J Urban Health (2023) 100:1093–1101
https://doi.org/10.1007/s11524-023-00778-z

ORIGINAL ARTICLE

In Search of the Promised Land: County-Level Disadvantage and Low Birth Weight among Black Mothers of the Great Migration

Cecilia Vu · Mariana C. Arcaya · Ichiro Kawachi · David R. Williams

Accepted: 19 July 2023 / Published online: 14 August 2023

Abstract The Great Migration was a movement of roughly eight million Black Southerners relocating to the North and West from 1910 to 1980. Despite being one of the most significant mass internal migrations during the twentieth century, little is known about the health outcomes resulting from migration and whether migrators' destination choices were potential mechanisms. This study measured the association between destination county disadvantage and odds of low birth weight during the last decade of the Great Migration. We used the US Census from 1970 as well as the birth records of first-time Black mothers who migrated from the South collected through the National Center of Health Statistics from 1973 to 1980 (n = 154,145). We examined three measures of area-based opportunity: Black male high school graduation rate, Black poverty rate, and racialized economic residential segregation. We used multilevel logistic regression, where mothers were nested within US counties, to quantify the relationship between county disadvantage and low birth weight. After adjusting for individual risk and protective factors for infant health, there was no relationship between county opportunity measures and low birth weight among migrators. Although high socioeconomic opportunity is typically associated with protection of low birth weight, we did not see these outcomes in this study. These results may support that persistent racial discrimination encountered in the North inhibited infant health even as migrators experienced higher economic opportunity relative to the South.

Keywords Migration · Birth outcomes · Racial residential segregation · Racism

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s11524-023-00778-z.

C. Vu
Center for Antiracist Research, Boston University, Boston, MA, USA

C. Vu (✉) · I. Kawachi · D. R. Williams
Department of Social and Behavioral Sciences, Harvard T.H. Chan School of Public Health, Boston, MA, USA
e-mail: cecvu@bu.edu

M. C. Arcaya
Department of Urban Studies, Massachusetts Institute of Technology, Cambridge, MA, USA

D. R. Williams
Department of African and African American Studies, Harvard University, Cambridge, MA, USA

Introduction

From 1910 to 1980, around eight million Black Southerners moved to the North and West in what became known as the Great Migration. This mass internal migration began with economic demand after World War I when labor shortages in Northern cities created employment opportunities for Black

Southerners [1, 2]. The Great Migration was sustained for decades longer as migrators moved for a variety of reasons. These motivations included fleeing from racial segregation and racial violence under the Jim Crow South, leaving a dwindling Southern agriculture economy, and joining established networks of family and friends [1–4]. The mass movement shifted the Black population from rural to urban. As a result, around 1% of the Black population lived on farms by 1980 compared to 45% in 1940 [1]. Many settled in popular destination cities like New York City, Los Angeles, Chicago, and Detroit, quadrupling the average Black composition in the typical Northern city from 4 to 16% in 1940 to 1970, respectively [5].

Research is beginning to uncover the ways in which health outcomes were associated with the Great Migration. Using birth records from Black mothers born in the South during the 1950s and 1960s, Vu et al. (2023) studied the odds of delivering infants with low birth weight among two groups of movers (migrators to the North and West and migrators moving within the South) compared to mothers who stayed in the South [6]. They found that migration was associated with reduced low birth weight in both types of movers, indicating that moving outside the South did not necessarily confer infant health gains. Moreover, studies focused on the earlier decades of the Great Migration suggest that migrating Northward was linked to worse health outcomes. Among Black Southerners born between 1916 and 1932, Black et al. (2015) found that migrators to the North had experienced a 10% lower probability of survival to age 75 compared to Southern stayers [7]. Eriksson and Niemesh (2016) showed a similar conclusion in their study of infant mortality. Linking US Census and death records, they found that infants born to Black migrators to the North in 1920 and 1930 had higher mortality rates by 9 and 5 percentage points, respectively, compared to infants born to families who remained in the South [8].

