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How Does Incarcerating Young People Affect Their Adult Health Outcomes?

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abstract

BACKGROUND AND OBJECTIVES: Despite the widespread epidemic of mass incarceration in the US, relatively little literature exists examining the longitudinal relationship between youth incarceration and adult health outcomes. We sought to quantify the association of youth incarceration with subsequent adult health outcomes.

METHODS: We analyzed data from 14 344 adult participants in the National Longitudinal Study of Adolescent to Adult Health. We used weighted multivariate logistic regressions to investigate the relationship between cumulative incarceration duration (none, <1 month, 1–12 months, and >1 year) before Wave IV (ages 24–34 years) and subsequent adult health outcomes (general health, functional limitations, depressive symptoms, and suicidal thoughts). Models controlled for Wave I (grades 7–12) baseline health, sociodemographics, and covariates associated with incarceration and health.

RESULTS: A total of 14.0% of adults reported being incarcerated between Waves I and IV. Of these, 50.3% reported a cumulative incarceration duration of <1 month, 34.8% reported 1 to 12 months, and 15.0% reported >1 year. Compared with no incarceration, incarceration duration of < 1 month predicted subsequent adult depressive symptoms (odds ratio [OR] = 1.41; 95% confidence interval [CI], 1.11–1.80; $P = .005$). A duration of 1 to 12 months predicted worse subsequent adult general health (OR = 1.48; 95% CI, 1.12–1.96; $P = .007$). A duration of >1 year predicted subsequent adult functional limitations (OR = 2.92; 95% CI, 1.51–5.64; $P = .002$), adult depressive symptoms (OR = 4.18; 95% CI, 2.48–7.06; $P < .001$), and adult suicidal thoughts (OR = 2.34; 95% CI, 1.09–5.01; $P = .029$).

CONCLUSIONS: Cumulative incarceration duration during adolescence and early adulthood is independently associated with worse physical and mental health later in adulthood. Potential mechanisms merit exploration.

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Dr Barnert conceptualized the study, designed and supervised the analysis, and drafted the manuscript and revisions; Drs Dudovitz, Nelson, and Coker provided strategic input on study design, interpretation of study results, and assisted with revision of the manuscript; Mr Biely provided strategic input on study design, performed the statistical programming, assisted with interpretation of study results, and assisted with revision of the manuscript; Dr Li provided expert consultation on biostatistical study design, analysis and interpretation, and manuscript revision; and Dr Chung supervised all aspects of the study, from conceptualization and design to data analysis and interpretation and writing of the manuscript; and all authors approve of the final manuscript as it is presented.

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WHAT'S KNOWN ON THIS SUBJECT: Despite compelling data on the unmet health needs of incarcerated youth, no existing studies describe the longitudinal relationship between the duration of incarceration of young people and subsequent adult health outcomes.

WHAT THIS STUDY ADDS: The study demonstrates that youth incarceration is independently associated with worse adult physical and mental health outcomes. This finding suggests an important role for pediatricians to protect youth from potentially harmful effects of incarceration and mitigate any downstream negative effects.

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Despite widespread use of incarceration in the United States, relatively little literature examines longitudinal effects of youth incarceration on adult health outcomes.[1,2] The United States incarcerates a far greater proportion of youth than any other developed country.[3] Each year, US law enforcement arrests 1.3 million juveniles (ie, children and adolescents <18 years old).[4] Of these, ~80% will be reincarcerated as adults.[5] Currently, 6.8 million adults, or 2.8% of the adult population, are under correctional supervision.[6] Furthermore, data from the US Bureau of Justice Statistics indicate that the lifetime imprisonment risk in a state or federal prison is 1 out of 17 for white men, 1 out of 3 for African American men, and 1 out of 6 for Hispanic men. These numbers increase dramatically if incarceration in jails is also included. These trends of racial and ethnic disparities in confinement are similar for females.[7]

