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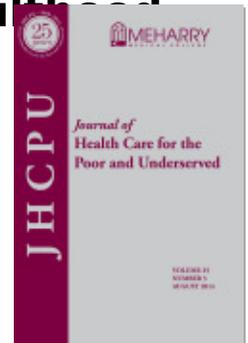
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## **Adverse childhood events: Incarceration of household members and health-related quality of life in adulthood**

Annie Gjelsvik, Dora M. Dumont, Amy Nunn, David L. Rosen

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## Adverse childhood events: incarceration of household members and health-related quality of life in adulthood

Annie Gjelsvik, PhD  
Dora M. Dumont, PhD, MPH  
Amy Nunn, ScD, MS  
David L. Rosen, PhD, MD

**Abstract:** **Background.** Incarceration of a household member has been associated with adverse outcomes for child well-being. **Methods.** We assessed the association between childhood exposure to the incarceration of a household member and adult health-related quality of life (HRQOL) in the 2009/2010 Behavioral Risk Factor Surveillance System controlling for age, race/ethnicity, education, and additional adverse childhood experiences. **Results.** Adults who lived in childhood with an incarcerated household member had higher risk of poor HRQOL compared with adults who had not (adjusted relative risk [ARR] 1.18; 95% CI 1.07, 1.31). Among Black adults the association was strongest with the physical health component of HRQOL (ARR 1.58 [95% CI 1.18, 2.12]); among White adults, the association was strongest with the mental health component of HRQOL (ARR 1.29, [95% CI 1.07–1.54]). **Conclusions.** Living with an incarcerated household member during childhood is associated with higher risk of poor HRQOL during adulthood, suggesting that the collateral damages of incarceration for children are long-term.

**Key words:** Adverse childhood experiences, incarceration, health-related quality of life, racial/ethnic disparities.

The U.S. leads the world in incarceration, with nearly one of every 100 adults behind bars.<sup>1,2</sup> There is growing attention to associations between incarceration and health disparities. Research on incarceration's collateral damage to children has also increased.<sup>3–9</sup> To date, though, there is little evidence of incarceration's long-term consequences for health, either for the individual or for his/her family.

Incarceration expanded rapidly starting in the 1970s, and racial and ethnic disparities in incarceration widened at the same time. This was largely due to the war on drugs,

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*ANNIE GJELSVIK is an Assistant Professor of Epidemiology and Pediatrics at the Brown University School of Public Health. DORA M. DUMONT is an Epidemiologist for the Rhode Island Department of Health. She was at The Miriam Hospital when this work was completed. AMY NUNN is an Assistant Professor of Medicine in the Division of Infectious Diseases at the Warren Alpert Medical School of Brown University. DAVID ROSEN is a Research Associate with the Institute for Global Health and Infectious Diseases at the University of North Carolina at Chapel Hill. Corresponding Author: Annie Gjelsvik, Department of Epidemiology, Brown University School of Public Health, Box G-121S, Providence, RI 02912; annie\_gjelsvik@brown.edu*

which disproportionately targeted Blacks and Hispanics.<sup>10</sup> Although the Substance Abuse and Mental Health Services Administration (SAMHSA) has shown consistently that Black and Hispanic adults do not use drugs more than White adults, between 1980 and 2007 Black adults were arrested on drug charges at rates that were 2.8 to 5.5 times higher than White adults.<sup>11,12</sup> By 2009, the Black male incarceration rate was 3,119 per 100,000 and the Hispanic male incarceration rate was 1,193 per 100,000, compared with a White male rate of 487 per 100,000.<sup>13</sup> Legal scholars have illustrated how these racial differences in arrest and incarceration can occur despite a purportedly race-neutral law enforcement and criminal justice system.<sup>10</sup>

These racial/ethnic differences in incarceration rates mean that Hispanic and especially Black children are at much higher risk of experiencing the incarceration of a parent or other household member, compared with Whites. An analysis of a 1990 birth cohort found that while White children had a 3.6–4.4% cumulative risk of experiencing parental incarceration by age 14, Black children in the same age cohort had a 25–28% cumulative risk.<sup>9</sup> Moreover, the precipitous rise in incarceration rates since the 1980s means that the number of children with an incarcerated family member has also increased dramatically over the past 30-plus years.

Concern is mounting regarding the public health consequences of incarceration. Population health datasets rarely include incarceration history, making it difficult to measure the association between incarceration and health outcomes, behaviors, and disparities<sup>14,15</sup> However, there is strong evidence of incarceration's adverse effects on the primary social determinants of health such as employment, homelessness, and marriage.<sup>16–19</sup> As a disruptive life event experienced disproportionately by young Black and Hispanic men, incarceration may also be contributing to health disparities in the U.S.