A potential explanation for the lack of health protection among migrators may be the characteristics of their Northern residential environments, particularly the role of racial residential segregation. Racial residential segregation is one vehicle in which systemic racism operates. It facilitates the exodus of residents and employment opportunities which can lead to the reduction in the municipal tax base, the loss of available jobs, and the increase in concentrated neighborhood poverty. Residents in highly racially segregated places may experience poor education quality, poor medical care access, worse physical environments, and less safety. Because health is associated with the socioeconomic opportunities available to communities, race-based segregation may have negative consequences for a variety of health outcomes [9, 10].

Migrators moving out of the South in the latter decades of the Great Migration arrived in highly racially isolated cities. Racial residential segregation increased rapidly from 1940 to 1970. In 1940, the average Black resident lived in a racially integrated area where they encountered Black and White neighbors almost equally. Three decades later, most Black residents lived in majority Black neighborhoods [5]. This change was partially driven by White residents flocking to the suburban ring, made easier by postwar highway building and mortgage loans obtained through the GI Bill [5]. However, it was also accelerated by discriminatory practices and policies that confined Black residents to their place. Home sellers commonly discriminated against home buyers, with little difference after this practice was banned by the 1968 Fair Housing Act [11]. Black home buyers faced high mortgage denial rates as lenders frequently refused loans for Black families moving into White neighborhoods [5, 12]. Those who successfully bought property in majority-White areas often paid the cost of being a pioneer. In 1963, for example, Detroit recorded around 65 incidents of riots, violence, and harassment from White residents onto Black neighbors [12].

The health consequences of area-based opportunity may apply to this group. Yet, no study to our knowledge has examined how destinations may have shaped the health of Great Migration movers. To respond to the research gaps, this study measured the association of racial residential segregation and concentrated disadvantage with low birth weight (LBW) among migrators living in the North and West during the last decade of the Great Migration. We used the birth records of infants born to Black mothers who migrated from the South collected through the National Center of Health Statistics from 1973 to 1980. The birth records were then linked to the socioeconomic conditions of Northern and Western counties using the 1970 US Census. We hypothesized that destination racial residential segregation and

concentrated disadvantage would be linked to higher odds of LBW.

Methods

Sample

This paper used two data sources. The first data set was the US administrative birth records from 1973 to 1980 collected by the National Center of Health Statistics [13]. These years were specifically selected because 1973 was the earliest year when mothers' state of birth was reported (making it possible to classify migration status) and 1980 was considered the last year of the Great Migration [1]. The second data set was the 1970 US Census Integrated Public Use Microdata, which was available to download through Social Explorer [14].

We used several restriction criteria for the US birth records in this study. We included only those who reported "Black" as their race. We limited our sample to migrators who were classified as women who were born in the South and who gave birth outside the South. Southern states were defined following the US Census classification of the Southern region and included Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Oklahoma, Tennessee, Texas, Virginia, and West Virginia [1]. Washington D.C. was not included in this list of Southern states because it was considered a popular Northern destination during the Great Migration [15, 16]. We restricted the data to mothers of first-born infants. This helped minimize clustering since those born to the same mother may have been more likely to have similar birth weights [17]. Additionally, we limited the data to counties with at least 30 migrating mothers to better ensure statistical power to capture the estimates of interest [18, 19]. We included 184 counties that were available in both the 1970 US Census and in the US birth records. The final sample was 154,145 mothers.

Variables

We captured individual-level characteristics reported in the US birth records. The outcome of low birth weight (LBW) was defined as infants born at 2500 g or less. Destination county of residence was defined as the county where mothers resided during the time of delivery. Other demographic covariates were maternal education, age, Southern birth state, history of prenatal care during the first trimester, and history of a past fetal death which was defined as reporting at least one spontaneous death after conception. We did not include marital status. Although this may have been associated with LBW, this variable was not recorded among eight Northern and Western states in this study.

