Paternal Incarceration and Adolescent Social Network Disadvantage

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Abstract

This paper explores the relationship between paternal incarceration and the structure and quality of adolescents' social networks. Previous research suggests that the composition of adolescents' social networks is important for exposing them to, or insulating them from, disadvantageous peer relationships and providing social support during a critical developmental period. Recent studies on the collateral consequences of incarceration have explored the implications of parental incarceration for children's behavioral problems, academic achievement, health, and housing stability, but none have yet examined the social networks of these children. Using network data from the National Longitudinal Study of Adolescent Health, I find that children of recently incarcerated fathers have more disadvantaged social networks than other adolescents: they have fewer friends, are more socially isolated, and are connected to less advantaged, less academically successful and more delinquent friends than their peers. These differences are robust to a variety of specifications and are generally consistent across race and gender subgroups. This adolescent social network disadvantage sheds new light on the young adult behavioral differences previously observed among children of incarcerated parents and reveals a new way in which mass incarceration may promote social exclusion.

Introduction

The emergence of historically high imprisonment rates in the United States has exposed large numbers of low-income, largely black and Latino, children to parental incarceration. Approximately 2.6 million American children had a parent in jail or prison on a typical day in 2012, up from 500,000 children in 1980 (Sykes and Pettit 2014). These 2.6 million children represented 11.4 percent of all black children, 3.5 percent of Hispanic children, and 1.8 percent of white children in the United States in 2012 (Sykes and Pettit 2014). The numbers are even more striking if we consider cumulative exposure rather than point-in-time estimates: by age 17 approximately 24 percent of all black children, 11 percent of all Hispanic children, and 4 percent of all white children in the U.S. have experienced some form of parental incarceration, and these percentages are markedly higher for children whose parents have not completed high school (Sykes and Pettit 2014; Wildeman 2009).

Research on the collateral consequences of incarceration has linked parental incarceration to household-level instability and disadvantage (Geller et al. 2009; Geller, Garfinkel, and Western 2011; Schwartz-Soicher, Geller, and Garfinkel 2011; Wildeman 2014), as well as child-level behavioral problems, like increased externalizing behavior, greater delinquency, lower educational attainment and higher levels of substance abuse in late adolescence and early adulthood (Cho 2011; Foster and Hagan 2013; Geller et al. 2012; Hagan and Foster 2012; Murray and Farrington 2005, 2008; Roettger and Swisher 2011; Wakefield and Wildeman 2014; Wildeman 2010). Taken together these results suggest that the disadvantages associated with incarceration – and perhaps even criminal involvement and incarceration itself – may be passed from one generation to the next.

This paper extends research on the effects of parental incarceration to consider adolescent social networks. Social networks are an important context through which information, social norms, and social support flow, particularly during adolescence (Giordano 2003). Adolescent peer groups differ greatly in their level of delinquency, academic orientation and structure (Coleman 1961; Ryan 2001), all of which are strongly associated with later academic achievement and deviance. Although previous research has not considered how adolescent social networks are shaped by parental incarceration, networks are an important pathway by which parental incarceration may negatively affect children's behavior and life chances.

I use the National Longitudinal Study of Adolescent Health (Add Health) to study the effects of paternal incarceration on adolescent social networks, examining how the structure and quality of networks differ by recent paternal incarceration. Across a wide variety of specifications that include adjustments for adolescent deviance, school fixed effects, and comparisons of matched respondents, I find strong evidence that teenagers whose fathers have recently been incarcerated are more socially isolated than their peers and have friends who are less advantaged, less academically successful and more delinquent than those of other students. Like earlier research, these findings point to the possibility of intergenerational inequalities associated with incarceration.

Background

Adolescent Social Networks and Peer Groups

Differential association and differential reinforcement theory propose that adolescent social groups play an important role in socializing youth into delinquent behavior (Akers 1985; Burgess and Akers 1966; Sutherland 1947; Sutherland and Cressey 1955). Many studies support these theories, finding that friends influence adolescents' engagement in deviant and delinquent

activities, ranging from alcohol and drug use to serious property and violent crimes (Clark and Lohéac 2007; Haynie 2002; Ingram et al. 2007; Kandel 1978; Warr and Stafford 1991). Delinquency among one's friends also contributes to children's school failure both directly and indirectly through diminished academic achievement (Battin-Pearson et al. 2000). Moreover, having a low-achieving friend group can reduce an adolescent's own academic aspirations and achievement (Davies and Kandel 1981; Flashman 2014; Kandel 1978; Ryan 2001).

In addition to friends' characteristics, adolescents' location within their peer social networks may also influence behavior and academic success. For example, Haynie (2001) finds that social location conditions the effect of friends' delinquency on an adolescent's own delinquency. Popularity and centrality – essentially, the condition of being well connected within a network – are associated with lower delinquency for adolescents embedded in non-delinquent friend groups, while these characteristics are associated with increased delinquency for adolescents embedded in delinquent friend groups. Other research has found that centrality predicts academic achievement: better connected adolescents perform better in school (Calvó-Armengol, Patacchini, and Zenou 2009). Additionally, many studies have found that social isolation and rejection by peers during childhood predict subsequent school failure and delinquency (Ollendick et al. 1992; Parker and Asher 1987).

In the context of historically high incarceration rates, parental incarceration may shape adolescent social networks, ultimately contributing to the delinquency and diminished achievement commonly observed among the children of incarcerated parents (Aaron and Dallaire 2010; Besemer et al. 2011; Cho 2011; Dannerbeck 2005; Hagan and Foster 2012; Murray and Farrington 2005; Roettger and Swisher 2011). I illuminate this potential pathway by

examining the structure of social networks and the peers that comprise them for adolescents experiencing paternal incarceration.

A child's social network may vary in both its structure and its content. Structure describes the pattern of one's connections in a network, including the number of one's social ties and the centrality of one's position in the whole network. Content refers to the specific characteristics – or quality – of one's social ties, such as the proportion of friends from two-parent homes, friends' mean GPA, and so on. Children of incarcerated parents may be socially marginalized in terms of both the structure and the content of their social networks.

The social networks of children with incarcerated parents may differ from those of other adolescents for two main reasons: stigma and the network effects of behavioral problems.

Few studies have directly examined the extent to which children of incarcerated parents experience stigma in various social contexts, but a variety of scholars have hypothesized that the poor outcomes often observed among these children are due at least partly to the stigma surrounding parental incarceration (Besemer et al. 2011; Gabel 1992; Hagan and Dinovitzer 1999; Johnson 2009; Murray and Farrington 2005; Murray and Murray 2010; Phillips and Gates 2011; Western and Wildeman 2009). While the evidence to support this hypothesis is limited, Braman (2004), for example, finds that families – including children – experience stigma and shame as the result of having an incarcerated relative, even in neighborhoods where incarceration is common. Dallaire, Ciccone, and Wilson (2010) also find that teachers stigmatize students with incarcerated parents, holding lower expectations for them once they learn of parental incarceration.

Stigma is fundamentally a social status, a socially-conferred judgment of moral contamination that attaches to one's biography, physical appearance, or social connections

(Goffman 1963). Peer groups are a particularly important domain in which adolescents are likely to experience and ascribe stigma (Moses 2010). Therefore, if children of incarcerated parents experience what Erving Goffman calls a "courtesy stigma" (1963:30), then we would expect both the structure and content of their social networks to reflect this. Goffman (1963) claims that stigmatized individuals are socially isolated, either because they are shunned or because they avoid social interactions in expectation of being shunned. Consequently, they connect with other stigmatized or marginalized individuals who share their situation. Thus, if parental incarceration confers a stigma on children, we should expect those children to have fewer friends and be more marginal in social networks. We would also expect them to disproportionately befriend other stigmatized adolescents, like those who also have an incarcerated parent or who have experienced other stigmatic forms of family disruption. I test both of these possibilities, assessing the proportion of their friends who have also experienced parental incarceration and who come from two parent households, as well as the size of each respondent's friend group and how well connected that respondent is to the rest of the students in her school.

In addition to stigma, behavioral problems may mediate the association between parental incarceration and the structure and content of adolescents' social networks. Various studies have linked parental incarceration to internalizing behaviors and depression in children (Foster and Hagan 2013; Johnson 2009; Murray and Farrington 2008; Wakefield and Wildeman 2011, 2014), which may, in turn, cause these children to withdraw from social networks, making them more socially isolated, with fewer friends than their peers (Laursen et al. 2007).

