Journal of Urban Health
https://doi.org/10.1007/s11524-024-00864-w

ORIGINAL ARTICLE

Exposure to Crime and Racial Birth Outcome Disparities

Nicholas Mark · Gerard Torrats-Espinosa

Accepted: 24 January 2024

Abstract Urban communities in the United States were transformed at the end of the twentieth century by a rapid decline in neighborhood crime and violence. We leverage that sharp decline in violence to estimate the relationship between violent crime rates and racial disparities in birth outcomes. Combining birth certificate data from US counties with the FBI's Uniform Crime Reporting statistics from 1992 to 2002, we show that lower crime rates are associated with substantially smaller Black-White disparities in birth weight, low birth weight, and small for gestational age. These associations are stronger in more segregated counties, suggesting that the impacts of the crime decline may have been concentrated in places with larger disparities in exposure to crime. We also estimate birth outcome disparities under the counterfactual that the crime decline did not occur and show that reductions in crime statistically explain between one-fifth and one-half of the overall reduction in Black-White birth weight, LBW, and SGA disparities that occurred during the 1990s. Drawing on recent literature showing that exposure to violent crime has negative causal effects on birth outcomes, which in turn influence life-course outcomes, we argue that these results suggest that changes in national crime rates have implications for urban health inequality.

Keywords Crime · Birth Outcomes · Black-White gap

Introduction

In the last decade of the twentieth century, the US began experiencing an unprecedented decline in violent and property crime that transformed urban life [1–3]. Between 1991 and 2002 the national murder rate fell from 9.8 murders per 100,000 residents to 5.6, a 43% decline [4].

This decline touched virtually all cities in the country, with some experiencing reductions in murder rates of more than 50% (e.g., New York, NY and Los Angeles, CA). This massive change in the social environment was primarily an urban phenomenon and was heavily concentrated in predominantly Black and low-income neighborhoods [5].[1] Black and Hispanic Americans have historically experienced higher levels of exposure

N. Mark
Department of Sociology, University of Wisconsin - Madison, Madison, WI, USA

G. Torrats-Espinosa (✉)
Department of Sociology,
Columbia University, New York, NY, USA
e-mail: gerard.torrats@columbia.edu

[1] While the available official crime statistics are not suitable to make inferences on the extent to which certain neighborhoods and racial/ethnic groups experienced larger changes in violent crime, indirect pieces of evidence indicate that racial and ethnic minorities, particularly Black Americans, experienced the largest improvements in public safety in their communities. Similarly, self-reported data on victimization from the National Crime Victimization Survey shows that individuals in low-income households experienced larger relative and absolute declines in vio-

Published online: 02 July 2024

to violent crime in their neighborhoods [6,7], pointing to the possibility that these racial minorities benefited in greater relative terms from the improvements in public safety that the fall in violence brought about. One implication is that, all else equal, the decline in crime reduced racial/ethnic disparities in a range of outcomes affected by crime. Links between the crime decline of the 1990s and shrinking racial/ethnic disparities have been documented in some outcomes, like school achievement gaps [8] and life expectancy (because of reductions in homicide mortality) [9]. Other studies have found strong evidence of a causal relationship between exposure to violence and socioeconomic outcomes like education and health [10–14], with specific types of violence (e.g., police killings) having different impacts by race/ethnicity [15]. In this study, we show that these relationships extend to infant health, an outcome which has the potential to influence both child and adult trajectories, including in cognitive, health, and labor market outcomes [16–20].

Aggregate descriptive statistics suggest links between the decline in crime in racial/ethnic birth outcome disparities: the years of the crime decline corresponded to a period in which in racial/ethnic birth outcome disparities shrank [21]. From 1990 to 2000, rates of low birth weight (LBW, an infant born weighing $<$ 2500 grams) increased for White mothers, from 5.61 to 6.60%, while they declined for Black mothers, from 13.32 to 13.13% [22]. This implies that the Black-White gap declined by 1.18 percentage points, or by about 15% of its 1990 level. For Hispanic mothers, LBW rates increased only slightly from 6.06% in 1990 to 6.41% in 2000, a .64 percentage point change. Trends in preterm birth (an infant born at $<$ 37 weeks of gestation) for singleton births followed similar patterns, with increases for White mothers (from 7.54% in 1990 to 8.98% in 2001), declines for Black mothers (from 17.85 to 16.01%), and only slight increases for Hispanic mothers [23].

