



Moving to opportunity? Low birth weight outcomes among Southern-born Black mothers during the Great Migration

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ABSTRACT

Objective: The Great Migration was a mass movement in the United States during the twentieth century of roughly eight million Black Southerners to the Northeast, Midwest, and West. Despite its significance, little is known about the health outcomes associated with this internal migration. This study assessed the relationship between migration and low birth weight among mothers born in the South between 1950 and 1969.

Methods: We used approximately 1.4 million birth records of Black infants maintained by the US National Center for Health Statistics. To tease out the roles of the healthy migrant bias and of destination contexts, we compared two migration groups to Southern non-migrants: (1) migrants moving to the North and (2) migrants moving within the South. Non-migrants were matched to migrants using coarsened exact matching. We estimated the relationship between migration status and low birth weight stratified by birth year cohorts using logistic regression models.

Results: There was positive selection in education and marriage among migrants moving out of the South and within the South. Results showed lower odds of low birth weight in both migration groups compared to Southern non-migrants. The odds ratios of low birth weight were similar in both comparisons.

Conclusion: We found evidence consistent with a healthy migrant bias in infant health among mothers during the last decades of the Great Migration. Despite better economic opportunity, migrating to the North may not have offered additional protection for infant birth weight outcomes.

1. Introduction

The Great Migration was a sweeping demographic movement in 20th century American history that left indelible prints across the United States as around eight million Black Americans left the South between 1910 and 1980. This migration can be divided into two waves: the First Great Migration spanning from approximately 1910 to 1940 and the Second Great Migration spanning from 1941 to around 1980 (Gregory, 2005). Although motivations to migrate varied, historians have pointed to economic and racial oppression as notable incentives. Migrants obtained readily available jobs with higher wages in the North (Boustan, 2016). They also sought reprieve from racial segregation and violence prevalent in the South. Racial segregation under Jim Crow touched virtually every aspect of Black lives, relegating them to poor quality

education and jobs while truncating opportunity for wealth and civil rights (Fairclough, 2001; Tolnay, 2003). Racial violence particularly influenced their exodus. Southern counties that experienced more lynching of Black residents from 1920 to 1930 saw higher out-migration rates (Tolnay and Beck, 1990). Because of the Great Migration, the demographics of the United States' Black population shifted considerably such that the portion of Black residents living outside of the South grew from only 8% in 1900 to 47% in 1970 (Gregory, 2005).

One relatively unexplored area in the study of the Great Migration is the extent to which migration was linked to health. The healthy migrant bias and place-based opportunity are two important factors that may help to explain this relationship. The healthy migrant bias is a hypothesis suggesting that migrants are healthier than non-migrants. Migrants may be more physically fit to endure long moves, may have social and

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resource support in their destinations, and may meet selective education and employment criteria (Hamilton, 2015; Palloni and Morenoff, 2001). This health selection bias has been documented in instances of international and internal American migration (Hamilton, 2015; Palloni and Morenoff, 2001; Riosmena et al., 2017; Arcaya et al., 2014, 2016; Wingate et al., 2009). The healthy migrant bias may also apply to migrants of the Great Migration. Some literature has documented positive selection on education and earnings among Great Migration migrants (Black et al., 2015; Margo, 1988; Tolnay, 1998). The well-known link between socioeconomic status and health might indicate that migrants had a health advantage as well.

Additionally, destinations may have shaped the relationship between migration and health during the Great Migration. Evidence for other United States internal migrations within recent decades has suggested that moving to areas with higher economic opportunity may be positively linked with better health outcomes, such as lower infant and all-cause mortality (Finkelstein et al., 2019; Venkataramani et al., 2015; Vos et al., 2014). The relationship between place-based economic opportunity and health may also be relevant to Great Migration migrants. Recent evidence has documented their economic gains after moving Northward. Comparing sibling pairs of migrants and non-migrants, Boustan (2016) showed that migrants who moved Northward in 1940 doubled their wages even after adjusting for the higher cost of living in the North. Additionally, children of migrants from the South gained almost a year of additional schooling in 1940 compared to the children of Southern non-migrants (Baran et al., 2022).

