



What Is the Relationship Between Incarceration of Children and Adult Health Outcomes?

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ABSTRACT

OBJECTIVE: We sought to quantify the association between child incarceration in the United States and subsequent adult health outcomes.

METHODS: We analyzed National Longitudinal Study of Adolescent to Adult Health data from 1727 adult (Wave IV) participants first incarcerated at age <25 years. Using chi-square tests and multivariate logistic regression models, we compared adult health outcomes (ie, mobility limitations, depressive symptoms, and suicidal thoughts) among those first incarcerated at age ≤14 years, 15 to 17 years, and 18 to 20 years, with those first incarcerated at 21 to 24 years as the reference group.

RESULTS: Of the 1727 participants, 105 (6.7%) were first incarcerated at age ≤14 years ("child incarceration category"), 315 (19.3%) were first incarcerated at 15 to 17 years, 696 (38.5%) were first incarcerated at 18 to 20 years, and 611 (35.6%) were first incarcerated at 21 to 24 years. Those first

incarcerated as children (age ≤14 years) were disproportionately black or Hispanic compared with those first incarcerated at 15 to 24 years. Compared with first incarceration at age 21 to 24 years, child incarceration independently predicted adult mobility limitations (adjusted odds ratio [OR], 3.74; $P = .001$), adult depression (OR, 1.98; $P = .034$), and adult suicidal thoughts (OR, 4.47; $P = .005$).

CONCLUSIONS: Child incarceration displays even wider socio-demographic disparities than incarceration generally and is associated with even worse adult physical and mental health outcomes.

KEYWORDS: child incarceration; incarcerated youth; juvenile incarceration; youth incarceration

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WHAT'S NEW

Child incarceration by age 14 years independently predicts worse adult health compared with first incarceration at older adolescent and young adult ages. Our findings suggest that individuals first incarcerated as children are medically vulnerable, indicating an important role for the health arena.

CHILDREN IN CONFLICT with the law, defined here as those age ≤14 years, are an underdiscussed but important segment of the pediatric population.¹ The United States is the world leader in youth incarceration.² In 2015, US law enforcement arrested 920,000 youths age <18 years,³

mostly for nonviolent charges, such as drug offenses or truancy.⁴ The US juvenile justice population is disproportionately composed of young men of color; approximately 85% are male, 40% are black, and 23% are Hispanic.⁴

In the United States, there is no federal statute specifying a minimum age of juvenile justice jurisdiction. As a result, thousands of children are arrested each year.¹ Currently, fewer than one half of US states have laws establishing a minimum age of juvenile justice jurisdiction.⁵ Current minimum age boundaries across the US range from 6 to 11 years, indicating that even in states with minimum age laws, children as young as 6 years can be processed in the juvenile justice system for a "delinquent" act.⁵ Further complicating the wide variation in state practices regarding how

young children in the justice system are processed is the lack of publicly available information on this group. The data gap for child incarceration is wide.

Youths who are first incarcerated as children may be especially medically vulnerable, although specific data on this population are generally lacking.⁶ Incarcerated children and adolescents have extremely high rates of unmet mental, physical, developmental, and social health needs.^{7,8} A landmark study on youths in custody found that on their intake health examination, 46% of newly detained youth had health needs requiring immediate medical attention.⁹ In addition, 70% of incarcerated youths meet the diagnostic criteria for at least 1 psychiatric disorder, with many experiencing multiple psychiatric conditions.¹⁰

Youth incarceration is believed to have long-term negative effects on health, a concept highly salient to individuals first incarcerated as children. In a previous study using the National Longitudinal Study of Adolescent to Adult Health (Add Health) data, we found that youths' duration of incarceration was associated with worse adult general health and higher rates of mobility limitations, depressive symptoms, and suicidal thoughts.¹¹ Other studies have similarly found youth incarceration to be associated with worse adult general health¹¹ and higher rates of mobility limitations,¹¹ depressive symptoms,¹¹ obesity,¹² and hypertension and other stress-related illness.¹³ Unfortunately, none of these studies, including our previous study, has provided data that explain how incarceration during childhood compared with young adulthood may be associated with health outcomes in adulthood. We postulate that individuals first incarcerated as children might be even more vulnerable to the potential negative downstream health effects of incarceration. To test whether younger age at first incarceration predicts worse health, we extended our previous longitudinal analysis on youth incarceration and adult health outcomes.