Parental incarceration also appears to increase children's aggressive and antisocial behaviors (Geller et al. 2012; Johnson 2009; Murray and Farrington 2005; Murray, Farrington, and Sekol 2012; Wakefield and Wildeman 2011; Wildeman 2010). Such behavior may increase a

child's risk of social isolation even in the absence of stigma (Cairns et al. 1988; Laursen et al. 2007). Other research shows that aggressive adolescents tend to associate with other aggressive adolescents and that early aggression is associated with delinquency in adolescence (Cairns et al. 1988; Vitaro et al. 1997). Thus, adolescents who have experienced parental incarceration may have more antisocial, delinquent friends than other adolescents.

Both of these channels – stigma and behavioral problems – point to the same set of hypotheses: adolescents who have experienced parental incarceration will be more socially isolated and will have fewer, more delinquent, and more disadvantaged friends than other adolescents.

Correlated Adversity and Selection Bias

Identifying the causal effects of incarceration on either adult or child outcomes is challenging because of selection bias. Incarceration predominantly affects the most disadvantaged members of American society. Incarcerated adults have less education, lower employment and lower wages than most Americans, and they are disproportionately likely to be black, Hispanic or Native American (Pettit and Western 2004; Western 2006; Western and Pettit 2010; Western and Wildeman 2009). In addition to these widely observed characteristics, those who are incarcerated have higher rates of drug abuse, mental illness, lower cognitive ability, and perhaps greater impulsivity even prior to incarceration (Loeber et al. 2012; Schnittker, Massoglia, and Uggen 2012). In addition, incarceration has been found to have a variety of effects on economic opportunities, health and well being (Geller and Curtis 2011; Holzer 2009; Johnson and Raphael 2009; Pager 2003; Pager, Western, and Bonikowski 2009; Turney, Wildeman, and Schnittker 2012; Western 2006; Western, Kling, and Weiman 2001). Both the correlates of incarceration and its adult effects may shape adolescent social networks.

As a result of these overlapping disadvantages and the limitations of most datasets with information on children of incarcerated parents, identification of the causal effects of parental incarceration is extremely difficult (Johnson and Easterling 2012; Wildeman, Wakefield, and Turney 2013). Selection bias that results from these social adversities correlated with incarceration could be addressed by pre- and post-incarceration observations, but no data are currently available that measure characteristics of children's social networks both before and after parental incarceration.[1]

While isolating exogenous variation in parental incarceration is challenging with observational data, below I examine the sensitivity of the estimates under a variety of different identification strategies. Robust associations between paternal incarceration and network characteristics under a variety of adjustments for observable factors and for different subsets of the sample would lend confidence that the observed differences are not only an artifact of unobserved confounding.

Data, Measures & Analytic Approach

Data

The National Longitudinal Study of Adolescent Health (Add Health) is a nationally representative survey that has followed over 15,000 adolescents from grades 7-12 through adulthood. Respondents were initially surveyed in the 1994-1995 school year, with follow up interviews in 1996, 2001-2002, and 2008. The data are unique in providing detailed information about adolescent networks and parental incarceration. The survey's school based sampling frame may under-observe high-risk teenagers who have dropped out or have a high rate of absenteeism,

[1] Though a limited set of social network data are collected in the second wave of Add Health, the vast majority of respondents who experience parental incarceration have already had a parent incarcerated prior to the first survey.

however. Parental incarceration effects may thus be under-estimated with this school-based design.[2]

Add Health selected a stratified sample of 80 high schools chosen to be representative of all U.S. schools with respect to region, urbanicity, size, type, and ethnic mix.[3] One feeder middle school was selected for each sampled high school (unless the selected high school spanned grades 7 to 12), adding 52 middle schools to the sample. In-school surveys were administered to all 7th through 12th graders present in these 132 schools on the day of the initial survey (N= 90,118). The Wave I in-school survey collected data on friendship networks, school activities, future expectations, health-related behaviors and conditions, and basic household characteristics. The friendship network data consist of up to five male and five female friend nominations for each in-school survey participant. Eighty-five percent of students identified at least one friend (Harris 2013).

Because most nominated friends also completed the Wave I in-school survey, characteristics of respondents' friendship networks can be constructed by linking respondents directly to their friends' questionnaire responses. Add Health has used these data to construct basic network descriptors for each respondent, respondent-centered measures of friend characteristics, and school-level measures of global network structure and segregation. I use several of these measures as dependent variables. I also use friends' responses from the in-school survey to create additional summary measures of friends' characteristics, such as proportion of friends who live in two-parent households and friends' average delinquency levels.

[2] Previous research suggests that children of incarcerated parents are more likely to drop out of school than other adolescents (Cho 2011), so the dropouts excluded from this analysis are probably disproportionately likely to have experienced paternal incarceration.
[3] High schools were defined as schools containing an 11th grade and more than 30 students.

A longitudinal in-home study sample was generated by stratifying each school by sex and grade and randomly selecting students within strata to yield a sample of approximately 200 students from each pair of sampled schools. This core student sample was supplemented with special oversamples of racial and ethnic minorities, sibling pairs, adopted students, and disabled students, yielding a total sample of 20,745 Wave I in-home study participants. Parent interviews, usually completed by the resident mother, were then conducted in respondents' homes in Wave I. A parent completed an interview for 85 percent of students in the longitudinal sample (N=17,670). The fourth survey wave in 2008, which collected data on parental incarceration, included 15,701 members of the original sample, for a 75.7 percent response rate (Harris 2013).

I use data from the Wave I in-school survey, the Wave I in-home survey of longitudinal sample members, and the Wave IV survey of longitudinal sample members.[4] Because data on parental incarceration history are only available for longitudinal sample members who participated in the Wave IV survey, I limit my analyses to these respondents. I look only at paternal incarceration in this paper, because few respondents experienced maternal incarceration prior to Wave I (N=232) and previous research suggests that maternal and paternal incarceration affect children differently (Lee, Fang, and Luo 2013). I focus specifically on biological father incarceration, rather than including social fathers, as it is unclear what role social fathers played in each respondent's life prior to Wave I and their incarceration.

My analytic sample is thus restricted to longitudinal sample members who could be correctly matched to their Wave I in-school questionnaires and who reported biological father incarceration history in Wave IV (N=11,356). I have created a subset of social network measures from the full Wave I in-school survey data for all respondents who meet these criteria.

[4] I use the more detailed data from the Wave I in-home survey to create control variables for these respondents.

Additionally, I use social network measures created by Add Health for some of my analyses. For the sake of reliability, these measures were only constructed for students in schools with response rates of 50 percent or higher and for friendship nominations in which both the sender and receiver of the nomination are uniquely identifiable students, leaving me with a total of 10,619 respondents when using these Add Health network measures.[5]

For analyses of friend characteristics, I limit the sample to respondents who nominated at least one in-school friend (N=10,146) so that friends' characteristics can be measured from their responses to the in-school survey.[6] The sample size for the analyses of friends' average characteristics, therefore, depends upon how many respondents had at least one in-school friend who completed the survey and provided a valid response on that particular question (e.g., GPA, household composition, delinquent activities). The sample size for each model is reported in Table 2. See Table A1 in the appendix for a schematic of the above noted sample size restrictions.

Dependent Variables

In order to assess whether and how adolescents' social network structures differ by paternal incarceration history, I examine differences in the size of an adolescent's friend group and her social location within the whole school social network. The specific measures I use are the *total number of friends nominated* by the respondent, the *number of friend nominations*

[5] I do not use Add Health's sample restriction criteria for the one network measure that I have created (total number of friends nominated), because it is not necessary to have a response rate of at least 50 percent or to be able to uniquely identify nominated friends to accurately identify the number of friends a respondent nominated. These restrictions are important, however, for getting a reliable picture of the number of friendship nominations a respondent receives and for calculating measures of centrality and social location.

[6] Approximately eight percent of all friendship nominations were to individuals whose names were not on the school rosters. Typically students were missing from school rosters because they had moved into the school system after the rosters were printed, but some nominations may not have been matched to the roster because students were known only by nicknames (Carolina Population Center 2001).

received from other students in the school, the respondent's *centrality* within her school social network, and her *network reach in three steps* within the school.

The number of friends a student nominates can be thought of as a measure of the extent to which she isolates herself from peers, while the number of friendship nominations received can be thought of as a measure of her popularity or exclusion within the school. Centrality is a measure of the respondent's prominence in the whole school social network – it is essentially a measure of the number of friends a respondent has, weighted by the popularity of those friends. Because the scale of the centrality measure is not intuitive, I log each respondent's centrality score to make coefficients easier to interpret. The results I obtain using this transformed centrality measure are consistent with those I find when using the untransformed measure of centrality. Network reach in three steps captures the size of each respondent's extended social network by counting how many students the respondent is connected to in three steps (i.e., friends of friends' friends), providing an indication of the extent to which the respondent and her friends are socially isolated within their school.