The incarceration of a household member affects children's welfare in many ways. In cases of domestic violence, the removal of the perpetrator may have a positive effect on the child's well-being. However, there is strong evidence that the net effect of incarceration on children is harmful.<sup>8</sup> This is especially evident in light of the extensive incarceration of people for nonviolent offenses or technical violations such as missing a parole meeting.<sup>20</sup> In such cases, parental incarceration has been linked to increased aggression, depression, and anxiety in their children.<sup>4,8,21</sup> Children's well-being can be affected through multiple pathways, including reduced economic resources, traumatic removal of the family member, and stigmatization.<sup>22,23</sup>

Longitudinal studies are tracking the children of incarcerated parents,<sup>21</sup> but these are in the early years and we still have limited means of quantifying the long-term health effects of incarceration on both the prisoner and his/her family. Recently, investigators added an Adverse Childhood Experiences (ACE) module to the Behavioral Risk Factor Surveillance Survey (BRFSS). This module allows us to assess the later-life effects of having a household member incarcerated during childhood. Elsewhere, these data have revealed that this childhood experience is associated with specific health behaviors such as substance use, smoking, and heavy drinking in adulthood.<sup>24,25</sup> We examined whether childhood exposure to the incarceration of a household member is also associated with overall health-related quality of life (HRQOL) in adulthood. Health-related quality of life, which includes both physical and mental health components, has been identified as a key health measure and has been used for over a decade to track the nation's health and health disparities.<sup>26</sup> It has been validated as predictive of mortality,

hospitalization, and use of health care.<sup>27</sup> We analyzed 2009–2010 BRFSS data to examine associations between childhood exposure to incarceration of a household member and adult HRQOL (and its components of physical health and mental health), first for the entire sample and then stratified by race/ethnicity. We hypothesized that experiencing incarceration of a household member in childhood would be associated with decreased HRQOL in adulthood.

## Methods

The BRFSS is a yearly cross-sectional telephone-administered survey, administered by all 50 states and the District of Columbia, Puerto Rico, the U.S. Virgin Islands, and Guam. The design and methodology of this survey are described in detail elsewhere.<sup>28</sup> An optional ACE module was administered in Arkansas, Louisiana, New Mexico, Tennessee, and Washington in 2009 and in the District of Columbia, Hawaii, Maine, Nevada, Ohio, Pennsylvania, Vermont, Washington, and Wisconsin in 2010. The response rates for these states in these years ranged from 47.0% (Pennsylvania) to 60.5% (Vermont).<sup>29</sup>

The ACE module was based on similar questions from the Kaiser Family Foundation—Centers for Disease Control and Prevention (CDC) ACE Study and adapted for a telephone survey.<sup>30</sup> Participants were asked of their first 18 years of life, “Did you live with anyone who served time or was sentenced to serve time in a prison, jail, or other correctional facility?”<sup>31</sup> with possible responses of “yes,” “no,” and “don’t know/not sure.” Using the same method as previous ACE studies<sup>30,32</sup> we categorized the responses into yes and no, with “don’t know or not sure” (<1% of sample) considered a negative response. Using the United States Census definition of a household as including “all the persons who occupy a housing unit,”<sup>33</sup> we refer to those with affirmative responses as having been “exposed to household incarceration during childhood.” After removing those with missing information and those who refused to answer the question (6.1% of participants in states that administered the ACE module), the initial analytic sample consisted of 81,910 adults.

We examined HRQOL as the primary outcome, measured by the number of days out of the past 30 that participants reported poor physical or poor mental health. Two questions were used for this measure: “Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?” and “Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?” We summed the number of poor mental or physical health days to obtain the overall number of poor health days (weighted mean 6.7; standard error (SE) 0.08; median 1; range 0–30). Overall poor HRQOL was defined as 14 or greater of the summed number of poor mental or physical health days.<sup>26</sup> In addition, we analyzed poor physical (weighted mean 3.7; SE 0.06; median 0; range 0–30) and poor mental health (weighted mean 3.4; SE 0.6; median 0; range 0–30) independently. We dichotomized both poor physical and mental health as 0–13 days or 14–30 days. Fourteen or more days of poor mental health or poor physical health was considered frequent mental distress<sup>34</sup> or physical distress, respectively.

Among the study population, we examined the distributions of five socio-demographic variables: sex (male/female), age (18–30/31–44/45–64/65–99), and race/ethnicity (non-Hispanic White/non-Hispanic Black/Hispanic/non-Hispanic other/non-Hispanic mul-

tiracial), education (less than high school education, high school graduation or GED, and at least some college) and income (<\$20,000/\$20,000–\$49,999)/ ≥ \$50,000/don't know/refused/missing).

