	.0054***	.0355
Child's Age <sup>2</sup>	.0021	.0025	.0023
	.0004***	.0003***	.0003***
Incarceration in Late Childhood	.0322	-.0078	-.0028
	.0228	.0184	.0184
Incarceration in Adolescence	.0146	-.0215	-.0165
	.0227	.0199	.0200

B) Cumulative Incidence of Paternal Incarceration			
	Year FE	Child FE	2-Way
Intercept	.7594	.8592	-.1081
	.0422***	.0750***	.4603
Child's Age	-.0481	-.0711	.0084
	.0080***	.0054***	.0355
Child's Age <sup>2</sup>	.0019	.0024	.0022
	.0004***	.0003***	.0003***
Incarceration in Late Childhood	.0223	-.0078	-.0042
	.0132+	.0106	.0107
Incarceration in Adolescence	.0247	-.0015	-.0005
	.0092**	.0080	.0080

C) Cumulative Duration of Paternal Incarceration			
	Year FE	Child FE	2-Way
Intercept	.7668	.8563	-.1229
	.0421***	.0748***	.4600
Child's Age	-.0506	-.0733	.0075
	.0078***	.0052***	.0355
Child's Age <sup>2</sup>	.0021	.0025	.0023
	.0004***	.0003***	.0003***
Incarceration in Late Childhood	.1206	.0709	.0821
	.0500*	.0433	.0432+
Incarceration in Adolescence	.0357	.0184	.0315
	.0579	.0542	.0543

<sup>+</sup>p<.10, \*p<.05, \*\*p<.01, \*\*\*p<.001

Table 6.3: Cumulative Paternal Incarceration and Children's Delinquency, Fixed Effects Models

A) Cumulative Prevalence of Paternal Incarceration			
	Year FE	Child FE	2-Way
Intercept	.1630 (.0296)***	.2225 (.0498)***	-.4080 (.2783)
Child's Age	-.0147 (.0056)**	-.0271 (.0040)***	.0234 (.0216)
Child's Age <sup>2</sup>	.0013 (.0003)***	.0014 (.0002)***	.0014 (.0002)***
Incarceration	.0176 (.0074)*	-.0198 (.0128)	-.0131 (.0133)

B) Cumulative Incidence of Paternal Incarceration			
	Year FE	Child FE	2-Way
Intercept	.1623 (.0296)***	.2133 (.0495)***	-.4127 (.2783)
Child's Age	-.0146 (.0056)**	-.0274 (.0040)***	.0233 (.0216)
Child's Age <sup>2</sup>	.0012 (.0003)***	.0015 (.0002)***	.0014 (.0002)***
Incarceration	.0118 (.0035)***	-.0046 (.0054)	-.0031 (.0055)

C) Cumulative Duration of Paternal Incarceration			
	Year FE	Child FE	2-Way
Intercept	.1634 (.0296)***	.1896 (.0494)***	-.4245 (.2780)
Child's Age	-.0148 (.0056)**	-.0275 (.0040)***	.0225 (.0216)
Child's Age <sup>2</sup>	.0013 (.0003)***	.0014 (.0002)***	.0014 (.0002)***
Incarceration	.0381 (.0161)*	.0666 (.0372) <sup>+</sup>	.0770 (.0375)*

<sup>+</sup>p<.10, \*p<.05, \*\*p<.01, \*\*\*p<.001

Table 6.4: Cumulative Paternal Incarceration and Timing of Children's Delinquency, Fixed Effects Models

A) Cumulative Prevalence of Paternal Incarceration			
	Year FE	Child FE	2-Way
Intercept	.1725	.2090	-.4169
	.0301***	.0486***	.2778
Child's Age	-.0172	-.0296	.0211
	.0058**	.0041***	.0216
Child's Age <sup>2</sup>	.0014	.0016	.0015
	.0003***	.0002***	.0002***
Incarceration in Late Childhood	.0256	.0050	.0066
	.0114*	.0106	.0106
Incarceration in Adolescence	.0038	-.0270	-.0252
	.0113	.0113*	.0113*

B) Cumulative Incidence of Paternal Incarceration			
	Year FE	Child FE	2-Way
Intercept	.1695	.2043	-.4270
	.0299***	.0486***	.2780
Child's Age	-.0161	-.0296	.0217
	.0057**	.0041***	.0216
Child's Age <sup>2</sup>	.0013	.0016	.0015
	.0003***	.0002***	.0002***
Incarceration in Late Childhood	.0175	.0094	.0104
	.0066**	.0061	.0062+
Incarceration in Adolescence	.0099	-.0035	-.0031
	.0046*	.0045	.0045

