

The Impact of Parental Incarceration on the Physical and Mental Health of Young Adults



WHAT'S KNOWN ON THIS SUBJECT: Although a growing body of literature suggests links between parental incarceration and negative child outcomes, research that uses representative US samples and focuses on health outcomes is limited.



WHAT THIS STUDY ADDS: Using a nationally representative US sample, we examined the association between parental incarceration and young adult mental and physical health outcomes. Results suggest childhood exposure to parental incarceration is associated with increased risk of long-term health problems.

abstract



OBJECTIVES: We investigated the relationship between parental incarceration history and young adult physical and mental health outcomes using Wave 1 and Wave 4 data from the National Longitudinal Study of Adolescent Health.

METHODS: Dependent variables included self-reported fair/poor health and health diagnoses. The independent variable was parental incarceration history. Cross-tabulations and logistic regression models were run.

RESULTS: Positive, significant associations were found between parental incarceration and 8 of 16 health problems (depression, posttraumatic stress disorder, anxiety, cholesterol, asthma, migraines, HIV/AIDS, and fair/poor health) in adjusted logistic regression models. Those who reported paternal incarceration had increased odds of 8 mental and physical health problems, whereas those who reported maternal incarceration had increased odds of depression. For paternal incarceration, with the exception of HIV/AIDS, larger associations were found for mental health (odds ratios range 1.43–1.72) as compared with physical health (odds ratios range 1.26–1.31) problems. The association between paternal incarceration and HIV/AIDS should be interpreted with caution because of the low sample prevalence of HIV/AIDS.

CONCLUSIONS: This study suggests exposure to parental incarceration in childhood is associated with health problems in young adulthood. Extant literature suggests underlying mechanisms that link parental incarceration history to poor outcomes in offspring may include the lack of safe, stable, nurturing relationships and exposure to violence. To prevent poor health in offspring of the incarcerated, additional studies are needed to (1) confirm the aforementioned associations and (2) assess whether adverse experiences and violence exposure in childhood mediate the relationship between parental incarceration history and offspring health problems. *Pediatrics* 2013;131:e1188–e1195

AUTHORS: Rosalyn D. Lee, PhD, MPH, MA, Xiangming Fang, PhD, and Feijun Luo, PhD

Division of Violence Prevention, National Center for Injury Prevention and Control, Centers for Disease Control and Prevention, Atlanta, Georgia

KEY WORDS

parental incarceration, prison, adverse childhood experiences, depression, anxiety, young adults, self-reported health

ABBREVIATIONS

Add Health—National Longitudinal Study of Adolescent Health
CI—confidence interval

PI—parental incarceration

PTSD—posttraumatic stress disorder

This article represents original research conducted as part of routine duties of employment at the Centers for Disease Control and Prevention. The research was undertaken in accordance with ethical standards and the order of authorship was approved by all authors.

Rosalyn D. Lee: Dr Lee conceptualized and designed the study, drafted the initial manuscript, participated in revision of the analyses, revised the original manuscript, and approved the final manuscript as submitted.

Xiangming Fang: Dr Fang conceptualized and designed the study, carried out the initial analyses, reviewed and revised the manuscript, and approved the final manuscript as submitted.

Feijun Luo: Dr Luo designed and carried out the revised analyses, critically reviewed and revised the manuscript, and approved the final manuscript as submitted.

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Dr Fang is currently affiliated with International Center for Applied Economics and Policy, College of Economics and Management, China Agricultural University, Beijing, China.

Dr Luo is currently with the Division of Analysis, Research, and Practice Integration, National Center for Injury Prevention and Control, Centers for Disease Control and Prevention, Atlanta, Georgia.

www.pediatrics.org/cgi/doi/10.1542/peds.2012-0627

doi:10.1542/peds.2012-0627

Accepted for publication Dec 28, 2012

Address correspondence to Xiangming Fang, PhD, International Center for Applied Economics and Policy, College of Economics and Management, China Agricultural University, 17 Qinghua East Road, Haidian, Beijing 10094, China. E-mail: xmfang@cau.edu.cn

(Continued on last page)

With more than 2.3 million individuals in the correctional system, the United States has the highest incarceration rate in the world (750 per 100 000 or 1 in every 100 adults).^{1–3} According to the Bureau of Justice Statistics at midyear 2007, 52% of state and 63% of federal inmates reported being parents to an estimated 1.7 million children (2.3% of US children younger than 18).⁴ Given that most prisoners are eventually released, a large population of former prisoners exists⁵ and many of them are parents. Because data on children exposed to parental incarceration (PI) and parents with incarceration histories is not routinely tracked by federal, state or local agencies,^{6,7} there is a dearth of information on lifetime burden and impact. Wildeman,⁸ however, suggests “parental imprisonment has emerged as a novel, and distinctly American, ‘childhood risk’” concentrated among blacks and the low educated and estimates the comparative risk of exposure for blacks and whites born in 1990 to be 25% vs 4%.