As a first step, in an immediate previous study, we described sociodemographic characteristics of individuals who were first incarcerated as children compared with those who were never incarcerated.⁶ Using Add Health data, we found that individuals first incarcerated as children were disproportionately of color, more likely to be from lower socioeconomic backgrounds, and more likely to have been raised in a single-parent household.⁶ In the present study, we examined whether associations between age at first incarceration and worse adult health outcomes are stronger among individuals first incarcerated as children compared with those first incarcerated later, controlling for adolescent health status and contextual characteristics.

METHODS

We analyzed Add Health data from 1727 adult (Wave IV) participants who were first incarcerated at age <25 years. Add Health is a nationally representative longitudinal survey of US youths.¹⁴ The Wave I survey, conducted in 1994, included 20,745 youth participants in grades 7 to 12. Wave IV, conducted in 2008, included 15,701 adult participants age 24 to 32 years. Parent/guardian consent and adolescent

assent was obtained for all participants. The Wave I survey included measures of health status and social determinants of health. The Wave IV follow-up survey, conducted in participants' homes and in correctional settings, included measures on history of incarceration, including age at first incarceration, and adult health status.¹⁴

To examine whether associations between incarceration and adult health outcomes are stronger among individuals first incarcerated as children than among individuals incarcerated at age 15 to 24 years, we included only individuals with a history of incarceration before age 25 and complete data on the primary predictor, primary outcome (adult general health), and sample weight. The resulting analytic sample included 1727 individuals.

AGE AT FIRST INCARCERATION PREDICTOR MEASURE

To examine the longitudinal relationship between child incarceration and adult health relative to incarceration at adolescent and young adult ages, we constructed a primary predictor that examined age of first incarceration before Wave IV. To determine the age of first incarceration, we combined the Wave IV questions asking whether participants had ever spent time in a correctional facility with participant self-reports of age at first incarceration. Variable categories were defined as child incarceration (first incarceration at age ≤ 14 years); middle adolescent incarceration (first incarceration at age 15 to 17 years), and later incarceration (first incarceration at age 18 to 20 years), with first incarceration age at 21 to 24 years as the reference category. Individuals first incarcerated at age ≥ 25 years were excluded because age 25 years is commonly used to mark the end of early adulthood. Age 14 years served as the cutpoint for child incarceration, because age 14 is when most US youth transition to high school, signifying an important social, developmental, and academic milestone.

ADULT HEALTH OUTCOMES

We selected 4 adult health outcomes that encompass important aspects of physical and mental health. These outcomes were adult general health, mobility limitations, depressive symptoms, and suicidal thoughts.

ADULT GENERAL HEALTH

Self-reported general health is a well-studied measure associated with disease burden and mortality risk.¹⁵ At Wave IV, participants were asked to describe their health as being either excellent, very good, good, fair, or poor. We used a dichotomous measure of Wave IV low self-rated health for responses of fair or poor (vs excellent, very good, or good). This cutpoint was chosen based on the response distributions in the relatively young and healthy Add Health population. A sensitivity analysis using an alternate cutpoint (low self-rated health as poor, fair, or good) revealed similar results.

ADULT MOBILITY LIMITATIONS

We constructed a dichotomous measure of adult mobility limitations by combining responses to the 2 Wave IV Add Health questions that asked whether health problems

created limitations in climbing flights of stairs and moderate activities, such as moving a table. Individuals who reported either of these limitations were categorized as having mobility limitations.

ADULT DEPRESSIVE SYMPTOMS

In Wave IV, Add Health participants completed the short-form Center for Epidemiologic Studies Depression Scale, which measures depressive symptoms during the previous week.¹⁶ We constructed an adult depressive symptoms variable using Wave IV Center for Epidemiologic Studies Depression Scale data. Consistent with the recommended clinical cutoff for this tool, we categorized a score ≥ 11 as a dichotomous measure of adult depressive symptoms.¹⁷

ADULT SUICIDAL THOUGHTS

The Wave IV single-item response that asked participants if they had seriously considered suicide in the previous 12 months was used to create a dichotomous measure of adult suicidality.

