



Casualties of context? Risk of cognitive, behavioral and physical health difficulties among children living in high-incarceration neighborhoods

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Abstract

Aim We examined if residence in high-incarceration neighborhoods is associated with risk of cognitive, behavioral and physical health problems for young children net of individual-level parental incarceration status.

Subjects and methods We used regression analysis and linked data from Year 9 of the Fragile Families and Child Wellbeing Study and zip code level information on neighborhood prison admission rates from Justice Atlas of Sentencing and Corrections in 2008.

Results Neighborhood incarceration rates appear to have some independent and negative associations with child cognitive outcomes. For behavioral outcomes, individual-level parental incarceration appears to be the most meaningful. For child physical health outcomes as indicated by BMI percentages and overall good health, neither neighborhood incarceration rates nor individual-level parental incarceration experiences show persistent significant associations. Living in a neighborhood with high incarceration may threaten children's health and wellbeing, suggesting that mass incarceration feeds into a system of inequality that extends beyond those who experience individual-level parental incarceration by exerting a broader public health impact.

Keywords Incarceration · Neighborhoods · Child health

A significant amount of interdisciplinary scholarship has found that neighborhood contexts matter for a broad range of child wellbeing outcomes. Growing up or living in impoverished, violent, resource poor, isolated or racially segregated communities can negatively impact child health and development (Alvarado 2016a; Alvarado 2016b), cognitive functioning (Sharkey 2010; Sharkey et al. 2012), labor market success (Chetty et al. 2016) and educational attainment (Chetty et al. 2016). In response to the sharp rise in imprisonment rates in the US, a parallel and similarly impactful body of work has emerged documenting the collateral consequences of mass incarceration for communities (Clear 2007), families

(Comfort 2008) and children (Wakefield and Wildeman 2014). Currently, 1 in every 35 adults (7 million) in the US is either incarcerated, jailed, under probation or on parole (Travis et al. 2014). If former prisoners (of which there are at least 5.2 million) are included in the estimates, the total US adult population that has ever been part of the correctional population rises to around 10% or 1 in 10 adult Americans (Shannon et al. 2011).

Given the rise of mass incarceration alongside the local concentration of incarceration in predominantly urban, impoverished, minority neighborhoods (Braman and Wood 2003; Clear 2007; Sampson and Loeffler 2010), increased attention to contextual effects of mass incarceration among communities has been highlighted as a growing social, economic and public health concern (Clear 2007; Golemski and Fullilove 2008; Travis et al. 2014; Wildeman and Muller 2012). Beyond the well-researched deleterious individual-level effects of imprisonment on health, employment, political participation and family wellbeing (for a review, see Travis et al. 2014), recent research has begun to suggest that exposure to high-incarceration neighborhoods is associated with reductions in the mental and physical health of non-incarcerated adult residents (Frank et al. 2013; Hatzenbuehler et al. 2015;

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Topel et al. 2018). This perspective considers the impacts of incarceration at multiple levels of context, allowing for an investigation of individual- and aggregate-level effects within the communities most at risk of experiencing high rates of incarceration and criminal justice involvement.

At the individual level, studies have found familial (mainly paternal) incarceration to have deleterious effects on a variety of indicators of child wellbeing (Haskins et al. 2018; Turney 2017; Wakefield and Wildeman 2014). Additionally, evidence has shown that negative individual-level shocks have damaging spillover consequences, particularly for children in schools (Carrell and Hoekstra 2010; Hagan and Foster 2012). Similar to schools, spillover effects of incarceration may also transform the social structure of neighborhoods through exposure to stressful environments, increased policing, or reductions in human and social capital that often accompany the formerly incarcerated upon re-entry (Clear 2007; Goffman 2009; Sharkey 2010). In light of residential segregation, spatial inequality in punishment and evidence of impacts on adult outcomes, there are likely to be cognitive, behavioral and physical health consequences for children living in high-incarceration communities.