We used three measures to operationalize area-based disadvantages of receiving Northern and Western counties in the 1970 US Census. The Index of Concentrated Extremes (ICE) in our study measured racialized economic residential segregation. The ICE is the degree that people in a geographic area live in the extremes of the social distribution [20]. For each county, we calculated the number of non-Hispanic White families living in highest quartile of household income compared to the number of Black families living in the lowest quartile of household income. ICE values ranged from − 1 (all members lived in the most extreme groups for deprivation) to 1 (all members lived in the most extreme groups of privilege) [20]. Additionally, we used two variables that measured concentrated disadvantage among Black residents: high school graduation rates among Black men who are 25 years or older and Black poverty rate defined as the percent of residents living below the poverty level. The poverty level was determined using guidelines from the Federal Interagency Committee in 1969 [21]. To convert these measures to analytical variables, we assigned each county a quartile value where "1" represented the most advantaged county and "4" represented the most disadvantaged county.

Statistical Analyses

The overall empirical strategy in this study was to estimate the association between county-level opportunity and odds of LBW. We used a multilevel logistic regression where mothers were nested within US counties. Multilevel regression modeling accounts for the fact that mothers' destination choices may depend on their state of origin, their socioeconomic status, and their health. There is some evidence of chain migration that followed major railroad pathways. For instance, migrators to New York were disproportionately from the Carolinas while those in Chicago were

more likely from Louisiana and Mississippi [2, 15]. Failure to account for these similarities may potentially misestimate the standard errors in a traditional regression model. Multilevel regression models may remedy this issue [19].

We estimated the association between county-level disadvantage and LBW by regressing the odds of LBW on each of the measures of disadvantage while adjusting for maternal age, education, state of origin, and history of past fetal deaths. We quantified the odds of LBW associated with each county-level disadvantage measure, where the reference groups were counties in the best-off quartiles. We also calculated the intraclass correlation (ICC) of LBW. The ICC measured the proportion of variance of the outcome that was attributed to counties [19]. We used the "lme4" package in R for all analyses.

Sensitivity Analyses

We performed several sensitivity analyses for this study. We tested preterm birth as an outcome to examine if similar patterns exist across other common infant health metrics. Preterm birth was defined as infants delivered below 37 weeks of gestation. Receiving prenatal care was not included in our main analysis because it may have been influenced by county opportunity. However, we tested for sensitivity to its inclusion in a separate analysis with comparable findings to the main results (Supplemental Table 1). To account for regional differences, we included an analysis adding mother's US region (West, Midwest, and Northeast) at the time they gave birth. Lastly, we analyzed only mothers moving to larger destination counties with over 2000 Black residents in 1970. This exclusion allowed us to study the common destinations in which Black Southerners typically settled and to avoid using unstable county opportunity measures resulting from low population density.

Table 1 Descriptive statistics (n = 154,145)

Birth weight	
Low birth weight (< 2500 g)	19,579 (12.7%)
Age	
< 18	32,005 (20.8%)
18–21	55,214 (35.8%)
22–26	40,313 (26.1%)
27–30	16,751 (10.9%)
31+	10,032 (6.5%)
Maternal education	
Less than HS	5761 (3.7%)
Some HS	47,089 (30.5%)
HS	66,645 (43.2%)
Some college	22,516 (14.6%)
College +	12,134 (7.9%)
Married	
Unmarried	55,719 (36.1%)
Married	29,892 (19.4%)
Missing	68,534 (44.5%)
Prenatal care in first trimester	
	59,269 (38.5%)
Ever had a fetal death	
	22,908 (14.9%)
State of mother's birth	
AL	18,317 (11.9%)
AR	9632 (6.2%)
FL	7113 (4.6%)
GA	11,741 (7.6%)
KY	2168 (1.4%)
LA	5929 (3.8%)
MS	25,674 (16.7%)
NC	22,628 (14.7%)
OK	1282 (0.8%)
SC	24,899 (16.2%)
TN	7925 (5.1%)
TX	3488 (2.3%)
VA	10,948 (7.1%)
WV	2401 (1.6%)