A considerable body of research describes the physical and mental health consequences of incarceration on individuals.^{9–16} Increased risk of health problems in former prisoners may be attributable to circumstances before and during incarceration, as high proportions of individuals with criminal justice contact come from backgrounds of economic and social disadvantage, exhibit high levels of risk behaviors, experience comorbid mental health problems, and are exposed to infectious diseases during incarceration. Additionally, this population faces challenges with respect to accessing needed health care services before, during, and after incarceration. Although studies may not have consistently or fully accounted for possible confounders, extant research that has adjusted for sociodemographic differences and other risk factors indicates

that jail and prison inmates have a higher burden of most chronic medical conditions in comparison with the general public.^{17–20}

A growing, interdisciplinary body of literature likewise suggests childhood exposure to PI is associated with an array of negative outcomes. PI has been linked to increased risk of economic disadvantage, residential mobility, primary caregiver disruptions, exposure to nonbiological parent figures, and stigma.^{7,21–23} Also, although limited research exists on links between PI and child maltreatment, one study of children investigated for maltreatment indicated exposure to PI increased children’s risk for experiencing violence in the home, multiple types of violence, and elevated posttraumatic stress symptoms.²⁴ Such experiences in the absence of safe, stable, and nurturing relationships and environments can increase vulnerability during key developmental periods. The literature on adverse childhood experiences and child maltreatment has indicated that such exposures increase risk of short- and long-term physical and mental health problems.^{25–32} Although studies on adverse childhood experiences have demonstrated a clear connection between accumulation of adversities and health outcomes,^{25–27} they tend to rely on an approximate measure of PI (ie, incarcerated household member) and rarely focus on PI-specific risk.

The extant health related literature on PI impact on offspring suggests PI is a marker for risks in the child’s environment (eg, substance abuse; intimate partner violence)³³ and that offspring outcomes may be both directly influenced by PI and influenced by the conditions of high adversity that PI-affected children live in before, during, and after a parent’s incarceration.³⁴ PI may directly or indirectly influence chronic, severe, or prolonged exposure to stress. According to

Shonkoff and Garner, such stress in the absence of protective factors is toxic. Exposure of the body’s stress response system to the aforementioned types of stimuli can disrupt brain circuitry and metabolic systems during sensitive developmental periods, resulting in anatomic changes and/or physiologic dysregulations that subsequently influence development of impairments and chronic stress-related physical and mental illnesses.³⁵ In addition to impaired stress response ability, other factors, such as stigma associated with incarceration-related health conditions (eg, HIV/AIDS, substance abuse, depression) and violence victimization (eg, intimate partner violence, incarceration related sexual assault), may affect a previously incarcerated parent’s ability to manage health care needs for themselves and their children. Furthermore, health risk may be directly imparted to offspring via infectious diseases acquired or exacerbated during a parent’s incarceration. Rosen et al. suggests that although literature on long-term implications of incarceration on former prisoners is not well developed, public health implications based on available evidence is troubling.³⁶ Likewise, on the basis of what we know about the experiences of children of the incarcerated, we suspect the long-term public health implications of PI on offspring could also be significant.

Most available literature on mental disorders in the offspring of the incarcerated focuses on behavioral disorders in children and adolescents^{37,38}; although several studies include young adults.^{39,40,41} Published research on young adult mental health, however, with a rare exception,⁴² has relied on small, nonrepresentative, non-US samples.³⁸ With respect to physical health, we are aware of one recent study that indicates an association between PI and obesity.⁴³ The current study thus aims to extend the literature by determining the

comparative prevalence of physical and mental health conditions in a nationally representative sample of young adults who were and were not exposed in childhood to parental incarceration. We hypothesize rates of health problems will be higher for individuals with a history of PI. Additionally, although there are more incarcerated fathers than mothers, mothers are more frequently primary caregivers before incarceration; whereas fathers are less likely to live in the same residence as their children immediately before incarceration.⁴⁴ Furthermore, some researchers suggest the effects of PI may be more negative for mothers with incarceration history as compared with fathers with such history.^{7,45} We thus assess prevalence of health conditions in offspring by the gender of the incarcerated parent. We hypothesize the prevalence of problems will be higher for individuals who report maternal as compared with paternal incarceration history. The second aim of this study was to assess whether a parent's incarceration history is predictive of health status in adult children, after controlling for factors known to affect the prevalence of health outcomes. PI may directly and indirectly influence the health of children (via pathways associated with adversity and violence exposure). As a first step in investigating this relationship, we examine whether there is a relationship between PI history and health outcomes. Additionally, based on research that suggests the impact of incarceration is worse for women and their children,^{7,45} we hypothesize that maternal incarceration will be more strongly associated with poor health outcomes in young adult children than paternal incarceration.