Since ACEs are highly correlated,<sup>35,36</sup> it is likely that a child who lived with an incarcerated household member also experienced other ACEs. We therefore created an ACE score following the method described in detail elsewhere where 11 questions were used to develop a score (range 0–8) of number of ACEs experienced.<sup>30,32</sup> Here, however, we excluded exposure to household incarceration during childhood (range 0–7) before categorizing the score and entering it into the model as dummy variables. The other seven ACEs were childhood sexual abuse, physical abuse, emotional abuse, witnessing domestic violence, exposure to drug or alcohol abuse, living with a mentally ill household member, and parental separation or divorce

We first compared the distribution of socio-demographic variables and the number and type of additional adverse childhood experiences in those who had lived with an incarcerated household member *vs.* those who had not, using chi-square tests. Next we examined differences in the distribution of HRQOL, including its physical and mental health components, across the main exposure variable. We ran separate regression models using the binomial distribution with a log link to obtain risk ratios. Each covariate was put in the model separately and those that changed the risk ratio by ≥10% were included in the final model. Race/ethnicity was retained in the model even though it did not change the risk ratio by ≥10% to facilitate interaction analyses. Results from models that controlled for income and models that controlled for education were substantially the same. We therefore present results from models that control for education since more than 12% of respondents refused to provide or did not know their current annual income. We also tested for change in the results when dummy variables for either year of interview or resident state were included. Since these variables did not change the association between exposure to household incarceration during childhood and any of the outcomes we present models without these terms. Similarly, interaction terms between race/ethnicity and exposure to household incarceration during childhood were tested but proved not significant and were not included in the final model. Finally, because of the large differences in incarceration rates by race and ethnicity, we re-ran the final model stratified by race and ethnicity for White, Black, and Hispanic adults. We used STATA SE v 12.1<sup>37</sup> with survey commands to account for the complex survey design and to weight the data to account for non-coverage and non-response.<sup>28</sup>

## Results

Among adults in the states included in this study, 6.5% were exposed to household incarceration during childhood. Those exposed were younger at the time of the survey (37% *vs.* 14% age 18–30), less educated (17% *vs.* 6% with less than a high school education), and less likely to be White (24% Black or Hispanic, *vs.* 11% Black or Hispanic) compared with those without the exposure. Those with exposure to household incarceration during childhood were also much more likely to have experienced other adverse experiences of childhood (36% had experienced 5–7 other ACEs, compared with 6% of those without the exposure; Table 1).

**Table 1.****CHARACTERISTICS OF 2009–2010 BRFSS RESPONDENTS IN 12 STATES AND THE DISTRICT OF COLUMBIA**

	No exposure to household incarceration during childhood 93.5% (n=78,193)	Exposure to household incarceration during childhood 6.5% (n=3,717)	p-value
Age (years)			p<.001
18–30	14% (4,654)	37% (763)	
31–44	31% (12,439)	35% (960)	
45–64	36% (34,104)	23% (1,475)	
65+	19% (26,455)	6% (508)	
Gender			p<.014
Male	48% (29,800)	52% (1,499)	
Female	52% (48,393)	48% (2,218)	
Income (\$)			p<.001
<20,000	20% (18,525)	35% (1,432)	
20,000–49,999	23% (19,460)	23% (891)	
≥50,000	45% (30,711)	28% (1,010)	
Don't know/refused/missing	12% (9,497)	13% (384)	
Education			p<.001
No high school degree	6% (5,598)	17% (590)	
High school or GED	30% (22,290)	37% (1,282)	
Some college/college degree	64% (50,181)	46% (1,841)	
Race/ethnicity			p<.001
White, non-Hispanic	83% (61,725)	69% (2,288)	
Black, non-Hispanic	6% (5,001)	16% (602)	
Hispanic	5% (3,807)	8% (356)	
Other, non-Hispanic	4% (4,420)	4% (216)	
Multi, non-Hispanic	2% (2,297)	4% (218)	
ACE Score <sup>a</sup>			p<.001
0	45% (35,153)	5% (249)	
1	23% (17,614)	12% (475)	
2	13% (9,584)	14% (579)	
3	8% (5,949)	18% (568)	
4	5% (3,984)	15% (499)	
5–7	6% (4,235)	36% (1,225)	
Other ACE experience:			
Emotional abuse	25% (19,259)	58% (2,054)	p<.001
Physical abuse	14% (11,059)	40% (1,443)	p<.001
Sexual abuse	10% (9,194)	30% (1,174)	p<.001
Exposure to domestic violence	13% (10,631)	47% (1,688)	p<.001
Exposure to substance abuse	23% (18,879)	81% (2,856)	p<.001

*(Continued on p. 1174)*

**Table 1. (continued)**

	<b>No exposure to household incarceration during childhood 93.5% (n=78,193)</b>	<b>Exposure to household incarceration during childhood 6.5% (n=3,717)</b>	<b>p-value</b>
Mentally ill household member	16% (11,647)	45% (1,578)	p<.001
Parental separation or divorce	22% (15,332)	59% (1,977)	p<.001
<i>Health-Related Quality of Life</i>			
Overall HRQOL (number of days in past 30 days)			p<.001
<14	80% (61,393)	67% (2,440)	
14–30	20% (16,800)	33% (1,277)	
Unhealthy mental days (of past 30)			p<.001
<14	90% (69,929)	77% (2,908)	
14–30	10% (7,202)	23% (762)	
Unhealthy physical days (of past 30)			p<.001
<14	89% (66,723)	85% (2,945)	
14–30	11% (9,961)	15% (699)	