Incarcerated juveniles have extremely high rates of unmet health needs.[8–11] Forty-six percent of newly detained juveniles have urgent medical needs requiring immediate attention.[9] Seventy percent of incarcerated juveniles have at least 1 psychiatric disorder.[12] Additionally, 12% of juveniles currently incarcerated, both boys and girls, are expecting a child of their own.[10]

Despite compelling, nationally representative cross-sectional data on the health status of incarcerated youth, there is surprisingly little evidence on the relationship between juvenile incarceration and subsequent adult health outcomes.[1,2] Overall, youth and adults with a history of incarceration have markedly worse health statuses than their non–justice involved counterparts.[8,13] However, the linkage between youth incarceration and subsequent worse adult health might not be causal. First, many social determinants of poor health (eg, poverty and racial/ethnic minority status) are also associated with greater incarceration risk.[14] Second, individuals with poor health may be at higher risk for incarceration (eg, many drug users and mentally ill offenders are incarcerated instead of treated).[1] Causal associations, however, are also plausible. Although incarceration may have some short-term health benefits, mostly due to the provision of health care during detention and removal from risk-promoting environments, incarceration is more frequently postulated to have overall detrimental effects on health.[1] Proposed mechanisms for a causal linkage between incarceration and worse subsequent health include exposures within detention facilities (eg, communicable diseases) and physical or sexual traumas sustained while confined.[1] Confinement also likely erodes mental health.[15] Postincarceration social and economic disadvantages related to stigma, disrupted social networks, and negative "social" credentials may also contribute to the higher rates of fatal drug overdose, suicide, and posttraumatic stress seen in former adult prisoners.[15,16] Finally, incarceration may compound existing socioeconomic and psychosocial health risks in vulnerable populations.[1]

The small existing literature on longitudinal health effects of youth incarceration suggests that any incarceration during adolescence or young adulthood is associated with worse general health,[17] severe functional limitations,[1] stress-related illnesses, such as hypertension,[2] and higher rates of overweight and obesity during adulthood.[18] We add to what is currently known by examining a dose measure of incarceration. The longitudinal impact of the cumulative duration of incarceration on subsequent adult health is unknown. We sought to quantify the association between youth incarceration and a diverse set of adult health outcomes.

METHODS

We analyzed data from the National Longitudinal Study of Adolescent to Adult Health (Add Health), a nationally representative survey of US youth sampled from 1994 to 2008.[19] The baseline survey (Wave I) included 20 745 youth in grades 7 to 12. The 14-year follow-up survey (Wave IV) included 15 701 adult participants between the ages of 24 to 34 years old. The Wave I baseline survey collected data on social determinants of health and youths' health status. The Wave IV Add Health follow-up survey collected data on if, when, and for how long individuals were incarcerated as well as data on adult health status. The Wave IV survey included in-home interviews conducted within the home residences of participants as well as interviews conducted within correctional settings.[20]

We sought to measure the association between youth incarceration and subsequent adult health outcomes. We define "youth" as adolescents and young adults <25 years old. To explore possible temporal associations between incarceration and subsequent adult health, we excluded the 311 individuals incarcerated before their Wave I interview. The resulting analytic sample included 14 344 participants with full data on the primary predictor, primary outcome (adult general health), and sample weight.

Incarceration Predictor Measures

To provide a dose measure of incarceration exposure, which, to our knowledge, no previous study has done, we constructed our primary predictor as cumulative lifetime duration of incarceration before Wave IV (ages 24 to 34 years). Based on the distribution of the raw data and a conceptual cut-point of "short,"

"medium," and "long" durations of incarceration, we constructed our cumulative incarceration duration predictor to have 4 categories: no incarceration (reference category), a duration of <1 month, a duration of 1 to 12 months, and a duration of >1 year. To construct our cumulative incarceration duration predictor, we combined responses to the Wave IV questions asking, "Before your 18th birthday, about how much total time did you spend in jail or detention?" and "Since your 18th birthday, about how much total time have you spent in jail or detention?" For ease of interpretation, we also created a dichotomous variable (ever versus never incarcerated) to display our descriptive and bivariate results.

