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Early age at childhood parental incarceration and STI/HIV-related drug use and sex risk across the young adult lifecourse in the US: Heightened vulnerability of black and Hispanic youth

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Abstract

Background—We measured associations between parental incarceration and STI/HIV-related drug use and sex risk, assessing differences by race, age at first parental incarceration, and potential mediators of the relationship.

Methods—We used Waves I (adolescence), III (young adulthood), and IV (adulthood) of the National Longitudinal Study of Adolescent to Adult Health (n=11,884) to measure associations between age of parental incarceration (never; < 8; 8–17; ≥18 years old) and marijuana and cocaine use, multiple partnerships, and STI in adolescence and adulthood among white, Black, and Hispanic participants and assessed mediation by sexual and physical abuse, mental disorder symptoms, and drug use.

Results—By Wave IV, approximately one in six had experienced a parental incarceration; higher prevalence observed among black (26%) and Hispanic (20%) versus white (15%) respondents ($p < 0.0001$). Parental incarceration at any age was moderately to strongly associated with STI/HIV risk outcomes. In multivariable models, parental incarceration at age < 8 years old (versus never) remained strongly associated with STI/HIV risk in both adolescence and adulthood, with strongest associations among non-whites. Among black participants, parental incarceration at < 8 years old was associated with over double the odds of adulthood use of marijuana (adjusted odds ratio

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Contributors

MR Khan conceptualized the analyses, wrote the first draft of the manuscript, and revised subsequent versions. JD Scheidell conducted the statistical analyses and contributed to writing the manuscript. DL Rosen, A Geller, and LM Brotman assisted in designing the analyses, interpreting results, and contributed to writing the manuscript. All authors contributed to and approved the final version.

Conflicts of interest

All authors state they have no conflicts of interest.

(AOR): 2.53, 95% confidence interval: 1.62, 3.95) and cocaine (AOR: 4.41, 95% CI: 2.05, 9.48). Delinquency, drug use, and mood disorders appeared to partially mediate the relationship.

Conclusions—Children impacted by parental incarceration constitute priority populations for substance use and STI/HIV prevention and treatment. The unintended consequences of incarceration for children should be considered in decarceration discussions.

Keywords

Parental incarceration; STI; HIV; Drug use; Adolescence; Race

1. Introduction

Sexually transmitted infection (STI) and HIV persist as critical threats to population health in the US (Centers for Disease Control and Prevention, 2015b) with adolescents and young adults at greatest risk (Centers for Disease Control and Prevention, 2012, 2014b). Black and Hispanic youth are disproportionately infected (Centers for Disease Control and Prevention, 2014b, 2015a). The racial/ethnic disparity emerges in adolescence and widens through the young adult period (Centers for Disease Control and Prevention, 2014a). Substance use is a critical behavioral determinant of STI/HIV sex risk (Cook and Clark, 2005; Hutton et al., 2005; Khan et al., 2013). There remains a need to identify the upstream factors that contribute both to STI/HIV-related substance use and sex risk.

Incarceration of a parent may constitute an important social determinant of STI/HIV risk given the unacceptable rate of incarceration in the US (Bureau of Justice Statistics, 2015) and that half of inmates are parents (Bureau of Justice Statistics, 2010). Parental incarceration may have particularly important implications for non-white children due to the marked racial/ethnic disparity in incarceration; though blacks comprise only 13% of the US population (United States Census Bureau, 2015) half of children who have an incarcerated parent are black (Bureau of Justice Statistics, 2010). There is an established relationship between parental incarceration and substance use (Kopak and Smith-Ruiz, 2015; Murray et al., 2012; Roettger et al., 2011), and, though less well researched, sexual risk behavior during adolescence (Nebbitt et al., 2014; Whalen and Loper, 2014) and adulthood (Hillis et al., 2001; Hillis et al., 2000) and HIV infection in adulthood (Lee et al., 2013). An important gap in the extant literature however is knowledge of how the age of the child during a parental incarceration influences risk. While parental incarceration appears to influence risk regardless of the child's age (Murray et al., 2012) there may be particularly deleterious impacts for the youngest children because they are dependent on their parents for basic necessities, the event occurs during a period of intensive cognitive development, and there is a greater length of time for incarceration-induced stress to impact cognitive development and mental health (Gunnar, 2003; Loman et al., 2010; Lupien et al., 2009). On the other hand, it is possible that parental incarceration occurring shortly before adolescence/emerging adulthood, when risk-taking is initiated and peaks, may have particularly harmful effects. We need to better understand how parental incarceration may influence risk at different developmental periods. Additionally, few studies have tested the impact of racial/ethnic differences on the associations between parental incarceration and risk outcomes. This could be particularly important considering that black and Hispanic youth are populations

disproportionately affected by both incarceration (Bureau of Justice Statistics, 2015) and STI/HIV (Centers for Disease Control and Prevention, 2014a, 2015a). Recent evidence of the strong association between parental incarceration and marijuana use among black youth highlights the need to examine associations by race (Kopak and Smith-Ruiz, 2015).

Though parental incarceration has been linked to substance use and sex risk, the mediating paths have not been well defined. Households affected by parental incarceration experience reduced social cohesion, emotional support, and material support and face risk of poverty and residential instability (Geller et al., 2009). This lack of social cohesion, poverty, and household instability are established risk factors for other traumatic experiences, including physical and sexual abuse, which play a role in substance use and sex risk (Bassuk et al., 1998). Lack of social cohesion and prosocial attachments are also linked to delinquent behaviors (Tolan, 1988) and delinquency is associated with later risk taking (Hunter et al., 2014). Further, when a parent is incarcerated, a child is left to cope with feelings of embarrassment, worry, loneliness, confusion, and anger (Johnson and Easterling, 2012). Each of these aforementioned factors (e.g., diminished social support, increased economic strain, and social stigma) that are linked to parental incarceration may contribute to persistent stress, which, in turn, can negatively impact cognitive development (Craigie, 2011; Lee et al., 2013; Shonkoff et al., 2012) and mental health (Trivedi, 2006). Impaired cognition and increased risk of mental disorders are risk factors for drug use (Center for Behavioral Health Statistics and Quality, 2015) and sexual risk behavior (Erbelding et al., 2001; Erbelding et al., 2004; Mazzaferro et al., 2006). Hence, childhood abuse, delinquency, and poor mental health may be pathways through which parental incarceration may influence subsequent drug use and sexual risk behavior, but no known studies have empirically explored mediation by these factors among racial/ethnic groups.

