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Original Research

Impact of parental incarceration on neonatal outcomes and newborn home environments: a case–control study

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ABSTRACT

Objectives: Parental incarceration (PI) is a prevalent adverse childhood experience (ACE) that has been linked to numerous social, emotional, and health problems in childhood and adulthood. A growing body of research has emphasized the importance of the timing of parent's incarceration on developmental outcomes.

Study design: The present study uses case–control matching to examine the impact of recent PI on newborn health and home safety outcomes.

Methods: Neonatal health and newborn sleep and home safety data, including rates of premature birth, low birth weight (LBW), neonatal intensive care unit admittance, breastfeeding initiation, safe sleep, and home environment (e.g. working smoke alarm, proper firearm storage), were collected from 108 women who completed the Virginia Pregnancy Risk Assessment Monitoring survey. Half of these women ($n = 54$) had experienced the incarceration of themselves or their partner during the previous 12 months. Participants were matched by age, race, income, and the education level with those of 54 women who completed the survey and who had not experienced incarceration in the previous year.

Results: Controlling for nicotine and alcohol consumption during pregnancy and other stressors, path analyses show that the women who experienced incarceration of themselves or their husband/partner were significantly less likely to deliver an LBW infant and more likely to live in a home with a loaded firearm in the home. No other significant differences emerged between the two matched groups among neonatal health or newborn sleep and home safety outcomes.

Conclusions: This result is considered from a public health perspective, as PI is an ACE which can be impacted by policy, particularly policies that promote practices that healthcare workers can use in correctional and other environments to encourage healthy pregnancies and home environments for newborns.

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Introduction

Adverse childhood experiences (ACEs) have been consistently linked to a host of health problems in adulthood.[1] ACEs encompass traumatic experiences related to emotional, physical, and sexual abuse during childhood, as well as familial and socioenvironmental experiences related to parental drug use, poverty, and domestic violence. One prevalent and common ACE is the incarceration of a parent. About half of approximately 2 million US prisoners are parents of one or more child who is younger than 18 years.[2] It is estimated that 2.7 million US children experience the collateral consequences of parental separation because of incarceration.

A burgeoning research literature indicates that children of incarcerated parents are exposed to a host of risk factors. They possess a heightened chance to develop poor social and emotional outcomes including aggressive and antisocial behavior, depression, and diminished educational attainment.[3] Increasingly, evidence suggests that youth with a history of parental incarceration (PI) also show declining physical health and have increased incidence of chronic conditions.[4]

The effects of PI should be considered from a developmental perspective. Infants and young children who have experienced PI show attachment disruptions,[5] school age children show social and emotional difficulties, and adolescents and young adults show behavioral and conduct problems.[3] Little research, however, has examined the impact of PI at the start of life. One study found that women who were either incarcerated or had a partner who was incarcerated during their pregnancy experienced additional hardships and this in turn decreased the likelihood for these women to engage in positive perinatal health behaviors important to infant and early childhood development.[6] A study in Australia found that children younger than 5 years whose mothers had been incarcerated experienced more contact with child protective services and higher mortality rates than a comparison group.[7] The present study extends this work by examining the association between recent parental (maternal or paternal) criminal justice involvement on birth weight, premature birth, hospital stays, and risks in the newborn home environment in a sample of US children.

The high rates of poor birth outcomes in the US are a serious concern. Every year, about 11% of infants are born premature (before 37 weeks gestation), and about 8% are born low birth weight (LBW, weighing less than 5 pounds, 8 ounces).[8] Prematurity and LBW can have serious health and cognitive implications. Health issues specific to premature birth include impaired lung function, hearing loss, intestinal problems, increased susceptibility to infection, and dental problems. Similarly, LBW is associated with an increased risk of respiratory distress syndrome, bleeding in the brain, heart problems, intestinal issues, diabetes, and obesity.

Little is known about how PI affects breastfeeding rates. According the National Immunization Survey, the rate of breastfeeding initiation for the total US population is 75%.[9] Breastfeeding is associated with numerous health benefits for both infants and mothers. For infants, the positive outcomes of breastfeeding include reduced risks of hospitalization for infections and increased psychological benefits, such as increased social-emotional understanding.[10] Mothers who breastfeed their infants also reap physical and psychological benefits, including decreased postpartum blood loss and decreased rates of postpartum depression. Women who breastfeed further experience reduced risks of hypertension, cardiovascular disease, diabetes, breast, and ovarian cancer.