<sup>a</sup>Adverse Childhood Experience score: count of all ACEs excluding exposure to household incarceration.  
ACE=Adverse Childhood Experiences  
HRQOL=Health-Related Quality Of Life

In unadjusted analysis (Table 2), exposure to household incarceration during childhood was associated with overall poor HRQOL in adulthood (RR 1.70 [95% CI 1.54, 1.88]) as well as both poor physical health (RR 1.42 [95% CI 1.23, 1.64]) and poor mental health (RR 2.38 [95% CI 2.08, 2.72]). When adjusted for age, race/ethnicity, education and number of other adverse childhood experiences, the associations between exposure to household incarceration during childhood and both poor overall adult HRQOL and poor mental HRQOL were attenuated but remained significant (ARR 1.18 [95% CI 1.07, 1.31] and ARR 1.22 [95% CI 1.06, 1.41] respectively). However, based on the adjusted model, the association between exposure to household incarceration during childhood and poor physical HRQOL was no longer statistically significant (ARR 1.15 [95% CI 0.99, 1.33]).

When stratified by race/ethnicity, the association between the childhood exposure and overall adult HRQOL was similar for White (ARR 1.18 (95% CI 1.04, 1.34)), Black (ARR 1.20 (95% CI 1.01, 1.43)), and Hispanic (ARR 1.15 (95% CI 0.80, 1.64)) adults, but the ARR for Hispanic adults did not reach statistical significance (Table 3). Among Whites, the association between the exposure to household incarceration during childhood and overall HRQOL was driven primarily by the higher odds of poor mental health days (ARR 1.29, 95% CI 1.07–1.54) rather than physical health days. Among Blacks, conversely, the childhood experience of living with an incarcerated household

**Table 2.**

**UNADJUSTED AND ADJUSTED RISK OF HEALTH OUTCOMES FOR ADULTS WHO, AS A CHILD, LIVED WITH SOMEONE WHO WAS INCARCERATED COMPARED TO ADULTS WHO DID NOT, 2009–2010 BEHAVIORAL RISK FACTOR SURVEILLANCE SURVEY (BRFSS)**

	Poor overall HRQOL <sup>a</sup>		Poor physical health		Poor mental health	
	RR	ARR (95% CI) <sup>b</sup>	RR	ARR (95% CI) <sup>b</sup>	RR	ARR (95% CI) <sup>b</sup>
No exposure to household incarceration during childhood	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
Exposure to household incarceration during childhood	1.70 (1.54, 1.88)	1.18 (1.07, 1.31)	1.42 (1.23, 1.64)	1.15 (0.99, 1.33)	2.38 (2.08, 2.72)	1.22 (1.06, 1.41)
No high school or GED		1.00 (reference)		1.00 (reference)		1.00 (reference)
High school or GED		0.71 (0.66, 0.77)		0.63 (0.57, 0.70)		0.66 (0.57, 0.77)
Some college/college degree		0.50 (0.46, 0.54)		0.42 (0.38, 0.46)		0.46 (0.40, 0.53)
Age 18–30 years		1.00 (reference)		1.00 (reference)		1.00 (reference)
Age 31–44 years		1.05 (0.93, 1.19)		1.57 (1.26, 1.96)		1.03 (0.88, 1.21)
Age 45–64 years		1.39 (1.25, 1.55)		2.96 (2.43, 3.61)		1.16 (1.02, 1.34)
Age 65+ years		1.57 (1.41, 1.75)		3.65 (3.00, 4.44)		0.73 (0.63, 0.85)
0 other ACEs		1.00 (reference)		1.00 (reference)		1.00 (reference)
1 other ACE		1.22 (1.12, 1.32)		1.14 (1.03, 1.26)		1.53 (1.33, 1.76)
2 other ACEs		1.56 (1.43, 1.70)		1.52 (1.37, 1.70)		2.29 (1.99, 2.64)
3–7 other ACEs		2.18 (2.04, 2.34)		2.09 (1.90, 2.29)		3.46 (3.08, 3.90)

<sup>a</sup>Defined as ≥14 poor physical or mental health days of the past 30 days.

<sup>b</sup>Adjusted for age, education, and number of additional adverse childhood experiences.

RR=Risk Ratio

ARR=Adjusted Risk Ratio

CI=Confidence Interval

ACE=Adverse Childhood Experiences

member was associated with poorer physical health in adulthood (ARR 1.58 (95% CI 1.18, 2.12)) but not poor mental health. Among Hispanics, the association between the exposure and overall HRQOL and its physical and mental health components was not significantly different for those who had exposure to household incarceration during childhood *vs.* those who had not (Results not shown).

## Discussion

Living with an incarcerated household member during childhood is associated with higher risk of poor HRQOL. Only part of this relationship is accounted for by coexisting adverse childhood events.

Other studies have also found that childhood exposure to household incarceration is associated with an increase in adverse health outcomes among adults such as ischemic heart disease<sup>38</sup> and depressive disorders.<sup>39</sup> And among young adults, childhood exposure to incarceration has been associated with more marijuana and other illegal drug use compared with youth without this exposure.<sup>24</sup> But to our knowledge, this is the first study using a population-based sample to provide an analysis of childhood exposure to household incarceration in relation to overall adult health.