I examine differences in the content of adolescents' social networks with the following measures of friends' average characteristics: *proportion of friends with an incarcerated parent*, *proportion from two-parent households*, *mean GPA*, and *mean level of delinquent behavior*. These measures can only be calculated for friends who attended the same school as the respondent and completed the in-school survey. More detailed descriptions of variable coding can be found in the appendix.

Key Independent Variable: Father Incarcerated in 3 years before Wave I

I use information on respondents' age at paternal incarceration and release to create an indicator variable identifying respondents whose biological father was incarcerated at some point

in the three years prior to the baseline survey (N=467), which collected complete in-school network data. I focus on paternal incarceration within this three-year window based on the assumption that a more recent paternal incarceration spell is likely to be more salient for both the respondent and her peers.

Analytic Approach

I report four estimates of the association between paternal incarceration and adolescent social network structure and content. First, I calculate a baseline estimate of mean differences between adolescents who did and did not experience paternal incarceration in the three years prior to Wave I. I then estimate the effects of paternal incarceration using three different approaches to account for compositional differences between these two groups and potentially confounding factors: regression, within-school fixed effects regression, and propensity score matching.

In the absence of pre-treatment data, I first estimate an OLS model that controls only for demographic characteristics that could not have been affected by paternal incarceration: *race, age* and *gender*. I cluster standard errors throughout to account for school-based sampling. The next model adds post-treatment controls that may have been affected by paternal incarceration but nevertheless represent factors that could confound the relationship between paternal incarceration and social network and friend characteristics: *years in attendance at current school*, *respondent's GPA*, *respondent's delinquency*, *presence of a mother and/or father figure in the respondent's household*, *education level of resident mother and/or father figures* and *school fixed effects*.

Because they experience greater housing instability (Geller et al. 2009; Tasca, Rodriguez, and Zatz 2011), children of incarcerated parents may change schools more often than other

children and may thus have less time to establish friendships. To account for residential mobility I control for the student's self-reported number of years in attendance at their current school. Additionally, I control for respondent's own GPA and standardized delinquency index score to help ensure that differences in social network characteristics between children of incarcerated fathers and their peers are not attributable to behavioral differences in these two groups. This model also controls for parental education, but because not every student lives with a mother and/or father figure, I interact mother and father figures' education with dummy variables indicating whether the student had a mother or father figure present in their household. I multiply impute missing values for years in current school (n=42), GPA (n=235), delinquency index score (n=445), and mother education and father education when a mother and/or father is present in the household (n=221 and n=348, respectively) using respondents' data from the other control variables noted above. Further description of the coding of these variables can be found in the appendix.

The third model also adds school fixed effects as Add Health respondents are clustered within schools and certain school-level characteristics – like the prevalence of parental incarceration, the size and diversity of the student body, or family income variance – may confound the relationship between paternal incarceration and social network characteristics. Fixed effects models yield the average difference in network characteristics within schools for children with and without a recently incarcerated father. The fixed effects model thus controls for all school-level variables correlated with paternal incarceration and adolescent networks. High rates of incarceration in poor schools, for example, are controlled in this specification.

The final estimates are based on within school nearest neighbor propensity score matching to restrict the comparison set to a subset of appropriate control-case respondents.

Ideally propensity scores should only be calculated based on pre-treatment characteristics, but as noted above I do not have access to such data. I, therefore, estimate propensity scores based on characteristics that seem least likely to have been affected by and most likely to help predict paternal incarceration: *race*, *biological mother's and/or father's education* (when available), *biological mother's and/or father's age at respondent's birth* (when available), *resident mother figure's education* (if applicable) and *resident mother figure's welfare receipt*, as well as missingness on these variables. I then use nearest neighbor caliper matching, within school, to match respondents who experienced paternal incarceration to other students in their school who had a similar propensity score (within one-quarter standard deviation of the respondent's own propensity score). Respondents with an incarcerated father who do not have a good match within their school are dropped from this analysis. I then compare average outcomes on network and friend characteristics between adolescents who have experienced paternal incarceration and those who have not within this matched sample.

Table 1 provides an overview of control variable characteristics for members of the analytic sample by paternal incarceration history. Adolescents with and without recently incarcerated fathers are closely matched on age, presence of a mother figure in the household and, to a lesser extent, on gender, years in current school and GPA. However, students whose father was incarcerated in the three years prior to Wave I are more likely to be black and tend to have less educated parents than students who have not experienced paternal incarceration. Those whose father had been incarcerated recently also have higher delinquency index scores on average and, unsurprisingly, are much less likely to have any father figure present in their home at Wave I (70 percent vs. 83 percent, respectively). I control for differences in these characteristics in the latter portion of my analyses to help account for the possibility that these

compositional differences between adolescents who have experienced paternal incarceration and those who have not drive any observed differences in network and friend characteristics.

Table 1. Control Variable Characteristics by Paternal Incarceration History

		Father incarcerated in 3 years before Wave I	
	All	No	Yes
Father incarcerated in 3 years before Wave I	4.1%	--	100%
Gender			
Male	46.3%	46.4%	43.0%
Female	53.8%	53.6%	57.0%
Race			
White	54.4%	55.0%	41.3%
Black	22.6%	21.9%	38.3%
Hispanic	14.7%	14.6%	15.9%
Asian	6.5%	6.7%	1.9%
Other	1.8%	1.7%	2.6%
Age (mean)	14.9	15.0	14.6
	(1.7)	(1.7)	(1.6)
Years in current school (mean)	2.7	2.7	2.5
	(1.6)	(1.6)	(1.5)
GPA (mean)	2.8	2.8	2.6
	(0.8)	(0.8)	(0.7)
Delinquency index score[a]	-0.04	-0.05	0.13
	(1.0)	(1.0)	(1.0)
Mother figure present in household	97.4%	97.4%	97.9%
Father figure present in household	82.8%	83.3%	69.6%
Mother figure's education (if present)			
No school	0.2%	0.2%	0.0%
Less than high school	15.3%	14.9%	23.6%
High school or GED	30.0%	30.1%	26.9%
Some college	27.4%	27.2%	31.1%
College graduate	15.8%	15.9%	12.3%
More than college	9.4%	9.7%	4.2%
Missing	2.0%	2.0%	2.0%
Father figure's education (if present)			
No school	0.2%	0.1%	0.9%
Less than high school	15.2%	14.9%	23.1%
High school or GED	28.8%	28.6%	33.9%
Some college	23.6%	23.7%	19.1%
College graduate	16.2%	16.4%	12.0%
More than college	12.4%	12.7%	5.2%
Missing	3.7%	3.6%	5.9%
N	11,356	10,889	467

Note: Standard deviations in parentheses

[a] Delinquency index score is standardized across all in-school survey respondents, not just members of the longitudinal cohort included here.

Results

Table 2 displays the regression and matching estimates of the effect of recent paternal incarceration on network and friend characteristics. (Tables A2 and A3 in the appendix display coefficients and standard errors for control variables.) The simple bivariate associations in column 1 show that the social networks of adolescents who have had a father incarcerated differ significantly from those of other adolescents. Respondents who reported recent paternal incarceration nominate significantly fewer friends (about .6 fewer on average) and are named as a friend by significantly fewer students in their school (about .4 fewer on average). These differences represent nearly one-tenth of the average number of friends nominated and friendship nominations received for all students. Baseline comparisons also reveal that respondents who have experienced recent paternal incarceration are less connected to other students in their schools on average. They have significantly lower centrality scores (approximately 10 percent lower than average), indicating that their friends are less well connected than the average student's friends. They also have smaller extended networks than their peers – they are able to reach about 10 fewer students in three steps than their peers who have not experienced paternal incarceration. All of these differences are consistent with those hypothesized above.

Adolescents with recently incarcerated fathers also have less advantaged, less academically successful, and more delinquent friends, on average, than other adolescents. In this bivariate comparison, a significantly higher proportion of their friends experience parental incarceration (about 8 percentage points more, on average), and a significantly lower share of their friends live in two-parent households (11 percentage points fewer, on average). Moreover, friends' mean GPA is significantly lower (by .18 points) and friends' average delinquency scores

are significantly higher (by .12 standard deviations) among adolescents who have experienced recent paternal incarceration.