Similarly, little is known about environmental risks that exist in the home environment for newborns and young children whose parents have experienced PI. One study on children in Denmark found an increased risk of child mortality among male children whose parents had been incarcerated.[11] There are several practices which may help reduce the incidence of infant mortality, including safe sleep position (e.g. on the back), car seat use, working smoke alarms, and proper storage of firearms in the home. However, little is known about the home environments of newborns whose parent has recently experienced incarceration.

This study examines the impact of mother or partner incarceration during pregnancy on neonatal outcomes and home environments using case-controlled matching (CCM). CCM designs are commonly implemented in the field of public health because they eliminate effects for potential confounding variables, strengthen internal validity of the measures, and lessen selection bias.[12] We expect the impact of PI as an ACE will be associated with poorer neonatal outcomes including higher rates of prematurity and LBW, neonatal intensive care unit (NICU) stays, and lower rates of breastfeeding. We also expect PI to be associated with riskier newborn home environments.

Methods

With permission from the Virginia Department of Health (VDH) and the human subjects review board of the authors' university, raw deidentified data from the VDH's Pregnancy Risk Assessment Monitoring System (VA PRAMS), phase 6, from three waves of data collection from 2009 to 2012 were analyzed. For each wave, we identified respondents who reported that either they or their partner had been incarcerated in the previous 12 months; this resulted in 21 cases for both waves 1 and 2 (2009–2010 and 2010–2011, respectively) and 12 cases for wave 3 (2011–2012). In total, 54 respondents over these three waves of data collection indicated that either they or their husband/partner had been incarcerated in the previous 12 months. For ease of communication, we will refer to this group as the criminal justice–involved (CJI) group. By wave, the cases were matched by using the SPSS Case–Control Matching option on age, race, education level, and income to a woman who gave birth in the same data collection wave who did not indicate that either she or her husband/partner had been incarcerated in the previous 12 months (we will refer to this as the non-CJI group). All cases were matched on maternal age, and 90% of cases were matched on at least two of the three remaining matching variables. The resultant database included 108 cases with half having indicated a recent incarceration of themselves or their husband/partner (CJI group) and the other had not

Table 1 – Matched and non-matched variables, neonatal outcomes, and newborn sleep and home safety.

	CJI group ($N = 54$)	Non-CJI group ($N = 54$)
Matched variables		
Race		
% African American	44.4%	42.6%
Maternal age in years		
<17	3.7%	3.7%
18–19	7.4%	7.4%
20–24	42.6%	42.6%
25–29	22.2%	22.2%
30–34	11.1%	11.1%
35–39	11.1%	11.1%
>40	1.9%	1.9%
Maternal education		
<8 years	1.9%	1.9%
9–11 years	31.5%	24.1%
12 years	33.3%	40.7%
13–15 years	24.1%	24.1%
>16 years	9.3%	9.3%
Income is $US		
<$10,000	55.6%	42.6%
$10,000–$14,999	7.4%	7.4%
$15,000–$19,999	5.6%	3.7%
$20,000–$24,999	3.7%	11.1%
$25,000–$34,999	7.4%	9.3%
$35,000–$49,999	7.4%	7.4%
>$50,000	13.0%	16.7%
Non-matched variables		
Self-reported recent life stress**	16.14 (2.61)[a]	14.42 (2.07)[a]
Experienced physical abuse during pregnancy	14.8%	7.4%
Self-reported social support	7.18 (1.16)[a]	7.09 (1.38)[a]
Percent carrying no health insurance	29.6%	37.0%
Percent receiving WIC	68.5%	61.1%
APNCU index	3.00 (1.17)[a]	3.19 (0.94)[a]
Health risk behaviors during pregnancy		
Smoked during pregnancy**	38.9%	16.7%
Drank alcohol during pregnancy*	14.8%	1.9%
Neonatal outcomes		
Low birth weight**	57.4%	83.3%
Premature birth	38.9%	44.4%
NICU stay	32.3%	40.7%
Breastfeeding initiation[t]	48.1%	64.8%
Newborn sleep and home safety		
Newborn always sleeps on their back	58.3%	55.1%
Newborn always rides in a car seat	98.0%	98.0%
Newborn home has working smoke alarm	98.0%	96.0%
Newborn home has loaded firearms*	12.2%	2.0%