The purpose of the current study was to use the National Longitudinal Study of Adolescent to Adult Health (Add Health), a large, nationally-representative longitudinal cohort, to examine the association between age at first parental incarceration and HIV-related drug use and sex risk in adolescence and adulthood. We examined differences by race/ethnicity and assessed factors that may result from parental incarceration as mediators of associations between parental incarceration and STI/HIV risk outcomes.

2. Materials and methods

2.1. Sample and study design

We used Add Health to conduct this secondary data analyses. Add Health's design has been described elsewhere (Carolina Population Center, 2016; Harris, 2005). In short, a nationally-representative sample of approximately 20,000 7th–12th graders completed an in-home interview during the 1994–95 school year (Wave I); a parent of the participant was also interviewed. The original cohort was re-interviewed in 2001–02 (Wave III; n = 15,197; ages 18–28) and 2007–08 (Wave IV; n = 15,701; ages 24–34). Our analytic sample consists of Add Health participants with valid sample weights at Waves I, III, and IV (N = 12,288) whom have data on parental incarceration (n = 11,884).

2.2. Measures

2.2.1. Parental incarceration—At Wave IV, participants were asked whether their biological mother or father had ever spent time in jail/prison, and their age when their parent was first incarcerated. We created a variable that captured the age at first parental incarceration (never; < 8; 8–17; ≥18 years old).

2.2.2. HIV-related drug and sex risk outcomes—At Wave I, participants reported the age at which they first used marijuana and cocaine, and we dichotomized this to indicate adolescent use as never versus ever used for each substance. Participants reported the total number of people with whom they had ever had a sexual relationship, and we created a dichotomous variable defining adolescent multiple sexual partners as ≥2 partners versus one or fewer partners. Participants were asked if they had ever been told by a doctor/nurse that they had chlamydia, gonorrhea, and/or trichomoniasis, and we created a dichotomous indicator of adolescent STI, defined as reporting at least one infection versus no infections. At Wave IV, participants reported how many days they used marijuana in the past 12 months, and we dichotomized this to define adulthood marijuana use as use on one day or more versus no use, given the association between any marijuana use and sexual risk behavior and STI in adulthood (van Gelder et al., 2011). We defined adulthood cocaine use as any reported cocaine use versus no reported use. Participants reported their number of sex partners in the past 12 months, and we defined adulthood multiple sexual partners as ≥2 partners versus one or fewer partners. Adulthood STI was dichotomous and defined as reporting that a doctor, nurse, or other health professional had told the participant he/she had chlamydia, gonorrhea, and/or trichomoniasis in the past 12 months versus no STI diagnoses.

2.2.3. Confounders: sociodemographics, parental binge drinking, and exposure to violence—We categorized race/ethnicity as Hispanic, white, black, and other (e.g., Asian, Native American). We calculated a continuous age variable at each Wave based on birth year and survey interview date. Gender was categorized as male and female. We measured two dichotomous indicators of functional poverty, defined as not having enough money to pay housing/utility bills in adolescence (reported by the parent at Wave I) and/or in emerging adulthood (reported by the participant at Wave III); the referent for each was answering no to each question. Education was reported at Wave IV and categorized as less than high school, high school, and greater than high school. We also controlled for dichotomous measures of parental binge drinking and exposure to violence in the year prior to the Wave I survey, including witnessing a shooting or stabbing or experience of being shot or stabbed; the referent for each was no exposure.

2.2.4. Mediating factors—When we detected significant associations between parental incarceration and adulthood drug and sex risk, we examined the degree to which the associations were mediated by childhood/adolescent factors hypothesized, based on the extant literature, to play a mediating role. Depressive symptoms at Waves I and III were assessed using a modified version of the Centers for Epidemiologic Studies Depression Scale (CES-D) (Radloff and Rae, 1979), on which participants reported the frequency they experienced depressive symptoms. As we have done in previous studies (Khan et al., 2009b), we included nine items from the original CES-D that were common to Waves I and III. We

summed the responses (range 0–27) and scores of ≥10 were considered indicative of depressive symptoms, based on the calibrated cut-point of the original CES-D. Anxiety symptoms at Wave I were measured by summing seven items used in previous studies (Wainright et al., 2004), in which higher scores indicate higher levels of anxiety (range 0–28). Suicidal ideation in the past year was dichotomous, defined as seriously thinking about committing suicide versus not, and was assessed at Waves I and III. At Wave I, participants reported the frequency of their engagement in seven delinquent behaviors, such as damaging property or theft (Aalsma et al., 2010); we summed dichotomous indicators of any engagement for each of the items and summed to create a score (range 0–7). History of childhood physical and/or sexual abuse between the ages of 8 to 18 were each dichotomous, with the referent being no exposure to each form of abuse, and were assessed retrospectively at Waves III and IV.

2.3. Analyses

We conducted analyses using SAS Version 9.4 (SAS Institute Inc., Cary, NC) and employed survey procedures. We used univariate analyses to describe the weighted prevalence or means of sample characteristics in the entire analytic sample and conducted bivariable analyses to examine characteristics by history of parental incarceration. We used logistic regression to estimate unadjusted and adjusted odds ratios and 95% confidence intervals for associations between age at first parental incarceration (< 8, 8–17, ≥18 years versus never, the referent) and outcomes. Adjusted models for adolescent outcomes included age, race/ethnicity, gender, adolescent poverty, parental binge drinking, and exposure to violence; models for adulthood outcomes additionally adjusted for poverty during young adulthood and adulthood education.