Table 2. Coefficients from Regression of Social Network and Friend Characteristics on Paternal Incarceration in Last Three Years

Dependent Variable	Bivariate Association	Pre-Treatment/ Demographic Controls Only	Full Controls + School Fixed Effects	Propensity Score Matched Pairs
Network Characteristics				
No. friends nominated	-0.617***	-0.514**	-0.340*	-0.547*
(std error)	(0.175)	(0.156)	(0.154)	(0.239)
N	11,356	11,356	11,356	812
No. friend nominations received	-0.360*	-0.252	-0.107	-0.0604
(std error)	(0.164)	(0.155)	(0.150)	(0.224)
N	10,619	10,619	10,619	762
Centrality (log)	-0.0960***	-0.0872***	-0.0572***	-0.0676**
(std error)	(0.016)	(0.015)	(0.015)	(0.022)
N	10,619	10,619	10,619	762
Network reach in 3 steps	-10.30***	-8.264***	-6.191***	-6.273*
(std error)	(2.117)	(1.885)	(1.634)	(2.515)
N	10,619	10,619	10,619	762
Friend Characteristics				
Prop. friends with incarcerated parent[a]	0.0825***	0.0752***	0.0406**	0.0394
(std error)	(0.020)	(0.017)	(0.015)	(0.020)
N	6,269	6,269	6,269	404
Prop. friends in two parent households	-0.110***	-0.0715***	-0.0490***	-0.0567**
(std error)	(0.017)	(0.013)	(0.013)	(0.020)
N	9,405	9,405	9,405	610
Mean GPA	-0.182***	-0.136***	-0.0707**	-0.112**
(std error)	(0.029)	(0.030)	(0.023)	(0.036)
N	10,123	10,123	10,123	694
Mean delinquency index score	0.123**	0.160***	0.0895*	0.126*
(std error)	(0.043)	(0.041)	(0.039)	(0.056)
N	9,359	9,359	9,359	610

Note: Standard errors in parentheses. Standard errors are clustered at the school level. Results for covariates are reported in Tables A2 and A3 in the appendix.

[a] Proportion of friends who also experienced parental incarceration can only be calculated for respondents who nominated at least one friend who (1) was also a member of the longitudinal sample and (2) participated in the fourth wave of the survey in which parental incarceration history questions were asked. Estimates are weighted by total number of Wave IV participant friends reported by the respondent.

*** p<0.001, ** p<0.01, * p<0.05 (two-tailed tests).

The coefficients in the second column represent residual differences in network and friend characteristics after controlling for demographic differences in race, gender, and age, none of which could plausibly have been affected by paternal incarceration. Once we account for these compositional differences between the two groups, all of the social network differences, with the

exception of friends' delinquency, diminish in size. However, only the difference in number of friendship nominations received between the two groups is no longer statistically significant. These findings suggest that adolescents affected by paternal incarceration may choose to self-isolate but are not necessarily shunned by their peers more often than other students. The fact that they have lower centrality scores, smaller extended networks, and less advantaged, lower achieving and more delinquent friends, however, suggests that perhaps they are being identified as friends by more peripheral, less advantageous peers within their schools (as well as disproportionately selecting such students as friends).

Accounting only for pre-treatment characteristics is the safest approach to modeling social network differences, but it limits us to a handful of demographic controls. The third column in Table 2 displays the coefficients from a regression model that controls for potential confounding variables (years in current school, GPA, delinquency, mother/father figure presence in household, and mother/father figure education) and includes school fixed effects in addition to demographic characteristics. As a result of the inclusion of school fixed effects, the coefficients in the third column of Table 2 reflect *within school* differences in social network and friend characteristics between adolescents who experienced paternal incarceration in the three years prior to Wave I and those who did not. Because the potentially confounding characteristics included in this model were measured post-treatment, the estimates in column 3 may underestimate the effect of paternal incarceration.

Once these additional controls and school fixed effects are added to the model, the magnitudes of the coefficients drop to somewhere between 40 and 70 percent of what they were in the bivariate association. With the exception of number of friend nominations received, however, the differences remain statistically significant, indicating that compositional

differences between adolescents who do and do not experience paternal incarceration and differences in school context do not fully explain the differences observed in column 1. Examining the coefficients in this third model, we see that, net of controls and school fixed effects, adolescents who experienced recent paternal incarceration nominated .3 fewer friends on average than other adolescents, which is roughly equivalent to the difference seen for respondents with three fewer years at their current school than the average respondent (see Table A3 in the appendix). Similarly, adolescents who recently experienced paternal incarceration now have centrality scores about 6 percent lower than those of their peers, and their extended networks (in three steps) contain about 6 fewer students, which is about 10 percent lower than the average network reach for all respondents. To help put the magnitude of these differences in context, this difference in centrality is roughly equivalent to the difference we see for respondents with two fewer years at the school than the average respondent, and the difference in extended network reach is approximately equal to the difference associated with a two standard deviation increase in delinquency.

Significant differences in friend characteristics remain even when we include this fuller set of demographic, household and behavioral controls and restrict comparison to within schools. Respondents who experienced paternal incarceration within the last three years report a significantly higher proportion of friends who have also experienced parental incarceration (4 percentage points, or roughly 37 percent, more than their peers), and the share of their friends who come from two-parent households is about 5 percentage points (roughly 7 percent) lower. This is roughly equivalent to the difference between adolescents who lack a mother figure in their household and those who do not. These adolescents' friends also have significantly lower GPAs (by .07 points, on average) and are significantly more delinquent (by about .09 standard

deviations) than other adolescent's friends. The difference in friend's average delinquency is approximately equal to what we would see for a respondent whose GPA is a full point lower than the average respondent's.

On the whole, these differences are consistent with the above hypotheses about how stigma and behavioral differences among children of incarcerated fathers may shape their social network outcomes. The findings in Table 2 confirm that, on average, children who experience paternal incarceration are more socially isolated and have more marginalized, more delinquent, and lower achieving friends than their peers even after we account for compositional differences between these two groups of children and compare them to students in their own schools.

Finally, the last column of Table 2 displays mean differences in network and friend characteristics from the within school nearest neighbor propensity score matches. Because I have used one-to-one nearest neighbor matching and dropped children of recently incarcerated fathers without close matches from the sample, the sample sizes are much lower and standard errors are larger for the results in this column. Though the magnitudes differ slightly, the differences observed from propensity score matching closely mirror those observed from the school fixed effects model with full controls. Again we see that, on average, adolescents whose father has been incarcerated within the last three years nominate fewer friends, are more socially isolated within their schools (lower centrality scores and smaller extended networks) and have more disadvantaged (i.e., less likely to come from two parent households), less academically successful and more delinquent friends than their peers who have not recently experienced paternal incarceration.

Robustness Checks

These findings are robust across a variety of model specifications. In addition to those listed above, I have also estimated models accounting for household income (as reported by the respondent's primary caregiver), gender interactions, and race interactions, finding substantively consistent results. Moreover, I have tried a variety of specifications for the paternal incarceration variable – including incarceration at Wave I, incarceration any time between birth and Wave I, years of paternal incarceration prior to Wave I, and a set of dummy variables representing age at paternal incarceration (birth to age 3, 4 to 8, 9 to 12, and 13 or older) – consistently finding that the experience of paternal incarceration is associated with the same general network and friend characteristic differences noted above.[7] I also estimated Poisson regression models for the 3 network characteristics variables that are counts: total number of friends nominated, number of friend nominations received, and size of network reach in three steps. The results of these models are qualitatively similar to those produced above.

To further explore the validity of these findings I conducted a falsification test in which I use paternal incarceration *after* Wave I (but not before or during) to predict differences in social network and friend characteristics at Wave I using the school fixed effect model in column 3. The relationship between recent paternal incarceration and network characteristics may be spuriously significant because of unobserved differences between children who experience paternal incarceration and those who do not. With unobserved confounders, we would expect to observe a significant association between network characteristics and post-Wave I paternal

[7] In general, the magnitudes in social network and friend characteristic differences are larger for more recent paternal incarceration (including at the time of Wave I, after age 12, and in the last 3 years) and for longer duration of incarceration. The only exception is for the relationship between paternal incarceration and friends' average delinquency, which appears to be largest for respondents who experience paternal incarceration between the ages of 4 and 8. Paternal incarceration at any time after birth but before Wave I is associated with the same trends in network differences indicated in Table 2, but the magnitudes are smaller.

incarceration, even though post-Wave I incarceration could not have influenced Wave I network characteristics. Insignificant estimates in a falsification test thus help to rule out unobserved confounders.

Results for six of the eight dependent variables are insignificant, as we would hope. Only two outcomes differ significantly by paternal incarceration after Wave I: the proportion of friends living in two parent households ($p<.01$) and the number of friendship nominations received ($p<.05$), which was *not* significantly different beyond the bivariate associations in the above analyses. These findings suggest that the differences in number of friends nominated, centrality, extended network reach, proportion of friends with incarcerated parents, friends' average GPA and friends' average delinquency observed above are not simply an artifact of unobserved differences in adolescents who experience paternal incarceration. The falsification test results are shown in Table A4 in the appendix.