COVARIATES

We applied an ecological framework¹⁸ to identify potential covariates, including Wave I health variables, sociodemographic variables, and other variables associated with both youth incarceration and adult health in the literature.^{7,13,19,20} We selected covariates with confirmed associations between the main predictor (age at first incarceration) and main outcome (adult general health). The Wave I health variables were Wave I general health (in the general health model), Wave I mobility limitations (in the mobility limitations model), Wave I depressive symptoms (in the depressive symptoms model), and Wave I suicidal thoughts (in the suicidal thoughts model). For Wave I general health, depressive symptoms, and suicidal thoughts, the questions asked were identical to the corresponding Wave IV variables. For Wave I mobility limitations, because identical questions were not available, we used the question eliciting information on difficulty using the limbs because of a permanent physical condition. The youth Wave I self-reported sociodemographic variables were sex, race/ethnicity (white, black, Hispanic, other), age, and highest level of parental education. Parents' reported household income was constructed from parent responses on the Wave I in-home parent survey.

To select the third category of covariates (ie, other variables associated with incarceration and health), we applied an ecological framework¹⁸ for reviewing relevant literature^{7,13,19,20} to identify potential individual, family, and community-level factors potentially associated with both youth incarceration and health. Potential individual youth-level covariates that we examined were school connectedness, measured on a 5-item scale (Cronbach's $\alpha = 0.83$ ²¹); high school grade point average, based on most-recent grades¹¹; perceived likelihood of attending college, measured on a single-item 5-point scale; delinquent behaviors, measured via a 12-item Serious

Delinquency Scale (Cronbach's $\alpha = 0.81$)²²; regular alcohol use, defined as drinking alcohol ≥ 2 days per month; cigarette use, defined as cigarette use once or more during the previous 30 days; marijuana use, defined as marijuana use at least once in the previous 30 days; and other drug use, defined as using "other drugs," such as cocaine, at least once in the previous 30 days. Candidate family-level covariates were family household structure, categorized per Add Health as 2 biological parents, 2 parents (≥ 1 non-biological), single parent, or other; parental incarceration, measured via single-item response; and family connectedness, measured on a 3-item scale (Cronbach's $\alpha = 0.77$ ²³). Candidate community-level covariates were perceived neighborhood safety, (measured via single-item response querying youths' perceived neighborhood safety); neighborhood unemployment (1990 census unemployment rate by block group); and proportion of neighborhood adults without a high-school diploma (proportion of community adults age ≥ 25 without a high-school diploma or equivalent designation). All covariates were constructed based on self-reported items from the youth in-home Wave I interviews, except for household income (in-home parent surveys), history of parental incarceration (in-home parent surveys), neighborhood unemployment (census data), and neighborhood high-school graduation rate (census data). Of these covariates, family structure, family connectedness, perceived neighborhood safety, neighborhood unemployment, and neighborhood high school graduation rate demonstrated significant associations with the incarceration predictor and general health outcome variable at the .05 significance level and thus were included in the multivariate models. Those that did not have any association with incarceration or health outcome were not included in the final models.

DATA ANALYSIS

To examine the relationship between child incarceration, we first computed descriptive statistics of Wave I social determinants of health and adult health outcomes. F-test and chi-square analyses compared covariates and adult health outcomes among individuals with a history of incarceration by young adulthood across the different youth incarceration age categories. Multivariate logistic regressions then evaluated the relationship between age at first youth incarceration and subsequent adult health outcomes (ie, self-reported general health, mobility limitations, depressive symptoms, and suicidal thoughts) in Wave IV, controlling for the aforementioned covariates. To ensure that findings were not driven by the frequency or duration of incarceration, models were also run controlling for cumulative frequency of incarceration (dichotomized as once vs more than once) and cumulative duration of incarceration (continuous variable) by Wave IV. We conducted analyses in Stata version 12.0 (StataCorp, College Station, Tex) using the "svy" suite of commands to account for the Add Health survey design elements of stratification, clustering, and weighting. The study was approved by UCLA's Institutional Review Board.