The extent to which these shrinking disparities are linked to changes in exposure to crime remains unknown. The primary mechanism by which such a link would occur is through stress, which is known to reduce intrauterine growth, induce early delivery, and increase susceptibility to infection [24–27]. Recent work leveraging quasi-experimental designs to estimate plausibly causal relationships has shown that exposure to violent crime affects outcomes such as LBW, preterm birth, and small for gestational age (SGA) [10–14,28]. Internationally, researchers have relied on plausibly exogenous variation in the timing and geographic distribution of violence [12–14,28]. In the US context, research has exploited plausibly exogenous differences in exposure to crime by comparing birth outcomes to mothers living in the same census tract whose pregnancies did or did not coincide with homicides in their census tract of residence [10,11]. These studies identify an effect of an individual (or multiple) act(s) of violence on mothers who were pregnant at the time the violence occurred by comparing the outcomes of their pregnancies to the outcomes of pregnancies in the same space (e.g., census tract) at times when a crime did not occur. While this effect is important and well-identified, it is distinct from the effects of area-level declines in violence, which could influence outcomes because they represent *potential* exposure to violence, and thus a chronic level of stress, that would affect the outcomes of pregnancies whether or not the mother actually experienced violence during the pregnancy. If such effects exist they are likely to be concentrated among populations most likely to be exposed to violence, leading to shrinking disparities between more and less exposed groups. Recent research provides suggestive evidence that this is the case; Mark and Torrats-Espinosa [21] found that associations between county-level homicide rates and adverse birth outcomes were larger for Black and Hispanic mothers than for White mothers.

In this study, we estimate associations between violent crime rates and birth outcome disparities using longitudinal county-level natality data covering all singleton births to White, Black, and Hispanic US resident mothers in metro counties from 1992 to 2002. Using an ecological longitudinal design that allows us to observe changes in crime and birth outcomes at the county level over time, we find that higher violent crime rates were associated with larger infant health disparities in LBW and SGA, even net of county fixed effects, year fixed effects, time-varying county-level socioeconomic conditions, and time-varying race-specific measures of the birthing mothers' attributes. Stratifying by the level of segregation, we find that associations between violent crime rates and birth outcome disparities are larger in more segregated counties. We also estimate birth outcome disparities under the counterfactual that the crime decline did not occur. This analysis provides a rough estimate of the potential contribution of the crime

lent victimization, as compared to individuals in higher-income households [3].

decline to changes in birth outcome disparities over the period of study. Combined with prior causal evidence on the effects of direct exposure to violent crime, our results strongly suggest that the crime decline at the end of the twentieth century reduced racial disparities in infant health and that the reductions were meaningful in size.

Data

We measure violent crime rates using county-level data from the FBI's Uniform Crime Reports (UCR) Program.[2] These data include all murder, rape, robbery, aggravated assault, burglary, larceny, motor vehicle theft, or arson that local law enforcement agencies operating within the county reported to the FBI. Crime rates are measured in counts per 100,000 residents and are standardized according to the 1992 distribution, so coefficients can be interpretable as the association with a 1 SD change in crime.[3]

Because the socioeconomic conditions of counties impact mothers' well-being, with direct effects on their pregnancies, we also control for county-level time-varying covariates, including the unemployment rate (provided annually by the Bureau of Labor Statistics), and other variables, listed below, obtained from the 1990 Census, the 2000 Census, and the 2008–2012 American Community Survey, which we linearly interpolate to generate year-to-year variation. Crime rates and time-varying county covariates lagged 1 year with respect to the birth outcomes.

We use restricted birth certificate data from the National Center for Health Statistics that include all singleton[4] births to Hispanic (N = 7,355,440), non-Hispanic Black (N = 5,643,989), or non-Hispanic White (N = 20,322,598) women aged 15+ residing in metro US counties in 1992–2002. The metropolitan status of the county is determined by their Office of Management and Budget designation. Our four outcomes are low birth weight (LBW), birth weight (in grams), small for gestational age (SGA), and preterm birth. Our measure of LBW is an indicator for whether the infant was born weighing less than 2500 g. Our measure of SGA is an indicator for whether the infant was born below the 10th percentile for weight by gestational age, using estimates corrected for implausible reports of gestational age [30]. Observations were excluded for SGA if gestation was less than 21 weeks. Preterm birth is coded to indicate whether the infant was born before 37 weeks. We code binary indicators as 0 and 100 to make linear regression coefficients interpretable as changes in percentage points.

For each county and racial/ethnic group, we include measures of the characteristics of birthing mothers: the percentage of births that are first births, the percentage of births to mothers with different levels of education (less than high school, high school, some college, college or more), the percentage of births to married mothers, and the percentage of births to mothers who were in each of six age groups (15–19, 20–24, 25–29, 30–34, 35–39, 40+).