Results

Table 1 displays the descriptive statistics for migrating mothers from 1973 to 1980. Overall, 12.7% of 154,145 first-born infants had LBW. In our data, 65.7% of mothers in our sample reported 4 years of high school or more. This was similar to the 1970 Census reporting that 65% of Black adults nationally between the ages 20 and 24 had 4 or more years of high school education [22]. Table 2 shows the range in Black high school graduation percentage, poverty percentage, and racialized economic residential segregation. The 1970 ICE for racialized economic segregation ranged from − 0.10 to 0.54. The mean county graduation rate of 63.9% suggests that mothers commonly lived in counties where

Table 2 Descriptive statistics of low birth weight by county-level disadvantage (154,145 mothers in 184 counties)

	Mean (SD)	LBW %	*p*
Black high school graduation %	63.9% (12.0%)		
Q1 [0.70–1.0] (best-off)		2358 (12.3%)	0.021
Q2 [0.65–0.69]		11,339 (12.6%)	
Q3 [0.61–0.64]		4550 (13.2%)	
Q4 [0.16–0.60]		1332 (12.5%)	
Black poverty %	21.9% (9.7%)		
Q1 [0.00–0.18] (best-off)		2632 (12.1%)	0.018
Q2 [0.19–0.21]		8720 (12.9%)	
Q3 [0.22–0.25]		6353 (12.7%)	
Q4 [0.26–0.78]		1874 (12.5%)	
ICE racialized economic residential segregation	0.20 (0.09)		
Q1 [0.25–0.54] (best-off)		8773 (12.8%)	0.156
Q2 [0.20–0.24]		3461 (13.0%)	
Q3 [0.16–0.19]		4799 (12.4%)	
Q4 [− 0.10–0.15]		2546 (12.6%)	

more than half of Black adults completed their high school education.

Table 2 also displays the county average prevalence of LBW for each quartile of Black high school graduation percentage, poverty percentage, and racialized economic residential segregation. Though most county disadvantage measure showed statistically significant differences ($p < 0.05$), they were slight and had no consistent direction between deprivation and LBW. For instance, mothers who lived in the highest quartile of Black high school graduation rate in 1970 had a similar LBW prevalence (12.3%) compared to mothers who lived in counties with the lowest Black high school graduation rate (12.5%), which would translate to a difference of around 383 infants with LBW.

Table 3 displays the odds ratio of LBW for each 1970 county-level disadvantage indicator. In all county measures, migrating mothers living in the worst-off counties were just as likely to have LBW infants as mothers living in the best-off counties. Our sensitivity analyses restricting to popular destination counties with over 2000 Black residents in 1970 (Supplemental Table 2) and our analysis adding US regions (Supplemental Table 3) both show similar findings to our main results. We observed similar trends between county-level disadvantage and preterm birth where mothers living in the most deprived counties showed no differences in the odds of delivering a preterm infant compared to mothers living in the most advantaged counties (Supplemental Table 4).

The ICC in Table 3 suggests that counties did not substantially differ in the percentage of LBW infants and that counties account for less an 1% of the total variation in LBW. Instead, the results show that individual characteristics explained more than 99% of the variation in LBW. Individual-level predictors were more associative than county-level opportunity. For example, lower levels of education attainment were linked to higher odds of delivering an LBW infant compared to mothers with a college degree. Similarly, older maternal ages were associated with higher odds of LBW compared to mothers under age 18.

Discussion

In this analysis of 154,145 mothers delivering first-born infants from 1973 to 1980, we did not find evidence that county-level racial residential segregation and concentrated disadvantage were linked with LBW among Black migrators. This analysis showed no substantial variation across county LBW prevalence. We showed that mothers living in the most disadvantaged counties were just as likely to deliver an infant with LBW as those living in the most advantaged counties.