Because the effects of parental incarceration may differ based on the gender of the child (Roettger and Boardman 2012; Wildeman 2010) and because incarceration rates in the US differ widely by race, I also examine variation in these estimated effects across four race and gender subgroups using the school fixed effects model from column 3 in Table 2. Figure 1 displays the coefficients from separate race and gender subgroup regressions using standardized versions of the dependent variables. (Table A5 in the appendix reports the coefficient values, standard errors and sample sizes.)

In general, paternal incarceration coefficients are signed consistently across subgroups. Paternal incarceration is associated with nominating fewer friends, being more socially isolated within one's school, having fewer friends from two parent households, and having friends who are less academically successful and more delinquent than other adolescents' friends across race

and gender subgroups. Although it appears that some of the effects may be heterogeneous across subgroups, models that include gender and race interactions with paternal incarceration do not reveal any significant differences by gender. The only significant difference by race is in the relationship between recent paternal incarceration and friends' average GPA; for black respondents paternal incarceration is not associated with friends' GPA.

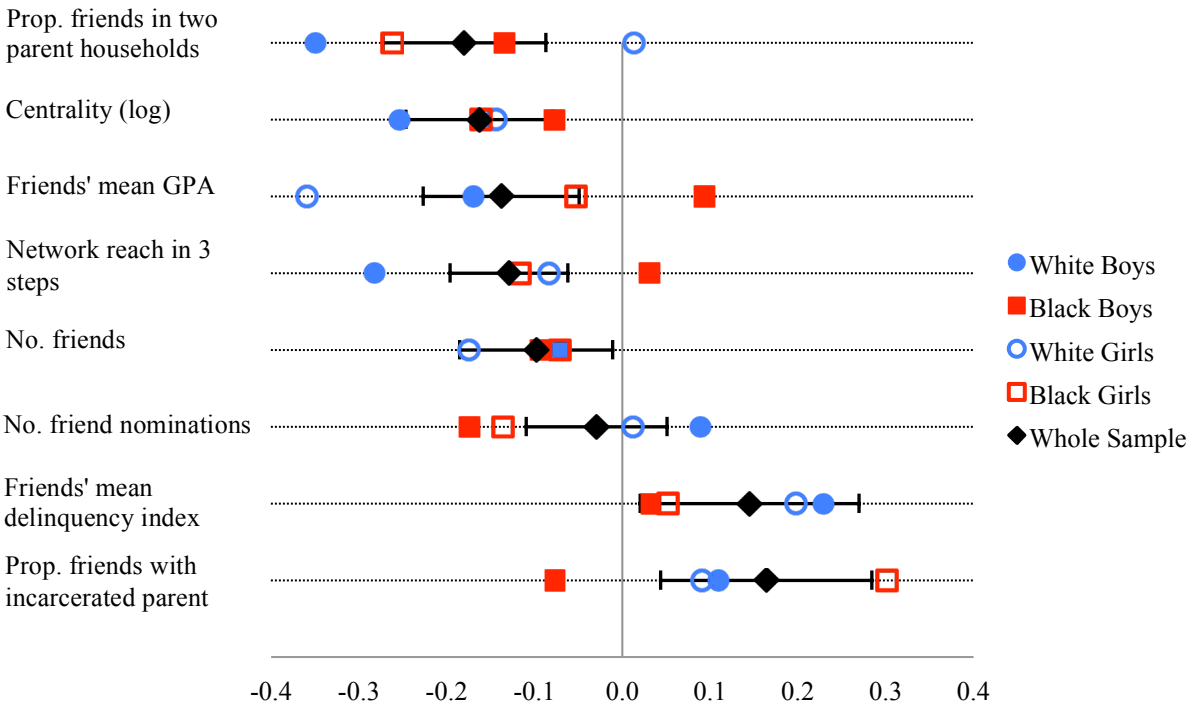

Figure 1. Coefficients on Paternal Incarceration for Race and Gender Subgroups
Note: Outcome variables have been standardized so they can be displayed on the same scale

In sum, the results indicate that there is a strong and robust association between paternal incarceration and social network disadvantage among adolescents. The above findings indicate that even when common demographic differences and likely confounders are controlled for and comparisons are limited to the most similar comparison group, children who have experienced paternal incarceration tend to report smaller, more socially isolated, and more disadvantageous friend groups than do other adolescents.

Discussion and Conclusion

Prior research indicates that incarceration introduces a host of disadvantages into the lives of adults who emerge from American prisons and jails (Holzer 2009; Pager 2003; Wakefield and Uggen 2010; Western 2006; Western et al. 2001). Research focused on the children of the formerly incarcerated links parental incarceration to a wide variety of disadvantages at both the household and child level. This paper explores a new context: adolescent social networks. I find that adolescents who have experienced paternal incarceration are embedded in less advantaged, more peripheral social relationships than their peers, indicating that children of incarcerated fathers experience social network disadvantage in their schools in addition to the resource deprivation and many other disadvantages they already face at home.

Adolescents who have experienced recent paternal incarceration limit the size of their social networks, nominating fewer friends than the average student in their school, and they befriend more disadvantaged and more peripheral peers. These adolescents are not necessarily nominated as friends less often than other students in their schools, but they are less connected within their schools than the average student, having significantly lower centrality scores and smaller extended networks. Moreover, the peers they befriend are less advantaged and less successful than other students' friends – they are significantly more likely to come from single-parent households, experience parental incarceration more often, get lower grades and are more delinquent than the average student's friends. These results are generally robust to a variety of models, a falsification test, and race-gender subgroups.

The findings are consistent with the hypothesized effects of parental incarceration stigma, lending support to the more general hypothesis that stigma contributes to poor outcomes for children of incarcerated parents. The fact that adolescents who have experienced paternal

incarceration are in less privileged positions in their social networks and associate with more disadvantageous friends – even after their own achievement and behavior are taken into account – also helps explain previous research linking parental incarceration to higher levels of delinquency and lower academic achievement in adolescence. Given that academic achievement and delinquency are influenced by friends as well as social location in one's school (Calvó-Armengol et al. 2009; Flashman 2014; Haynie 2002; Parker and Asher 1987; Vitaro, Brendgen, and Tremblay 2000; Weerman and Smeenk 2005), my findings suggests that social networks may be a mechanism through which the children of incarcerated parents become more delinquent and lower achieving. Ideally, the strength of this mechanism could be tested in the future with data that observe the social networks of children with incarcerated parents in early adolescence, then observe academic achievement and delinquency in late adolescence.

Despite the strength of the results under a variety of specifications, threats to causal inference remain where unobserved factors are both associated with incarceration and affect peer networks. In particular, behavioral characteristics of fathers such as criminal involvement, substance abuse and propensity for violence are unobserved in the Add Health data.[8] Future research could improve the current estimates with more detailed measurement of paternal behaviors and contact with child prior to incarceration.

Data limitations also prevent me from adjudicating between the relative influence of the two mechanisms I proposed earlier in this paper: stigma and behavioral differences. I can control for respondents' own delinquency and achievement at the time of the baseline survey, but because friends may influence each other's behavior, it is not possible to distinguish between baseline behavioral differences resulting from paternal incarceration and those resulting from

[8] To the extent that these characteristics of fathers are correlated with children's own delinquency, they are controlled for in model 3.

friends' influence. Therefore, I cannot confidently attribute all of the social network differences that remain after adding behavioral controls to stigma. Future research might distinguish these two mechanisms by including behavioral observations both before and after parental incarceration, as well as measures of stigma, such as teacher's observations of classroom interactions. Despite the challenges of causal identification and empirically isolating the distinct mechanisms for incarceration effects, the results clearly show inequality in the distribution of social capital associated with paternal incarceration.

In connecting paternal incarceration to childhood social network disadvantage, these findings add a new dimension to our understanding of the social exclusion associated with mass incarceration in America. Previous research has established mass incarceration as an institution for social isolation and exclusion for adults entangled in the system (Murray 2007; Travis 2002). With this paper we see evidence of very literal social isolation and exclusion crossing generational bounds and touching the lives of the children of America's prisoners.

Moreover, in identifying the social network disadvantages – both in structure and content – faced by children of incarcerated fathers, this paper contributes to the existing literature on the constriction and disadvantage of social networks among the poor in modern America (Desmond 2012; Sampson, Raudenbush, and Earls 1997; Smith 2007). We see in these findings that even in adolescence the children of America's prisoners find themselves embedded in more isolated and disadvantaged social groups than their peers. Rather than being a domain in which children are insulated from the burden of parental incarceration, adolescent friendship networks appear to be yet another site in which the disadvantage surrounding the children of incarcerated parents is tangible.