NICU, neonatal intensive care unit; APNCU, adequacy of prenatal care utilization; CJI, criminal justice involved. WIC is the special supplemental nutrition program for women, infants, and children.
[t] $P < 0.10$; * $P < 0.05$; ** $P < 0.01$.
[a] Mean scores with standard deviations in parentheses.

experienced a recent incarceration (non-CJI group). Demographic data for both groups are presented in Table 1. None of the newborns in the resultant database were reported to be born with a birth defect, and all but one of the newborns were alive at the time of PRAMS data collection. The one infant mortality was reported in the CJI group (the reason for infant mortality was not listed).

As part of their participation in the VA PRAMS, respondents provided information about their demographic characteristics (e.g. age, education) and answered 13 questions about their experience of stressors in the previous 12 months. This set of questions contained the grouping item about recent incarceration (i.e. 'My husband or partner or I went to jail'). The remaining 12 items assessing other recent life stressors (e.g. 'I had a lot of bills I could not pay') were summed to create a total recent life stress score.

Additional VA PRAMS questions assess adequacy of prenatal care (using the Adequacy of Prenatal Care Utilization Index[13]), amount of perceived social support (four binary yes/no items assessing the types of help available, e.g. 'During my pregnancy I had someone to loan me $50'), health risk behaviors during pregnancy (nicotine and alcohol consumption), neonatal outcomes, including birth weight, length of gestation, NICU stay, participants' breastfeeding initiation, newborn sleep (e.g. mother's report of newborn sleeping on their back), and home safety (three items assessing newborn frequency of car seat use, presence of working fire alarm in the home, and presence of a loaded firearm in the home). More information about the VA PRAMS can be found on the VDH website.[14]

Results

Although the two groups were nearly identical on several key demographic variables, the groups differed in some important ways. The CJI group reported significantly more recent life stress, $t\ (102) = 3.74$, $P = 0.000$, $d = 0.73$. The CJI group was also more likely to report nicotine (38.9% vs 16.7%) and alcohol (14.8% vs 1.9%) consumption during pregnancy.

As reported in Table 1, there were no significant differences between the two groups in the incidence of premature birth and NICU admittance after birth. Compared with the non-CJI group, the CJI group was less likely to deliver a LBW newborn, $X^2 = 8.70$, $P = 0.006$, and they tended to be less likely to initiate breastfeeding immediately after birth, $X^2 = 2.92$, $P = 0.088$. The CJI group was also more likely to report that the newborn home contained loaded firearms, $X^2 = 3.95$, $P = 0.047$.

Preliminary findings were more fully examined with a path model using Amos in SPSS 24. The path model provides a simultaneous regression while also accounting for covariance among related dependent variables (e.g. neonatal outcomes; sleep and home safety items). The model depicted in Fig. 1 was tested. For ease of presentation, error terms and correlated error terms were omitted from the figure. Because the two groups differed in their prenatal health behaviors (nicotine and alcohol consumption during pregnancy) and recent life stress, these variables were included as control variables. In addition to the control variables, the model depicted the group (CJI and non-CJI), predicting to the four neonatal outcomes and the four newborn sleep and home safety items. The model fits the data well ($X^2 = 18.17$, $P = 0.314$; root mean square error of approximation (RMSEA) = 0.036; comparative fit index