Adult Health Outcomes

We chose adult health outcomes for their high prevalence and impact on morbidity, mortality, and overall well-being. Our primary adult health outcome was adult general health, which may incorporate aspects of physical health, mental health, and psychosocial well-being. We selected the secondary outcomes of adult functional limitations, adult depressive symptoms, and suicidal thoughts to assess for differential associations between youth incarceration and physical versus mental health domains.

Adult General Health

To measure adult general health, we used self-report of health, a well-studied general health measure associated with morbidity and mortality.[21] In both Waves I and IV, participants were asked to rate their health as excellent, very good, good, fair, or poor. Given the response distributions in the relatively young and healthy Add Health population, we used a dichotomous measure of worse self-rated health for responses of good, fair, or poor. A sensitivity analysis using the alternate cut-point of defining worse self-related health as fair or poor revealed similar results.

Adult Functional Limitations

Adult functional limitations are an important physical health outcome that likely also has implications for mental health. We created a dichotomous measure of adult functional limitations based on a question that asked whether health problems created limitations with climbing flights of stairs. We categorized individuals as having functional limitations if they reported any limitations in climbing stairs.

Adult Depressive Symptoms

We selected adult depressive symptoms as a secondary adult health outcome because depression is one of the most common adult mental health disorders and is associated with poor social and physical health.[22,23] In Waves I and IV, respondents completed the short-form Center for Epidemiologic Studies Depression Scale (CESD-10), a well-validated 10-item screening for depression symptoms in the previous 7 days.[24] We used Wave IV CESD-10 data to construct the adult depressive symptoms variable and Wave I CESD-10 data to construct the baseline depressive symptoms variable. Consistent with previous studies, we categorized a score $\geq$11 as a dichotomous measure of depressive symptoms.[25]

Adult Suicidal Thoughts

Suicidality is an important concern in adult populations[22] and is especially a risk for incarcerated and formerly incarcerated adults.[26] We created a dichotomous measure of adult suicidal thoughts using the Wave IV single-item response that asked respondents if they had seriously considered suicide in the previous 12 months.

Covariates

We selected covariates that were associated with both youth incarceration and adult health[1,2,11,17]; these included baseline health variables, sociodemographic variables, and, based on existing literature, additional variables associated with incarceration and health. Potential covariates were identified based on the literature and then confirmed to be significantly associated with the main predictor (duration of incarceration) and main outcome (adult general health) in bivariate analyses. Specifically, the baseline health variables were baseline general health in the general health model, baseline functional limitations in the functional limitations model, and baseline depressive symptoms and suicidal thoughts in the depressive symptoms and suicidal thoughts models. For the Wave I baseline health variables of general health, depressive symptoms, and suicidal thoughts, questions were asked that were identical to those for the adult Wave IV participants. For baseline functional limitations, because an identical item was not asked in Wave I, we created a dichotomous measure using a single-item response that asked participants whether they had difficulty using their limbs because of a permanent physical condition. The sociodemographic variables included: self-reported gender; race/ethnicity (white, African American, Hispanic, other); age; parents' reported household income; and highest level of parental education. We also included other individual, family, and community-level factors that may be associated with both incarceration and health based on findings from existing literature. Individual-level covariates were: (1) school connectedness, measured via a 5-item scale (Cronbach's α, 0.83)[27]; (2) high-school grade point average, constructed based on self-reported most recent grades in English or language arts, math, history or social science, and science; (3) perceived likelihood of attending college (single-item, 5-point scale