RESULTS

Among the sample of 14,689 adult Add Health participants, 2248 (16.5%) reported any incarceration, including 1727 (13.1%) first incarcerated at age <25. Of these 1727 participants, 105 (6.7%) were first incarcerated at age ≤14 years, 315 (19.3%) were first incarcerated at age 15 to 17 years, 696 (38.5%) were first incarcerated at age 18 to 20 years, and 611 (35.6%) were first incarcerated at age 21 to 24 years. Among the 105 adult participants who reported child incarceration (age ≤14 years), first incarceration was at 7 years in 1, at 10 years in 1, at 11 years in 9, at 12 years in 8, at 13 years in 37, and at 14 years in 49; up to 95 of these children were first incarcerated before their Wave I interview.

SOCIODEMOGRAPHIC DATA

Most individuals in the child incarceration category were male, although at a lower proportion than in those first incarcerated at age 15 to 17 years ($P = .06$). Significant racial/ethnic differences were observed by age of incarceration ($P < .001$). Specifically, white participants were comparatively less represented in the child incarceration category than at other ages, whereas black, Hispanic, and “other” youth were comparatively more represented. A trend toward lower household income was observed for youths first incarcerated at younger ages ($P = .051$). Differences across family household structure type were significant ($P = .003$), with individuals in the child incarceration category more likely to be from single-parent households (40.7%) than from 2–biological parent households (17.7%).

WAVE I HEALTH

At Wave I, individuals in the child incarceration category were more likely to report worse general health (21.5% for child incarceration category [≤ 14 years] vs. 8% for older incarceration age categories; $P = .008$) and more depressive symptoms (34.3% child incarceration category vs. 17.3–25.0% for older incarceration age categories; $P = .003$), compared with individuals incarcerated at later ages (Table 1). Between-group differences were not statistically significant for Wave I mobility limitations or suicidal thoughts.

WAVE I ECOLOGICAL FACTORS

Family connectedness was lowest among individuals in the child incarceration category (10.2 vs. 10.7–11.0; $P = .013$). The community-level factors of perceived neighborhood safety, neighborhood unemployment, and neighborhood graduation rates did not differ significantly by age at first incarceration; however, notable trends were present, with the greatest risk consistently seen in the child incarceration category.

CHILD INCARCERATION AND ADULT HEALTH

In the child incarceration category, unadjusted results demonstrated statistically significant differences in the adult health outcomes of mobility limitations (OR, 3.07;

95% CI, 1.46–6.44; $P = .003$), adult depressive symptoms (OR, 2.35; 95% CI, 1.28–4.28; $P = .006$), and adult suicidal thoughts (OR, 4.22; 95% CI, 1.72–10.34; $P = .002$).

Multivariate analyses demonstrated that younger ages of first incarceration remained significantly associated with higher odds of having adult mobility limitations, depressive symptoms, and suicidality, after adjusting for covariates (Table 2). Child incarceration predicted subsequent adult mobility limitations (adjusted OR, 3.74; 95% CI, 1.69–8.31; $P = .001$), depressive symptoms (OR, 1.98; 95% CI, 1.05–3.72; $P = .034$), and suicidality (OR, 4.47; 95% CI, 1.59–12.52; $P = .005$) and was the highest-risk category in each of these models. Child incarceration was not a significant predictor of adult general health. Results showed similar trends in multivariate models that controlled for frequency and duration of incarceration, with the exception that the child incarceration category was no longer significant in the depressive symptoms model (Table 2). Results were also sustained in sensitivity analyses of the adult general health multivariate model adjusted for Wave I depressive symptoms and suicidal thoughts. We also examined the predictor age of incarceration as a continuous variable, and our findings were sustained.

DISCUSSION

Our findings indicate that younger age at first incarceration independently predicts worse adult health, after controlling for relevant sociodemographic and ecological factors. Compared with incarceration at later adolescent and young adult ages, child incarceration has wider sociodemographic disparities and is more strongly associated with poor physical and mental health outcomes during adulthood. Our findings are aligned with previous longitudinal studies that found an association between youth incarceration and worse long-term health.^{11–13,20} Our study is unique in its focus on the youngest subset, children age ≤14 years. Given the wide variation in juvenile justice policies and age thresholds, including the current absence of a minimum age law in most US states,⁵ understanding how young age at first incarceration may impact adult health is critical.