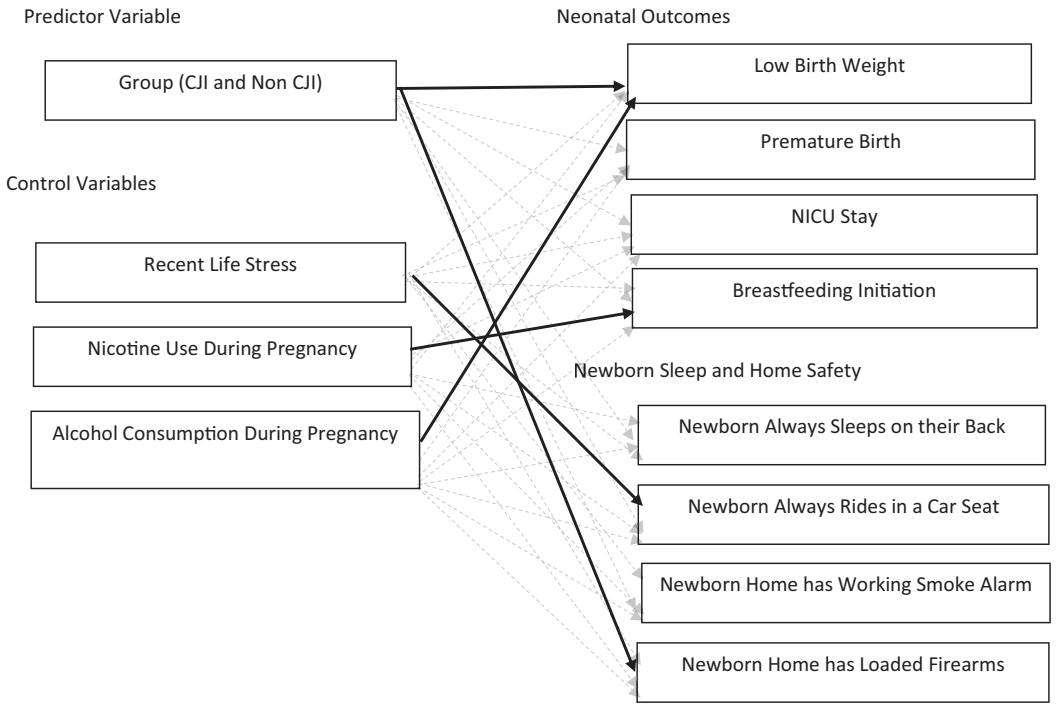


Fig. 1 – Basic path model testing the predictor and control variables on neonatal and newborn sleep and home safety outcomes. Significant paths are indicated with bold. For ease of presentation, error terms and correlated error terms are not depicted. Data fit the model well according to traditional fit indexes, $X^2 = 18.17$, $p = 0.314$; RMSEA = 0.036; CFI = 0.982; NFI = 0.907. CJI, criminal justice involved; NICU, neonatal intensive care unit. RMSEA, root mean square error of approximation; NFI, normed fit index; CFI, comparative fit index.

(CFI) = 0.982; normed fit index (NFI) = 0.907). The path from the group was significant to LBW, $B = -0.330$, $P < 0.01$, and to the item assessing the presence of loaded firearms in the home, $B = 0.114$, $P = 0.045$. These findings confirm the preliminary analyses showing that criminal justice involvement was associated with decreased likelihood of delivering an LBW infant and an increased likelihood of having a loaded firearm in the home.

Additional findings warrant mention. Specifically, the association between the group and breastfeeding initiation was non-significant, but the path from nicotine use during pregnancy to breastfeeding initiation was significant, $B = -0.383$, $P < 0.01$. Alcohol consumption during pregnancy was associated with LBW, $B = 0.320$, $P = 0.037$. Finally, recent life stress was associated with decreased car seat safety, $B = -0.016$, $P = 0.007$.

Discussion

Scant previous research has examined the impact of PI as an ACE during the earliest stages of development. Our results contribute important new insights into associations between PI and neonatal health and the newborn home environment. PI was associated with two of the outcomes assessed: (i) LBW, in the opposite direction than as predicted; and (ii) the presence of a loaded firearm in the home. These findings are explored more detail in the following section.

The findings regarding incidence of LBW were contrary to what was expected. They should be interpreted cautiously, however, because it is unclear if the mother or her husband/partner was incarcerated. If a mother was incarcerated during her pregnancy, the period of incarceration may have served as a period of forced withdrawal from illicit substances or other teratogens and stressors, which may negatively impact fetal development.[15] If the mother's husband/partner was incarcerated, the mother may have been separated from a potentially abusive spouse. Without knowing more about who was incarcerated, the timing of the incarceration, and the reason for the incarceration, it is difficult to further interpret this finding.

Relative to the overall sample, the rate of LBW among the CJI group was much higher. The rates found in the present study were higher than the reported rates in Virginia of 8.0–8.4% during that same time period.[16] Although the PRAMS over samples for LBW, the incidence of LBW in the high-risk sample used in these analyses is alarming. When compared with women with similar demographics, these results suggest that PI does not pose additional risk for LBW, and may, for reasons that are not clear, be associated with lower incidence of LBW.