asking about likelihood of attending college); (4) delinquent behaviors, measured by the 12-item serious delinquency scale (Cronbach's α, 0.81)[28]; (5) regular alcohol use, defined as drinking at least 2 days per month; (6) cigarette use, defined as use at least once during the previous 30 days; (7) marijuana use, defined as use at least once in the previous 30 days; (8) other drug use, defined as using "other drugs," such as, lysergic acid diethylamide (LSD), phencyclidine (PCP), cocaine, ecstasy, inhalants, or mushrooms at least once in the previous 30 days. Family-level covariates were: (1) family household structure, (2 biological parents, 2-parent [≥1 nonbiological], single parent, other); (2) history of parental incarceration, measured by self-report in Wave IV; and (3) family connectedness, measured via a 3-item scale (Cronbach's α, 0.77).[29] Community-level covariates were: (1) perceived neighborhood safety, (single-item response asking about perceived neighborhood safety; reference category was "yes"); (2) neighborhood unemployment, as defined by the 1990 census standardized unemployment rate by block group; and (3) proportion of neighborhood adults without a high-school diploma, defined as the standardized proportion of community adults age ≥25 years without a high-school diploma or equivalent, and also measured by the 1990 census unemployment rate by block group. All of the covariates were constructed based on self-report items from the adolescent in-home Wave I interviews with the exceptions of household income, grade point average, parental incarceration, neighborhood unemployment, and neighborhood high school graduation rate.

Data Analysis

We first explored descriptive statistics and then performed bivariate and multivariate analyses on the relationship between baseline social determinants of health, baseline health status, incarceration, and subsequent adult health outcomes. F-test and χ^2 analyses were performed to compare covariates and adult health outcomes between individuals with a history of incarceration and those without any incarceration. Multivariate logistic regressions investigated the relationship between an individual's cumulative duration of incarceration before Wave IV (age 24–34 years) and subsequent adult health outcomes (self-reported general health, functional limitations, depressive symptoms, and suicidal thoughts) in Wave IV, controlled for the covariates described above. We conducted analyses in Stata version 12.0 (Stata Corp, College Station, TX) using the "svy" suite of commands to account for the Add Health survey design elements of stratification, clustering, and weighting. We tested for interactions by gender and race/ethnicity by creating interaction terms and by exploring analyses stratified by gender and race/ethnicity. The study was approved by the UCLA institutional review board.

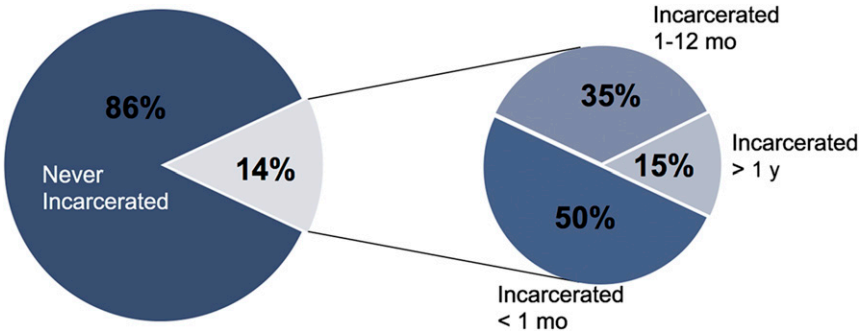

FIGURE 1
Young people's cumulative duration of incarceration: results by Add Health Wave IV (n = 14 344).

RESULTS

Fourteen percent of the analytic sample of 14 344 young adults reported ever being incarcerated. Of these, 50.3% reported a cumulative incarceration duration of <1 month, 34.8% reported 1 to 12 months, and 15.0% reported >1 year (Fig 1). At Wave IV, 57.6% of the analytic sample reported very good or excellent health, our reference category; 42.4% reported poor, fair, or good health. Similarly, at Wave IV, 6.1% reported functional limitations, 6.9% reported suicidal thoughts in the last 12 months, and 16.0% described symptoms of depression in the last week.