C) Cumulative Duration of Paternal Incarceration			
	Year FE	Child FE	2-Way
Intercept	.1708	.2063	-.4338
	.0298***	.0485***	.2777
Child's Age	-.0166	-.0291	.0228
	.0056**	.0040***	.0215
Child's Age <sup>2</sup>	.0014	.0015	.0015
	.0003***	.0002***	.0002***
Incarceration in Late Childhood	.0673	.0495	.0540
	.0249**	.0246*	.0246*
Incarceration in Adolescence	-.0099	-.0349	-.0292
	.0288	.0306	.0307

<sup>+</sup>p<.10, \*p<.05, \*\*p<.01, \*\*\*p<.001

APPENDIX A: LIST OF ITEMS INCLUDED IN CHILD BEHAVIOR CHECKLIST

<i>Toddler (2-3) Aggression Items</i>
Is defiant?
Has demands that must be met immediately?
Is disobedient?
Is easily frustrated?
Is easily jealous?
Gets into many fights?
Hits others?
Has angry moods?
Doesn't change (his/her) behavior after punishment?
Screams a lot?
Is selfish or won't share?
Has sudden changes in (his/her) mood or feelings?
Has temper tantrums or a hot temper?
Is unusually loud?
Whines?

<i>Youth (4+) Aggression Items</i>
Argues a lot?
Braggs or boasts?
Is cruel, bullying, or mean to others?
Demands a lot of attention?
Destroys (his/her) own things?
Destroys things belonging to (his/her) family or others?
Is disobedient at home?
Is disobedient at school?
Is easily jealous?
Gets into many fights?
Prefers being with older kids?
Screams a lot?
Clowns or shows off?
Is stubborn, sullen, or irritable?
Has sudden changes in (his/her) mood or feelings
Talks too much?
Teases a lot?
Has temper tantrums or a hot temper?
Threatens people?
Is unusually loud?

<i>Youth (4+) Delinquency Items</i>
Doesn't seem to feel guilty after misbehaving?
Hangs around with others who get in trouble?
Lies or cheats?
Refuses to talk?
Runs away from home?
Sets fires?
Steals at home?
Steals outside the home?
Swears or uses obscene language?
Thinks about sex too much?
Is truant or skips school?
Uses alcohol or drugs for non-medical purposes?
Vandalizes?

## APPENDIX B: SUPPLEMENTAL EQUATIONS

### Chapter 4

#### Unconditional Means Model

$$y_{it} = \gamma_{00} + \zeta_{0i} + \varepsilon_{it}$$

#### Calculation of ICC

##### *Aggression*

$$\rho = \frac{\sigma_0^2}{\sigma_0^2 + \sigma_\varepsilon^2} = \frac{.0751}{.0751 + .0591} = .5596$$

##### *Delinquency*

$$\rho = \frac{\sigma_0^2}{\sigma_0^2 + \sigma_\varepsilon^2} = \frac{.0166}{.0166 + .0165} = .5015$$

#### Unconditional Linear Growth Model

$$y_{it} = \beta_{0i} + \beta_{1i}X_{it} + \varepsilon_{it}$$

#### Unconditional Quadratic Growth Model

$$y_{it} = \beta_{0i} + \beta_{1i}X_{it} + \beta_{2i}X_{it}^2 + \varepsilon_{it}$$

#### Random Intercept Model

##### *Level-2 Equations*

$$\beta_{0i} = \gamma_{00} + \zeta_{0i}$$

$$\beta_{1i} = \gamma_{10}$$

$$\beta_{2i} = \gamma_{20}$$

##### *Reduced Equation*

$$y_{it} = \gamma_{00} + \gamma_{10}X_{it} + \gamma_{20}X_{it}^2 + \zeta_{0i} + \varepsilon_{it}$$

#### Random Coefficient Model

##### *Level-2 Equations*

$$\beta_{0i} = \gamma_{00} + \zeta_{0i}$$

$$\beta_{1i} = \gamma_{10} + \zeta_{1i}$$

$$\beta_{2i} = \gamma_{20} + \zeta_{2i}$$

##### *Reduced Equation*

$$y_{it} = \gamma_{00} + \gamma_{10}X_{it} + \gamma_{20}X_{it}^2 + \zeta_{0i} + \zeta_{1i}X_{it} + \zeta_{2i}X_{it}^2 + \varepsilon_{it}$$

### Cross-Level Interaction Models – Intercepts Only

#### Level-2 Equations

$$\beta_{0i} = \gamma_{00} + \gamma_{01}Inc_i + \Sigma\gamma_{0k}C_i + \zeta_{0i}$$

$$\beta_{1i} = \gamma_{10} + \zeta_{1i}$$

$$\beta_{2i} = \gamma_{20} + \zeta_{2i}$$

#### Reduced Equation

$$y_{it} = \gamma_{00} + \gamma_{10}X_{it} + \gamma_{20}X_{it}^2 + \gamma_{01}Inc_i + \Sigma\gamma_{0k}C_i + \zeta_{0i} + \zeta_{1i}X_{it} + \zeta_{2i}X_{it}^2 + \varepsilon_{it}$$