Previous research has been mixed when looking at birth outcomes for pregnant incarcerated women: some studies show that infants born to incarcerated mothers are more likely to be born of LBW or prematurely, whereas other studies show no differences in comparison to community women

from similar backgrounds.[17] Our results extend this work to consider parental criminal justice experience more generally and provide additional outcomes. Our results also highlight the importance of matching and controlling for key demographic characteristics. Case–control matching is a powerful statistical tool that illustrates important differences between the two groups. Our results also differ from previous work in this area: although we did not find differences between our two groups in the quality of prenatal care received, PI was associated with prenatal use of nicotine and alcohol.

In the present study, PI was associated with an increased risk for the presence of loaded firearms in the newborn home. Loaded firearms in the home pose a serious risk for child and infant mortality.[18] Approximately 7% of US children live in a home with an improperly secured firearm.[19] Our results suggest that this rate is higher among new mothers with recent criminal justice experience. This study is the first to demonstrate such an association and has clear public health implications. Our results extend previous research suggesting that healthcare workers should sensitively discuss firearm storage with all new parents and that this may be an effective strategy to decrease firearm-related injuries and fatalities in children.[20] It may be especially important among new mothers who have been recently incarcerated or have experienced the incarceration of their husband/partner.

Women who experienced the recent incarceration of themselves or their partner around the time of their pregnancy were more likely to consume alcohol and nicotine during their pregnancy, and they tended to be less likely to initiate breastfeeding than demographically similar women who did not experience this stressor. However, on further examination, differences in breastfeeding initiation may be due to differences in health-related behaviors such as smoking. Although PI was not associated with breastfeeding initiation, the rates of breastfeeding in this sample were lower than the reported rates across the commonwealth of Virginia during this same time period. Overall, in Virginia, during this time, breastfeeding initiation ranged from 84% to 89% among all births but was at 72.9% for black women.[21] The rates for the current sample were at 48.1% for women who had experienced a recent criminal justice involvement and 64.8% among their counterparts. Nicotine consumption during pregnancy might help explain the relation between PI and breastfeeding initiation. In addition to smoking, breastfeeding initiation might be lower in the group impacted by incarceration because they may perceive or receive less support for breastfeeding from their partner and others (e.g. hospital staff); they may also feel stigmatized. Taken together, these results suggest that healthcare workers in correctional facilities and elsewhere should offer support and resources on nicotine cessation, alcohol consumption, and breastfeeding to help encourage healthy habits during pregnancy.

Limitations of the present study suggest several avenues for future research. First, the questionnaire did not provide much information about the experience of incarceration. It is unclear if the woman was incarcerated or her partner, how long the incarceration lasted, or if it was ongoing. This is a limitation of using archival data to address issues related to incarceration. Future research should be purposefully designed to address questions related to pregnancy and childbirth within the context of incarceration. Second, data were obtained exclusively from women in Virginia; therefore, the sample is not nationally representative. It would be important to replicate this finding using PRAMS data from other states. Third, this study relied on retrospective reporting of experiences before, during, and after pregnancy. It would be important for future research to obtain additional reports and corroboration of birth outcomes (e.g. review medical records), experiences during pregnancy, and newborn sleep and home safety.

Overall, this study provides new statistical data examining the impact of a significant and prevalent ACE on neonatal and newborn home safety outcomes. PI is an ACE shown to be uniquely associated with poor health outcomes in adults. This is the first study to examine the impact of this ACE at such a young age. The data show that rates of LBW are high in this sample, and rates of breastfeeding initiation are low in comparison to the statewide rates reported during the same time frame. However, in this matched sample, PI did not confer risk for neonatal outcomes. PI was only associated with prenatal health risk behaviors and improper firearm storage. The US ranks among the highest in rates of incarceration worldwide. Healthcare workers and those providing prenatal care to high-risk populations in correctional settings and elsewhere should consider a range of familial demographic risks, including the recent history of maternal or partner incarceration, and provide support for decreasing prenatal health risk behaviors and increasing newborn home safety, specifically safe firearm storage.

Author statements

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Ethical approval

Ethical approval was obtained from the College of William & Mary, Protection of Human Subjects Research Committee, reference number: PHSC-2014-04-02-9512-dhdall. The project was also approved by the Virginia Department of Health through their expedited review process, Study #40199.

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Competing interests

The authors have no conflicts of interest to disclose.

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