Bridging recent work on neighborhood incarceration rates and adult wellbeing with the body of literature on the intergenerational impacts of incarceration on children, we explore whether living in a high-incarceration neighborhood is associated with child cognitive, behavioral and physical health problems. That is, is the wellbeing of children who live in high-incarceration neighborhoods at risk even if their parent never goes to jail or prison? Second, we ask whether associations differ by individual-level parental incarceration status.

Methods

We ran multivariate linear regression models with clustered standard errors using linked data from the Fragile Families and Child Wellbeing Study (FFS) and the Justice Atlas of Sentencing and Corrections (Justice Atlas) to estimate the effect of neighborhood incarceration on cognitive, behavioral and physical health outcomes of resident children. The FFS is a longitudinal birth-cohort study that follows 4898 focal children and their parents, providing a contemporary and diverse sample of urban hospital births in large US cities between the years of 1998–2000. Marital and non-marital births were randomly sampled within hospitals that were stratified by labor market conditions and policy environments (for a complete description of the sample and design, see Reichman et al. 2001). Non-marital births were oversampled, making the unweighted data a sample of relatively disadvantaged families. For mothers, baseline interviews took place in hospitals within 48 h after the birth of the focal child and for fathers soon thereafter. Since the baseline wave, five additional follow-up waves of phone interviews have occurred, taking

place when the focal child was approximately 1, 3, 5, 9 and 15 years old. At each wave separate parent interviews were conducted, in-home direct assessments of the child started at the Year 3 follow-up wave, and a focal child survey was added at Year 9. The baseline response rate for the nationally representative sample of mothers is 86%, while for fathers it is slightly lower at 79%. The survey's design has been described in detail elsewhere (Reichman et al. 2001).

The Justice Atlas is an online tool for mapping the residential distribution of people involved in the criminal justice system (<https://www.justiceatlas.org>). It uses aggregated address data to map the flow of people being removed to prison and reentering communities from prison and the standing population concentrations of people under parole or probation supervision. It also provides information by zip code from US Census Bureau data about local conditions, such as median household income, the unemployment rate or the prevalence of single parent households. Thus far, it has collected this information for 22 of the 50 states, with help from the respective states' departments of Corrections, Parole and Probation.

Restricted FFS data were merged with a data set of zip code level incarceration rates from the Justice Atlas, and regression analyses are used to describe contextual effects of mass incarceration for children (age 9) living in high incarceration neighborhoods on cognitive, behavioral and physical health indicators.

Measures

Neighborhood incarceration rate Our key independent variable is a continuous measure of prison admissions rates taken at the zip code level. Prison admissions rates in the Justice Atlas data were expressed per 1000 adults and ranged from 0 to 43 (mean = 5.99; SD = 6.15), indicating substantial variation across neighborhoods. While we explored other potential specifications, including dichotomized indicators at various cut points (i.e., 50th and 75th percentiles), we selected the continuous measure because it better reflects the presence of variation in prison admission rates across both neighborhoods and states.

Next, we merged the 2008 zip code level incarceration rate data from the Justice Atlas to the restricted FFS data at Year 9 (which were collected between August 2007 and April 2010). Our sample ($N = 1664$) focuses on children from the FFS sample who had follow-up primary caregiver interviews at Year 9 and who reported zip codes that overlap with the neighborhood incarceration rate information available from the 22 states included in the Justice Atlas data. The sample includes 924 unique zip codes across these 22 states.

Childhood outcomes Three sets of child health and wellbeing outcomes are examined, each drawn from Year 9 of the FFS.

The cognitive outcomes include standardized scores on three administered academic assessments covering reading (Woodcock-Johnson Passage Comprehension Test), math (Woodcock-Johnson Applied Problems Test) and attentional skills (Wechsler Intelligence Scale for Children Digit Span subtest). Behavioral outcomes consist of caregiver and child self-reports of internalizing and externalizing behavioral problems from two widely used standardized assessments [the parent-reported Child Behavior Checklist (CBCL); child-reported Self-Description Questionnaire (SDQ)]. Physical health is measured using a parent-reported indicator of whether the child is in overall good health as well as two indicators of the body mass index (BMI), an age- and sex-specific measure of body fat that uses percentile growth charts to estimate weight status categories. We examine reported BMIs of above 85 and 95%, which correlate to the weight status categories of overweight and obese, respectively.