Methods

Our longitudinal data allow us to adjust for both county- and time-specific factors, in addition to individual and time-varying county-level characteristics. Figure 1 illustrates these different factors and their relationships. Our main interest is in the effect of changes in exposure to violent crime, measured at the county level, on changes in racial gaps in birth outcomes. But this relationship may be confounded by several characteristics of the environment where these changes are occurring and by attributes of the mothers for whom those effects are being estimated. One set of confounding factors includes demographic and socioeconomic characteristics that change over time in each county and can influence violent crime and birth outcomes (e.g., the unemployment rate). Another set of factors has to do with the selection on socioeconomic characteristics of the mothers giving birth in the county each year (e.g., systematic outmigration of higher-educated White, but not Black, mothers would lead to smaller birth outcome gaps if the education levels of both groups were not controlled for). A third set of factors involves time-invariant attributes of the counties that are related to

[2] Some have cautioned against the use of UCR county-level crime data [29] due to the inconsistencies in reporting patterns across large and small law enforcement agencies. In the appendix, we report results using only murders, which are less likely to be under-reported so the extent of measurement error is small. Results are similar to those reported in the main text.

[3] Data from 1993 were not made public, so we impute 1993 values as the average of the 1992 and 1994 values. Results are not sensitive to the exclusion of 1993.

[4] Multiple births are much more likely to be LBW, SGA, and preterm, and are therefore excluded.

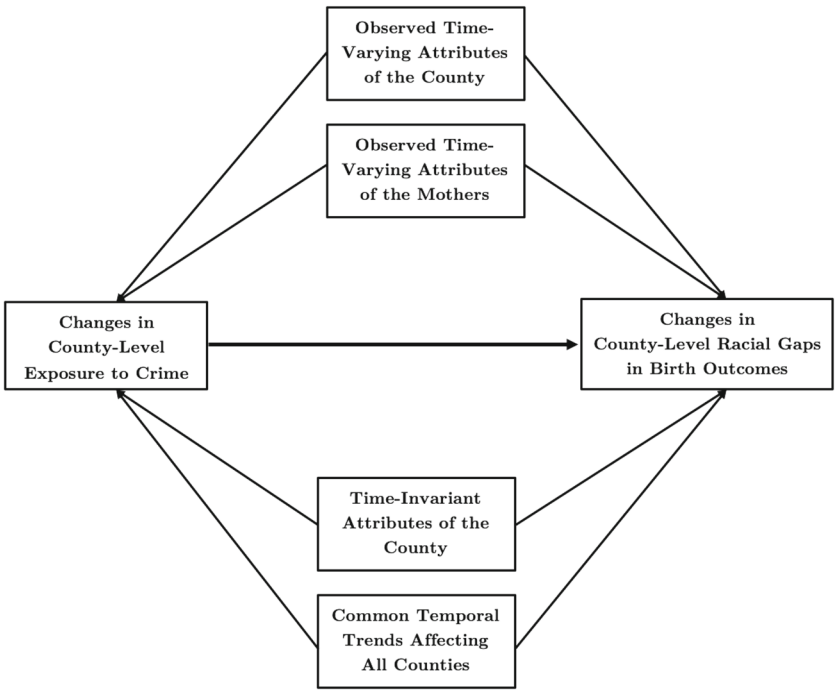

Fig. 1 Model illustrating the longitudinal ecological research design

changes in violent crime rates and changes in birth outcomes. One possible confounder in this category would be the general policy environment of the state or the urban/rural status of the county. The last set of confounding factors involves temporal trends affecting all counties. For example, if economic conditions were improving nationwide, that may have played a role in the decline in violence and also produced better birth outcomes for mothers of disadvantaged racial and ethnic groups.

The relationships illustrated in Fig. 1 map onto the following models that we estimate via OLS:

$$Y_{ct}^{RW} = \beta_0 + \beta_1 C_{ct} + \theta_c + \psi_t + \epsilon_{ct} \quad (1)$$

In Model Eq. 1, the outcome Y_{ct}^{RW} is the difference in the average birth outcome at the county level for births to White mothers and mothers of the two other racial/ethnic groups R, Black and Hispanic. The key independent variable is the violent crime rate measured annually at the county level C_{ct}. Model Eq. 1 also includes county and year fixed effects, θ_c, and ψ_t.

Model Eq. 2 adds a battery of time-varying county-level controls. These controls are a key element of the two-way fixed effects modeling strategy that we described above. While the county fixed effects account for observed and unobserved attributes of the county that don't vary over time, the time-varying controls added to the model help us deal with endogeneity concerns arising from demographic and socioeconomic conditions changing every year. One set of these variables, X'_{rct}, consists of the characteristics of the women of each racial group giving birth in the county. Thus, when the Black-White gap is the outcome it includes the characteristics of White and Black mothers, and when the Hispanic-White gap is the outcome it includes the characteristics of White and Hispanic mothers. These variables include the percentage of births that are first births, the percentage of births to mothers with different levels of education (less than high school, high school, some college, college or more), the percentage of births to married mothers, and the percentage of births to mothers who were in each of six age groups (15–19, 20–24, 25–29, 30–34, 35–39, 40+). The second set of controls, (A'_{ct}), is measured at the county level and accounts for the time-varying socioeconomic characteristics of the counties: the percent employed among the working-age population, the unemployment rate, the percent of vacant housing units, the percent of the population in poverty, county median household income, the percent of the population that is Black, White, and Hispanic, and the percent without a high

school degree, with a high school degree, and with at least some college.