Table 3 Odds ratio of low birth weight by county-level disadvantage ($i = 154{,}145$ and $j = 184$ counties)

	Intercept only	Black male high school graduation rate			Black poverty rate			ICE racialized economic residential segregation		
		OR	95%CI		OR	95%CI		OR	95%CI	
ICC in LBW	0.0005			0.0001			0.0002			0.00002
County-level disadvantage										
Q1 (best-off)		ref								
Q2		0.97	0.90	1.04	1.04	0.98	1.10	0.96	0.91	1.01
Q3		1.01	0.95	1.07	1.03	0.97	1.10	1.02	0.96	1.08
Q4 (worst-off)		0.99	0.94	1.04	1.02	0.95	1.09	0.97	0.93	1.02
Age										
< 18		ref								
18–21		1.07	1.02	1.12	1.07	1.02	1.12	1.07	1.02	1.12
22–26		1.08	1.02	1.14	1.08	1.02	1.14	1.08	1.02	1.14
27–30		1.17	1.10	1.25	1.17	1.10	1.25	1.17	1.10	1.25
31+		1.59	1.48	1.70	1.59	1.48	1.70	1.59	1.48	1.71
Maternal education										
College +		ref								
Some college		1.24	1.15	1.33	1.23	1.15	1.33	1.24	1.15	1.33
High school		1.42	1.33	1.51	1.41	1.32	1.51	1.42	1.33	1.52
Some high school		1.87	1.74	2.01	1.87	1.73	2.01	1.87	1.74	2.01
Less than high school		1.98	1.79	2.19	1.98	1.79	2.19	1.98	1.79	2.19
Ever had a fetal death										
		1.43	1.38	1.49	1.43	1.38	1.49	1.43	1.38	1.49
State of mother's birth										
AL		ref								
AR		1.06	0.99	1.15	1.06	0.98	1.15	1.06	0.99	1.14
FL		1.04	0.96	1.13	1.04	0.96	1.13	1.04	0.96	1.13
GA		0.97	0.91	1.05	0.98	0.91	1.05	0.97	0.91	1.05
KY		1.14	1.00	1.30	1.14	1.00	1.30	1.13	0.99	1.29
LA		1.08	0.99	1.18	1.09	0.99	1.19	1.08	0.99	1.18
MS		1.04	0.98	1.10	1.04	0.98	1.10	1.04	0.98	1.11
NC		0.99	0.93	1.06	1.00	0.94	1.06	0.99	0.93	1.06
OK		1.10	0.93	1.30	1.10	0.93	1.30	1.09	0.92	1.28
SC		1.06	1.00	1.13	1.07	1.00	1.13	1.07	1.01	1.13
TN		1.08	1.00	1.17	1.08	1.00	1.17	1.08	1.00	1.17
TX		1.04	0.93	1.16	1.04	0.93	1.16	1.03	0.93	1.15
VA		1.12	1.04	1.21	1.13	1.05	1.21	1.12	1.05	1.21
WV		1.13	0.99	1.28	1.13	0.99	1.28	1.12	0.99	1.27

In contrast, other historical studies on Black infants situated near our study's time frame have found connections between racial residential segregation and infant mortality and LBW [23–25]. Because of the unexpected results, we explore two possible explanations. First, it is possible that migrators continued facing racial oppression wherever they went. The North and West were believed to offer some relief from the racial climate of the South. However, Great Migration movers encountered racism persistently in their new homes even as they gained higher socioeconomic opportunity relative to the South [4, 5]. In

addition to residential segregation, migrators experienced employment discrimination. Black and White workers were rarely integrated because of discrimination in union membership and in job promotions [1, 5, 12]. Black migrators in the North were often relegated to the lowest paid segment of the labor force and commonly worked in service sectors rather than in managerial or clerical roles [26]. Research situated in more contemporary periods has found that exposure to perceived racial discrimination has been associated with infant mortality, LBW, and preterm birth among Black women [27, 28]. If applied to the Great Migration, it is possible that migrators' experiences of discrimination may be an important contributor to the LBW outcomes in this study. However, more research is needed to examine the ways that racial discrimination encountered during the Great Migration may have harmed reproductive health for migrators.