METHODS

Participants

The current study used data from the National Longitudinal Study of Adolescent

Health (Add Health), a 4-wave longitudinal study following a nationally representative probability sample of adolescents in grades 7 through 12 in the 1994–1995 school year.⁴⁶ The first 3 waves of Add Health data were collected from April to December 1995, from April to August 1996, and from August 2001 to April 2002. The fourth wave of data was collected in 2007 and 2008. The full sample for Wave 4 included 15 701 or 80.3% of the eligible participants from Wave 1. The response rates for Waves 1, 2, 3, and 4 were 79.0%, 88.6%, 77.4%, and 80.3%, respectively. The mean ages of participants during the 4 waves of data collection were 15.7 years, 16.2 years, 22.0 years, and 28.8 years, respectively.

The current study was based on 14 800 participants who were interviewed during Wave 1 and Wave 4 and have a sampling weight. Of the 15 701 participants who participated in both Wave 1 and Wave 4 interviews, 14 800 participants have a sampling weight at Wave 4 interview that could be used to compute population estimates. For data analysis, data describing participants' sociodemographic characteristics from Wave 1 of the Add Health study were combined with Wave 4 self-reported health outcomes and PI history.

Measures

Parental Incarceration

The present analysis focused on lifetime history of maternal and paternal incarceration. Respondents were asked whether their parents (including parent figures) had “ever spent time in jail or prison.” Given that a small subgroup of individuals reported nonbiological parent figures and the subgroup prevalence rates of PI were low, we focused the analysis on biological parents. Father incarceration and mother incarceration dummy variables and a 4-category PI variable (ie, neither parent, father only, mother only, and both parents) were constructed for different models.

Health Conditions

In Wave 4 of the Add Health survey, respondents were asked “Has a doctor, nurse, or other health care provider ever told you that you have or had” (1) cancer, (2) high blood cholesterol, (3) diabetes, (4) heart disease, (5) asthma, (6) migraines, (7) depression, (8) anxiety, (9) epilepsy, (10) attention-deficit/hyperactivity disorder, (11) HIV/AIDS, and (12) hepatitis C. Responses were yes or no. Respondents were also asked “In general how is your health?” Response categories ranged from excellent to poor. We constructed a dichotomous variable, comparing fair/poor to excellent/very good/good. Last, we included a dichotomous indicator of obesity.

Sociodemographic Factors

Several sociodemographic factors collected during Wave 1 of Add Health that are commonly known to be associated in the literature with health outcomes were included to control for potential confounders. These sociodemographic factors included race/ethnicity (white, Hispanic, black, and other), gender, grade (to capture cohort effects), whether the respondent was foreign born, 3 forms of child maltreatment (emotional abuse, physical abuse, and sexual abuse), family structure (2 biological parents, 2 parents: 1 biological, single parent, or other), mother and father educational attainment, mother and father alcoholism, and family receipt of public assistance.

Statistical Analysis

Descriptive analyses were conducted to obtain the prevalence of each condition. Next, cross-tabulations with χ^2 tests were run to determine whether parental incarceration history was associated with the health conditions. Last, a series of logistic regression models were run for each health condition with PI and potential confounders. Model 1 included a dummy variable for “Father

Incarceration” (reference group: father never incarcerated). Model 2 included a dummy variable for “Mother Incarceration” (reference group: mother never incarcerated). Model 3 included the categorical PI variable (reference group: neither parent incarcerated). All analyses were performed using Stata SE version 10 (Stata Corp, College Station, TX), which allows for the control of survey design effects of individuals clustered within schools and stratification by geographic region. Poststratification weights were applied to generate nationally representative estimates.

RESULTS

The prevalence of any PI was 12.5% with the 95% confidence interval (CI) of 11.3% to 13.8%. The distribution of incarceration status by category was: neither parent (87.5%, 95% CI: 86.2%–88.7%), father only (9.9%, 95% CI: 8.9%–10.9%), mother only (1.7%, 95% CI: 1.4%–2.0%), and both parents (0.9%, 95% CI: 0.7%–1.2%). A significant association was found between race and PI. Black and Hispanic individuals had the highest prevalence of PI, 20.6% and 14.8%, compared with 11.9% for white individuals and 11.6% for those classified as other. Pairwise comparison indicated the black and white prevalence rates were significantly different. As indicated by Table 1, there were relatively low rates of chronic physical health problems (eg, cancer, diabetes, and heart disease were <5%) as compared with mental health–related problems (eg, depression and anxiety were 13.0% to 16.4%) reported by these young adults. The most prevalent physical health conditions were obesity (39.5%), asthma (15.1%), migraine (14.8%), and hypertension (11.1%). Fewer than 10% of the sample rated their overall health as fair/poor.

As shown in Table 2, bivariate analyses indicate PI was significantly associated with 8 of the 16 health conditions

(heart disease, asthma, migraines, depression, anxiety, posttraumatic stress disorder [PTSD], HIV/AIDS, and fair/poor health). With the exception of heart disease and HIV/AIDS, individuals who reported neither parent had an incarceration history had the lowest prevalence rates of these 8 health conditions. Individuals who reported father incarceration only had the highest prevalence rates of 3 of the 8 health conditions (heart disease, HIV/AIDS, and fair/poor health); whereas individuals who reported mother incarceration only were highest on 2 conditions (depression and anxiety) and individuals who reported incarceration of both parents were highest on 3 conditions (asthma, migraine, and PTSD).