$$Y_{ct}^{RW} = \beta_0 + \beta_1 C_{ct} + \beta_2 X'_{rct} + \beta_3 A'_{ct} + \theta_c + \psi_t + \epsilon_{ct} \quad (2)$$

In Model Eq. 3, we interact the violent crime rate with the level of segregation in the county. Because crime is spatially concentrated in minority and low-SES neighborhoods [7], county-level declines in violent crime likely underestimate actually experienced declines for these neighborhoods' residents. The degree of that underestimation is likely correlated with measures of the spatial concentration of populations, such that changes in crime rates may be most strongly correlated with minority-White gaps in highly-segregated places. In Model Eq. 3, S_c is the time-invariant measure of segregation, which is interacted with the crime rate. We measured racial segregation via the county Black-White and Hispanic-White Dissimilarity indices, which we computed from tract-level counts of Black, Hispanic, and White residents. The index ranges from 0 to 1, where 0 indicates perfect integration (e.g., indicating that Blacks and Whites are distributed identically across all tracts) and 1 signifies complete segregation (e.g., indicating that Blacks and Whites are entirely separated, with no overlap in any tract). For both the Black-White and Hispanic-White Dissimilarity indices, we computed values in 1990 and 2000 and take the average of the two years.

$$Y_{ct}^{RW} = \beta_0 + \beta_1 C_{ct} + \beta_2 C_{ct} * S_c + \beta_3 X'_{rct} + \beta_4 A'_{ct} + \theta_c + \psi_t + \epsilon_{ct} \quad (3)$$

Standard errors were clustered at the county level for all three models, and county observations were weighted by the number of births to the smaller of the groups that make up the gap. This is because gaps are estimated using the difference between two groups, and the estimate is only as precise as the smaller of the two groups.

We then estimated Black-White and Hispanic-White gaps under the counterfactual scenario in which violent crime rates did not decline. Using the associations estimated in Model 3 using all of the data, counterfactual estimates were obtained by predicting gaps for each year under two scenarios, one in which the crime rate trends as observed (thus declining for most counties), and another in which each county's crime rate is held at its 1992 level but all other covariates are allowed to trend as observed.[5] The first scenario yields estimates very close to the actual observed values. The second scenario essentially decomposes the observed trends into a fraction that can be (statistically) explained by the decline in crime and a fraction explained by other observed and unobserved factors. Counterfactuals were estimated at the national level and separately for high- and low-segregation counties.

Results

Results from Models Eqs. 1 and 2 for all counties are shown in Fig. 2.[6] Results from both models were similar: crime rates were strongly associated with Black-White, but not Hispanic-White, birth outcome disparities. Net of the fixed effects and controls (Model Eq. 2), Black-White LBW, birth weight, and SGA gaps were strongly associated with the crime rate. A 1 SD increase in crime was associated with Black-White LBW gaps that were .25 percentage points wider, SGA gaps that were .2 percentage points wider, and an additional 5 g birth weight advantage for babies born to White mothers. Given that over this period the average violent crime rate in a metro county where a Black mother gave birth declined by more than 2,500 per 100,000 (about one 1992 SD) these changes were meaningful. Preterm birth gaps were not associated with the crime rate.

Table 1 shows results from Model Eq. 3, in which the violent crime rate interacts with the level of segregation. We report the coefficient on violent crime and on the interaction between violent crime and the corresponding segregation index (Black-White Dissimilarity for the Black-White gap models and Hispanic-White Dissimilarity for the Hispanic-White gap models). Looking at the coefficients on the interaction term, the overall pattern is that associations between crime rates and birth outcome disparities were considerably stronger in more segregated counties than less segregated ones. As segregation increases, birth weight decreases, and the probabilities of LBW, SGA, and pre-term birth increase. These differences are statistically significant

[5] Specifically, we estimated predicted birth outcome gaps using Stata's *margins* command [31] by setting county-level violent crime rates in Model 3 at their 1992 level and allowing all other variables to trend as observed.

[6] Coefficients, standard errors, and R-squared for Model Eq. 2 are reported in the appendix.