Covariates We include individual-level control variables from the FFS data and neighborhood-level control variables from the Justice Atlas data. Individual-level controls are gender, race, family structure, poverty level, parental reporting of whether the neighborhood is unsafe and an indicator of whether either parent had even been incarcerated by Year 9. Neighborhood-level controls are the percent of households in the zip code earning < \$25,000, percent of residents who are non-White or Hispanic, percent of households that are single-parent headed and percent of residents who were unemployed in 2008. Descriptive statistics for both individual- and neighborhood-level controls are shown in Table 1.

Analytic approach

We examined how neighborhood incarceration is associated with child cognitive, behavioral and physical health outcomes and whether these associations vary by parental incarceration status using regression. For each outcome, we include four models. The first two separately explore the bivariate relationships between neighborhood incarceration rate (M0) and parental incarceration status (M0alt) and our various outcomes of interest. The third model (M1) examines the relationship between neighborhood incarceration and our outcomes controlling for individual parental incarceration status, and the fourth (M2) introduces our individual- and neighborhood-level covariates.

Results

The analytic sample is 20% White, nearly 50% Black and 31% Hispanic, as seen in Table 1. More than half of the sample has a parent who has been imprisoned (51.2%). Descriptive results (not shown) indicate that minority

children live in neighborhoods with twice the incarceration rate as non-Hispanic white children. The most economically disadvantaged children live in neighborhoods with higher incarceration rates. Children with incarcerated parents live in neighborhoods with higher rates—with around two additional people per 1000 adult residents admitted from their neighborhoods to prison. Unadjusted models (M0, Tables 2, 3 and 4) suggest children who live in neighborhoods with higher incarceration rates perform worse across each cognitive assessment and nearly all behavioral measures and also have BMIs that are higher in both the overweight and obese categories; however, no major differences surface for parent reports of child's overall good health. Interestingly, descriptively (not shown) children with incarcerated parents living in low incarceration rate neighborhoods perform better on cognitive assessments than do children with no parental incarceration but who live in neighborhoods with high incarceration rates.

The multivariate results (Tables 2, 3 and 4) parallel much of the descriptive analyses and suggest that neighborhood incarceration rates appear to have some independent and negative association for child cognitive outcomes. For behavioral assessments, individual-level parental incarceration appears to be the most meaningful. For child physical health outcomes as indicated by BMI percentages and parent-reported overall good health, neither neighborhood rates nor individual-level parental incarceration experiences, net of controls, show significant associations.

As indicated in M2 of Table 2, residence in a high-incarceration neighborhood was associated with negative cognitive outcomes net of parental incarceration status and neighborhood- or individual-level covariates. For reading comprehension, neighborhood incarceration is significantly associated with a decrease in scores at the 90% level ($b = -0.009$). For math problem solving and digit span scores (which measure memory, sequencing, attention and concentration), neighborhood incarceration is significantly associated with decreased scores at the 95% level ($b = -0.012$) and 99% level ($b = -0.017$), respectively.

For behavioral examinations (M2, Table 3), neighborhood incarceration effects lost significance across both the parent- and child-reported outcomes after controlling for neighborhood and individual socio-demographic characteristics. However, individual-level parental incarceration associations persisted after covariate adjustment, suggesting it may play a larger role in children's behavioral problems than neighborhood incarceration rates. Strong positive associations between parental incarceration and parent-reported (CBCL) externalizing ($b = 0.231$) behaviors remained significant at the 99.9% level. For children's self-report using the SDQ, positive associations persisted for both externalizing ($b = 0.181$) and

Table 1 Descriptive summary of the sample and neighborhoods using the FFS and Justice Atlas data