Our findings reinforce that individuals with a history of child incarceration were more likely to be from racial/ethnic minorities and from single parent households.⁶ They were also more likely to have worse adolescent health. It is unclear whether the worse health measured in the Wave I Add Health survey was a predisposing factor that heightened youths' risk of early incarceration in childhood, an effect of child incarceration (at least for those whose incarceration preceded the Wave I survey), or a combination of the two. Regardless, it is evident that individuals with a history of child incarceration should be considered a medically vulnerable population and warrant identification as children and youths with special health care needs.²⁴ These children and youths potentially may benefit more from health and psychosocial-focused

Table 1. Characteristics of the Study Sample by Age at First Incarceration

Characteristic	First Incarceration at Age 7–14 y (n = 105)	First Incarceration at Age 15–17 y (n = 315)	First Incarceration at Age 18–20 y (n = 696)	First Incarceration at Age 21–24 y (n = 611)	P Value (Chi-Square) Test
Sex, %					.058
Female	24.6	17.2	20.6	26.2	
Male	75.4	82.8	79.4	73.8	
Race/ethnicity, %					<.001
White	35.7	60.2	66.9	61.1	
Black	33.1	23.1	17.3	21.0	
Hispanic	17.7	13.7	13.6	10.4	
Other	13.6	3.0	2.3	7.5	
Age at Wave I, y, mean (SD)	14.9 (1.5)	15.2 (1.7)	15.5 (1.8)	15.3 (1.8)	.089
Highest level of parental education, %					.235
Less than high school	15.7	17.8	15.7	10.0	
High school diploma	41.8	37.2	37.3	36.7	
Some college	23.8	22.4	20.8	23.1	
College degree or more	18.8	22.6	26.1	30.3	
Annual household income, \$, %					.051
0–24,999	46.1	33.3	29.0	26.3	
25,000–49,999	14.2	28.4	27.0	28.4	
50,000–74,999	6.4	12.7	13.9	15.4	
≥75,000	2.0	5.6	6.7	7.6	
Missing	31.3	20.0	23.4	22.2	
Family household structure, %					.003
Two biological parents	17.7	34.3	40.8	44.6	
Two parents (≥1 nonbiological parent)	31.8	20.7	21.7	24.2	
Single parent	40.7	36.7	28.8	26.0	
Other	9.9	8.4	8.8	5.3	
Family connectedness, mean (SD)	10.2 (2.3)	10.9 (2.4)	10.7 (2.5)	11.0 (2.2)	.013
Perceived neighborhood safety, %					.401
Yes	83.0	85.2	89.0	87.3	
No	17.1	14.8	11.0	12.8	
Neighborhood unemployment, mean (SD)	0.09 (0.06)	0.09 (0.06)	0.08 (0.06)	0.08 (0.06)	.386
Neighborhood high-school graduation rate, mean (SD)	0.28 (0.14)	0.29 (0.15)	0.30 (0.15)	0.29 (0.15)	.864
Wave I (adolescent) health status, %					
Worse general health*	21.5	8.4	8.6	8.9	.008
Mobility limitations	4.7	3.6	4.6	3.2	.771
Depressive symptoms	34.3	25.0	24.5	17.3	.003
Suicidal thoughts	24.2	18.0	16.4	14.1	.215
Wave IV (adult) health status, %					
Worse general health*	16.9	16.6	12.8	11.0	.322
Mobility limitations	21.5	16.2	10.9	8.2	.016
Depressive symptoms	36.9	25.6	26.0	20.0	.087
Suicidal thoughts	21.6	9.0	11.6	6.1	.013

SD indicates standard deviation.

Percentages are weighted to account for survey design. Numbers for individual variables might not sum to the full analytic sample (n = 1727) because of missing data.

*“Worse” refers to self-report of poor or fair health compared with excellent, very good, or good.

Table 2. Results From Multivariate Analyses Showing the Relationship Between Child Incarceration Compared With Incarceration at Other Young Adult Ages for the Adult Health Outcomes of Adult General Health, Adult Mobility Limitations, Adult Depressive Symptoms, and Adult Suicidality (n = 1727)