Results of individual logistic regression models by parent gender, models 1 and 2, which adjusted for confounders (see Table 3) are as follows: father incarceration was significantly associated with 5 health conditions (asthma, migraine, depression, PTSD, and anxiety) and mother incarceration was significantly associated with 1 health condition (depression). In model 3, which included the categorical PI variable, father incarceration only was significantly associated with 8 health conditions (high cholesterol, asthma, migraine, depression, PTSD, anxiety, HIV/AIDS, fair/poor health) with odds ratios ranging from 1.26 to 4.05; mother incarceration only was associated with 1 condition (depression); and incarceration of both parents was associated with 1 condition (obesity). For those who reported father incarceration only, their odds of having migraines, high cholesterol, asthma, and fair/poor health were approximately 1.3 times ($P \leq .05$) the odds for those who reported no PI. Likewise their odds of HIV/AIDs and mental health problems were 4 times ($P \leq .05$) and 1.4 to 1.7 times ($P \leq .01$ or $P \leq .001$) the odds for those who reported no PI.

TABLE 1 Distribution of Health Conditions Within the Full Sample: National Longitudinal Study of Adolescent Health, 2007–2008

Health Condition	Prevalence, % ^a	95% CI
Cancer	1.29	1.02–1.56
High cholesterol	8.04	7.33–8.76
Hypertension	11.07	10.25–11.90
Diabetes	2.56	2.19–2.93
Heart disease	0.88	0.55–1.21
Asthma	15.12	14.26–15.98
Migraine	14.83	13.94–15.73
Depression	16.38	15.21–17.56
PTSD	2.97	2.55–3.39
Anxiety	13.03	11.97–14.09
Epilepsy	1.34	1.05–1.63
ADHD	5.70	4.95–6.46
HIV/AIDS	0.09	0.03–0.16
Hepatitis	0.22	0.11–0.33
Obesity	39.53	37.89–41.17
Fair/Poor health	9.29	8.39–10.19

ADHD, attention-deficit/hyperactivity disorder.

^a Weighted percentage; sample sizes varied from 14 611 to 14 800 due to missing data; age range was 24–34 y.

Alternatively, for those who reported mother incarceration only, their odds of depression were 1.6 times ($P \leq .05$) the odds for those who reported no PI. We also tested whether the associations of health conditions with PI varied by race. We added to model 3 the interaction terms between PI and race and did not find significant interactions in general. So we chose not to include those interaction terms in model.

DISCUSSION

A growing, interdisciplinary body of literature suggests that childhood risk of PI is associated with an array of negative health, social, and economic outcomes for children. These risks are likely influenced by the disadvantage, disruptions, and instability that often characterize the childhood experience of children of the incarcerated. Such factors can place children at risk for neglect, victimization, risky behavior, and inadequate access to health care or role models for maintaining health. On the basis of what we know about the experiences of children of the incarcerated, we suspected the long-term public health implications of PI on the

TABLE 2 Cross-tabulation of Health Condition by Parental Incarceration History Status: National Longitudinal Study of Adolescent Health, 2007–2008

Health Condition	Parental Incarceration History			
	Neither, % ^a	Father Only, % ^a	Mother Only, % ^a	Both, % ^a
Cancer	1.22	1.37	2.06	0.93
High cholesterol	7.87	9.57	8.07	3.56
Hypertension	10.43	13.25	10.58	14.37
Diabetes	2.30	2.84	1.89	2.91
Heart disease*	0.77	1.56	0.16	1.27
Asthma**	14.14	18.27	17.63	22.55
Migraine**	14.08	19.17	17.64	20.23
Depression***	14.91	22.35	26.01	24.36
PTSD***	2.46	5.29	5.75	6.37
Anxiety***	12.14	17.44	18.22	12.90
Epilepsy	1.25	1.98	0.95	1.14
ADHD	5.62	5.63	5.50	9.63
HIV/AIDS*	0.07	0.37	0.06	0.00
Hepatitis	0.24	0.11	0.00	1.64
Obesity	38.95	41.25	42.68	31.32
Fair/Poor health***	8.32	13.47	12.21	9.80

Significance level of the association between a health condition and parental incarceration history: * $P \leq .05$, ** $P \leq .01$, *** $P \leq .001$. ADHD, attention-deficit/hyperactivity disorder.