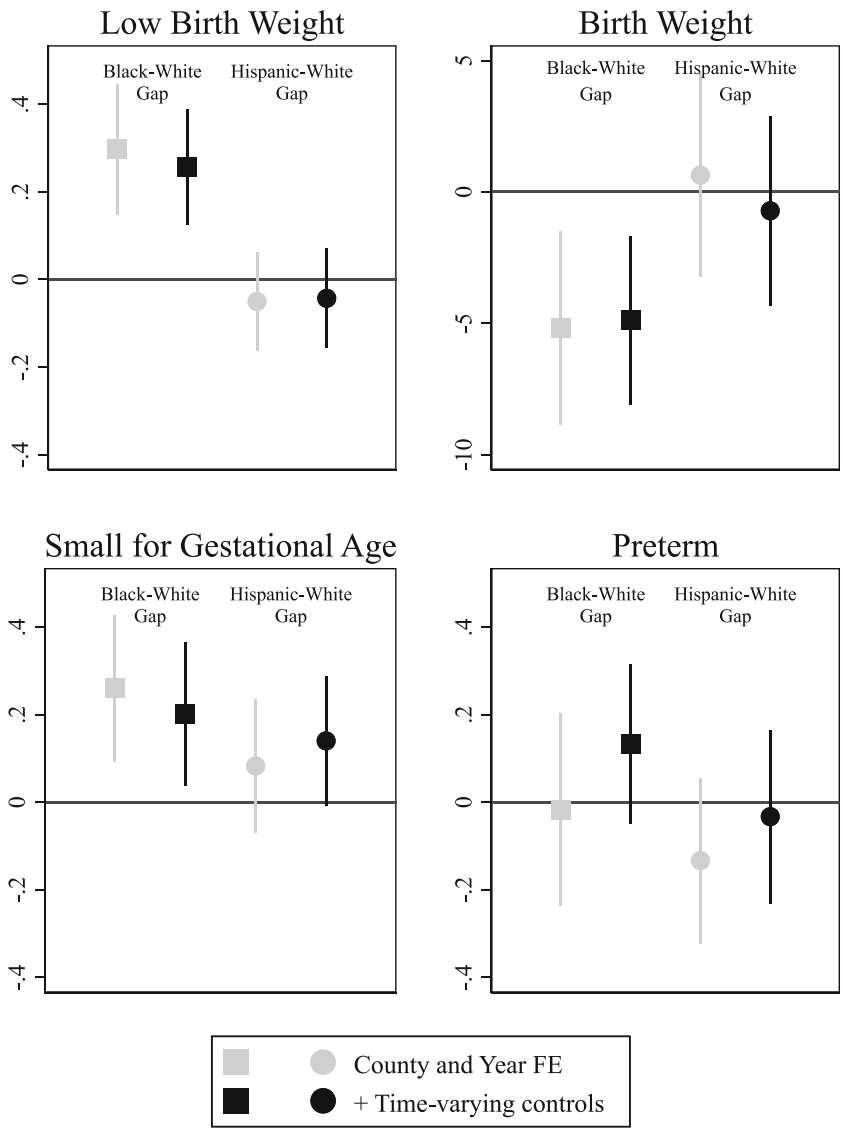

Fig. 2 Regression estimates of the relationship between a 1 SD change in the violent crime rate and birth outcome disparities. Note: data from the National Center for Health Statistics restricted birth certificate files, Census, ACS, and UCR. Results from Models Eqs. 1 and 2 with 95% CIs

Table 1 Model 3 estimates of associations between violent crime and birth outcomes, interacted with county segregation

Outcome	Variable	LBW	BirthWeight	SGA	Preterm
Black-White gap	Violent Crime rate	–0.173	0.605	–0.305	–0.036
		(0.192)	(5.456)	(0.239)	(0.273)
	Violent Crime rate * Segregation	0.641**	–8.190	0.757**	0.250
		(0.296)	(8.908)	(0.349)	(0.427)
Hispanic-White gap	Violent Crime rate	–0.314**	12.662**	–0.573**	0.071
		(0.160)	(5.794)	(0.234)	(0.245)
	Violent Crime rate * Segregation	0.565*	–27.906**	1.487***	–0.217
		(0.310)	(13.460)	(0.499)	(0.526)

Note: Data from National Center for Health Statistics restricted birth certificate files, Census, ACS, and UCR. Results from Model Eq. 3. *$p<$ .05, $**p <$ .01. Coefficients for control variables not shown

for the Black-White gap and LBW and SGA, and the Hispanic-White gap and LBW, birth weight, and SGA.

Figure 3 illustrates the observed trends in Black-White LBW, birth weight, and SGA disparities alongside counterfactual trends in which the violent crime rate was held constant at its 1992 level. The difference between the observed and counterfactual estimates is thus a combination of two factors: (1) the association between the violent crime rate and the birth outcome disparity (as shown in Fig. 2), and (2) trends in the violent crime rate. A comparison of the observed trend to the counterfactual trend also permits an analysis of the degree to which trends in disparities from 1992 to 2002 were explained by changes in violent crime rates as opposed to other observed or unobserved factors. Importantly, even the counterfactual estimates of disparities decline from 1992 to 2002, reflecting the fact that factors other than the decline in crime account for significant fractions of the shrinking birth outcomes disparities. Yet by 2002, observed disparities were considerably lower than in the counterfactual scenario of no crime decline. The difference between the observed and counterfactual disparities emerges throughout the 1990s, reflecting the consistent decline in crime over this period. It is also a substantively important fraction of the overall change in the disparity across this period. From 1992 to 2002, the Black-White disparity in LBW declined from around 7.1 percentage points to around 6.1 percentage points; we estimate that the decline in crime accounted for a little more than 1/5 of that change or about .2 percentage points. Likewise, the Black-White gap in birth weight closed by about 17 g, 4 of which were accounted for by changes in violent crime according to our models. And the gap in SGA closed by .6 percentage points, of which about .3 are explained by changes in violent crime.