	Mean	SD	Min	Max	N
Neighborhood Incarceration Rate (JA data)	5.99	6.15	0	43	1664
Quartile cutoffs					
25%	1.980				1248
50%	4.420				834
75%	7.310				416
Year 9 outcomes (FFS data)					
Cognitive health					
WJ Reading	0.057	0.99	−6.44	3.05	1533
WJ Math	0.057	1.04	−5.99	3.35	1546
Digit Span	−0.005	1.00	−2.96	3.43	1553
Behavioral health					
PR Externalizing	−0.002	0.99	−0.89	9.12	1452
PR Internalizing	0.037	1.04	−0.89	9.69	1461
CR Externalizing	−0.024	0.98	−1.27	2.89	1523
CR Internalizing	0.035	1.00	−1.65	2.64	1520
Physical health					
BMI 85%+	0.427	–	0	1	1549
BMI 95%+	0.265	–	0	1	1549
PR Child Good Health	0.971	–	0	1	1664
Individual covariates (FFS data)					
Race					
White	0.198	–	0	1	1664
Black	0.490	–	0	1	1664
Hispanic	0.312	–	0	1	1664
Boy	0.529	–	0	1	1664
Parental incarceration	0.512	–	0	1	1664
Poverty status	3.002	1.35	1	5	1598
Married HH	0.381	–	0	1	1602
Neighborhood unsafe	0.169	–	0	1	1664
Neighborhood covariates (JA data)					
% HH income 25 K	0.288	0.14	0	1	1664
% Non-White or Hispanic	0.567	0.32	0	1	1664
% Single parent HH	0.230	0.12	0.12	1	1664
% Unemployed	0.071	0.05	0	1	1664

Notes. Linked data from the Fragile Families and Child Wellbeing Study and the Justice Atlas of Sentencing and Corrections are used. HH is household, WJ Reading is the Woodcock-Johnson Passage Comprehension Test, WJ Math is the Woodcock-Johnson Applied Problems Test, Digit Span is the Wechsler Intelligence Scale for Children Digit Span subtest, PR is parent reported, CR is child reported, and BMI is body mass index

internalizing ($b = 0.187$) behaviors at the 99 and 99.9% levels, respectively.

Living in a high incarceration neighborhood was positively associated with reporting a BMI of over 85% or 95% regardless of parental incarceration status. However, after including individual- and neighborhood-level covariates, this association becomes insignificant (M2, Table 4). The vast majority of parents (97%) report that their child is in good health, and thus there were no significant associations for this outcome by neighborhood- or individual-level incarceration status, neither prior to, nor net of, covariates.

Discussion

We found that children living in neighborhoods with high incarceration rates perform worse across each cognitive assessment and most reports of behavioral problems; they also have BMIs that are higher in both the overweight and obese categories in unadjusted analyses. Negative associations for child cognitive outcomes—reading comprehension, math problem solving and memory and attentional capacities—remained significant after the inclusion of socio-demographic characteristics, neighborhood-level controls and the individual-level parental

Table 2 Regression models representing the association between living in a high incarceration zip code and children's cognitive outcomes at age 9

	WJ Reading				WJ Math				Digit Span					
	M0	M0alt	M1	M2	M0	M0alt	M1	M2	M0	M0alt	M1	M2	N	
	Baseline	Baseline	+PI/NI	+ controls	Baseline	Baseline	+PI/NI	+ Controls	Baseline	Baseline	+PI/NI	+ Controls	N	
Neighborhood	-0.025***													
incarc rate	[0.004]													
Parental		-0.189***												
incarceration		[0.050]												
Controls included				Yes				Yes				Yes	1546	1553
				[0.058]				[0.059]				[0.057]		
				-0.009+				-0.012*				-0.017**		
				[0.005]				[0.006]				[0.005]		
				-0.021				-0.065				-0.004		
				[0.053]				[0.054]				[0.052]		
				Yes				Yes				Yes		
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Table 4 Regression models representing the association between living in a high incarceration zip code and children's physical outcomes at age 9