^a Weighted percentage in each parental incarceration history status; sample sizes varied from 13 566 to 13 738 due to missing data; age range was 24–34 y.

offspring of individuals with incarceration histories could mirror the experiences of their parents whom research has shown experience higher rates of

morbidity and mortality than the general population. The findings of this study partly supported our hypotheses. We hypothesized

that individuals with a history of PI would have higher prevalence of health problems. Our findings support this in general, but were counterintuitive with respect to the relative burden of maternal and paternal incarceration on the health of offspring. On the basis of a growing body of literature on the impact of maternal incarceration, we hypothesized a negative relationship between PI and health would more strongly be found among those reporting maternal as compared with paternal incarceration history. Paternal incarceration, however, was found associated with a greater number of health outcomes than maternal incarceration. Also, paternal incarceration was found to be associated with both physical and mental health problems, whereas maternal incarceration was found associated only with poor mental health.

For paternal incarceration, with the exception of HIV/AIDS, larger associations

TABLE 3 Logistic Regression Analyses of the Association between Parental Incarceration History and Young Adult Health Conditions: National Longitudinal Study of Adolescent Health, 2007–2008

Health Condition	Model 1		Model 2		Model 3	
	Father Incarceration ^a		Mother Incarceration ^b		Incarceration of Both Parents ^c	
	Adjusted Odds Ratio, 95% CI		Adjusted Odds Ratio, 95% CI		Adjusted Odds Ratio, 95% CI	
Cancer	0.93 (0.49–1.77)		0.97 (0.41–2.28)		0.98 (0.50–1.92)	
High cholesterol	1.22 (0.95–1.56)		0.95 (0.58–1.55)		1.31* (1.01–1.69)	
Hypertension	1.23 (0.98–1.54)		1.25 (0.91–1.73)		1.22 (0.96–1.55)	
Diabetes	0.99 (0.63–1.56)		1.09 (0.63–1.92)		0.98 (0.63–1.53)	
Heart disease	1.64 (0.79–3.40)		0.40 (0.13–1.22)		1.62 (0.77–3.39)	
Asthma	1.30* (1.06–1.60)		1.19 (0.85–1.65)		1.30* (1.05–1.62)	
Migraine	1.28* (1.05–1.56)		1.23 (0.83–1.81)		1.26* (1.03–1.54)	
Depression	1.43*** (1.15–1.77)		1.39* (1.02–1.89)		1.43** (1.15–1.78)	
PTSD	1.68** (1.16–2.42)		1.46 (0.86–2.48)		1.72** (1.21–2.45)	
Anxiety	1.44*** (1.19–1.76)		1.28 (0.87–1.89)		1.51*** (1.23–1.85)	
Epilepsy	1.37 (0.75–2.51)		1.18 (0.51–2.73)		1.43 (0.78–2.64)	
ADHD	0.98 (0.73–1.32)		1.11 (0.68–1.82)		0.93 (0.67–1.28)	
HIV/AIDS	3.49 (0.84–14.4)		0.05 (0.00–1.31)		4.05* (1.03–15.88)	
Hepatitis	0.59 (0.16–2.21)		1.32 (0.19–9.37)		0.25 (0.05–1.36)	
Obesity	0.90 (0.78–1.04)		0.85 (0.67–1.09)		0.94 (0.81–1.10)	
Fair/Poor health	1.23 (1.00–1.51)		0.87 (0.58–1.31)		1.28* (1.03–1.59)	
					0.95 (0.48–1.87)	
					0.10 (0.00–4.19)	
					NA	
					2.71 (0.36–20.72)	
					0.56* (0.35–0.91)	
					0.74 (0.38–1.44)	

ADHD, attention-deficit/hyperactivity disorder; NA, not available because there is no variation in a health condition for a specific parental incarceration category.

Sample sizes varied from 12 136 to 14 523 due to missing data; age range was 24–34 y.

Models controlled for race, grade, gender, family structure, foreign born, father and mother education, father and mother alcoholism, maltreatment (physical, emotional, sexual), and family receipt of public assistance.

^a Reference group: no father incarceration.

^b Reference group: no mother incarceration.

^c Reference group: neither father nor mother incarceration.

* $P \leq .05$.

** $P \leq .01$.

*** $P \leq .001$.

were found for mental health as compared with physical health outcomes. Caution should be taken in understanding the significance of the finding related to HIV/AIDS, given its low overall sample prevalence and wide CI. If this is a true association, it may be related to paternal HIV/AIDS status and other risk factors related to father absence. Given the high correlation between HIV/AIDS and incarceration, increased odds of HIV/AIDS in offspring could come from perinatal transmission. However, social factors may also explain this relationship. Although separation of parents and children is by definition expected during incarceration, these parents are at increased risk for parental absence before and after incarceration. Parental absence may increase odds of low parental monitoring and supervision, which in turn may increase the likelihood of risky behaviors associated with HIV/AIDS (eg, substance abuse, early sexuality). Additionally, father absence and the presence of father surrogates have been shown to place children at increased risk of all forms of maltreatment, including sexual abuse by nonrelated males.^{47–50} Maltreatment in turn has been linked to behaviors and experiences (eg, mental health and substance abuse issues, early sexuality, risky sexual behaviors) that increase risk of contracting HIV/AIDS.^{51–53} Further studies are needed to (1) confirm the potential association between PI and offspring HIV/AIDS status and (2) identify underlying mechanisms.