Parameter	Model 1, OR (95% CI)				Model 2, OR (95% CI)			
	Worse Adult General Health*	Adult Mobility Limitations	Adult Depressive Symptoms	Adult Suicidality	Worse Adult General Health	Adult Mobility Limitations	Adult Depressive Symptoms	Adult Suicidality
Age at first incarceration, y								
7–14	0.97 (0.36–2.58)	3.74 (1.69–8.31)	1.98 (1.05–3.72)	4.47 (1.59–12.52)	1.32 (0.45–3.88)	3.70 (1.39–9.87)	1.59 (0.80–3.18)	4.48 (1.58–12.71)
15–17	1.47 (0.85–2.55)	1.84 (1.05–3.22)	1.17 (0.72–1.90)	1.34 (0.56–3.19)	1.54 (0.87–2.72)	1.66 (0.92–3.02)	1.04 (0.61–1.80)	1.36 (0.56–3.29)
18–20	1.27 (0.72–2.24)	1.52 (0.89–2.57)	1.44 (0.94–2.20)	1.90 (1.15–3.14)	1.35 (0.74–2.45)	1.51 (0.87–2.62)	1.42 (0.92–2.21)	1.94 (1.16–3.25)
21–24	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Sex								
Female	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Male	0.94 (0.62–1.44)	0.82 (0.51–1.33)	0.83 (0.59–1.16)	1.24 (0.77–2.01)	1.17 (0.76–1.80)	0.85 (0.52–1.39)	0.79 (0.56–1.10)	1.28 (0.76–2.13)
Race/ethnicity								
White	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Black	1.43 (0.86–2.35)	0.92 (0.51–1.66)	1.63 (1.04–2.55)	0.94 (0.50–1.77)	1.36 (0.77–2.41)	0.88 (0.48–1.61)	1.69 (1.10–2.61)	1.13 (0.59–2.18)
Hispanic	2.54 (1.51–4.28)	0.56 (0.30–1.05)	1.13 (0.59–2.18)	0.83 (0.40–1.72)	2.50 (1.48–4.22)	0.61 (0.33–1.13)	0.95 (0.46–1.95)	0.92 (0.44–1.95)
Other	2.79 (1.24–6.25)	0.23 (0.07–0.76)	1.0 (0.45–2.23)	0.56 (0.16–1.91)	3.26 (1.46–7.31)	0.24 (0.07–0.80)	1.09 (0.49–2.42)	0.62 (0.19–2.03)
Age at Wave I	0.92 (0.82–1.03)	0.96 (0.86–1.08)	0.92 (0.83–1.03)	0.99 (0.86–1.14)	0.93 (0.82–1.04)	0.96 (0.86–1.09)	0.93 (0.84–1.04)	0.98 (0.85–1.13)
Highest level of parental education								
Less than high school	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
High school diploma	0.95 (0.51–1.78)	0.96 (0.43–2.12)	1.19 (0.67–2.14)	1.28 (0.60–2.73)	0.99 (0.52–1.86)	0.92 (0.42–2.00)	1.41 (0.76–2.62)	1.25 (0.56–2.78)
Some college	0.64 (0.30–1.35)	0.81 (0.35–1.87)	1.09 (0.56–2.10)	1.10 (0.51–2.37)	0.57 (0.27–1.23)	0.73 (0.32–1.64)	1.24 (0.63–2.44)	1.02 (0.46–2.28)