	BMI 85%+				BMI 95%+				Child overall health good (parent reported)				
	M0	M0alt	M1	M2	M0	M0alt	M1	M2	M0	M0alt	M1	M2	N
	Baseline	Baseline	+PI/NI	+ Controls	Baseline	Baseline	+PI/NI	+ controls	Baseline	Baseline	+PI/NI	+ Controls	N
Neighborhood	0.028*		0.029*	0.011	0.025*		0.026*	0.004	-0.015		-0.012	0.015	1664
incarceration	[0.013]		[0.013]	[0.014]	[0.010]		[0.010]	[0.012]	[0.015]		[0.018]	[0.024]	
Parental		0.016	-0.038	-0.124		0.001	-0.048	-0.199		-0.210	-0.148	-0.066	
incarceration		[0.103]	[0.103]	[0.116]		[0.115]	[0.125]	[0.138]		[0.295]	[0.0291]	[0.312]	
Controls included				Yes				Yes				Yes	1549
													1549

Notes. Linked data from the Fragile Families and Child Wellbeing Study and the Justice Atlas of Sentencing and Corrections are used. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$. Standard errors clustered at the neighborhood level in brackets. Controls include: gender, race, family structure, poverty, neighborhood unsafe and four neighborhood characteristics (% under 25 K, non-white, single-parent households, unemployed). BMI is body mass index

incarceration experiences of children. While the causal mechanisms that underlie the effects of neighborhood and parental incarceration on childhood health and wellbeing remain unidentified, recent work in the areas of public health and epigenetics (Burke et al. 2011; Knudsen et al. 2006; Nishi et al. 2013; Shonkoff et al. 2012) has shed light on how exposure to chronic stressors and accumulated adversity (toxic stress), such as homelessness, extended exposure to violence, poverty and the incarceration of a family member in early childhood, is associated with increased childhood risks. Evidence from studies on acute stress and cognitive functioning (Sharkey 2010; Sharkey et al. 2012) demonstrate that young children's cognitive performance is highly sensitive to proximal traumatic or violent events, whether they are witnessed personally or occur within the neighborhood of residence. As such, living in a neighborhood with high incarceration rates can likely lead to direct and indirect exposure to acute environmental trauma that could impact wellbeing. Experiencing acute stress and chronic disadvantage in childhood is particularly consequential for cognitive development and academic functioning. Future public health research focused on exploring whether parental incarceration leads to increased risk of experiencing episodes of acute stress, chronic stressors or accumulated adversity could provide much needed insight into the specific mechanisms involved in the creation of this pathway of disadvantage.

Behavioral outcomes, on the other hand, were more significantly associated with individual parental incarceration status than neighborhood incarceration. Child physical health, measured by BMI and parent-reported overall good health, after covariate adjustment, suggested null associations. These null findings are not necessarily surprising given the risk factors for reporting high BMI reflect the risk factors for living in a high incarceration neighborhood—both are more common among minorities and people of low socioeconomic status (Golemski and Fullilove 2008; Mujahid et al. 2005). Thus, the clustering of high BMI and high neighborhood incarceration in specific communities may allow high incarceration to serve as an indicator of communities, which should be targeted for fresh and healthy food programs and educational diet and exercise outreach by public health practitioners.

Limitations

This study is not without limitations. First, our measure of neighborhood incarceration rate is based on prison admission rates obtained at the zip code level. Zip codes, while often used, may not be the most meaningful indicators of neighborhood boundaries (Hatzenbuehler et al. 2015; Schootman et al. 2016). Second, prison admission rates, while important indicators of the movement of residents from areas due to incarceration, might not reflect the whole situation occurring within an area regarding criminal justice contact, as individuals are also released from prison and on parole and probation within

neighborhoods and experience varying degrees of policing that might also be impactful in meaningful ways. Third, our indicator of neighborhood incarceration rate was measured in 2008, which roughly coincides with the time frame of our outcome variables; however, for some children there is a chance that this measurement occurred either prior to or after the collection of outcome data, as the restricted FFS data at Year 9 were collected between August 2007 and April 2010.

Fourth, our reliance on observational FFS data and basic regression analyses precludes us from making any causal claims. Moreover, our analytic sample, while drawn from the FFS—which is a large, contemporary urban sample of disadvantaged families—represents only a subsample of the full study, as we could only match neighborhood incarceration rates to families living in the 22 states that had available Justice Atlas data. Thus, our findings may not be generalizable beyond the subsample of urban-born children in our analyses.