A substantial body of research suggests that the punishment inflicted by America's prison system extends well beyond those who have been convicted of crimes and the stated duration of their sentences. This study highlights a previously undocumented way in which the children of prisoners are penalized for their parents' infractions. By shedding light on the smaller, less advantageous friendship networks in which children of incarcerated parents are embedded, this paper enriches our understanding of the broad variety of ways in which both inmates and their children are marginalized in American society and provides further evidence of the social isolation and inequality associated with mass incarceration.

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APPENDIX A. Variable Coding

Key Independent Variable: Paternal Incarceration

Father incarcerated in 3 years before Wave I	In the Wave IV survey respondents indicated whether any of their biological parents or, if applicable, social parents had ever been incarcerated, the number of times each parent was incarcerated, and their own age when each parent was first incarcerated and last released from prison or jail. I use the respondent's age at the time of the Wave I in-school survey and her reported age at biological father's first imprisonment and last release to identify respondents whose biological father was incarcerated at some point in the three years preceding the baseline survey.

Dependent Variables: Social Network Characteristics

Total number of friends nominated[a]	The total number of friends the respondent identified on the in-school survey, regardless of whether those friends were located in the student's school or could be matched to names on the school's student roster.
No. of friend nominations received[a]	A measure of the number of times the respondent was nominated as a friend by other students in the respondent's school.
Centrality (log)[a]	I use the Add Health calculated measure of Bonacich centrality, which weights how many connections a respondent has (both the number of friends they nominate and the number of students who nominate them as friends) by the centrality of the friends that she nominated (i.e., how many connections they have). This measure is premised upon the notion that "one's status is a function of the status of those one is connected to" (Bonacich 1987:1181). In practical terms, this means that the centrality of a respondent is determined by the centrality (i.e., number of ties) of her ties. To make interpretation easier I log each respondent's Bonacich centrality. The centrality score equals zero for respondents who do not nominate any friends and are not nominated by any other students as friends. To avoid losing these respondents when logging the centrality score, I add 1 to each respondent's centrality score before taking the natural log.
Reach in 3 steps[a]	The number of other students the respondent can reach in just three steps. If *i* nominates *j, j* nominates *k,* and *k* nominates *l*, then *i* and *l* are three steps apart.
Prop. Wave IV friends with incarcerated parent	The share of a respondent's Wave IV participant friends who had any parent figure incarcerated at some point after their birth and before their 18th birthday. Because parental incarceration history is only known for respondents who participated in Wave IV, this measure is calculated using only nominated friends who also participated in the Wave IV survey and for whom we know parental incarceration history. Therefore, the sample is restricted to respondents with at least one friend who also completed the Wave IV survey (N=6,269). I weight analyses by total number of Wave IV participant friends nominated when proportion of friends with an incarcerated parent is the dependent variable.

Prop. friends with two parents	The share of the respondent's nominated friends who indicated that they lived with both a mother figure (biological, step, adoptive or foster) and a father figure at the time of the in-school survey. Only friends who attended the same school as the respondent and completed the in-school survey are used to calculate this measure.
Mean GPA[a]	An Add Health created measure of the approximate mean GPA for the respondent's in-school friend group (both the friends that the respondent nominated and other students who nominated the respondent as a friend), excluding the respondent. Students reported their letter grade in English/Language Arts, Mathematics, History/Social Studies, and Science on the in-school survey. GPA is calculated as the mean grade across these four core subjects with grades weighted as follows: A = 4, B = 3, C = 2, D or F = 1. GPA was calculated using only valid responses for identifiable friends in the same school as the respondent.
Mean delinquency	The delinquency index is based upon the respondent's friends' responses to questions about the frequency with which they engaged in the following 7 activities in the last 12 months: smoking cigarettes, drinking alcohol, getting drunk, engaging in dangerous activities on a dare, lying to parents, skipping school without an excuse, and getting in physical fights. I standardized responses for each activity across all 90,118 participants in the Wave I in school survey. I then calculated the mean of all valid responses across these seven activities and standardized it to create an index score for each of the respondents' friends with a mean of zero and a standard deviation of one. I average these friend delinquency index scores across each respondent's friends.
Control Variables	
Race	I measure respondent race with a series of five mutually exclusive dummy variables including white, black, Hispanic, Asian and other, based on response to the Wave I in-home survey. Respondents who selected two or more races were asked to identify the single race that best suited them. If they did not do so, their race was recorded as Other. Respondents who indicated a Hispanic background are classified as Hispanic, regardless of their racial background. I replaced missing race data from the Wave I in-home interviews with reported race from Wave I in-school questionnaires. White is the reference category in regressions.
Gender[b]	A dummy variable set equal to one if the adolescent is male.
Age[b]	Age on the date of the Wave I in-school survey.
Years in current school	Self-reported by the respondent on the in-school Wave I survey.
GPA	Students reported their letter grade in English/Language Arts, Mathematics, History/Social Studies, and Science on the in-school survey. GPA is calculated as the mean grade across these four core subjects with grades weighted as follows: A = 4, B = 3, C = 2, D or F = 1.

Delinquency index score	The respondent's standardized score on the delinquency index described above.
Mother and/or father figure presence in household	Dummy variables respectively set equal to one if the student had some sort of mother or father figure in the house according to the parent survey and in-school student survey.
Mother Figure Education & Father Figure Education	A series of dummy variables for highest level of educational attainment: no school, less than high school, high school or GED, some college, college graduate, and more than college, with high school or GED completion omitted as the reference category. Because not every student lived with a mother and/or father figure, I interact mother's and father's education level with a dummy variable indicating whether or not the student had a mother or father figure present in the household. Because student reports of parent education levels may be incorrect, I use reported education level from the in-home parent survey when possible. In most cases the parent survey was completed by the adolescent's resident mother; however other adults in the household sometimes completed the survey if the interviewer was unable to schedule an interview with the child's mother or father (Carolina Population Center 2008). The parent survey recorded the education level of the respondent and that of his or her spouse/partner, when applicable. I have recoded these education level variables into mother figure and father figure education based on the respondent's self-reported gendered relationship to the child (e.g., biological mother, grandfather, etc.) and the gender of respondent parent's partner. Thus, the education level for any female respondent to the parent survey – or that of the female partner for a male respondent to the parent survey – is recorded as the education level of the child's "mother figure." When parents did not participate in the survey or did not report their level of education I fill in missing data with parent education level as reported by the student on the in-school survey. In cases where a respondent's biological respondent lived in the same household as the respondent but did not complete the survey (and the biological parent's spouse did not complete it) I use student-reported parent education from the in-school survey.

[a] Created by Add-Health for respondents in schools with at least a 50 percent response rate and for social ties in which both students were uniquely identifiable.

[b] I use gender and age reported in the Wave IV survey as Add Health considers data from the last wave of participation to be the most correct (Carolina Population Center n.d.).

APPENDIX B. Additional Tables

Table A1. Analytical Sample

		Wave I In-School Survey Respondents	
		Total	With Add Health Network Measures[a]
		90,118	75,871
Wave I In-Home Respondents (Longitudinal Sample Members)	20,745	15,356	14,317
Wave IV Survey Participants	15,701	11,682	10,926
With valid data on paternal incarceration	15,243	**11,356**	**10,619**
With at least one *in-school* friend		**10,146**	**9,590**
With at least one in-school friend *with valid data on parental incarceration*		**6,269**	N/A

[a] For the sake of reliability, these measures were only constructed for students in schools with response rates of 50 percent or higher and for friendship nominations in which both the sender and receiver of the nomination are uniquely identifiable students.