Our study provides additional evidence that the epidemic of incarceration in the U.S.<sup>1,40</sup> is one mechanism by which health disparities are perpetuated. As in previous research,<sup>32</sup> exposure to household incarceration during childhood was much more prevalent among Black (15%) and Hispanic (11%) adults than among White adults (5%). While the relationship between living with an incarcerated household member during childhood and poor overall adult HRQOL is similar for both Black and White adults, the prevalence is much higher for Black adults than for White adults.

We also found racial/ethnic differences when looking at the component physical and mental health parts of HRQOL in relation to exposure to household incarceration during childhood. Among Black adults poor physical health was associated with exposure to household incarceration during childhood, but this association was not significant for White adults. Conversely, among Whites poor mental health was associated with childhood exposure to household incarceration; this association was not significant among Blacks or Hispanics. We caution that similar analyses should be conducted with other datasets before concluding that exposure to household incarceration during childhood is not associated with Hispanic adult HRQOL. Given the dramatic increase in racial incarceration disparities in the past decades and the impact of living with an incarcerated household member during childhood, racial disparities in poor adult health will also continue to grow as the children who had household members incarcerated in the 1990s continue to reach adulthood.

Black adults have consistently reported higher rates of both poor physical and mental health than White adults have reported.<sup>41,42</sup> This was true in the present study population, although differences were modest. It is unclear why childhood exposure to incarceration would have stronger associations with adult physical health for Black adults, but with adult mental health for White adults. A possible explanation is that the effects are not different but that the manifestations of mental health issues differ by race. For instance, somatization, or the physical manifestation of mental illness

**Table 3.**  
**UNADJUSTED AND ADJUSTED RISK OF POOR OVERALL HEALTH-RELATED QUALITY OF LIFE FOR ADULTS WHO, AS A CHILD, LIVED WITH SOMEONE WHO WAS INCARCERATED COMPARED TO ADULTS WHO DID NOT, STRATIFIED BY RACE/ETHNICITY, 2009–2010 BEHAVIORAL RISK FACTOR SURVEILLANCE SURVEY (BRFSS)**

	White, Non-Hispanic		Black, Non-Hispanic		Hispanic	
	Risk Ratio	Adjusted Risk Ratio <sup>a</sup>	Risk Ratio	Adjusted Risk Ratio <sup>a</sup>	Risk Ratio	Adjusted Risk Ratio <sup>a</sup>
No exposure to household incarceration during childhood	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
Exposure to household incarceration during childhood	1.74 (1.54, 1.97)	1.18 (1.04, 1.34)	1.59 (1.25, 2.01)	1.20 (1.01, 1.43)	1.38 (0.99, 1.91)	1.15 (0.80, 1.64)
No high school degree		1.00 (reference)		1.00 (reference)		1.00 (reference)
High school or GED		0.70 (0.63, 0.78)		0.78 (0.64, 0.94)		0.72 (0.55, 0.93)
Some college/college degree		0.48 (0.44, 0.53)		0.52 (0.42, 0.64)		0.70 (0.54, 0.90)
Age 18–30 years		1.00 (reference)		1.00 (reference)		1.00 (reference)
Age 31–44 years		0.99 (0.86, 1.15)		1.44 (1.02, 2.03)		0.97 (0.69, 1.35)
Age 45–64 years		1.28 (1.12, 1.46)		2.05 (1.51, 2.79)		1.63 (1.18, 2.25)
Age 65+ years		1.44 (1.26, 1.65)		2.38 (1.73, 3.27)		1.67 (1.18, 2.36)
0 other ACEs		1.00 (reference)		1.00 (reference)		1.00 (reference)
1 other ACE		1.21 (1.10, 1.32)		1.05 (0.84, 1.33)		1.33 (0.97, 1.83)
2 other ACEs		1.54 (1.40, 1.69)		1.49 (1.15, 1.95)		1.65 (1.21, 2.27)
3–7 other ACEs		2.12 (1.96, 2.30)		2.25 (1.83, 2.75)		2.14 (1.66, 2.74)

<sup>a</sup>Adjusted for age, education, and number of additional adverse childhood experiences.

ACE=Adverse Childhood Experiences

or distress, is estimated to occur at a rate of 15% among Black adults and 9% among White adults,<sup>43</sup> which might provide a partial explanation for the race-specific patterns for physical and mental health that we found.

Incarceration's strains on households appear to have enduring associations with health into adulthood. Although incarceration appears to have crested in the U.S.,<sup>2</sup> we caution that children exposed to incarceration during its peak will continue to reach adulthood with the accompanying health consequences for many years to come. We see at least three ways that health providers can act to address the needs of this high-risk but hard-to-identify population.