Bivariate analyses demonstrated worse adult health outcomes for individuals with a history of incarceration compared with those without incarceration. These unadjusted results were statistically significant for all 4 of the adult health outcomes and, overall, show a strong statistically significant relationship between social determinants of health, such as poverty, parental education, and parental incarceration, and subsequent incarceration risk (Table 1).

Multivariate analyses revealed that any length of incarceration was associated with higher odds of having worse adult health (Table 2). In the model for adult general health, we found that compared with no incarceration, a cumulative incarceration duration of 1 to 12 months predicted worse subsequent adult general health (odds ratio [OR] = 1.48; 95% confidence interval [CI], 1.12–1.96;

TABLE 1 Characteristics of the Study Sample by Incarceration History (n = 14 344)

Variable	Any Incarceration (% or Mean and SD)	No Incarceration (% or Mean and SD)	P (χ^2 or F-Tests)
Baseline characteristics			
Sociodemographics			<.001
Sex			
Girl	24.3%	54.5%	
Boy	75.7%	45.5	
Race/ethnicity			.007
White	63.4%	69.1%	
African-American	19.9%	14.8%	
Hispanic	12.2%	10.8%	
Other	4.5%	5.3%	
Age	15.2 (1.7)	15.4 (1.8)	.006
Household income (amount per year)			<.001
$0–$24 999	28.7%	20.9%	
$25 000–$49 999	27.4%	26.5%	
$50 000–$74 999	14.7%	19.1%	
≥$75 000	6.7%	11.8%	
Missing	22.5%	21.7%	
Highest level of parental education			<.001
Less than high school	13.9%	8.9%	
High school diploma	36.5%	30.8%	
Some college	21.9%	21.8%	
College degree or more	27.7%	38.5%	
Individual-level characteristics			
School connectedness	17.7 (3.7)	18.7 (3.8)	<.001
Grade point average	2.4 (0.74)	2.9 (0.76)	<.001
Perceived likelihood of attending college	3.8 (1.2)	4.2 (1.1)	<.001
Delinquent behaviors	3.2 (4.2)	1.4 (2.9)	<.001
Regular alcohol use	25.6%	16.0%	<.001
Cigarette use	37.7%	25.1%	<.001
Marijuana use	23.6%	11.9%	<.001
Other drug use	9.4%	4.6%	<.001
Family-level characteristics			
Family household structure			<.001
2 biological parents	42.1%	57.4%	
2 parents (≥1 nonbiological parent)	23.1%	15.8%	
Single parent	28.1%	21.6%	
Other	6.7%	5.2%	
Parental incarceration	33.3%	14.2%	<.001
Family connectedness	10.9 (2.4)	11.3 (2.5)	<.001
Community-level characteristics			
Perceived neighborhood safety	86.8%	90.7%	.001
Neighborhood unemployment	0.08 (0.06)	0.07 (0.06)	.011
Proportion of neighborhood adults without high school diploma	0.29 (0.15)	0.27 (0.16)	.002
Baseline health			
Worse baseline general health	39.2%	31.5%	<.001
Baseline functional limitations	2.9%	2.1%	.181
Baseline depressive symptoms	20.1%	17.6%	.045
Baseline suicidal thoughts	15.0%	12.9%	.068
Adult health			
Worse adult general health	52.4%	40.8%	<.001
Adult functional limitations	7.8%	5.8%	.049
Adult depressive symptoms	23.0%	14.9%	<.001
Adult suicidal thoughts	9.5%	6.5%	<.001

Percentages, means, and SDs reflect survey weights, clusters, and strata except for neighborhood unemployement and proportion of neighborhood adults without a high school diploma, for which we report the unstandardized mean and SD.