### Cross-Level Interaction Models – Intercepts and Slopes

#### Level-2 Equations

$$\beta_{0i} = \gamma_{00} + \gamma_{01}Inc_i + \Sigma\gamma_{0k}C_i + \zeta_{0i}$$

$$\beta_{1i} = \gamma_{10} + \gamma_{11}Inc_i + \zeta_{1i}$$

$$\beta_{2i} = \gamma_{20} + \gamma_{21}Inc_i + \zeta_{2i}$$

#### Reduced Equation

$$y_{it} = \gamma_{00} + \gamma_{10}X_{it} + \gamma_{20}X_{it}^2 + \gamma_{01}Inc_i + \Sigma\gamma_{0k}C_i + \gamma_{11}X_{it}Inc_i + \gamma_{21}X_{it}^2Inc_i + \zeta_{0i} + \zeta_{1i}X_{it} + \zeta_{2i}X_{it}^2 + \varepsilon_{it}$$

Where,

$y_{it}$  = the problem behavior score for child  $i$  at time  $t$

$\gamma_{00}$  = the population average or grand mean, of problem behavior scores across all children at all ages

$\zeta_{0i}$  = a random term that represents between-individual differences in individual intercept for child  $i$ , where  $\zeta_{0i} \sim N(0, \sigma_0^2)$

$\varepsilon_{it}$  = a within-individual residual for child  $i$  at time  $t$ , where  $\varepsilon_{it} \sim N(0, \sigma_\varepsilon^2)$

$X_{it}$  = age of child  $i$  at time  $t$

$\beta_{0i}$  = an individual-level intercept for child  $i$

$\beta_{1i}$  = an individual linear rate of change in problem behavior scores for child  $i$

$\beta_{2i}$  = an individual quadratic rate of change in problem behavior scores for child  $i$

$\gamma_{10}$  = the average linear rate of change in problem behavior scores across all children

$\gamma_{20}$  = the average quadratic rate of change in problem behavior scores across all children

$\zeta_{1i}$  = an individual-specific deviation from the average linear rate of change for child  $i$ , where  $\zeta_{1i} \sim N(0, \sigma_1^2)$ ,

$\zeta_{2i}$  = an individual-specific deviation from the average quadratic rate of change for child  $i$ , where  $\zeta_{2i} \sim N(0, \sigma_2^2)$

$\gamma_{01}Inc_i$  = regression of the random intercept on father's incarceration, average intercept conditional on fathers' incarceration status

$\Sigma\gamma_{0k}C_i$  = regression of the random intercept on a set of  $k$  covariates, average intercept conditional on covariate  $k$

$\gamma_{11}X_{it}Inc_i$  = regression of the random linear term on fathers' incarceration, average linear rate of change conditional on fathers' incarceration status

$\gamma_{21}X_{it}^2Inc_i$  = regression of the random quadratic term on fathers' incarceration, average quadratic rate of change, conditional on fathers' incarceration status

## Chapter 5

### Random Coefficient Model with TVC

#### Level-1 Equation

$$y_{it} = \beta_{0i} + \beta_{1i}X_{it} + \beta_{2i}X_{it}^2 + \beta_{3i}Inc_{it} + \varepsilon_{it}$$

#### Reduced Equation

$$y_{it} = \gamma_{00} + \gamma_{10}X_{it} + \gamma_{20}X_{it}^2 + \gamma_{30}Inc_{it} + \Sigma\gamma_{0k}C_i + \zeta_{0i} + \zeta_{1i}X_{it} + \zeta_{2i}X_{it}^2 + \varepsilon_{it}$$

#### Reduced Equation after TVC Person-Mean Centered

$$y_{it} = \gamma_{00} + \gamma_{10}X_{it} + \gamma_{20}X_{it}^2 + \gamma_{30}(Inc_{it} - \overline{Inc}_i) + \gamma_{40}\overline{Inc}_i + \Sigma\gamma_{0k}C_i + \zeta_{0i} + \zeta_{1i}X_{it} + \zeta_{2i}X_{it}^2 + \varepsilon_{it}$$

## Chapters 5 & 6

### Fixed Effects Models

#### Year Fixed Effects

$$y_{it} = \mu_t + \beta_1X_{it} + \beta_2X_{it}^2 + \beta_3Inc_{it} + \varepsilon_{it}$$

#### Child Fixed Effects

$$y_{it} = \alpha_i + \beta_1X_{it} + \beta_2X_{it}^2 + \beta_3Inc_{it} + \varepsilon_{it}$$

#### 2-Way Fixed Effects

$$y_{it} = \mu_t + \beta_1X_{it} + \beta_2X_{it}^2 + \beta_3Inc_{it} + \alpha_i + \varepsilon_{it}$$

Where,

$\mu_t$  = a year-specific parameter, or fixed effect, that is directly estimated

$\alpha_i$  = a child-specific parameter, or fixed effect, that is directly estimated



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