College degree or more	0.88 (0.43–1.82)	0.73 (0.32–1.66)	0.78 (0.41–1.46)	0.72 (0.30–1.74)	0.85 (0.41–1.77)	0.66 (0.30–1.47)	0.91 (0.47–1.76)	0.70 (0.29–1.71)
Annual household income, \$								
0–24,999	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
25,000–49,999	2.18 (1.18–4.04)	0.77 (0.42–1.43)	1.28 (0.79–2.08)	1.43 (0.74–2.77)	2.30 (1.24–4.29)	0.75 (0.39–1.46)	1.16 (0.70–1.92)	1.40 (0.72–2.73)
50,000–74,999	1.68 (0.71–3.94)	1.18 (0.47–2.96)	1.39 (0.71–2.72)	1.52 (0.58–3.95)	1.68 (0.72–3.94)	1.21 (0.47–3.12)	1.35 (0.68–2.68)	1.54 (0.59–4.01)
≥75,000	0.98 (0.35–2.72)	1.34 (0.44–4.11)	1.61 (0.83–3.14)	1.14 (0.35–3.69)	0.96 (0.34–2.70)	1.36 (0.44–4.13)	1.60 (0.82–3.12)	1.13 (0.34–3.71)
Missing	1.84 (0.97–3.49)	0.99 (0.58–1.70)	0.98 (0.62–1.55)	0.99 (0.53–1.85)	1.72 (0.89–3.36)	1.00 (0.58–1.74)	0.88 (0.54–1.43)	0.90 (0.47–1.72)
Family household structure								
Two biological parents	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Two parents (≥1 nonbiological parent)	1.05 (0.56–1.95)	1.43 (0.79–2.59)	1.22 (0.81–1.83)	0.92 (0.47–1.79)	1.12 (0.58–2.15)	1.42 (0.76–2.64)	1.25 (0.82–1.91)	0.93 (0.48–1.80)
Single parent	1.26 (0.73–2.19)	1.37 (0.79–2.38)	1.27 (0.83–1.93)	0.80 (0.42–1.54)	1.36 (0.75–2.47)	1.40 (0.79–2.48)	1.22 (0.77–1.92)	0.82 (0.41–1.63)
Other	1.70 (0.79–3.64)	1.24 (0.48–3.16)	1.0 (0.48–2.10)	1.39 (0.52–3.72)	1.84 (0.82–4.11)	1.34 (0.52–3.49)	1.08 (0.51–2.27)	1.10 (0.38–3.19)
Family connectedness	0.93 (0.85–1.01)	0.99 (0.92–1.06)	0.96 (0.90–1.04)	0.96 (0.89–1.04)	0.93 (0.85–1.02)	0.98 (0.91–1.05)	0.95 (0.88–1.03)	0.96 (0.88–1.05)
Perceived neighborhood safety	1.57 (0.90–2.73)	0.88 (0.42–1.84)	1.33 (0.69–2.55)	1.97 (1.10–3.52)	1.74 (0.98–3.09)	0.94 (0.45–1.97)	1.37 (0.69–2.73)	1.56 (0.84–2.91)
Neighborhood unemployment	1.36 (1.04–1.77)	1.15 (0.80–1.66)	1.20 (0.95–1.53)	1.15 (0.81–1.62)	1.36 (1.01–1.81)	1.19 (0.80–1.76)	1.21 (0.96–1.53)	1.12 (0.80–1.57)
Neighborhood high school graduation rate	1.02 (0.79–1.31)	1.12 (0.81–1.54)	0.91 (0.77–1.08)	0.91 (0.62–1.32)	1.00 (0.76–1.32)	1.06 (0.75–1.49)	0.91 (0.77–1.09)	0.92 (0.62–1.37)
Wave I general health	3.11 (1.87–5.16)	–	–	–	3.32 (2.00–5.50)	–	–	–