In all analyses, we reported associations separately for white, black, and Hispanic participants; we did not report estimates for the “other” racial/ethnic groups due to low power. We tested the significance of parental incarceration by race/ethnicity (black versus white, Hispanic versus white) product-interaction terms and indicated a statistically significant race difference if the interaction term p-value was ≤0.15; the significance level for interaction analyses was increased to avoid type II error, due to low power of tests of effect modification (Selvin, 1996).

Among populations in which we observed an association between parental incarceration and STI/HIV-related drug and sex risk outcomes, we explored whether variables predicted by parental incarceration were mediators of the parental incarceration-STI/HIV risk relationship following the causal steps approach (Baron and Kenny, 1986; Valeri and Vanderweele, 2013). If the associations between parental incarceration and STI/HIV-related drug and sex risk outcomes were attenuated on further adjustment for the behavioral intermediates, we assumed these variables mediated the association between parental incarceration and STI/HIV-related drug and sex risk.

3. Results

Of the 18,924 participants in the Wave I sample, 12,288 were located and reinterviewed during Waves III and IV and had complete sample weights and of these, 11,884 had data on

parental incarceration. Of respondents in the analytic sample, 50.5% were male and 49.5% were female (Table 1). The mean age was 16 years at Wave I; and 66.0% were white, 15.7% were black, 11.9% were Hispanic, and 6.4% represented other racial/ethnic groups. In the analytic sample, 16.9% (N = 2,037) had a history of parental incarceration; 5.5% first had a parent incarcerated before the age of 8 years, 4.2% when 8–17 years old, and 3.6% when 18 years old or older; 3.1% had a missing value for the age of the parent's first incarceration. Levels of marijuana, cocaine, multiple partnerships, and STI were 27.7%, 3.5%, 19.5%, ad 1.7%, respectively in adolescence (Wave I), and 23.2%, 20.7%, 24.9%, and 3.4%, respectively in adulthood (Wave IV).

3.1. Respondent characteristics by history of parental incarceration

Parental incarceration was much more commonly reported among participants who were black (26.0%) and Hispanic (19.5%) than those who were white (14.5%) or of other racial/ethnic background (Table 1; $p < 0.0001$). Participants who had a parent incarcerated were more likely than those with no parental incarceration to have reported family poverty during adolescence (unadjusted odds ratio (OR): 1.99, 95% CI: 1.69, 2.36) and had reduced odds of completing high school (OR: 0.58, 95% CI: 0.44, 0.76) and one-third the odds of greater than high school (OR: 0.33, 95% CI: 0.26, 0.42) (versus no high school education, the referent). Parental incarceration was associated with elevations in depressive symptoms during both adolescence (OR: 1.46, 95% CI: 1.24, 1.73) and young adulthood (OR: 1.64, 95% CI: 1.37, 1.98). Levels of anxiety during adolescence were higher among those with a history of parental incarceration (OR: 1.04, 95% CI: 1.02, 1.06). Parental incarceration was associated with increased odds of suicidal ideation during adolescence and young adulthood, as well as with increased odds of delinquency and childhood physical and sexual abuse.

3.2. Age at first incarceration and drug use in adolescence and adulthood

3.2.1. Adolescence—In the overall sample, parental incarceration versus no history of parental incarceration (the referent) was associated with adolescent marijuana use, with stronger associations observed among children who were < 8 years old (AOR: 2.55, 95% CI: 1.95, 3.34) than those who were 8–17 years old (AOR: 1.70, 95% CI: 1.29, 2.24; Table 2) when a parent first left for jail or prison. No racial/ethnic differences in associations were observed.

In the overall sample, those who had experienced a parental incarceration were approximately twice as likely to use cocaine in adolescence, though a significant association did not persist when adjusting for confounders for those less than 8 years of age at first parental incarceration (< 8 years AOR: 1.92, 95% CI: 0.91, 4.05; parental incarceration 8–17 years AOR: 2.03, 95% CI: 1.14, 3.61). The association between parental incarceration and adolescent cocaine use did not differ depending on race/ethnicity.

3.2.2. Adulthood—In the overall sample, the adjusted association between parental incarceration and adult marijuana use appeared to be somewhat stronger among those who were < 8 years old (AOR: 1.89, 95% CI: 1.47, 2.42) than those who were 8–17 years old (AOR: 1.47, 95% CI: 1.07, 2.01) or 18 years or older (AOR: 1.32, 95% CI: 0.96, 1.82) at the first parental incarceration (Table 2).

Adjusted models suggested the association between parental incarceration and adult cocaine use was moderate and significant for those who were < 8 years old (AOR: 1.86, 95% CI: 1.38, 2.50) and those who were 18 years or older (AOR: 1.66, 95% CI: 1.16, 2.37) at the time of the first parental incarceration and was not associated for those who were 8–17 years when a parent was first incarcerated (AOR: 1.35, 95% CI: 0.93, 1.97). The association between early parental incarceration (< 8 years old) and adulthood cocaine use risk was statistically significantly stronger among blacks (AOR: 4.41, 95% CI: 2.05, 9.48) and elevated, though not statistically significantly different, among Hispanics (AOR: 2.99, 95% CI: 1.46, 6.13) versus whites (AOR: 1.55, 95% CI: 1.10, 2.18).

3.3. Age at first parental incarceration and sex risk in adolescence and adulthood

3.3.1. Adolescence—In adjusted analyses, across all racial/ethnic groups, parental incarceration was modestly associated with adolescent multiple partnerships (parental incarceration < 8 years AOR: 1.72, 95% CI: 1.25, 2.37); parental incarceration 8–17 years AOR: 1.48, 95% CI: 1.10, 1.99; Table 2). Parental incarceration was associated with approximately twice the odds of adolescent STI, though in adjusted analyses, the associations were attenuated and were no longer significant. The exception was observed among blacks, for whom we observed very strong adjusted associations between parental incarceration < 8 years old and adolescent STI (AOR: 2.75, 95% CI: 1.26, 6.03).