Discussion

At the end of the twentieth century, the US was transformed by a rapid decline in violent crime [3]. While this decline was felt across the country, urban communities experienced the largest drops in violence [5]. The literature on the causes of the fall in violent crime is broad [2], but we know much less about the consequences of such a dramatic improvement in public safety for urban health.

Recent literature has shown that exposure to violent crime has negative causal effects on birth outcomes

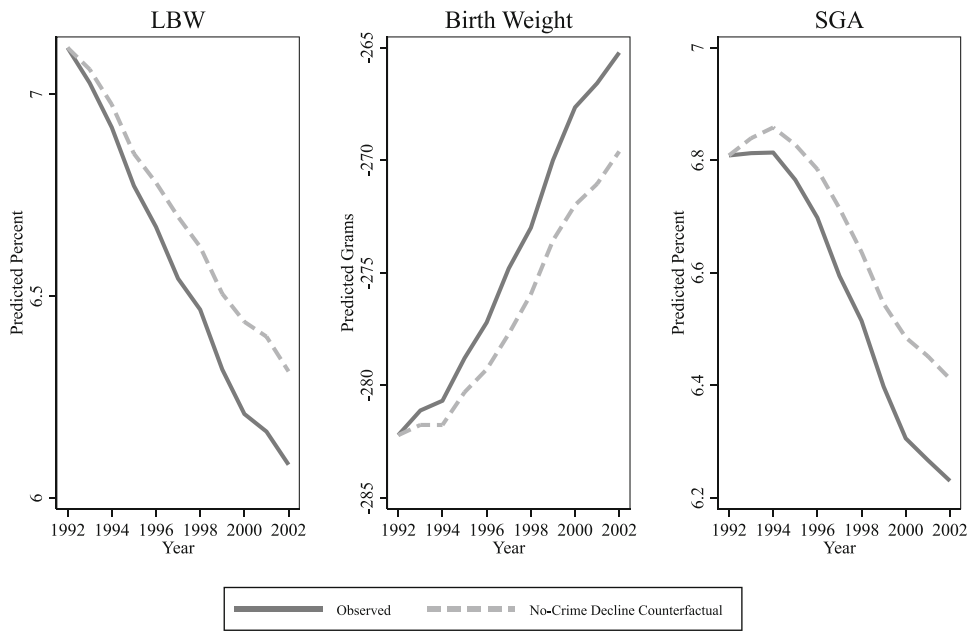

Fig. 3 Counterfactual estimates of Black-White birth outcome disparities. Note: data from the National Center for Health Statistics restricted birth certificate files, Census, ACS, and UCR. Predicted values from Model Eq. 2, with counterfactual estimated holding county-level violent crime rate at their 1992 levels

[10–14] and has suggested that the effects of the crime decline were larger for Black and Hispanic communities than for Whites [21], implying that the decline in crime led to reductions in racial/ethnic birth outcome disparities. In this paper, we find that from 1992 to 2002 lower violent crime rates were associated with substantially smaller county-level Black-White disparities in low birth weight and small for gestational age, and smaller Hispanic-White disparities in small for gestational age. These associations hold net of county and year fixed effects and a range of time-varying county-level controls and were stronger in more segregated counties.

Reductions in racial/ethnic disparities at birth have the potential to influence racial/ethnic inequalities in other domains. We can only speculate about the extent to which such changes would occur, but the literature on the importance of infant health for a range of outcomes provides some guidance. One set of such outcomes includes the cognitive development of children and their performance in school. Twin and sibling studies have shown that lower weight at birth is associated with decreased cognitive abilities early in childhood, slower growth rates, lower school attainment, and lower chances of graduating from high school, with these effects being more acute among low-SES families [32–36]. Given the spatial concentration of crime in minority and low-SES neighborhoods [7], the improvements in public safety that these communities started to experience in the early 1990s are likely to yield reductions in racial/ethnic gaps in human capital outcomes among the cohorts of children born in years when crime was lower, all else equal [8].