Maltreatment, although controlled in the present analysis, may play a strong explanatory role for many of the health outcomes. Thus, our next step will be to explore other potential explanatory or mediational factors, such as maltreatment. Links between PI, child maltreatment, and peer victimization may also explain the stronger associations between PI and mental health outcomes as compared with physical

health outcomes. Given that maltreatment and peer victimization have been linked to poor mental health, it is plausible that the association between PI and health outcomes may be partially explained by these factors. Thus, findings of the current study suggest the need for additional research on mechanisms linking PI to both physical and mental health outcomes to identify whether PI is linked to childhood adversity and violence-related factors and to identify modifiable factors that can prevent or reduce the likelihood of poor mental and physical health.

The current study contributes to a growing literature on the long-term collateral damage of incarceration on children of individuals with a history of incarceration. The findings should, however, be discussed within the context of limitations. First, PI, measured retrospectively, may be underestimated because of recall bias, lack of awareness, or stigma. Some individuals may not have knowledge of, whereas others, owing to social desirability, may not disclose a parent's history. Second, accounting for timing of health problem onset was not possible, as most outcomes examined in this study were not measured in earlier waves of Add Health.

Additionally, there were a number of issues related to prevalence rates that may have influenced the results. First, the low prevalence of maternal incarceration in this sample could lead to lack of power in detecting significant associations between maternal incarceration and health problems. This may explain why more associations were found between paternal, as compared with maternal, incarceration history and health problems, although we hypothesized otherwise. Second, the prevalence of several diseases, such as cancer, heart disease, and hepatitis are low for young adults, thus there may not have been enough power to detect significant associations between PI and

these outcomes. This, however, does not rule out the influence of PI history on such outcomes, as significant associations may emerge in later developmental stages when prevalence rates are typically higher. Last, prevalence rates may have been underestimated because of racial disparities in access and use of health care, which may affect reports of diagnosed health problems among racial minorities.

With respect to survey items, although well known, some measures lack specificity, which may result in misspecified prevalence rates. For example, in this young population, the expected prevalence of heart disease would be higher if the definition of heart disease included arrhythmia, but lower if it specified coronary heart disease. Also, detailed information on the construction of obesity was not available. With respect to PI measures, information on parental offenses was not available and it was not possible to disentangle jail and prison exposures. Logistic regression models adjusted for confounders, however, several factors, including childhood exposure to intimate partner violence were not available for inclusion. Furthermore, because key variables were measured at wave 4 and models could not include all potential confounders, causality cannot be inferred.

Even in the context of these limitations, findings suggest the impact of incarceration on health may be transmitted to offspring. Given the large numbers of parents and children affected by incarceration in the United States, additional research is needed to specify the impact of PI, the influence of incarceration-related characteristics (eg, frequency, lifetime duration), and underlying mechanisms that may influence development of long-term health problems. Such knowledge can inform prevention and intervention efforts, which may help reduce the overall burden of incarceration on health.

ACKNOWLEDGMENTS

This research uses data from Add Health, a program project directed by Kathleen Mullan Harris and designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris at the University of North Carolina at Chapel Hill,

and funded by grant P01-HD31921 from the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development, with cooperative funding from 23 other federal agencies and foundations. Special acknowledgment is due Ronald R. Rindfuss and Barbara

Entwisle for assistance in the original design. Information on how to obtain the Add Health data files is available on the Add Health Web site (<http://www.cpc.unc.edu/addhealth>). No direct support was received from grant P01-HD31921 for this analysis.