3.3.2. Adulthood—In the overall sample, the unadjusted and adjusted associations between parental incarceration and adult multiple partnerships were stronger for those who were < 8 years old (AOR: 1.40, 95% CI: 1.07, 1.83) or older than 18 years old (AOR: 1.37, 95% CI: 1.03, 1.84) at the first parental incarceration than for those who were 8–17 years old (AOR: 0.81, 95% CI: 0.56, 1.16). The association between parental incarceration at age < 8 years old and multiple partnerships was significantly stronger among Hispanics (AOR: 2.50, 95% CI: 1.24, 5.05) than among whites (AOR: 1.17, 95% CI: 0.78, 1.76). The association between parental incarceration and adult STI likewise tended to be stronger for those who were < 8 years old (AOR: 1.84, 95% CI: 1.04, 3.28) and older than 18 years old (AOR: 2.09, 95% CI: 1.20, 3.65) at the first parental incarceration than for those who were 8–17 years old (AOR: 1.72, 95% CI: 0.95, 3.10). We observed significantly stronger associations between parental incarceration and adulthood STI among Hispanics (parental incarceration < 8 years old AOR: 5.85, 95% CI: 1.81, 18.88; parental incarceration 8–17 years old AOR: 7.01, 95% CI: 2.10, 23.40) than whites (parental incarceration < 8 years old AOR: 2.05, 95% CI: 0.94, 4.48; parental incarceration 8–17 years old AOR: 2.00, 95% CI: 0.85, 4.71). Parental incarceration was not associated with adult STI among blacks (Table 2).

3.4. Investigation of factors that mediate the association between early age of parental incarceration and adulthood HIV-related drug and sex risk outcomes

In white, black, and Hispanic participants, early parental incarceration before age 8 years old was associated with marijuana and cocaine use. Hence, in mediation analyses, we examined parental incarceration before age 8 years old versus no parental incarceration, the referent, and drug outcomes (those with a first parental incarceration when aged 8 years or older were omitted from the analysis; Table 3). In analyses adjusting for original confounding factors, the associations between early parental incarceration and adulthood marijuana use (AOR:

1.87, 95% CI: 1.46, 2.40 and cocaine use (AOR: 1.84, 95% CI: 1.36, 2.49) were attenuated upon adjustment for physical and sexual abuse (marijuana use AOR: 1.62, 95% CI: 1.21, 2.18; cocaine use AOR: 1.71, 95% CI: 1.24, 2.37), delinquency (marijuana use AOR: 1.64, 95% CI: 1.26, 2.14; cocaine use AOR: 1.57, 95% CI: 1.17, 2.12), and adolescent drug use (marijuana use AOR: 1.52, 95% CI: 1.10, 2.04; cocaine use AOR: 1.49, 1.10, 2.04). Mood factors appeared to be very weak mediators of parental incarceration-drug use associations. Associations when adjusting for all hypothesized mediators – abuse, delinquency, drug use, and mood factors – were strongly attenuated (marijuana use AOR: 1.27, 95% CI: 0.91, 1.78; cocaine use AOR: 1.33, 95% CI: 0.94, 1.89).

We observed strong significant associations between parental incarceration and sex risk outcomes among Hispanic participant in particular and hence evaluated mediators in this sub-group only (Table 3). Among Hispanic participants in analyses adjusting for original confounding factors, the associations between early parental incarceration and adulthood multiple partnerships (AOR: 2.52, 95% CI: 1.23, 5.18) and STI (AOR: 5.85, 95% CI: 1.93, 17.75) were most strongly attenuated upon adjustment for delinquency (multiple partnerships AOR: 2.37, 95% CI: 1.15, 4.88; STI AOR: 5.34, 95% CI: 2.17, 13.14) and adolescent and emerging adulthood drug use (multiple partnerships AOR: 2.01, 95% CI: 0.96, 4.19; STI AOR: 3.99, 95% CI: 1.45, 10.97). Mood factors appeared to be weak mediators of parental incarceration-sex risk associations. Associations when adjusting for all hypothesized mediators – delinquency, drug use, and mood factors – were strongly attenuated (multiple partnerships AOR: 2.05, 95% CI: 0.86, 4.91; STI AOR: 4.87, 95% CI: 1.78, 13.34). In fact, the association between early parental incarceration and sex risk outcomes somewhat strengthened when adjusting for physical and sexual abuse, suggesting these factors did not mediate and pointed to the likely confounding effects of these associations.

4. Discussion

In this nationally-representative cohort first interviewed in 1994–95 during adolescence and followed into adulthood, approximately one in six reported their mother and/or father had been incarcerated. Black and Hispanic youth disproportionately experienced parental incarceration, with over one quarter of black and one in five Hispanic versus 15% of white participants reporting parental incarceration. This is the first study, to our knowledge, to document the relationship between parental incarceration and substance use, sexual risk behavior, and STI from adolescence into adulthood. Parental incarceration at any age was moderately to strongly associated with STI/HIV risk outcomes. Across racial/ethnic groups, in analyses adjusting for socio-demographics, parental binge drinking, exposure to violence, and early parental incarceration remained significantly associated with increased risk of both drug and sex risk outcomes, with effects persisting into adulthood. We observed especially robust associations between parental incarceration and outcomes in non-white groups. For example, early parental incarceration was independently associated with four times the odds of cocaine use in adulthood among black participants and with twice the odds of multiple partnerships and six times the odds of STI in adulthood among Hispanic participants. Baseline levels of cocaine use in blacks and of STI in Hispanics are lower than in other groups, yet parental incarceration raised the risk of these considerably. Given these strong

associations, these findings indicate that children whose parents are incarcerated constitute a priority population for substance use and STI/HIV prevention, screening, and treatment.