Second, the early life course of Southern-born migrators may potentially be more consequential to LBW than the residential environments during their pregnancy. The life course perspective emphasizes that both the pregnancy and the early life course of the mother, starting in utero, influence reproductive health [29]. Research has linked childhood upbringing in the South—with its legalized segregation, suppressed civil rights, racial violence, and poorer education—with worsened physical health among Black adults even if they moved out of the South. Compared to Northern-born Black residents living in the North at the time of their death from 1980 to 2004, research has found that Southern-born Black residents in the North had higher risks for stroke, pancreatic cancer, and cardiovascular disease [30–32]. The life course approach may also apply to the mothers of the Great Migration. Even as migrators moved to higher opportunity areas in the North and West, it is possible that mothers' early social conditions may be a more important predictor of LBW outcomes than their destination choices. Future research is necessary to establish migrators' early life contexts as a key mechanism to reproductive health.

There are several limitations worth noting when interpreting the results of this study. First, we were unable to include pre-migration variables such as childhood socioeconomic position or childhood area-based opportunity, which may have better controlled for individual sorting. Second, smaller geographic units might have more precisely captured the exposures in this study and produced stronger relationships between the county environment and LBW [20]. Third, education may act like a mediator between county disadvantage and LBW. However, migrators moving out of the South from 1950 to 1970 commonly moved as young adults between ages 15 and 29. Therefore, it is possible that many completed most of their education before having their first child [1]. Last, we could not include the age when mothers moved. This may be a variable of interest as longer times spent in high economic opportunity have been linked to reduced preterm birth outcomes among Black women in contemporary studies [33, 34].

Despite these limitations, there are notable strengths. First, this study is one of the first to examine the association between the residential environment and the reproductive health of Great Migration movers. This study fills in an important research gap in the literature on how the destinations of migrators shaped their health. Prior research has shown that migrating Northward may not have been associated with improved adult mortality, infant mortality, and infant LBW outcomes compared to remaining in the South [6–8]. We contribute to this research area by exploring the degree that the socioeconomic environment may be one mechanism linked to these adverse health outcomes. Second, the inclusion of 184 counties across the US Northeast, Midwest, and West reflected the geographic span of the Great Migration and generalized the findings to multiple regions. Last, the use of multilevel regressions adjusting for migrators' characteristics helped overcome the fact that destination choices were not random. Multilevel regression also re-weighed counties. As a result, LBW rates in more sparsely populated counties, like Maricopa County in Arizona, were brought closer to the mean LBW rate of the study whereas LBW rates from larger counties, like Wayne County in Michigan, were less affected [35].

This study of Great Migration mothers across the US who delivered infants from 1973 to 1980 showed that county-level racial residential segregation and concentrated disadvantage in the North and West had no association with LBW. High socioeconomic opportunity, which has been shown to have a protective association for a wide range of health outcomes for Black Americans, may not have guaranteed better birth outcomes for mothers who moved during the last decade of the Great Migration. The findings

from this study may carry two important implications for Great Migration research and present population health. First, it is possible that the window of opportunity for maternal health among Black women in the US is more important in childhood than in adulthood. Second, economic opportunity alone may not protect Black maternal health. Living in a higher opportunity area may not necessarily safeguard from racial discrimination. Studying area-based opportunity alongside racial discrimination may more comprehensively explain birth outcomes among Black mothers. Overall, this study contributes to understanding the population health impact of the Great Migration, an area with a large potential for future research to answer the mounting questions of this understudied historical movement.