Table A2. Full Regressions of Social Network and Friend Characteristics on Recent Paternal Incarceration with Pre-Treatment Controls Only

	Network Characteristics				Friend Characteristics			
	No. friends nominated	No. friend nominations received	Centrality (log)	Network reach in 3 steps	Prop. friends with incarcerated parent[a]	Prop. friends in two parent homes	Mean GPA	Mean delinquency index score
Father incarcerated in 3 years before Wave I	-0.514**	-0.252	-0.087***	-8.264***	0.075***	-0.072***	-0.136***	0.160***
	(0.156)	(0.155)	(0.015)	(1.89)	(0.017)	(0.013)	(0.030)	(0.041)
Black	-1.132***	-1.182***	-0.108***	-20.32***	0.031	-0.253***	-0.263***	-0.155***
	(0.170)	(0.183)	(0.016)	(5.13)	(0.017)	(0.016)	(0.044)	(0.030)
Hispanic	-1.222***	-1.188***	-0.059**	-26.08***	0.015	-0.083**	-0.278***	-0.043
	(0.161)	(0.218)	(0.021)	(4.33)	(0.016)	(0.026)	(0.075)	(0.064)
Asian	-0.923***	-1.322***	-0.026	-30.13***	-0.045***	0.011	0.200***	-0.290***
	(0.251)	(0.206)	(0.039)	(4.18)	(0.009)	(0.026)	(0.045)	(0.030)
Other Race/Ethnicity	-0.683*	-0.443	-0.066*	-15.56***	0.088*	-0.106***	-0.010*	0.012
	(0.304)	(0.369)	(0.027)	(4.47)	(0.0375)	(0.029)	(0.041)	(0.057)
Male	-1.223***	-0.407***	-0.055***	-4.65***	-0.010	0.007	-0.025	0.045**
	(0.082)	(0.092)	(0.008)	(1.28)	(0.005)	(0.006)	(0.013)	(0.015)
Age	-0.048	-0.085*	-0.020***	-0.74	-0.001	-0.002	-0.033***	0.070***
	(0.035)	(0.038)	(0.003)	(0.82)	(0.002)	(0.002)	(0.009)	(0.007)
Constant	8.656***	6.467***	0.889***	81.50***	0.114**	0.822***	3.408***	-1.028***
	(0.506)	(0.535)	(0.042)	(11.75)	(0.034)	(0.038)	(0.126)	(0.106)
Observations	11,356	10,619	10,619	10,619	6,269	9,405	10,123	9,359

Note: Standard errors in parentheses. Standard errors are clustered at the school level.

[a] Proportion of friends who also experienced parental incarceration can only be calculated for respondents who nominated at least one friend who (1) was also a member of the longitudinal sample and (2) participated in the fourth wave of the survey in which parental incarceration history questions were asked. Estimates are weighted by total number of Wave IV participant friends.

*** p<0.001, ** p<0.01, * p<0.05 (two-tailed tests).

Table A3. Full Regressions of Social Network and Friend Characteristics on Recent Paternal Incarceration with Full Controls and School Fixed Effects

	Network Characteristics				Friend Characteristics			
	No. friends nominated	No. friend nominations received	Centrality (log)	Network reach in 3 steps	Prop. friends with incarcerated parent[a]	Prop. friends in two parent homes	Mean GPA	Mean delinquency index score
Father incarcerated in 3 years before Wave I	-0.197*	-0.081	-0.034***	-3.12**	0.014	-0.039***	-0.066***	0.072***
	(0.114)	(0.126)	(0.012)	(1.43)	(0.013)	(0.010)	(0.015)	(0.022)
Black	-0.702***	-0.452***	-0.130***	-13.25***	0.068***	-0.203***	-0.181***	-0.133***
	(0.107)	(0.120)	(0.012)	(1.37)	(0.015)	(0.009)	(0.014)	(0.020)
Hispanic	-0.244**	0.229	-0.027**	-2.65*	-0.005	-0.008	-0.055***	0.016
	(0.124)	(0.139)	(0.013)	(1.58)	(0.025)	(0.010)	(0.017)	(0.024)
Asian	-0.333**	-0.156	-0.031*	-6.82***	-0.027	0.005	0.163***	-0.147***
	(0.155)	(0.171)	(0.017)	(1.94)	(0.020)	(0.013)	(0.021)	(0.029)
Other Race/Ethnicity	-0.332	0.060	-0.054**	-4.99*	0.043**	-0.061***	-0.065**	-0.002
	(0.239)	(0.266)	(0.026)	(3.02)	(0.020)	(0.020)	(0.032)	(0.045)
Male	-1.235***	-0.352***	-0.041***	-2.55***	-0.017***	0.012**	0.012	-0.022*
	(0.063)	(0.070)	(0.007)	(0.79)	(0.005)	(0.005)	(0.008)	(0.012)
Age	-0.161***	-0.186***	-0.041***	-5.30***	-0.004	-0.004*	0.002	0.043***
	(0.029)	(0.032)	(0.003)	(0.36)	(0.003)	(0.002)	(0.004)	(0.005)
Years in current school	0.117***	0.212***	0.024***	1.39***	-0.004*	0.004*	0.005	0.006
	(0.027)	(0.030)	(0.003)	(0.34)	(0.002)	(0.002)	(0.004)	(0.005)
GPA	0.413***	0.565***	0.057***	4.31***	-0.018***	0.021***	0.184***	-0.098***
	(0.046)	(0.051)	(0.005)	(0.58)	(0.004)	(0.004)	(0.006)	(0.009)
Delinquency Index score	0.165***	0.172***	-0.020***	-3.08***	0.011***	-0.015***	-0.051***	0.195***
	(0.035)	(0.039)	(0.004)	(0.44)	(0.0029)	(0.003)	(0.005)	(0.007)
Mother figure present in household	0.666***	0.511**	0.079***	7.84***	0.009	0.050***	-0.007	0.002
	(0.200)	(0.222)	(0.021)	(2.52)	(0.023)	(0.018)	(0.027)	(0.040)
Father figure present in household	0.071	0.151	0.017	1.84	-0.020**	0.034***	0.009	-0.017
	(0.101)	(0.112)	(0.011)	(1.27)	(0.009)	(0.008)	(0.013)	(0.019)
Mother Figure Education (if present)								
No school*Mother figure in household	-0.005	0.292	-0.009	-7.73	0.035	0.154**	-0.233**	0.151
	(0.784)	(0.843)	(0.082)	(9.61)	(0.110)	(0.067)	(0.101)	(0.155)

Less than high school*Mother figure in household	-0.251**	-0.202*	-0.030***	-4.03***	-0.009	-0.001	-0.028**	0.023
	(0.106)	(0.117)	(0.011)	(1.33)	(0.009)	(0.009)	(0.014)	(0.020)
Some college*Mother figure in household	0.212**	0.130	0.015*	1.09	-0.006	0.005	0.029***	0.0035
	(0.085)	(0.094)	(0.009)	(1.06)	(0.006)	(0.007)	(0.011)	(0.016)
College graduate*Mother figure in household	0.070	0.302***	0.017	1.01	-0.013*	0.019**	0.066***	-0.038**
	(0.104)	(0.115)	(0.011)	(1.32)	(0.008)	(0.009)	(0.014)	(0.019)
More than college*Mother figure in household	0.291**	0.533***	0.048***	4.24***	-0.021**	0.026**	0.113***	-0.037
	(0.131)	(0.145)	(0.014)	(1.64)	(0.010)	(0.011)	(0.017)	(0.024)
Father Figure Education (if present)								
No school*Father figure in household	-2.512***	-2.238**	-0.221**	-19.49*	0.107	0.009	-0.071	0.022
	(0.854)	(0.969)	(0.094)	(11.04)	(0.087)	(0.085)	(0.126)	(0.198)
Less than high school*Father figure in household	-0.080	-0.324**	-0.015	-0.96	0.024***	-0.014	-0.067***	0.031
	(0.114)	(0.126)	(0.012)	(1.43)	(0.009)	(0.009)	(0.015)	(0.021)
Some college*Father figure in household	0.082	0.014	0.013	1.66	0.003	-0.005	0.032**	-0.002
	(0.097)	(0.107)	(0.010)	(1.22)	(0.007)	(0.008)	(0.013)	(0.018)
College graduate*Father figure in household	0.062	0.268**	0.031***	1.45	-0.004	0.007	0.054***	-0.021
	(0.112)	(0.125)	(0.012)	(1.41)	(0.008)	(0.009)	(0.015)	(0.021)
More than college*Father figure in household	-0.011	0.052	0.018	0.18	0.004	0.013	0.072***	-0.018
	(0.131)	(0.146)	(0.014)	(1.65)	(0.011)	(0.011)	(0.017)	(0.024)
Constant	7.811***	4.602***	0.870***	116.6***	0.124**	0.680***	2.246***	-0.319***
	(0.474)	(0.527)	(0.051)	(5.98)	(0.046)	(0.039)	(0.063)	(0.090)
Observations	11,356	10,619	10,619	10,619	6,269	9,405	10,123	9,359
Number of schools	133	121	121	121	128	132	121	132

Note: Standard errors in parentheses. Standard errors are clustered at the school level.

[a] Proportion of friends who also experienced parental incarceration can only be calculated for respondents who nominated at least one friend who (1) was also a member of the longitudinal sample and (2) participated in the fourth wave of the survey in which parental incarceration history questions were asked. Estimates are weighted by total number of Wave IV participant friends.