(continued on next page)

Table 2 (Continued)

Parameter	Model 1, OR (95% CI)			Model 2, OR (95% CI)		
	Worse Adult General Health*	Adult Mobility Limitations	Adult Depressive Symptoms	Worse Adult General Health	Adult Mobility Limitations	Adult Depressive Symptoms
Wave I mobility limitations	—	1.91 (0.79–4.58)	—	—	1.95 (0.80–4.73)	—
Wave I depressive symptoms	—	—	2.25 (1.59–3.17)	—	—	2.24 (1.55–3.23)
Wave I suicidal thoughts	—	—	—	—	—	3.91 (2.19–6.96)
Cumulative incarceration frequency	—	—	—	0.92 (0.56–1.52)	0.78 (0.47–1.29)	1.26 (0.85–1.86)
Cumulative incarceration duration	—	—	—	0.99 (0.98–1.00)	1.00 (0.99–1.01)	1.01 (1.00–1.01)

OR indicates odds ratio; CI, confidence interval.

Model 1 represents the full model adjusted for covariates. Model 2 represents the full model adjusted for covariates and cumulative frequency and duration of incarceration.

*“Worse general health” refers to self-report of poor or fair health compared with excellent, very good, or good.

interventions than from the more punitive²⁵ and potentially harmful approach of incarceration.¹¹

The observed relationship between child incarceration and subsequent adult depressive symptoms and suicidality is striking, although not surprising. Suicide is the leading cause of death for youths in confinement.^{26,27} Rates of self-injurious and suicidal behaviors in juvenile justice populations are high, as are mental health conditions such as depression and substance use disorder, which independently potentiate the risk of suicidal behaviors.¹⁰

Roughly one-third of incarcerated youth report exposure to 5 or more adverse childhood experiences (ACEs).²⁸ Furthermore, youth incarceration itself can signify an adverse exposure as it can be traumatic to both youth and their families, creating a state of toxic stress that disrupts healthy brain development.²⁹ Experiencing just one ACE can increase the risk of suicide by 2- to 5-fold.³⁰ The extent to which ACEs act as a precursor for child incarceration, depression, and suicidal thoughts—or, alternatively, the extent to which child incarceration itself is the ACE that predicts worse adult mental health—is unclear. Understanding the relationship between ACEs and child incarceration is relevant to determining the best practices for pediatric health providers serving young children exposed to trauma and determining whether the justice system, as opposed to health and child welfare systems, are most appropriate for serving these vulnerable children. Solving this underdiscussed ethical and child health problem is critical.

Our findings have important implications for pediatrics. Child health professionals should be aware that child incarceration exists. Pediatric providers can take steps to provide needed treatments to troubled children to prevent cycles of incarceration. This may involve explicitly addressing underlying health needs and social determinants of health that put children at risk for incarceration. For the special population of children in conflict with the law, pediatric health providers can also work to reduce the negative downstream health effects of child incarceration by providing close follow-up and care of children and adolescents following incarceration.

The results also suggest that a new policy approach may be needed—one in which justice system involvement is prohibited for the very young, avoided whenever possible for those slightly older, and intentionally buffered by health-protective interventions for those ultimately incarcerated. Several states are actively considering legislative proposals to raise or establish a minimum age of juvenile delinquency jurisdiction; Nebraska recently passed a minimum age of 11.^{1,31,32} The Society of Adolescent Health and Medicine³³ and the United Nations Convention on the Rights of the Child³⁴ both recommend a minimum age of criminal responsibility of at least 12 years. Regardless of juvenile justice minimum age statutes, our results indicate an urgent need for the health arena to proactively care for these vulnerable children and adults with life histories of child incarceration.

This study has some limitations. The Wave I Add Health survey was a school-based sample, which might

have introduced a selection bias; however, we noted that the observed Wave IV incarceration rate is consistent with national figures.³⁵ In addition, we postulate that any selection bias would underestimate the associations between child incarceration and adult health, because higher-risk individuals with worse adult health would have been less likely to participate in the Wave IV Add Health survey. Wave I participants spanned grades 7 to 12, which might have introduced differences between youth of different ages; to account for this, the models controlled for age at Wave I. Also, data were collected by self-report and cannot be verified, and recall bias might have been an issue, as participants were asked to recall as adults their age at first incarceration. There is also a concern that the observed association between child incarceration and worse adult health was due solely to a child having poor mental or physical health before first incarceration that was not captured by the Wave I health measures; this is a limitation of the dataset, because the youngest participants in the Wave I survey were 12 years old. Nonetheless, it is reassuring that sensitivity analyses of the adult general health model adjusted for Wave I depressive symptoms and suicidal thoughts yielded similar results. Furthermore, our study does not intend to establish causality, and regardless of this limitation, the observed association between child incarceration and worse adult health has public health importance. It is notable that we found significant results despite the relatively small number of individuals first incarcerated as children ($n = 105$). Because we examined age as a categorical variable with a cutoff for child incarceration of ≤ 14 years, differences by year within the child age group and, for example, between adolescents age 14 and 15 are unclear. Finally, youths who are incarcerated often have preexisting risk factors such as exposure to child maltreatment or mental health problems. In our ecological framework, we examined several potential covariates that may influence both youth incarceration and adult health. We accounted for potential confounding by frequency and duration of incarceration and found similar results. However, other potentially relevant factors, such as region or charge severity, remain unmeasured. Despite these study limitations, our findings suggest that child incarceration is a signal for adult health risk, and that mechanisms directly linking child incarceration and worse downstream adult health may exist.

CONCLUSIONS

Incarcerated children should be viewed as a medically vulnerable population. By meeting the unmet health needs of this highly vulnerable group of children, child health professionals have the opportunity to lead in solving a major pediatric health issue while simultaneously addressing an underdiscussed aspect of racial, ethnic, and socioeconomic disparities. Youths' trajectories and life courses have the potential to be positively reshaped by such a change.

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