Findings of mediation analyses suggest programs for children experiencing parental incarceration should aim to address delinquency and early initiation of drug use to prevent a trajectory of drug and sex risk that persists into adulthood. Findings from adjusted analyses also suggest parental incarceration not only serves as a marker of risk but also may contribute to the short and long-term STI/HIV risk of inmates' children. By highlighting potential unintended consequences of parental incarceration on the health of our nation's children and adolescents, the findings underscore the need for changes to criminal justice policies and programs that minimize disruption of families.

Surprisingly, despite numerous studies on the influence of parental incarceration on mental disorders (Craigie, 2011; Lee et al., 2013; Murray et al., 2012), there is comparatively limited research on the relationship between parental incarceration and substance use and sex risk. The current study supports evidence suggesting parental incarceration may influence substance use risk (Kopak and Smith-Ruiz, 2015; Roettger et al., 2011) and expands our understanding of the potential effects of parental incarceration by documenting the link to sexual risk behavior and STI. Our group has documented incarceration impacts the risk not only of those who have been incarcerated but also that of their primary committed partners, and findings suggest incarceration likely has influences on the STI/HIV risk of the larger social and sexual network (Khan et al., 2009a; Khan et al., 2011; Khan et al., 2008). The results of the current study corroborate our models and suggest indirect effects of incarceration extend to the children of those involved in the criminal justice system.

In general, the magnitude of parental incarceration's effects tended to be greater among those who were youngest when a parent was incarcerated. For example, among black children who were less than eight years old at the time of the first parental incarceration, 13% were using cocaine in adulthood compared with 7% of those whose parent was first incarcerated when they were between 8 and 17 years old, and 4% of those with no history of parental incarceration. These results support current models suggesting the heightened impact of stressors in early childhood, during the period of active brain development (Gunnar, 2003; Loman et al., 2010; Lupien et al., 2009).

That said, we also observed "acute" effects of parental incarceration in the adulthood period. Specifically, compared to those with no parental incarceration, those who reported experiencing parental incarceration for the first time after the age of 18 years had comparable elevations in adulthood cocaine use, multiple partnerships, and STI as those who experienced early parental incarceration prior to eight years of age. Hence, while early parental incarceration may adversely shape one's trajectory that results in risk behavior and infection downstream, it also may have acute effects on STI/HIV risk when it occurs later in adolescence/young adulthood, the developmental period when risk-taking and infection is initiated and peaks. Parents continue to provide a range of support throughout their child's life, particularly as children enter early adulthood (Cooney and Uhlenberg, 1992). Given the

protective nature of social support (Kawachi and Berkman, 2001), loss of that support may still confer risk to individuals who are older when their parent is first incarcerated.

There were several study limitations. A primary concern is that under- or over-control of confounders may have biased associations. We may be overestimating associations between parental incarceration and adulthood drug and sex risk, for example, by choosing not to control for adolescent drug and sex risk in adult models. However, we chose to omit these variables from our models to avoid over-controlling for them because we hypothesize that they mediate the relationship between parental incarceration and drug and sex risk in adulthood. On the other hand, it is possible we may be underestimating associations between parental incarceration and STI/HIV risk given our control for parental binge drinking and exposure to violence, which may share a common mechanism or pathway with parental incarceration. An additional study limitation is that we have limited data on the nature, timing, frequency, and duration of the parental incarceration. Future studies that follow children from families affected by incarceration over time will be able to collect more fine-grained information on the experience of having a parent leave for jail and prison and will be better able to tease apart the degree to which parental incarceration may lead to traumas (e.g., neglect, abuse) that serve as paths that mediate the relationship between parental incarceration and STI/HIV risk outcomes. Finally, though Add Health's sampling weights account for attrition during study follow-up, the study's school-based sampling design may have resulted in selection bias if those at greatest risk of experiencing parental incarceration and/or STI/HIV risk outcomes were never included in the original sampling frame.

Despite these study limitations, the current study provides support for the hypothesis that mass incarceration has deleterious effects on STI/HIV-related drug and sex risk not only for those directly impacted by jail and prison incarceration, as has been shown previously (Khan et al., 2013; Khan et al., 2009a; Khan et al., 2011; Khan et al., 2008), but also their children. The findings highlight the potential for particularly damaging effects for non-white children, given the disproportionate risk of parental incarceration and the particularly strong effects on drug use and sex risk. The findings highlight the need for more fine-grained data and mixed methods to elucidate the mechanisms through which parental incarceration works to negatively influence children's trajectories and research on interventions to reduce incarceration-related disruption of family ties. The results also should inform decarceration policy discussions so that unintended consequences of incarceration on health are considered when evaluating the costs of incarceration.

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Table 1

Sociodemographic Factors, Mental Health, and Childhood Traumatic Experiences by History of Parental Incarceration among Add Health Participants (N = 11,884).

Characteristic	N (weighted%) in Total Sample	No History of Parental Incarceration N = 9847 (weighted%)	History of Parental Incarceration N = 2037 (weighted%)	Odds Ratio (95% CI) for Association with Parental Incarceration	P (χ^2 test)
Socio-demographics					
Gender					0.5092
Male	5418 (50.5)	4530 (82.9)	1149 (16.5)	Ref	
Female	6466 (49.5)	5317 (83.5)	888 (17.1)	0.96 (0.85, 1.08)	
Race					< 0.0001
White	6397 (66.0)	5436 (85.5)	961 (14.5)	Ref	
Black	2501 (15.7)	1894 (74.0)	607 (26.0)	2.08 (1.65, 2.61)	
Hispanic	1867 (11.9)	1527 (80.5)	340 (19.5)	1.43 (1.06, 1.94)	
Other	1112 (6.4)	985 (86.4)	127 (13.6)	0.93 (0.64, 1.35)	
Years of Age at Wave I (mean, SE)	15.9 (0.12)	16.0 (0.12)	15.8 (0.14)	0.96 (0.91, 1.01)	0.1009
Years of Age at Wave IV (mean, SE)	28.8 (0.12)	28.8 (0.12)	28.7 (0.14)	0.97 (0.92, 1.02)	0.2052
Concern about Ability to Pay Bills during Adolescence					< 0.0001
No	8295 (83.2)	7025 (85.5)	1270 (14.5)	Ref	
Yes	1775 (16.8)	1345 (74.7)	430 (25.3)	1.99 (1.69, 2.36)	
Education					< 0.0001
Less than High School	861 (8.4)	572 (67.3)	289 (32.7)	Ref	
Completed High School	1857 (17.2)	1460 (78.1)	397 (21.9)	0.58 (0.44, 0.76)	
Greater than High School	9166 (74.4)	7815 (86.1)	1351 (13.9)	0.33 (0.26, 0.42)	
Mental Health and Other Childhood Traumatic Experiences					
Depressive Symptoms during Adolescence					< 0.0001
No	9628 (83.1)	8063 (84.2)	1565 (15.8)	Ref	
Yes	2214 (16.9)	1748 (78.4)	466 (21.6)	1.46 (1.24, 1.73)	
Depressive Symptoms during Young Adulthood					< 0.0001
No	10233 (86.1)	8579 (84.2)	1654 (15.8)	Ref	
Yes	1634 (13.9)	1253 (76.5)	381 (23.5)	1.64 (1.37, 1.98)	
Anxiety Score during Adolescence (mean, SE)	5.4 (0.06)	5.3 (0.06)	5.8 (0.13)	1.04 (1.02, 1.06)	0.0002