First, it is crucial that health providers and public health practitioners use their professional authority to support policies aimed at reducing the epidemic of incarceration. Without question, some people must be incarcerated for the protection of society. However, many people convicted of minor and nonviolent offenses could be more effectively handled by alternatives to incarceration such as community justice programs, drug courts, and mental health courts.<sup>44-46</sup>

Second, the effects of familial incarceration may be mitigated by improving coordination and active partnerships among state agencies, especially Departments of Correction, health departments, and Departments of Children, Youth and Families. It is important to note that there are household stressors pertaining to not only incarceration but reentry, which is also often a period of stress and anxiety. Most prisons offer some discharge planning, but a 2007 study found that only 10% of state prison releasees received it as needed.<sup>47</sup> Interagency cooperation in expanding either parenting programming during incarceration or discharge planning that addresses family health may interrupt some of the pathways between childhood exposure and adult health. Existing programs and services should also be systematically evaluated and reviewed, as there is minimal information available regarding their effectiveness.

Third, while clinical recommendations are beyond the scope of this research, health providers and public health practitioners may better target patient needs by remaining alert to the role that childhood exposure to household incarceration may play in their patients' overall health or chronic disease risk behaviors such as smoking.<sup>25</sup> There is the possibility that patient-provider discussions may help identify and address the specific pathways of that association (e.g., stress, trauma, or economic strain). Given the high rates of co-occurrence between exposure to household incarceration and other adverse childhood experiences, providers (especially mental or behavioral health providers) who are regularly trained to look for other ACEs could add incarceration to the conditions they ask about in their patients' lives.

There are several limitations to this study. While there is evidence suggesting that a single question about household incarceration is valid and reliable,<sup>48,49</sup> we were unable to evaluate the effects of which household member was incarcerated, for how long, for what type of offense (including violent *versus* other offenses), and at what time point in the participant's childhood. We assumed that in most cases the incarcerated household member was a parent but are unable to verify that assumption. Evidence to date is mixed on whether which parent is incarcerated modifies the effect of parental incarceration among children manifesting antisocial behavior.<sup>5,6,50</sup> There are critical differences between the household and caretaking experiences of children with incarcerated

mothers and those of children with incarcerated fathers<sup>51</sup> that may be contributing to the racial differences observed here. While we controlled for the number of additional ACEs experienced we did not control for each individual ACE and the association observed here may be due to these other factors.

We were also unable to account for the adult participants' own incarceration histories in our analyses since the BRFSS, like many other nationally representative health data sets,<sup>14</sup> does not collect this information. Since the BRFSS is a telephone survey with a target population of the non-institutionalized adult population,<sup>28</sup> adults who are currently incarcerated were not a part of the study. People who have family members—especially parents—who were incarcerated may themselves be at greater risk of incarceration;<sup>52</sup> therefore, incarcerated people excluded from the sample are also more likely to have had household members incarcerated during their childhood, which may have biased our results. Six percent of participants in the states that administered the ACE module were excluded due to invalid or missing information on the exposure to household incarceration during childhood question. Participants who were excluded were younger, poorer and more likely to refuse to give income information, less educated, more likely to be Black or Hispanic, and more likely to have poor health outcomes. As a consequence, we speculate that our estimated associations among Blacks and Hispanics were modestly attenuated towards the null.

People who were exposed to the incarceration of a household member during childhood are at heightened risk for poor health-related quality of life into adulthood. Continued epidemiological studies of the children of people redirected to such alternatives may provide a valuable basis for measuring the impact of reduced incarceration on health disparities.<sup>53</sup>