*** p<0.001, ** p<0.01, * p<0.05 (two-tailed tests).

Table A4. Falsification Test: Regressions of Social Network and Friend Characteristics on Paternal Incarceration AFTER Wave I with Full Controls and School Fixed Effects

	Network Characteristics				Friend Characteristics			
	No. friends nominated	No. friend nominations received	Centrality (log)	Network reach in 3 steps	Prop. friends with incarcerated parent[a]	Prop. friends in two parent homes	Mean GPA	Mean delinquency index score
Father incarcerated after Wave I	0.057 (0.204)	-0.530* (0.230)	-0.004 (0.022)	-1.01 (2.60)	-0.013 (0.012)	-0.049** (0.017)	-0.016 (0.027)	0.042 (0.039)
Black	-0.721*** (0.107)	-0.455*** (0.121)	-0.132*** (0.012)	-13.38*** (1.37)	0.069*** (0.015)	-0.206*** (0.009)	-0.187*** (0.014)	-0.127*** (0.020)
Hispanic	-0.253* (0.124)	0.240 (0.140)	-0.028* (0.014)	-2.66 (1.59)	-0.004 (0.026)	-0.007 (0.010)	-0.056*** (0.017)	0.017 (0.024)
Asian	-0.334* (0.155)	-0.151 (0.171)	-0.031 (0.017)	-6.81*** (1.94)	-0.026 (0.020)	0.006 (0.013)	0.163*** (0.021)	-0.146*** (0.029)
Other Race/Ethnicity	-0.367 (0.241)	0.053 (0.268)	-0.054* (0.026)	-5.00 (3.04)	0.036 (0.022)	-0.058** (0.020)	-0.062 (0.032)	-0.009 (0.045)
Male	-1.237*** (0.063)	-0.351*** (0.070)	-0.041*** (0.007)	-2.54** (0.79)	-0.017*** (0.005)	0.012* (0.005)	0.011 (0.008)	-0.022 (0.012)
Age	-0.158*** (0.029)	-0.185*** (0.032)	-0.041*** (0.003)	-5.33*** (0.37)	-0.004 (0.003)	-0.004 (0.002)	0.002 (0.004)	0.043*** (0.005)
Years in current school	0.117*** (0.027)	0.208*** (0.030)	0.024*** (0.003)	1.42*** (0.34)	-0.004 (0.002)	0.004 (0.002)	0.006 (0.004)	0.006 (0.005)
GPA	0.418*** (0.047)	0.563*** (0.051)	0.058*** (0.005)	4.47*** (0.58)	-0.018*** (0.004)	0.021*** (0.004)	0.184*** (0.006)	-0.100*** (0.009)
Delinquency Index score	0.161*** (0.035)	0.173*** (0.039)	-0.020*** (0.004)	-3.11*** (0.44)	0.011*** (0.003)	-0.015*** (0.003)	-0.052*** (0.005)	0.196*** (0.007)
Mother figure present in household	0.657** (0.201)	0.523* (0.223)	0.078*** (0.022)	7.71** (2.53)	0.007 (0.024)	0.050** (0.018)	-0.003 (0.027)	0.004 (0.040)
Father figure present in household	0.082 (0.101)	0.149 (0.112)	0.019 (0.011)	2.02 (1.27)	-0.021* (0.009)	0.032*** (0.008)	0.012 (0.013)	-0.019 (0.019)
Mother Figure Education (if present)								
No school*Mother figure in household	0.007 (0.784)	0.283 (0.844)	-0.007 (0.082)	-7.33 (9.61)	0.039 (0.109)	0.154* (0.067)	-0.231* (0.102)	0.154 (0.155)

Less than high school*Mother figure in household	-0.253*	-0.196	-0.029*	-3.83**	-0.009	-0.002	-0.031*	0.027
	(0.106)	(0.117)	(0.011)	(1.33)	(0.009)	(0.009)	(0.014)	(0.020)
Some college*Mother figure in household	0.206*	0.122	0.014	1.06	-0.005	0.004	0.028*	0.004
	(0.085)	(0.094)	(0.009)	(1.06)	(0.007)	(0.007)	(0.011)	(0.016)
College graduate*Mother figure in household	0.065	0.304**	0.017	0.90	-0.013	0.019*	0.064***	-0.038
	(0.105)	(0.116)	(0.011)	(1.32)	(0.008)	(0.009)	(0.014)	(0.019)
More than college*Mother figure in household	0.288*	0.527***	0.048***	4.17*	-0.021*	0.027*	0.113***	-0.036
	(0.131)	(0.145)	(0.014)	(1.65)	(0.010)	(0.011)	(0.017)	(0.024)
Father Figure Education (if present)								
No school*Father figure in household	-2.552**	-2.280*	-0.227*	-20.16	0.106	0.002	-0.087	0.029
	(0.854)	(0.970)	(0.094)	(11.03)	(0.086)	(0.085)	(0.126)	(0.198)
Less than high school*Father figure in household	-0.084	-0.334**	-0.017	-1.22	0.025**	-0.016	-0.069***	0.033
	(0.114)	(0.126)	(0.012)	(1.43)	(0.009)	(0.009)	(0.015)	(0.021)
Some college*Father figure in household	0.089	0.015	0.014	1.78	0.003	-0.005	0.034**	-0.002
	(0.097)	(0.107)	(0.010)	(1.22)	(0.007)	(0.008)	(0.013)	(0.018)
College graduate*Father figure in household	0.068	0.259*	0.032**	1.52	-0.004	0.008	0.055***	-0.022
	(0.112)	(0.125)	(0.012)	(1.41)	(0.008)	(0.009)	(0.015)	(0.021)
More than college*Father figure in household	-0.003	0.054	0.019	0.30	0.004	0.013	0.073***	-0.018
	(0.131)	(0.146)	(0.014)	(1.65)	(0.011)	(0.011)	(0.017)	(0.024)
Constant	7.762***	4.626***	0.863***	115.9***	0.132**	0.680***	2.240***	-0.314***
	(0.474)	(0.527)	(0.051)	(5.98)	(0.047)	(0.039)	(0.063)	(0.090)
Observations	11,356	10,619	10,619	10,619	6,269	9,405	10,123	9,359
Number of schools	133	121	121	121	128	132	121	132

Note: Standard errors in parentheses. Standard errors are clustered at the school level.

[a] Proportion of friends who also experienced parental incarceration can only be calculated for respondents who nominated at least one friend who (1) was also a member of the longitudinal sample and (2) participated in the fourth wave of the survey in which parental incarceration history questions were asked. Estimates are weighted by total number of Wave IV participant friends.

*** p<0.001, ** p<0.01, * p<0.05 (two-tailed tests).

Table A5. Coefficients from Regression of Social Network and Friend Characteristics on Paternal Incarceration

	White Boys	Black Boys	White Girls	Black Girls
Network Characteristics				
No. friends nominated	-0.070	-0.093	-0.175*	-0.072
(std error)	(0.105)	(0.145)	(0.082)	(0.097)
N	2,931	1,062	3,248	1,506
No. friend nominations received	0.089	-0.174	0.013	-0.136
(std error)	(0.119)	(0.129)	(0.110)	(0.082)
N	2,768	995	3,035	1,420
Centrality (log)	-0.254*	-0.077	-0.144	-0.161
(std error)	(0.110)	(0.139)	(0.093)	(0.096)
N	2,768	995	3,035	1,420
Network reach in 3 steps	-0.282**	0.031	-0.084	-0.116
(std error)	(0.107)	(0.121)	(0.086)	(0.083)
N	2,768	995	3,035	1,420
Friend Characteristics				
Prop. friends with incarcerated parent[a]	0.109	-0.077	0.091	0.301
(std error)	(0.119)	(0.202)	(0.106)	(0.156)
N	1,605	466	2,019	852
Prop. friends in two parent households	-0.349***	-0.134	0.013	-0.262*
(std error)	(0.101)	(0.201)	(0.085)	(0.123)
N	2,459	709	2,959	1,255
Mean GPA	-0.169	0.094	-0.359***	-0.053
(std error)	(0.095)	(0.126)	(0.082)	(0.084)
N	2,652	900	2,975	1,345
Mean delinquency index score	0.229*	0.033	0.198*	0.053
(std error)	(0.112)	(0.153)	(0.092)	(0.098)
N	2,457	703	2,954	1,248

Note: Standard errors in parentheses. Standard errors are clustered at the school level.

[a] Proportion of friends who also experienced parental incarceration can only be calculated for respondents who nominated at least one friend who (1) was also a member of the longitudinal sample and (2) participated in the fourth wave of the survey in which parental incarceration history questions were asked. Estimates are weighted by total number of Wave IV participant friends.

*** p<0.001, ** p<0.01, * p<0.05 (two-tailed tests).