Characteristic	N (weighted%) in Total Sample	No History of Parental Incarceration N = 9847 (weighted%)	History of Parental Incarceration N = 2037 (weighted%)	Odds Ratio (95% CI) for Association with Parental Incarceration	P (χ^2 test)
Suicide Ideation during Adolescence					0.0007
No	10196 (86.5)	8526 (87.2)	1670 (83.3)	Ref	
Yes	1600 (13.5)	1245 (12.8)	355 (16.7)	1.37 (1.14, 1.64)	
Suicide Ideation during Young Adulthood					0.0060
No	11019 (93.4)	9190 (93.8)	1829 (91.5)	Ref	
Yes	718 (6.6)	540 (6.2)	178 (8.5)	1.40 (1.10, 1.78)	
Delinquency Score during Adolescence (mean, SE)	1.6 (0.03)	1.5 (0.03)	2.1 (0.07)	1.22 (1.16, 1.27)	< 0.0001
Physical Abuse					< 0.0001
No	9823 (87.8)	8323 (85.0)	1500 (15.0)	Ref	
Yes	1422 (12.2)	1007 (70.2)	415 (29.8)	2.40 (2.02, 2.84)	
Sexual Abuse					< 0.0001
No	10485 (91.8)	8821 (84.3)	1664 (15.7)	Ref	
Yes	949 (8.2)	667 (71.0)	282 (29.0)	2.20 (1.72, 2.81)	
Parental Binge Drinking					< 0.0001
No	9041 (87.1)	7622 (84.9)	1419 (15.1)	Ref	
Yes	1230 (12.9)	915 (75.3)	315 (26.7)	1.84 (1.54, 2.20)	
Witnessed Violence					< 0.0001
No	10429 (89.1)	8764 (84.4)	1665 (15.6)	Ref	
Yes	1393 (10.9)	1028 (73.1)	365 (26.9)	1.99 (1.62, 2.43)	

*Prevalence of parental incarceration is 16.9%.

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Table 2

Associations between Age at First Parental Incarceration and Drug Use and Sex Risk[a] in Adolescence and Adulthood.

	Adolescence			Adulthood		
	% with Outcome	Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)[b]	% with Outcome	Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)[c]
Total Sample (n = 11,884)						
Marijuana						
No Incarcerated Parent	25.5	Ref	Ref	21.7	Ref	Ref
Parent Incarcerated < 8YO	43.2	2.22 (1.73, 2.86)	2.55 (1.95, 3.34)	36.4	2.06 (1.64, 2.59)	1.89 (1.47, 2.42)
Parent Incarcerated 8–17 YO	35.9	1.64 (1.26, 2.12)	1.70 (1.29, 2.24)	29.1	1.48 (1.10, 1.98)	1.47 (1.07, 2.01)
Parent Incarcerated 18+YO	–	–	–	28.4	1.43 (1.06, 1.93)	1.32 (0.96, 1.82)
Cocaine						
No Incarcerated Parent	3.1	Ref	Ref	19.6	Ref	Ref
Parent Incarcerated < 8YO	5.9	1.98 (1.15, 3.41)	1.92 (0.91, 4.05)	30.3	1.78 (1.39, 2.29)	1.86 (1.38, 2.50)
Parent Incarcerated 8–17 YO	6.2	2.09 (1.29, 3.38)	2.03 (1.14, 3.61)	23.9	1.29 (0.94, 1.78)	1.35 (0.93, 1.97)
Parent Incarcerated 18+YO	–	–	–	27.3	1.54 (1.10, 2.16)	1.66 (1.16, 2.37)
Multiple Partners						
No Incarcerated Parent	18.3	Ref	Ref	24.1	Ref	Ref
Parent Incarcerated < 8YO	27.3	1.68 (1.27, 2.21)	1.72 (1.25, 2.37)	33.0	1.55 (1.23, 1.96)	1.40 (1.07, 1.83)
Parent Incarcerated 8–17 YO	25.8	1.55 (1.18, 2.03)	1.48 (1.10, 1.99)	23.1	0.95 (0.70, 1.29)	0.81 (0.56, 1.16)
Parent Incarcerated 18+YO	–	–	–	31.5	1.45 (1.12, 1.86)	1.37 (1.03, 1.84)
STI						
No Incarcerated Parent	1.5	Ref	Ref	2.9	Ref	Ref
Parent Incarcerated < 8YO	2.9	1.99 (1.21, 3.28)	1.74 (0.92, 3.30)	6.6	2.33 (1.47, 3.71)	1.84 (1.04, 3.28)
Parent Incarcerated 8–17 YO	2.8	1.90 (1.02, 3.55)	0.93 (0.43, 2.00)	7.8	2.77 (1.78, 4.30)	1.72 (0.95, 3.10)
Parent Incarcerated 18+YO				5.3	1.84 (1.06, 3.21)	2.09 (1.20, 3.65)
White (n = 6397)						
Marijuana						
No Incarcerated Parent	26.2	Ref	Ref	23.2	Ref	Ref
Parent Incarcerated < 8YO	41.0	1.96 (1.40, 2.74)	2.53 (1.81, 3.55)	38.2	2.04 (1.50, 2.78)	1.72 (1.22, 2.43)
Parent Incarcerated 8–17 YO	37.1	1.67 (1.10, 2.52)	1.71 (1.17, 2.51)	34.8	1.76 (1.19, 2.60)	1.44 (0.95, 2.19)
Parent Incarcerated 18+YO	–	–	–	28.4	1.31 (0.86, 2.00)	1.19 (0.77, 1.85)