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## Notes

1. Rich JD, Wakeman SE, Dickman SL. Medicine and the epidemic of incarceration in the United States. *N Engl J Med*. 2011 Jun 2;364(22):2081–3. <http://dx.doi.org/10.1056/NEJMp1102385>
2. Glaze L, Parks E. Correctional populations in the US, 2011. Washington, DC: Bureau of Justice Statistics, 2012.
3. Foster H, Hagan J. The mass incarceration of parents in America: issues of race/ethnicity, collateral damage to children, and prisoner reentry. *Ann Am Acad Political Soc Sci*. 2009;623(1):179–94. <http://dx.doi.org/10.1177/0002716208331123>
4. Geller A, Garfinkel I, Cooper CE, et al. Parental incarceration and child wellbeing: implications for urban families. *Soc Sci Q*. 2009 Dec 1;90(5):1186–202. <http://dx.doi.org/10.1111/j.1540-6237.2009.00653.x>
5. 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 Mar;138(2):175–210. <http://dx.doi.org/10.1037/a0026407>
6. Lee RD, Fang X, Luo F. The impact of parental incarceration on the physical and mental health of young adults. *Pediatrics.* 2013 Apr;131(4):e1188–95. <http://dx.doi.org/10.1542/peds.2012-0627>
  7. Schwartz-Soicher O, Geller A, Garfinkel I. The effect of paternal incarceration on material hardship. *Soc Service Rev.* 2011;85(3):447–73. <http://dx.doi.org/10.1086/661925>
  8. Wakefield S, Wildeman C. Mass imprisonment and racial disparities in childhood behavioral problems. *Am Soc Criminology.* 2011 Aug;10(3):793–817.
  9. Wildeman C. Parental imprisonment, the prison boom, and the concentration of childhood disadvantage. *Demography.* 2009 May;46(2):265–80. <http://dx.doi.org/10.1353/dem.0.0052>
  10. Alexander M. *The new Jim Crow: mass incarceration in the age of colorblindness.* New York, NY: The New Press, 2010.
  11. Substance Abuse and Mental Health Services Administration. *Results from the 2009 National Survey on Drug Use and Health (Volume I).* Rockville, MD: Substance Abuse and Mental Health Services Administration, 2010.
  12. Human Rights Watch. *Decades of disparity: drug arrests and race in the United States.* New York, NY: Human Rights Watch, 2009.
  13. West HC, Sabol WJ, Greenman SJ. *Prisoners in 2009.* Washington, DC: US Department of Justice Bureau of Justice Statistics, 2010.
  14. Ahalt C, Binswanger IA, Steinman M, et al. Confined to ignorance: the absence of prisoner information from nationally representative health data sets. *J Gen Intern Med.* Feb 2012 Feb;27(2):160–6. Epub 2011 sep 16.
  15. Wang EA, Wildeman C. Studying health disparities by including incarcerated and formerly incarcerated individuals. *JAMA.* 2011 Apr 27;305(16):1708–9. <http://dx.doi.org/10.1001/jama.2011.532>
  16. Pager D, Western B, Sugie N. Sequencing disadvantage: barriers to employment facing young black and white men with criminal records. *Ann Am Acad Pol Soc Sci.* 2009 May 2;623(1):195–213. <http://dx.doi.org/10.1177/0002716208330793>
  17. Massoglia M. Incarceration, health, and racial disparities in health. *Law & Society Review.* 2008;42(2):275–306. <http://dx.doi.org/10.1111/j.1540-5893.2008.00342.x>
  18. London AS, Myers NA. Race, Incarceration, and Health: a life-course approach. *Research on Aging.* 2006 May 1;28(3):409–22. <http://dx.doi.org/10.1177/0164027505285849>
  19. Massoglia M, Firebaugh G, Warner C. Racial variation in the effect of incarceration on neighborhood attainment. *Am Soc Rev.* 2012 Dec 26;78(1):142–65. <http://dx.doi.org/10.1177/0003122412471669>
  20. Pew Center on the States. *1 in 100: behind bars in America.* Washington, DC: Pew Center on the States, 2008.
  21. Wildeman C, Western B. Incarceration in fragile families. *Future Child.* 2010 Fall; 20(2):157–77. <http://dx.doi.org/10.1353/foc.2010.0006>
  22. Comfort M. Punishment beyond the legal offender. *Annu Rev Law Soc Sci.* 2007;3: 271–96. <http://dx.doi.org/10.1146/annurev.lawsocsci.3.081806.112829>
  23. Nichols EB, Loper AB. Incarceration in the household: academic outcomes of adolescents with an incarcerated household member. *J Youth Adolesc.* 2012 Nov;41(11): 1455–71. <http://dx.doi.org/10.1007/s10964-012-9780-9>
  24. Roettger ME. 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 United States. *Addiction* (Abingdon, England). 2011; 106(1):121. <http://dx.doi.org/10.1111/j.13600443.2010.03110.x>
25. Gjelsvik A, Dumont DM, Nunn A. Incarceration of a household member and Hispanic health disparities: childhood exposure and adult chronic disease risk behaviors. *Prev Chronic Dis*. 2013;10:E69. <http://dx.doi.org/10.5888/pcd10.120281>
  26. Centers for Disease Control and Prevention. Measuring healthy days. In: Centers for Disease Control and Prevention, (ed). United States Department of Health and Human Services. Atlanta, GA: Centers for Disease Control and Prevention, 2000.
  27. Moriarty DG, Zack MM, Kobau R. The Centers for Disease Control and Prevention's Healthy Days Measures—population tracking of perceived physical and mental health over time. *Health Qual Life Outcomes*. 2003 Sep 2;1:37. <http://dx.doi.org/10.1186/1477-7525-1-37>
  28. Centers for Disease Control and Prevention. Behavioral risk factor surveillance system operational and users guide (Version 3.0) In: Centers for Disease Control and Prevention, (ed). United States Department of Health and Human Services. Atlanta, GA: Centers for Disease Control and Prevention, 2006.
  29. Centers for Disease Control and Prevention. Behavioral risk factor surveillance system 2010 summary data quality report (Version 1). In: Centers for Disease Control and Prevention, (ed). United States Department of Health and Human Services. Atlanta, GA: Centers for Disease Control and Prevention, 2010.
  30. Ford ES, Anda RF, Edwards VJ, et al. Adverse childhood experiences and smoking status in five states. *Prev Med*. 2011 Sep;53(3):188–93. <http://dx.doi.org/10.1016/j.pmed.2011.06.015>
  31. Centers for Disease Control and Prevention. Behavioral risk factor surveillance system survey questionnaire. In: Centers for Disease Control and Prevention, (ed). United States Department of Health and Human Services. Atlanta, GA: Centers for Disease Control and Prevention, 2010.
  32. Centers for Disease Control and Prevention. Adverse childhood experiences reported by adults—five states, 2009. *MMWR Morb Mortal Wkly Rep*. 2010 Dec 17;59(49):1609–13.
  33. United States Census Bureau. Current population survey (CPS)—definitions. Washington, DC: United States Census Bureau, 2013.
  34. Centers for Disease Control and Prevention. Self-reported frequent mental distress among adults—United States, 1993–2001. *MMWR Morb Mortal Wkly Rep*. 2004 Oct 22;53(41):963–6.
  35. Dong M, Anda RF, Felitti VJ, et al. The interrelatedness of multiple forms of childhood abuse, neglect, and household dysfunction. *Child Abuse Negl*. 2004 Jul;28(7):771–84. <http://dx.doi.org/10.1016/j.chiabu.2004.01.008>
  36. Anda RF, Croft JB, Felitti VJ, et al. Adverse childhood experiences and smoking during adolescence and adulthood. *JAMA*. 1999 Nov 3;282(17):1652–8. <http://dx.doi.org/10.1001/jama.282.17.1652>
  37. StataCorp LP. Release 12, (computer program). College Station, TX: StataCorp LP, 2011.
  38. Dong M, Giles WH, Felitti VJ, et al. Insights into causal pathways for ischemic heart disease: adverse childhood experiences study. *Circulation*. 2004 Sep 28;110(13):1761–6. <http://dx.doi.org/10.1161/01.CIR.0000143074.54995.7F>
  39. Chapman DP, Whitfield CL, Felitti VJ, et al. Adverse childhood experiences and the risk of depressive disorders in adulthood. *J Affect Disord*. 2004 Oct 15;82(2):217–25. <http://dx.doi.org/10.1016/j.jad.2003.12.013>