A second set of outcomes concerns health later in life. A highly influential theory known as the Developmental Origins of Health and Disease (DOHaD) holds that associations between adverse birth outcomes and adult onset of mental and physical health conditions are the result of developmental responses to early adverse environmental exposures such as maternal stress during pregnancy [20,37]. According to theoretical pathways outlined by DOHaD scholars, smaller racial disparities in adverse environmental exposures, and thus disparities in developmental origins, would result in smaller disparities in birth outcomes and subsequent adult health. We find evidence in favor of the first step: racial disparities in LBW and SGA were smaller when crime was lower. All else equal, then, these theories would predict that some of the positive health effects of being born and growing up when crime in America was markedly lower will emerge at later ages. As these cohorts are beginning to reach middle age, the extent to which urban adult health disparities decline remains an empirical question for future research.

Our study has a notable limitation due to the inherent nature of its ecological design. Ecological designs, particularly those that rely on cross-sectional data, often use unreliable methods or contain statistical oversights [38]. Our longitudinal data and fixed-effects approach represents an improvement on cross-sectional studies. However, the reliance on county-level crime data prevents us from accurately determining if all mothers included in our study have been uniformly exposed to crime. This discrepancy can give rise to the ecological fallacy, where conclusions are drawn about individuals based solely on group-level information. By reporting average relationships, we overlook the potential heterogeneity among individuals and their unique experiences. Factors such as socioeconomic status, personal behaviors, and access to healthcare may significantly contribute to birth outcomes, potentially confounding the relationship between crime and these outcomes. Therefore, while our analyses shed light on the association between crime and birth outcomes at a population level, generalizing these findings to individual cases should be done with caution.

Data limitations have prevented us from testing our hypotheses in periods when crime was increasing. The possibility that the effects of crime on birth outcomes may vary depending on whether crime rates are increasing or decreasing is an important consideration that our study does not address. In times of increasing crime, heightened levels of collective fear and insecurity may contribute to elevated stress levels among pregnant individuals, negatively affecting maternal health and fetal development. In periods when crime is on the rise, heightened media attention may lead to greater awareness and concern among the general population. This increased awareness can influence individual behaviors, healthcare-seeking patterns, and stress levels, which may have implications for birth outcomes. Future studies that take a longer view should assess the possibility of differential impacts during times of increasing and decreasing crime rates.

Acknowledgements This project received no outside funding.

Data Availability Statement The birth certificate data from the National Center for Health Statistics(NCHS) were obtained through a restricted use data agreement. For more information on how to apply for restricted-usevital statistics data, see https://www.cdc.gov/nchs/nvss/nvss-restricted-data.htm