P = .007). In the model for adult functional limitations, we found that an incarceration duration of >1 year predicted subsequent adult functional limitations (OR = 2.92; 95% CI, 1.51–5.64; P = .002). In the model for adult depressive symptoms, we found that adult symptoms of depression were

TABLE 2 Results from Multivariate Models Showing Longitudinal Relationship Between Cumulative Lifetime Duration of Incarceration by Add Health Wave IV; Adult Health Outcomes of Adult General Health, Adult Functional Limitations, Adult Depressive Symptoms, and Adult Suicidality; and Covariates (n = 14 344)

	Worse Adult General Health Model OR (95% CI)	Functional Limitations Model OR (95% CI)	Depressive Symptoms Model OR (95% CI)	Suicidal Thoughts Model OR (95% CI)
Cumulative incarceration duration[a]				
No incarceration	1.0 (reference)	1.0 (reference)	1.0 (reference)	1.0 (reference)
<1 mo	1.1 (0.88–1.39)	1.13 (0.76–1.68)	1.41[b] (1.11 – 1.80)	1.10 (0.75 – 1.63)
1–12 mo	1.48[b] (1.12–1.96)	1.09 (0.63 – 1.88)	1.23 (0.84 – 1.80)	1.22 (0.81 – 1.82)
>1 y	1.33 (0.84–2.12)	2.92[b] (1.51 – 5.64)	4.18[b] (2.48 – 7.06)	2.34[b] (1.09 – 5.01)
Sex				
Girl	1.0 (reference)	1.0 (reference)	1.0 (reference)	1.0 (reference)
Boy	0.88[b] (0.79–0.98)	0.55[b] (0.44–0.70)	0.63[b] (0.53–0.75)	0.99 (0.73–1.34)
Race/ethnicity				
White	1.0 (reference)	1.0 (reference)	1.0 (reference)	1.0 (reference)
African-American	1.21[b] (1.02–1.43)	1.09 (0.80–1.47)	1.17 (0.94–1.45)	0.93 (0.67–1.28)
Hispanic	1.13 (0.91–1.40)	0.68 (0.42–1.09)	0.95 (0.72–1.26)	0.82 (0.48–1.42)
Other	1.48[b] (1.12–1.95)	0.71 (0.42–1.20)	1.17 (0.88–1.55)	0.85 (0.54–1.33)
Age	1.00 (0.97–1.04)	1.02 (0.96–1.08)	0.98 (0.94–1.03)	0.93 (0.87–1.00)
Household income (amount per year)				
$0–$24 999	1.0 (reference)	1.0 (reference)	1.0 (reference)	1.0 (reference)
$25 000–$49 999	0.94 (0.81–1.10)	0.73[b] (0.54–0.98)	0.95 (0.76–1.18)	1.07 (0.77–1.48)
$50 000–$74 999	0.88 (0.72–1.08)	0.66 (0.44–1.01)	0.74[b] (0.56–0.98)	1.13 (0.80–1.59)
≥$75 000	0.68[b] (0.54–0.86)	0.38[b] (0.23–0.64)	0.91 (0.68–1.23)	0.85 (0.55–1.31)
Missing	0.79[b] (0.67–0.93)	0.79 (0.58–1.08)	0.89 (0.71–1.11)	0.82 (0.59–1.14)
Highest level of parental education				