40. Drucker E. *A plague of prisons: the epidemiology of mass incarceration in America*. New York, NY: The New Press, 2011.
41. Chowdhury PP, Balluz L, Strine TW. Health-related quality of life among minority populations in the United States, BRFSS 2001–2002. *Ethn Dis*. 2008 Autumn;18(4): 483–7.
42. Skarupski KA, de Leon CF, Bienias JL, et al. Black-white differences in health-related quality of life among older adults. *Qual Life Res*. 2007 Mar;16(2):287–96. <http://dx.doi.org/10.1007/s11136-006-9115-y>
43. United States Department of Health and Human Services. *Mental health: culture, race, and ethnicity—a supplement to mental health: a report of the Surgeon General*. Rockville, MD: United States Department of Health and Human Services, 2001.
44. 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 Jun; 78(2):214–35. <http://dx.doi.org/10.1093/jurban/78.2.214>
45. Brown RT. Systematic review of the impact of adult drug-treatment courts. *Transl Res*. 2010 Jun;155(6):263–74. <http://dx.doi.org/10.1016/j.trsl.2010.03.001>
46. Steadman HJ, Redlich A, Callahan L, et al. Effect of mental health courts on arrests and jail days: a multisite study. *Arch Gen Psychiatry*. 2011 Feb;68(2):167–72. <http://dx.doi.org/10.1001/archgenpsychiatry.2010.134>
47. Mellow J, Greifinger RB. Successful reentry: the perspective of private correctional health care providers. *J Urban Health*. 2007 Jan;84(1):85–98. <http://dx.doi.org/10.1007/s11524-006-9131-9>
48. Dube SR, Williamson DF, Thompson T, et al. Assessing the reliability of retrospective reports of adverse childhood experiences among adult HMO members attending a primary care clinic. *Child Abuse Negl*. 2004 Jul;28(7):729–37. <http://dx.doi.org/10.1016/j.chiabu.2003.08.009>
49. Hardt J, Rutter M. Validity of adult retrospective reports of adverse childhood experiences: review of the evidence. *J Child Psychol Psychiatry*. 2004 Feb;45(2):260–73. <http://dx.doi.org/10.1111/j.1469-7610.2004.00218.x>
50. Foster H, Hagan J. Maternal and paternal imprisonment in the stress process. *Soc Sci Res*. 2013 May;42(3):650–69. <http://dx.doi.org/10.1016/j.ssresearch.2013.01.008>
51. Glaze LE, Maruschak LM. *Parents in prison and their minor children*. Washington, DC: U.S. Dept. of Justice, 2008.
52. Huebner BM, Gustafson R. The effect of maternal incarceration on adult offspring involvement in the criminal justice system. *Journal of Criminal Justice*. 2007 Jun; 35(3):283–296. <http://dx.doi.org/10.1016/j.jcrimjus.2007.03.005>
53. Binswanger IA, Redmond N, Steiner JF, et al. Health disparities and the criminal justice system: an agenda for further research and action. *J Urban Health*. 2012 Feb; 89(1):98–107. <http://dx.doi.org/10.1007/s11524-011-9614-1>