References

1. Blumstein A, Wallman J, editors. *The crime drop in America*. Revised. New York, NY: Cambridge Univ. Press; 2006.
2. Zimring FE. *The great American crime decline*. New York City, NY: Oxford University Press; 2007.
3. Sharkey P. *Uneasy peace: the great crime decline, the renewal of city life, and the next war on violence.* New York, NY: WW Norton & Company; 2018.
4. Federal Bureau of Investigation. Crime data explorer. *Summary reporting system*. 2021. http://www.ucrdatatool.gov. Accessed 1 Mar 2021
5. Friedson M, Sharkey P. Violence and neighborhood disadvantage after the crime decline. *Ann Am Acad Political Soc Sci*. 2015;660(1):341–58. https://doi.org/10.1177/0002716215579825. ISSN 15523349.
6. Peterson J. The feminization of poverty. *J Econ Issues*. 1987;21(1):329–37.
7. Peterson RD, Krivo LJ. Divergent social worlds: neighborhood crime and the racial-spatial divide. New York, NY: Russell Sage Foundation; 2010.
8. Torrats-Espinosa G. Crime and inequality in academic achievement across school districts in the United States. *Demography*. 2020;57(1):123–45. https://doi.org/10.1007/s13524-019-00850-x. ISSN 15337790.
9. Sharkey P, Friedson M. The impact of the homicide decline on life expectancy of African American males. *Demography*. 2019;56(2):645–63.
10. Goin DE, Gomez AM, Farkas K, Zimmerman SC, Matthay EC, Ahern J. Exposure to community homicide during pregnancy and adverse birth outcomes: a within-community matched design. *Epidemiology*. 2019;30(5):713–22. https://doi.org/10.1097/EDE.0000000000001044. ISSN 15315487.
11. Grossman D, Khalil U. Neighborhood crime and infant health. *J Urban Econ*. 2022:103457
12. Brown R. The mexican drug war and early-life health: the impact of violent crime on birth outcomes. *Demography*. 2018;55(1):319–40. https://doi.org/10.1007/s13524-017-0639-2. ISSN 15337790.
13. Mansour H, Rees DI. Armed conflict and birth weight: evidence from the al-Aqsa Intifada. *J Dev Econ*. 2012;99(1):190–9. https://doi.org/10.1016/j.jdeveco.2011.12.005. ISSN 03043878.
14. Torche F, Shwed U. The hidden costs of war: exposure to armed conflict and birth outcomes. *Sociol Sci*. 2015;2:558–81.
15. Ang D. The effects of police violence on inner-city students. *Q J Econ*. 2021;136(1):115–68.
16. Reichman NE. Low birth weight and school readiness. *Futur Child*. 2005;15(1):91–116. https://doi.org/10.1353/foc.2005.0008. ISSN 10548289.
17. Almond D, Chay KY, Lee DS. The costs of low birth weight. *Q J Econ*. (August) 2005.
18. Conley D, Strully KW, Bennett NG. The starting gate: birth weight and life chances. Berkeley, CA: University of California Press; 2003.
19. Aizer A, Currie J. The intergenerational transmission of inequality: maternal disadvantage and health at birth. *Science*. 2014;344(6186):856–61. https://doi.org/10.1126/science.1251872. ISSN 10959203.
20. Van den Bergh BR, van den Heuvel MI, Lahti M, Braeken M, de Rooij SR, Entringer S, Hoyer D, Roseboom T, Räikkönen K, King S, et al. Prenatal developmental origins of behavior and mental health: the influence of maternal stress in pregnancy. *Neurosci Biobehav Rev*. 2020;117:26–64.
21. Mark NDE, Torrats-Espinosa G. Declining violence and improving birth outcomes in the us: evidence from birth certificate data. *Soc Sci Med*. 2022;294:114595.
22. Martin JA, Hamilton BE, Osterman MJ, Driscoll AK, Matthews TJ. Births: final data for 2015. *Natl Vital Stat Rep*. 2017;66(1):1–70. https://doi.org/10.1016/B978-0-12-374407-4.00228-4. ISSN 00836729.
23. Martin JA, Hamilton BE, Sutton PD, Ventura SJ, Menacker F, Munson ML. Births: final data for 2002. *Natl Vital Stat Rep*. 2003;52(10):1–113.
24. Torche F. The effect of maternal stress on birth outcomes: exploiting a natural experiment. *Demography*. 2011;48(4):1473–91.
25. Brown R. The Intergenerational impact of terror: did the 9/11 tragedy impact the initial human capital of the next generation? *Demography*. 2020. https://doi.org/10.1007/s13524-020-00876-6. ISSN 15337790.
26. Mulder EJH, Robles De Medina PG, Huizink AC, Van Den Bergh BRH, Buitelaar JK, Visser GHA. Prenatal maternal stress: effects on pregnancy and the (unborn) child. *Early Hum Dev*. 2002;70(1–2):3–14. https://doi.org/10.1016/S0378-3782(02)00075-0. ISSN 03783782.
27. Segerstrom SC, Miller GE. Psychological stress and the human immune system: a meta-analytic study of 30 years of inquiry. *Psychol Bull*. 2004;130(4):601–30. https://doi.org/10.1037/0033-2909.130.4.601. ISSN 00332909.
28. Koppensteiner MF, Manacorda M. Violence and birth outcomes: evidence from homicides in Brazil. *J Dev Econ*. 2016;119:16–33.
29. Maltz MD, Targonski J. A note on the use of county-level UCR data. *J Quant Criminol*. 2002;18(3):297–318. https://doi.org/10.1108/eb046606. ISSN 00330337.
30. Talge NM, Mudd LM, Sikorskii A, Basso O. United States birth weight reference corrected for implausible gestational age estimates. *Pediatrics*. 2014;133(5):844–53. https://doi.org/10.1542/peds.2013-3285. ISSN 10984275.
31. Williams R. Using the margins command to estimate and interpret adjusted predictions and marginal effects. *Stata Journal*. 2012;12(2):308–31. https://doi.org/10.1177/1536867x1201200209. ISSN 1536867X.

32. Conley D, Bennett NG. Is biology destiny? Birth weight and life chances. *Am Sociol Rev*. 2000;65(3):458–67.
33. Behrman JR, Rosenzweig MR. Returns to birthweight. *Rev Econ Stat*. 2004;86(2):586–601.
34. Currie J, Moretti E. Biology as destiny? Short-and long-run determinants of intergenerational transmission of birth weight. *J Labor Econ*. 2007;25(2):231–64.
35. Royer H. Separated at girth: US twin estimates of the effects of birth weight. *Am Econ J Appl Econ*. 2009;1(1):49–85.
36. Cheadle JE, Goosby BJ. Birth weight, cognitive development, and life chances: a comparison of siblings from childhood into early adulthood. *Soc Sci Res*. 2010;39(4):570–84.
37. Barker DJ. The fetal and infant origins of adult disease. *BMJ: Br Med J*. 1990;301(6761):1111.
38. Dufault B, Klar N. The quality of modern cross-sectional ecologic studies: a bibliometric review. *Am J Epidemiol*. 2011;174(10):1101–7.