On the other hand, Northern destinations during the Great Migration were not free of racial discrimination. Upon their arrival in the North, Southern migrants faced hiring discrimination and were frequently relegated to the lowest paying and unskilled occupations (Boustan, 2016; Gregory, 2005). Migrants arrived in cities that were rapidly becoming more racially segregated as the typical Black resident lived in a neighborhood that was 75% Black in 1970 (Boustan, 2016). Racial residential segregation has been shown to reduce education, employment, and public health resources for its residents (Williams and Mohammed, 2013). For these reasons, it has been linked to poorer health outcomes like adult and infant mortality during the latter decades of the twentieth century among Black individuals (LaVeist, 1993; Polednak, 1996; Williams and Collins, 2001). Experiences of racism in the North may have played a harmful role in migrants' health.

So far, two studies have examined the health outcomes resulting from moving out of the South during the First Great Migration (1910–1940) with both suggesting that moves were disadvantageous for health outcomes (Black et al., 2015; Eriksson and Niemesh, 2016). Among Black residents born in South Carolina, Georgia, Alabama, Mississippi, and Louisiana in 1916–1932, Black et al. (2015) found that migrants had lower survival rates compared to people who did not move. Migrants lowered their probability of survival to age 70 by 6% and to age 75 by 10%. Eriksson and Niemesh (2016) drew a similar conclusion studying migration and infant mortality. Using linked US Census and death records, they found that the infant mortality rates among migrants to the North were 9 and 5 percentage points higher in 1920 and 1930, respectively, compared to the rates of families who remained in the South.

However, several gaps remain in our understanding of the extent to which moving to the North was associated with the health of migrants. First, there is a dearth of research on the relationship between migration and health outcomes during the Second Great Migration (1941–1980), a period involving five million migrants (W. J. Collins, 2021; Gregory, 2005). Second, to our knowledge, no other study on the health of Great Migration migrants parsed out the role of the healthy migrant bias from the role of the destination environments (Boustan, 2016; Tolnay, 2003). Migrants moving within the South could be an ideal comparison group. Migration within the South was sizable, even though it was smaller than Northern and Western migration. For instance, 47% of Mississippi-born Black residents moved out of the South while 15% moved to another

Southern state in 1970 (Gregory, 2005). Both migration groups similarly moved from primarily rural to metropolitan areas. Yet, those moving within the South commonly relocated to nearby cities in neighboring states whereas migrants to the North and West traveled farther (Gregory, 2005). Migrants within the South more likely remained in comparable socioeconomic environments with similar systems of racial segregation compared to migrants to the North and West (Fairclough, 2001). Examining multiple groups of migrants may be similar to the “Moving to Opportunity” experiment in which researchers compared families who stayed, moved to any neighborhood, and moved to low-poverty neighborhoods (Katz et al., 2001).

To address these research gaps, this study examined the association between migrating among Black mothers born between 1950 and 1969, years that fall within the Second Great Migration, and low birth weight (LBW). We used US birth certificate records of Black mothers born in the South. Our research goal was to study the roles of the healthy migrant bias and the Northern environment on LBW by examining two groups of migrants: migrants to the North and migrants relocating within the South. We predicted that a protective relationship between migration and LBW in both groups of migrants would support a healthy migrant bias. Lower odds ratios of LBW among Northern migrants compared to those of migrants moving within the South would also suggest more conducive conditions in the North for infant health.

2. Methods

2.1. Sample

The analysis used the US birth certificate data among infants born between 1975 and 1999. These records were part of the United States Department of Health and Human Services' National Center for Health Statistics. The sample was restricted to mothers who reported “Black” as their race, a Southern birth state, who delivered in the contiguous US (excluding Hawaii and Alaska), and who were born between 1950 and 1969. Only first-born infants were included to reduce clustering as infants born to the same mother might have similar birth weights (Wang et al., 1995).