REFERENCES

1. Walmsley R. World prison population list. 8th ed. London, UK: International Centre for Prison Studies, King's College London; 2009. Available at: www.prisonstudies.org/info/downloads/wppi-8th_41.pdf. Accessed December 15, 2011
2. Glaze LE. *Correctional Population in the U.S., 2010. Publication NCJ: 236319*. Washington, DC: US Department of Justice, Office of Justice Programs, Bureau of Justice Statistics; 2011
3. Pew Center on the States. One in 100: behind bars in America. Available at: www.pewcenteronthestates.org. Accessed December 15, 2011
4. Glaze LE, Maruschak LM. *Parents in Prison and Their Minor Children. August 2008 (Revised March 2010). Publication NCJ 1222984*. Washington, DC: Bureau of Justice Statistics, Office of Justice Programs; 2008
5. Bonczar TP. *Prevalence of Imprisonment in the U.S. population, 1974-2001. Publication NCJ 197976*. Washington, DC: US Department of Justice, Office of Justice Programs, Bureau of Justice Statistics; 2003
6. Phillips SD, Dettlaff AJ, Baldwin MJ. An exploratory study of the range of implications of families' criminal justice system involvement in child welfare cases. *Child Youth Serv Rev*. 2010;32:544–550
7. Dallaire DH. Children with incarcerated mothers: developmental outcomes, special challenges and recommendations. *J Appl Dev Psychol*. 2007;28:15–24
8. Wildeman C. Parental imprisonment, the prison boom, and the concentration of childhood disadvantage. *Demography*. 2009;46(2):265–280
9. Golembeski C, Fullilove R. Criminal (in)justice in the city and its associated health consequences. *Am J Public Health*. 2005;95(10):1701–1706
10. Maruschak LM, Beck AJ. *Medical Problems of Inmates, 1997. Publication NCJ 181644*. Washington, DC: Bureau of Justice Statistics, Office of Justice Programs; 1997
11. Freudenberg N. Jails, prisons, and the health of urban populations: a review of the impact of the correctional system on community health. *J Urban Health*. 2001;78(2):214–235
12. Binswanger IA, Krueger PM, Steiner JF. Prevalence of chronic medical conditions among jail and prison inmates in the USA compared with the general population. *J Epidemiol Community Health*. 2009;63(11):912–919
13. Massoglia M. Incarceration as exposure: the prison, infectious disease, and other stress-related illnesses. *J Health Soc Behav*. 2008;49(1):56–71
14. Schnittker J, John A. Enduring stigma: the long-term effects of incarceration on health. *J Health Soc Behav*. 2007;48(2):115–130
15. Binswanger IA, Stern MF, Deyo RA, et al. Release from prison—a high risk of death for former inmates. *N Engl J Med*. 2007;356(2):157–165
16. Wilper AP, Woolhandler S, Boyd JW, et al. The health and health care of US prisoners: results of a nationwide survey. *Am J Public Health*. 2009;99(4):666–672
17. Blitz CL, Wolff N, Pan KY, Pogorzelski W. Gender-specific behavioral health and community release patterns among New Jersey prison inmates: implications for treatment and community reentry. *Am J Public Health*. 2005;95(10):1741–1746
18. Conklin TJ, Lincoln T, Tuthill RW. Self-reported health and prior health behaviors of newly admitted correctional inmates. *Am J Public Health*. 2000;90(12):1939–1941
19. Freudenberg N, Daniels J, Crum M, Perkins T, Richie BE. Coming home from jail: the social and health consequences of community reentry for women, male adolescents, and their families and communities. *Am J Public Health*. 2005;95(10):1725–1736
20. Underwood RL, Treadwell H. Public health implications of medical care discontinuity for imprisoned Black men. *Am J Public Health*. 2011;101(9):1540–1541, author reply 1541
21. Phillips SD, Burns BJ, Wagner HR, Kramer TL, Robbins JM. Parental incarceration among adolescents receiving mental health services. *J Child Fam Stud*. 2002;11:385–399
22. Geller A, Garfinkel I, Cooper CE, Mincy RB. Parental incarceration and child wellbeing: implications for urban families. *Soc Sci Q*. 2009;90(5):1186–1202
23. Tasca M, Rodriguez N, Zatz MS. Family and residential instability in the context of paternal and maternal incarceration. *Crim Justice Behav*. 2011;38(3):231–247
24. Phillips SD, Zhao JA. The relationship between witnessing arrests and elevated symptoms of posttraumatic stress: findings from a national study of children involved in the child welfare system. *Child Youth Serv Rev*. 2010;32:1246–1254
25. Brown DW, Anda RF, Tiemeier H, et al. Adverse childhood experiences and the risk of premature mortality. *Am J Prev Med*. 2009;37(5):389–396
26. Dong M, Dube SR, Felitti VJ, Giles WH, Anda RF. Adverse childhood experiences and self-reported liver disease: new insights into the causal pathway. *Arch Intern Med*. 2003;163(16):1949–1956
27. Chapman DP, Whitfield CL, Felitti VJ, Dube SR, Edwards VJ, Anda RF. Adverse childhood experiences and the risk of depressive disorders in adulthood. *J Affect Disord*. 2004;82(2):217–225
28. Hussey JM, Chang JJ, Kotch JB. Child maltreatment in the United States: prevalence, risk factors, and adolescent health consequences. *Pediatrics*. 2006;118(3):933–942
29. Corso PS, Edwards VJ, Fang X, Mercy JA. Health-related quality of life among adults who experienced maltreatment during childhood. *Am J Public Health*. 2008;98(6):1094–1100
30. Edwards VJ, Holden GW, Felitti VJ, Anda RF. Relationship between multiple forms of childhood maltreatment and adult mental health in community respondents: results from the adverse childhood experiences study. *Am J Psychiatry*. 2003;160(8):1453–1460
31. Arnow BA. Relationships between childhood maltreatment, adult health and