	Adolescence			Adulthood		
	% with Outcome	Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)[b]	% with Outcome	Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)[c]
Cocaine						
No Incarcerated Parent	3.4	Ref	Ref	23.2	Ref	Ref
Parent Incarcerated < 8YO	5.4	1.60 (0.97, 2.66)	1.36 (0.66, 2.82)	36.6	1.91 (1.40, 2.62)	1.55 (1.10, 2.18)
Parent Incarcerated 8–17 YO	7.6	2.34 (1.27, 4.33)	1.98 (0.95, 4.10)	31.8	1.55 (0.98, 2.44)	1.19 (0.71, 1.98)
Parent Incarcerated 18+YO	–	–	–	35.8	1.85 (1.23, 2.78)	1.74 (1.14, 2.66)
Multiple Partners						
No Incarcerated Parent	16.9	Ref	Ref	21.9	Ref	Ref
Parent Incarcerated < 8YO	23.9	1.54 (1.04, 2.27)	1.97 (1.31, 2.96)	27.9	1.38 (0.99, 1.92)	1.17 (0.78, 1.76)
Parent Incarcerated 8–17 YO	24.6	1.60 (1.02, 2.52)	1.59 (0.98, 2.59)	19.8	0.88 (0.51, 1.51)	0.84 (0.47, 1.52)
Parent Incarcerated 18+YO	–	–	–	29.4	1.48 (1.07, 2.06)	1.42 (0.98, 2.04)
STI						
No Incarcerated Parent	0.9	Ref	Ref	1.9	Ref	Ref
Parent Incarcerated < 8YO	0.9	0.98 (0.32, 3.08)	1.04 (0.23, 4.69)	3.7	1.97 (0.95, 4.10)	2.05 (0.94, 4.48)
Parent Incarcerated 8–17 YO	1.1	1.27 (0.20, 7.88)	Unable to converge	3.8	2.05 (0.92, 4.56)	2.00 (0.85, 4.71)
Parent Incarcerated 18+YO	–	–	–	3.4	1.85 (0.68, 5.03)	2.03 (0.81, 5.11)
Black (n = 2501)						
Marijuana						
No Incarcerated Parent	22.0	Ref	Ref	17.8	Ref	Ref
Parent Incarcerated < 8YO	42.6	2.63 (1.68, 4.11)	2.30 (1.26, 4.19)	36.8	2.69 (1.79, 4.04)	2.53 (1.62, 3.95)
Parent Incarcerated 8–17 YO	28.9	1.44 (0.96, 2.17)	1.42 (0.93, 2.17)	24.6	1.50 (0.86, 2.63)	1.73 (0.83, 3.58)
Parent Incarcerated 18+YO	–	–	–	21.2	1.24 (0.68, 2.28)	1.28 (0.69, 2.37)
Cocaine						
No Incarcerated Parent	1.5	Ref	Ref	4.1	Ref	Ref
Parent Incarcerated < 8YO	2.6	1.83 (0.55, 6.09)	2.13 (0.58, 7.82)	13.2	3.57 (1.85, 6.87) *	4.41 (2.05, 9.48) *
Parent Incarcerated 8–17 YO	0.8	0.57 (0.08, 3.82)	0.69 (0.09, 5.23)	6.5	1.62 (0.70, 3.72)	2.35 (0.90, 6.14)
Parent Incarcerated 18+YO	–	–	–	2.6	0.63 (0.13, 2.94)	1.04 (0.18, 5.93)
Multiple Partners						
No Incarcerated Parent	28.9	Ref	Ref	35.6	Ref	Ref
Parent Incarcerated < 8YO	36.6	1.41 (0.90, 2.23)	1.25 (0.70, 2.23)	40.0	1.21 (0.79, 1.85)	1.49 (0.90, 2.48)