Finally, there is always the possibility of selection bias due to unobserved heterogeneity, particularly with research assessing broader incarceration impacts. It is possible that unmeasured factors related to neighborhood incarceration rates are driving the observed negative associations for our various child health and wellbeing outcomes. To minimize this, we controlled for various individual and neighborhood risk factors, in particular children's parental incarceration experiences.

Public health implications

Overall, these findings suggest that neighborhood incarceration rates may function as a marker for public health practitioners and authorities seeking to target population-based interventions aimed at addressing the cognitive, behavioral and physical health and wellbeing needs of young school-aged children. Understanding high-incarceration neighborhoods as a public health risk suggests a need for increased funding for community-based public health interventions. This is particularly important in light of the existing diversion of resources from high-incarceration neighborhoods through reduced counts for public funding and decreased political power (Golemski and Fullilove 2008; Wildeman 2010). Children who live in high incarceration neighborhoods, which often have reduced access to healthcare and reduced funding for public health initiatives (Wildeman 2010), additionally face this community-based exposure associated with some negative cognitive, behavioral and physical health effects. Public health practitioners should advocate for increased funding to develop and implement community-based treatment programs to mitigate these neighborhood risks and advocate for a reduction in over-incarceration, concentrating on the deleterious consequences of incarceration in specific, often minority communities.

Conclusion

This project aimed to bridge recent work on neighborhood incarceration rates and adult wellbeing (Frank et al. 2013; Hatzenbuehler et al. 2015; Topel et al. 2018)—which suggests that exposure to high incarceration neighborhoods is associated with reductions in the mental and physical health of non-incarcerated adult residents—with the body of literature on the vast intergenerational consequences of parental incarceration for children (Haskins et al. 2018; Wakefield and Wildeman 2014; Wildeman 2010) by describing potential contextual consequences for children's cognitive, behavioral and physical health. This perspective considers the impacts of incarceration at multiple levels of context, allowing for an investigation of individual- and neighborhood-level associations within urban communities most at risk of experiencing high rates of incarceration and criminal justice contact. Given that negative individual-level shocks can often aggregate to create damaging spillover consequences (Carrell and Hoekstra 2010; Hagan and Foster 2012), contextual effects of incarceration have the potential to transform the social structure of neighborhoods through exposure to stressful environments, increased policing, or reductions in human and social capital that often accompany the formerly incarcerated upon reentry (Clear 2007; Goffman 2009; Sharkey 2010). Moreover, recent work on spatial stigma (Keene and Padilla 2010; Sampson and Loeffler 2010) suggests that the process of stigmatization not only occurs at the individual level, but is also applicable to spaces and places with stigmatizing characteristics such as high incarceration rates.

Our study advances this literature by determining that living in a high-incarceration neighborhood acts as a community-level treatment associated with potentially hazardous cognitive, behavioral and physical health outcomes, some of which persist regardless of individual parental incarceration status. Research has shown that poor child health has negative consequences for social mobility (Case et al. 2005; Haas 2006; Jackson 2010; Palloni 2006); a child's later-life success can be impacted by poor early health through delayed or impaired cognitive, physical and socio-emotional development as well as the ramifications of missed schooling due to health-related absences. These results suggest a broader public health impact of mass incarceration, which extends far beyond the incarcerated individual and their family members and into communities. By documenting the consequences of residing in high incarceration neighborhoods on children's health and wellbeing, we draw attention to how mass incarceration feeds into a system of inequality and illuminate important future lines of inquiry to better understand and address the broader health and wellbeing risk factors of children who live in high incarceration neighborhoods.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest, and existing data were used in this study. IRB approval was obtained for use of the restricted access Fragile Families data and was not needed for use of the Justice Atlas data, which are publically available at the link imbedded in the Methods section of the manuscript. Informed consent was obtained by the Fragile Families team during the data collection—we were not involved in that data collection.

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