- psychiatric outcomes, and medical utilization. *J Clin Psychiatry*. 2004;65(suppl 12):10–15
32. Wegman HL, Stetler C. A meta-analytic review of the effects of childhood abuse on medical outcomes in adulthood. *Psychosom Med*. 2009;71(8):805–812
 33. Kemper KJ, Rivara FP. Parents in jail. *Pediatrics*. 1993;92(2):261–264
 34. Quilty S, Levy MH, Howard K, Barratt A, Butler T. Children of prisoners: a growing public health problem. *Aust N Z J Public Health*. 2004;28(4):339–343
 35. Shonkoff JP, Garner AS; The Committee on Psychosocial Aspects of Child and Family Health, Committee on Early Childhood, Adoption and Dependent Care, and Section on Developmental and Behavioral Pediatrics. The lifelong effects of early childhood adversity and toxic stress. *Pediatrics*. 2012; 129(1). Available at: www.pediatrics.org/cgi/content/full/129/1/e232
 36. Rosen DL, Schoenbach VJ, Wohl DA. All-cause and cause-specific mortality among men released from state prison, 1980-2005. *Am J Public Health*. 2008;98(12):2278–2284
 37. Wilbur MB, Marani JE, Appugliese D, et al. Socioemotional effects of fathers' incarceration on low-income, urban, school-aged children. *Pediatrics*. 2007;120(3). Available at: www.pediatrics.org/cgi/content/full/120/3/e678
 38. Murray J, Farrington DP, Sekol I. Children's antisocial behavior, mental health, drug use, and educational performance after parental incarceration: a systematic review and meta-analysis. *Psychol Bull*. 2012;138(2):175–210
 39. Crowe RR. An adoptive study of psychopathy: Preliminary results from arrest records and psychiatric hospital records. In: Fieve RR, Rosenthal D, Brill H, eds. *Genetic Research in Psychiatry*. Baltimore, MD: Johns Hopkins University Press; 1975:95–103
 40. Crowe RR. An adoption study of antisocial personality. *Arch Gen Psychiatry*. 1974;31(6):785–791
 41. Murray J, Farrington DP. Parental imprisonment: long-lasting effects on boys' internalizing problems through the life course. *Dev Psychopathol*. 2008;20(1):273–290
 42. Roettger ME, Swisher RR, Kuhl DC, Chavez J. Paternal incarceration and trajectories of marijuana and other illegal drug use from adolescence into young adulthood: evidence from longitudinal panels of males and females in the U.S. *Addiction*. 2010;106: 121–132
 43. Roettger ME, Boardman JD. Parental incarceration and gender-based risks for increased body mass index: evidence from the National Longitudinal Study of Adolescent Health in the United States. *Am J Epidemiol*. 2012;175(7):636–644
 44. Mumola CJ. *Special Report: Incarcerated Parents and Their Children. Publication NCJ 182335*. Washington, DC: US Department of Justice, Office of Justice Programs, Bureau of Justice Statistics; 2000
 45. Dallaire D, Wilson L. The relation of exposure to parental criminal activity, arrest, and sentencing to children's maladjustment. *J Child Fam Stud*. 2010;19:404–418
 46. Harris KM. *The National Longitudinal Study of Adolescent Health (Add Health), Waves I & II, 1994–1996; Wave III, 2001–2002; Wave IV, 2007–2009*. Chapel Hill, NC: Carolina Population Center, University of North Carolina at Chapel Hill; 2009 [machine-readable data file and documentation]
 47. Daly M, Wilson M. Child abuse and other risks of not living with both parents. *Ethol Sociobiol*. 1985;6:197–210
 48. Margolin L. Child abuse by mothers' boyfriends: why the overrepresentation? *Child Abuse Negl*. 1992;16(4):541–551
 49. Radhakrishna A, Bou-Saada IE, Hunter WM, Catellier DJ, Kotch JB. Are father surrogates a risk factor for child maltreatment? *Child Maltreat*. 2001;6(4):281–289
 50. Finkelhor D, Hotaling G, Lewis IA, Smith C. Sexual abuse in a national survey of adult men and women: prevalence, characteristics, and risk factors. *Child Abuse Negl*. 1990;14(1):19–28
 51. Oshri A, Tubman JG, Burnette ML. Childhood maltreatment histories, alcohol and other drug use symptoms, and sexual risk behavior in a treatment sample of adolescents. *Am J Public Health*. 2012;102(suppl 2):S250–S257
 52. Oshri A, Tubman JG, Jaccard J. Psychiatric symptom typology in a sample of youth receiving substance abuse treatment services: associations with self-reported child maltreatment and sexual risk behaviors. *AIDS Behav*. 2011;15(8):1844–1856
 53. Houck CD, Nugent NR, Lescano CM, Peters A, Brown LK. Sexual abuse and sexual risk behavior: beyond the impact of psychiatric problems. *J Pediatr Psychol*. 2010;35(5): 473–483

(Continued from first page)

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275); published in the public domain by the American Academy of Pediatrics

FINANCIAL DISCLOSURE: The authors have indicated they have no financial relationships relevant to this article to disclose.

FUNDING: No outside funding was provided for this study, however data used for this research were provided by Add Health, a longitudinal survey supported by funding from the National Institutes of Health.