Less than high school	1.0 (reference)	1.0 (reference)	1.0 (reference)	1.0 (reference)
High school diploma	0.94 (0.74–1.19)	1.03 (0.70–1.51)	0.88 (0.65–1.18)	1.13 (0.76–1.68)
Some college	0.89 (0.71–1.13)	1.00 (0.67–1.50)	0.89 (0.65–1.24)	1.10 (0.69–1.76)
College degree or more	0.70[b] (0.55–0.88)	0.95 (0.61–1.47)	0.73 (0.53–1.01)	1.10 (0.65–1.88)
School connectedness	0.98[b] (0.96–0.99)	0.98 (0.95–1.01)	0.97[b] (0.95–0.99)	0.99 (0.96–1.01)
Grade point average	0.84[b] (0.76–0.93)	0.73[b] (0.62–0.85)	0.81[b] (0.72–0.91)	0.95 (0.80–1.12)
Delinquent behaviors	1.00 (0.99–1.02)	0.99 (0.95–1.04)	1.00 (0.98–1.02)	0.99 (0.95–1.03)
Regular alcohol use	0.94 (0.80–1.10)	0.86 (0.63–1.17)	0.85 (0.71–1.01)	0.65[b] (0.50–0.85)
Cigarette use	0.98 (0.86–1.11)	1.11 (0.82–1.49)	0.93 (0.77–1.14)	0.92 (0.70–1.20)
Marijuana use	0.92 (0.76–1.12)	0.77 (0.53–1.12)	0.95 (0.75–1.22)	1.01 (0.69–1.48)
Other drug use	0.98 (0.77–1.25)	2.05[b] (1.42–2.97)	1.27 (0.89–1.83)	1.33 (0.84–2.10)
Perceived likelihood of attending college	0.91[b] (0.84–0.99)	0.96 (0.86–1.07)	0.94 (0.87–1.01)	0.93 (0.82–1.06)
Family household structure				
2 biological parents	1.0 (reference)	1.0 (reference)	1.0 (reference)	1.0 (reference)
2 parents (≥1 nonbiological)	1.12 (0.95–1.32)	1.09 (0.79–1.49)	1.03 (0.84–1.27)	0.99 (0.74–1.33)
Single parent	0.99 (0.85–1.15)	0.91 (0.71–1.17)	1.08 (0.90–1.29)	1.07 (0.80–1.43)
Other	1.02 (0.80–1.30)	1.34 (0.89–2.00)	1.58[b] (1.22–2.05)	1.74[b] (1.12–2.71)
Parental incarceration	1.22[b] (1.06–1.39)	1.02 (0.76–1.38)	1.16 (0.93–1.43)	1.48[b] (1.16–1.90)
Family connectedness	0.97[b] (0.94–0.99)	1.00 (0.95–1.05)	0.96[b] (0.93–0.99)	0.95[b] (0.90–0.99)
Perceived neighborhood safety	1.10 (0.93–1.30)	1.07 (0.78–1.46)	1.19 (0.93–1.52)	1.27 (0.88–1.84)
Neighborhood unemployment	1.08 (1.00–1.16)	1.12 (0.99–1.26)	1.07 (0.96–1.20)	1.07 (0.95–1.20)
Proportion of neighborhood adults without high-school diploma	1.00 (0.93–1.09)	1.08 (0.94–1.25)	0.91[b] (0.84–1.00)	0.86 (0.73–1.01)
Worse baseline general health	2.00[b] (1.79–2.25)	—	—	—
Baseline functional limitations	—	2.98[b] (1.84–4.82)	—	—
Baseline depressive symptoms	—	—	2.05[b] (1.71–2.46)	1.33[b] (1.04–1.70)
Baseline suicidality	—	—	1.48[b] (1.21–1.81)	2.86[b] (2.23–3.67)