References

1. Gregory JN. *The Southern Diaspora: How the Great Migrations of Black and White Southerners Transformed America*. New edition. Chapel Hill, NC: University of North Carolina Press; 2005.
2. Tolnay SE. The African American "Great Migration" and beyond. *Annu Rev Sociol*. 2003;29(1):209–32. https://doi.org/10.1146/annurev.soc.29.010202.100009.
3. Fairclough A. *Better day coming: Blacks and equality, 1890-2000*: Viking; 2001. Accessed August 2, 2021. https://catalog.hathitrust.org/Record/004192896
4. Wilkerson I. *The Warmth of Other Suns: The Epic Story of America's Great Migration*. Reprint edition. New York, NY: Vintage; 2011.
5. Boustan LP. *Competition in the Promised Land: Black Migrants in Northern Cities and Labor Markets*. Princeton, NJ: Princeton University Press; 2016.
6. Vu C, Arcaya MC, Kawachi I, Williams DR. Moving to opportunity? Low birth weight outcomes among Southern-born Black mothers during the Great Migration. *Soc Sci Med*. 2023;328:115983. https://doi.org/10.1016/j.socscimed.2023.115983.
7. Black DA, Sanders SG, Taylor EJ, Taylor LJ. The impact of the Great Migration on mortality of African Americans: evidence from the deep south. *Am Econ Rev*. 2015;105(2):477–503. https://doi.org/10.1257/aer.20120642.
8. Eriksson K, Niemesh G. *Death in the promised land: the Great Migration and Black infant mortality*: Social Science Research Network; 2016. https://doi.org/10.2139/ssrn.3071053.
9. Schulz AJ, Williams DR, Israel BA, Lempert LB. Racial and spatial relations as fundamental determinants of health in Detroit. *Milbank Q*. 2002;80(4):677–707. https://doi.org/10.1111/1468-0009.00028.
10. Williams DR, Collins C. Racial residential segregation: a fundamental cause of racial disparities in health. *Public Health Rep*. 2001;116(5):404–16.
11. Collins WJ. The housing market impact of state-level anti-discrimination laws, 1960–1970. *J Urban Econ*. 2004;55(3):534–64. https://doi.org/10.1016/j.jue.2003.11.003.
12. Sugrue TJ. *The Origins of the Urban Crisis: Race and Inequality in Postwar Detroit*. Revised edition. Princeton, NJ: Princeton University Press; 2005.
13. U.S. Department of Health and Human Services (1973-1980). National Center for Health Statistics. Natality Detail File (1973-1980). https://doi.org/10.3886/ICPSR03305.v1
14. U.S. Census Bureau (1970). Social Explorer. https://www.socialexplorer.com/data/C1970
15. Derenoncourt E. Can you move to opportunity? Evidence from the Great Migration. *Am Econ Rev*. 2022;112(2):369–408. https://doi.org/10.1257/aer.20200002.
16. Price-Spratlen T. Urban destination selection among African Americans during the 1950s Great Migration. *Soc Sci Hist*. 2008;32(3):437–69. http://dx.doi.org.ezp-prod1.hul.harvard.edu/10.1017/S0145553200014012
17. Wang X, Zuckerman B, Coffman GA, Corwin MJ. Familial aggregation of low birth weight among Whites and Blacks in the United States. *N Engl J Med*. 1995;333(26):1744–9. https://doi.org/10.1056/NEJM199512283332606.
18. Schoeneberger JA. The impact of sample size and other factors when estimating multilevel logistic models. *J Exp Educ*. 2016;84(2):373–97. https://doi.org/10.1080/00220973.2015.1027805.
19. Sommet N, Morselli D. Keep calm and learn multilevel logistic modeling: a simplified three-step procedure using Stata, R, Mplus, and SPSS. *Int Rev Soc Psychol*. 2017;30(1):203–18. https://doi.org/10.5334/irsp.90.
20. Krieger N, Kim R, Feldman J, Waterman PD. Using the Index of Concentration at the Extremes at multiple geographical levels to monitor health inequities in an era of growing spatial social polarization: Massachusetts, USA (2010-14). *Int J Epidemiol*. 2018;47(3):788–819. https://doi.org/10.1093/ije/dyy004.
21. U.S. Census Bureau. *1970 Census Users' Guide*. Washington, D. C.: U. S. Government Printing Office; 1970. p. 1970.
22. U.S. Census Bureau (1970). Educational attainment in the United States: 1970 - Detailed Tables. Accessed June 18, 2023 at https://www.census.gov/data/tables/1970/demo/educational-attainment/p20-207.html
23. LaVeist TA. Segregation, poverty, and empowerment: health consequences for African Americans. *Milbank Q*. 1993;71(1):41–64. https://doi.org/10.2307/3350274.
24. Niemesh GT, Shester KL. Racial residential segregation and black low birth weight, 1970–2010. *Reg Sci Urban Econ*. 2020;83:103542. Accessed November 17, 2021. https://ideas.repec.org/a/eee/regeco/v83y2020ics0166046219303886.html
25. Polednak AP. Trends in US urban black infant mortality, by degree of residential segregation. *Am J Public Health* Published online October. 2011;7 https://doi.org/10.2105/AJPH.86.5.723.