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	Adolescence			Adulthood		
	% with Outcome	Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)[b]	% with Outcome	Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)[c]
Parent Incarcerated 8–17 YO	23.1	0.74 (0.49, 1.12)*	0.96 (0.63, 1.47)	33.8	0.93 (0.56, 1.54)	0.99 (0.56, 1.76)
Parent Incarcerated 18+YO	–	–	–	50.9	1.88 (1.24, 2.86)	1.81 (1.10, 2.96)
STI						
No Incarcerated Parent	4.3	Ref	Ref	8.4	Ref	Ref
Parent Incarcerated < 8YO	10.1	2.53 (1.47, 4.34)*	2.75 (1.26, 6.03)	12.2	1.52 (0.86, 2.69)	1.22 (0.52, 2.85)
Parent Incarcerated 8–17 YO	6.6	1.59 (0.85, 2.97)	1.15 (0.51, 2.56)	14.4	1.84 (1.06, 3.19)	0.98 (0.52, 1.85)*
Parent Incarcerated 18+YO	–	–	–	15.1	1.95 (0.82, 4.67)	2.39 (1.00, 5.71)
Hispanic (n = 1867)						
Marijuana						
No Incarcerated Parent	26.2	Ref	Ref	18.1	Ref	Ref
Parent Incarcerated < 8YO	56.2	3.61 (2.13, 6.11)*	3.55 (1.93, 6.56)	26.9	1.66 (0.87, 3.17)	1.55 (0.78, 3.08)
Parent Incarcerated 8–17 YO	38.0	1.73 (1.02, 2.95)	1.77 (0.94, 3.36)	17.9	0.99 (0.34, 2.87)	1.08 (0.35, 3.35)
Parent Incarcerated 18+YO	–	–	–	34.2	2.34 (1.16, 4.75)	1.76 (0.79, 3.89)
Cocaine						
No Incarcerated Parent	3.3	Ref	Ref	17.0	Ref	Ref
Parent Incarcerated < 8YO	10.8	3.57 (1.13, 11.23)	2.89 (0.44, 18.97)	32.2	2.32 (1.34, 4.00)	2.99 (1.46, 6.13)
Parent Incarcerated 8–17 YO	7.3	2.34 (0.68, 8.03)	2.33 (0.62, 8.74)	25.5	1.67 (0.91, 3.07)	1.47 (0.81, 2.69)
Parent Incarcerated 18+YO	–	–	–	22.3	1.41 (0.64, 3.11)	1.48 (0.57, 3.85)
Multiple Partners						
No Incarcerated Parent	15.5	Ref	Ref	24.4	Ref	Ref
Parent Incarcerated < 8YO	26.5	1.96 (1.05, 3.68)	2.14 (0.97, 4.73)	40.9	2.14 (1.17, 3.92)	2.50 (1.24, 5.05)*
Parent Incarcerated 8–17 YO	30.2	2.36 (1.30, 4.28)	2.32 (1.03, 5.22)	14.9	0.54 (0.24, 1.21)	0.46 (0.18, 1.19)
Parent Incarcerated 18+YO	–	–	–	19.6	0.75 (0.29, 1.97)	0.56 (0.19, 1.66)*
STI						
No Incarcerated Parent	1.5	Ref	Ref	2.3	Ref	Ref
Parent Incarcerated < 8YO	0.0	N/A	Unable to converge	10.6	5.10 (1.81, 14.33)*	5.85 (1.81, 18.88)*
Parent Incarcerated 8–17 YO	2.2	1.42 (0.21, 9.68)	1.24 (0.18, 8.85)*	10.5	5.05 (1.71, 14.89)	7.01 (2.10, 23.40)*
Parent Incarcerated 18+YO	–	–	–	2.8	1.23 (0.21, 7.23)	1.68 (0.23, 12.34)

[*] Parental incarceration by race interaction term p value < 0.15; suggests association between parental incarceration and outcome differs significantly from whites (referent population).

[a] During adolescence, marijuana, cocaine, multiple partnerships, and STI are any reported history; during adulthood, marijuana, multiple partnerships and STI are during the past 12 months, and cocaine are any reported history.

[b] Adjusted for age, gender, poverty in adolescence, parental binge drinking in adolescence, and witnessed violence in adolescence; analyses in the total sample additionally adjusted for race.

[c] Adjusted for age race, gender, poverty in adolescence and young adulthood, parental binge drinking in adolescence, and witnessed violence in adolescence, and adulthood educational attainment; analyses in the total sample additionally adjusted for race.

Table 3

Exploration of Mediation of the Relationship between Early Parental Incarceration (< 8 Years versus No Parental Incarceration) and Adulthood STI/HIV-related Drug Use and Sex Risk[a]

	Crude Odds Ratio (OR) 95% Confidence Interval (CI)	Adjusted OR (aOR): Adjusted for Confounders Only[b]	Direct Effects: Adjustment for Hypothesized Mediators						
			aOR Further Adjusted for Physical and/or Sexual Abuse after Age 8	aOR Further Adjusted for Depression during Adolescent and/or Emerging Adulthood	aOR Further Adjusted for Adolescent Anxiety	aOR Further Adjusted for Suicidal Ideation during Adolescent and/or Emerging Adulthood	aOR Further Adjusted for Delinquency	aOR Further Adjusted for Drug Use during Adolescence (for Drug Outcomes) and Emerging Adulthood (Sex Risk Outcomes)	aOR Further Adjusted for All[c] Mediators
Marijuana	2.06 (1.64, 2.59)	1.87 (1.46, 2.40)	1.62 (1.21, 2.18)	1.80 (1.39, 2.31)	1.83 (1.42, 2.35)	1.85 (1.43, 2.39)	1.64 (1.26, 2.14)	1.52 (1.14, 2.00)	1.27 (0.91, 1.78)
Cocaine	1.78 (1.39, 2.29)	1.84 (1.36, 2.49)	1.71 (1.24, 2.37)	1.80 (1.34, 2.41)	1.79 (1.33, 2.42)	1.73 (1.27, 2.37)	1.57 (1.17, 2.12)	1.49 (1.10, 2.04)	1.33 (0.94, 1.89)
Multiple Partners	2.14 (1.17, 3.92)	2.52 (1.23, 5.18)	2.58 (1.24, 5.38)	2.38 (1.15, 4.92)	2.49 (1.19, 5.22)	2.33 (1.05, 5.15)	2.37 (1.15, 4.88)	2.01 (0.96, 4.19)	2.05 (0.86, 4.91)
STI	5.10 (1.81, 14.33)	5.85 (1.93, 17.75)	8.10 (2.39, 27.40)	5.53 (1.87, 16.37)	5.63 (1.84, 17.20)	5.83 (2.01, 16.96)	5.34 (2.17, 13.14)	3.99 (1.45, 10.97)	4.87 (1.78, 13.34)

[a] Among all participants for drug outcomes and among Hispanics only for adulthood sex risk outcomes (N = 10,957 for drug use outcomes; N = 1689 for sex risk outcomes).

[b] Adjusted for age, race, gender, witnessed violence during adolescence, parental binge drinking during adolescence, poverty during adolescence and adulthood education.

[c] Includes all mediators except physical and sexual abuse for sex risk outcomes given these factors did not attenuate the association upon adjustment.