—, not applicable.

[a] The reference category for the cumulative incarceration duration variable was no incarceration.

[b] OR was statistically significant.

predicted by a youth incarceration duration <1 month (OR = 1.41; 95% CI, 1.11–1.80; P = .005) and a duration of >1 year (OR = 4.18; 95% CI, 2.48–7.06; P < .001). In the model for adult suicidal thoughts, we found that a duration of >1 year predicted subsequent adult suicidal thoughts (OR = 2.34; 95% CI, 1.09–5.01; P = .029). Overall, the largest magnitude ORs were seen for the more specific outcomes

of adult functional limitations, adult depressive symptoms, and adult suicidal thoughts, all in the incarceration >1-year category.

Several covariates held significance across at least 3 models: gender, household income, family connectedness, grade point average, and the baseline health variables. The associations between incarceration and our primary outcome, general health, were not modified by gender or race/ethnicity.

DISCUSSION

Our results suggest that incarceration during adolescence and early adulthood is independently associated with worse physical and mental health outcomes during adulthood. This relationship holds even when accounting for baseline health and key social determinants of health. Our findings linking youth incarceration and worse adult health are consistent with previous longitudinal studies, which have similarly shown an association between youth incarceration and worse long-term health.[1,2,17,18] Our study adds the dimension of a dose measure of incarceration. Given the wide variations in sentencing and amount of justice involvement different youth may experience, it is critical to understand how duration of incarceration might affect health. We found that an incarceration duration of >1 month is associated with worse adult general health, and a duration of >1 year is associated with worse adult mental health and adult functional limitations. In addition to the observation of a temporal relationship between youth incarceration and subsequent worse adult health outcomes, the higher ORs in the >1-year category observed when we examined the specific adult health outcomes of functional limitations, depressive symptoms, and suicidal thoughts provide evidence that a causal relationship may exist.

Given the current era of mass incarceration, this observation has important health implications. Incarcerated and formerly incarcerated individuals face disproportionate morbidity and mortality compared with their non–justice involved counterparts, which may compound any social vulnerabilities and additionally hinder opportunities for success.[8,16] For the 1.3 million children and adolescents arrested in the United States each year,[4] incarceration may systemically degrade their healthy development. The juvenile justice system, initially created to rehabilitate youthful offenders, has become increasingly harsh and punitive.[30] Our findings speak to an urgent need for pediatricians to increase efforts to: (1) prevent youth incarceration by addressing key behavioral and social determinants of health and (2) mitigate potential downstream health effects of youth incarceration. Our findings align with the American Academy of Pediatrics 2011 policy statement on youth involved in the juvenile justice system, which put forth several actions pediatricians can take to improve the health of justice-involved youth, including to actively advocate to reduce the number of youth confined.[8]

Our study has several potential limitations. First, the baseline Add Health survey was a school-based sample, which could have created a selection bias for our study. Also, although follow-up surveys were conducted in correctional settings, it is possible that survey participants with a history of incarceration may still have been lost to follow-up at a higher rate. However, it is reassuring that the observed incarceration rate at Wave IV is consistent with national figures.[31] It is also important to note that the age range for our adult health outcomes was relatively wide (24–34 years old). Overall, we postulate that these limitations may have led to an underestimate of the associations between cumulative incarceration and health, because higher-risk, justice-involved individuals and those with worse adult health outcomes would have been less likely to be included in the final Add Health sample. Additionally, the study sample included some individuals first incarcerated after young adulthood (ie, 25–34 years old); however, our sensitivity analyses excluding these individuals did not substantially alter our results. Another issue is the possibility of unmeasured factors that we were not able to account for in our analysis, such as system-level differences within correctional settings, including the quality of health care delivered and the overall conditions of confinement. Despite these limitations, our findings support that mechanisms causally linking youth incarceration with worse adult health may exist. These potential mechanisms merit additional examination and, if confirmed, intervention.

CONCLUSIONS

Given the high prevalence of incarceration, coupled with a current bipartisan willingness to pursue criminal justice reform,[32] the finding that more months in confinement as adolescents and young adults correlates with worse adult health outcomes is timely. Individuals with a history of incarceration may need increased support to overcome any long-term detrimental physical and mental health effects of incarceration. Health professionals can stand at the forefront of the juvenile and

criminal justice reform movement to more fully explore how justice reform can adapt alongside healthcare reform to develop systems that may protect rather than harm the health of these youth. Pediatricians have the opportunity to improve youths' long-term adult health outcomes by ensuring that unnecessary, potentially harmful exposures to incarceration are minimized and, for those exposed, to monitor for and mitigate any negative downstream health effects.

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ABBREVIATIONS

Add Health: National Longitudinal Study of Adolescent to Adult Health
CESD-10: Center for Epidemiologic Studies Depression Scale
CI: confidence interval
OR: odds ratio

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