26. Collins WJ. The Great Migration of Black Americans from the US South: a guide and interpretation. *Explor Econ Hist*. 2021;80:101382. https://doi.org/10.1016/j.eeh.2020.101382.
27. Bower KM, Geller RJ, Perrin NA, Alhusen J. Experiences of racism and preterm birth: findings from a pregnancy risk assessment monitoring system, 2004 through 2012. *Womens Health Issues*. 2018;28(6):495–501. https://doi.org/10.1016/j.whi.2018.06.002.
28. Slaughter-Acey JC, Sealy-Jefferson S, Helmkamp L, et al. Racism in the form of micro aggressions and the risk of preterm birth among black women. *Ann Epidemiol*. 2016;26(1):7–13.e1. https://doi.org/10.1016/j.annepidem.2015.10.005.
29. Osypuk TL. Invited commentary: integrating a life-course perspective and social theory to advance research on residential segregation and health. *Am J Epidemiol*. 2013;177(4):310–5. https://doi.org/10.1093/aje/kws371.
30. Glymour MM, Avendaño M, Haas S, Berkman LF. Life-course social conditions and racial disparities in incidence of first stroke. *Ann Epidemiol*. 2008;18(12):904–12. https://doi.org/10.1016/j.annepidem.2008.09.010.
31. Glymour MM, Kosheleva A, Boden-Albala B. Birth and adult residence in the Stroke Belt independently predict stroke mortality. *Neurology*. 2009;73(22):1858–65. https://doi.org/10.1212/WNL.0b013e3181c47cad.
32. Maria GM, Mauricio A, Berkman LF. Is the 'Stroke Belt' worn from childhood? *Stroke*. 2007;38(9):2415–21. https://doi.org/10.1161/STROKEAHA.107.482059.
33. Collins JW, Rankin KM, David RJ. African American women's lifetime upward economic mobility and preterm birth: the effect of fetal programming. *Am J Public Health*. 2011;101(4):714–9. https://doi.org/10.2105/AJPH.2010.195024.
34. Pearl M, Ahern J, Hubbard A, et al. Life-course neighbourhood opportunity and racial-ethnic disparities in risk of preterm birth. *Paediatr Perinat Epidemiol*. 2018;32(5):412–9. https://doi.org/10.1111/ppe.12482.
35. Schwartz GL, Jahn JL. Mapping fatal police violence across U.S. metropolitan areas: overall rates and racial/ethnic inequities, 2013-2017. *PLoS One*. 2020;15(6):e0229686. https://doi.org/10.1371/journal.pone.0229686.