2.2. Variables

There were three exposure groups: (1) Northern migrants, (2) internal Southern migrants, and (3) Southern stayers. Northern migrants were defined as those born in a Southern state and delivered in a Northern or Western state. Internal Southern migrants were those born in a Southern state and delivered in another Southern state. Southern stayers, the control group, were those who delivered infants in their same native Southern state. The Southern region included Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Oklahoma, Tennessee, Virginia, and West Virginia following the US Census criteria (Gregory, 2005). Washington D.C. was not included on this list. Although a Southern state by US Census definition, Washington D.C. was also considered a popular destination during the Great Migration (Derenoncourt, 2022; Price--Spratlen, 2008). We excluded mothers who gave birth in California and Texas because these states did not report maternal education until 1989. The exclusion reduced the sample by 14.8%, but we believe that the remaining 35 Northern and Western states and 13 Southern states represented the scope of the Great Migration.

Low birth weight was defined as infants born below 2500 g. This birth weight cut off was consistent with other historical public health literature studying low birth weight among Black mothers between the 1970s and 1990s (Colen et al., 2006; Niemesh and Shester, 2020). Other demographic covariates were maternal education; marital status; age; year of birth; and Southern birth state. Health-related covariates were receiving at least one prenatal care visit during the first trimester; experiencing a past fetal death defined as reporting at least one history

of spontaneous fetal death after conception; substance use, defined as ever smoking tobacco or drinking alcohol during pregnancy; and reporting at least one pregnancy-related medical condition that includes anemia, cardiac disease, diabetes, hydramnios, hemoglobinopathy, chronic hypertension, pregnancy-associated hypertension, and eclampsia. The latter two health-related variables were only included in birth records starting in 1989. We did a complete case analysis and excluded mothers who were missing the variables of interest.

2.3. Statistical analyses

The overall empirical strategy was to quantify the differences in the odds of LBW of migrants compared to non-migrants. We compared two types of migrants (Northern migrants and internal Southern migrants) to non-migrants to tease out the role of the healthy migrant bias from the role of the Northern and Western contextual environments. Our rationale was that the existence of a healthy migrant bias would result in a protective association in LBW in both groups of migrants compared to non-migrants, regardless of the destination. Additionally, place-based opportunity in the North could have resulted in an even more protective association between migration and LBW among Northern migrants than among internal Southern migrants. We matched to reduce differences between migrants and non-migrants, comparing our results to estimates produced from propensity score matching and covariate adjusted-only models.

We used logistic regressions to estimate the odds of LBW by migration status, stratifying among four time periods of maternal birth (i.e., 1950–1954, 1955–1959, 1960–1964, 1965–1969) and among two migration groups. We divided the sample by years to check if associations remain the same across a 20-year stretch as the study straddles a period of significant change in Civil Rights legislation, such as the Civil Rights Act of 1964 (Almond and Chay, 2006). We adjusted for education, history of fetal death, age, marital status, mother's birth year, and mothers' state of origin.

We employed three different methods to control for group differences and to create more exchangeable treatment groups: coarsened exact matching (CEM), propensity score matching (PSM), and covariate adjustment-only (i.e., no matching). Matching is a way to pre-process the data before statistical testing, helping to produce more causal estimates as the groups become more similar (Ho et al., 2007). Matching was useful in this study because of the positive socioeconomic selection among migrants to the North compared to Southern stayers (Black et al., 2015; Margo, 1988; Tolnay, 1998). Both PSM and CEM prune the data to create groups with more balanced covariates. PSM is a more traditional and widely used method whereas CEM is an alternative method shown to better minimize group differences (Iacus et al., 2012). Guidance from Vable et al. (2019) suggests comparing various matching methods to avoid selecting biased models. If the point estimates of matching models and covariate models are dissimilar (i.e., the confidence intervals do not overlap), matching methods would typically be more unbiased.

CEM is a method to pair treated and control observations to produce a more balanced covariate distribution. CEM has been shown to have some noteworthy advantages compared to other matching methods, such as reduction of covariate differences between groups and computational efficiency (Iacus et al., 2012). In this study, matching was exact on state of birth, birth year, marriage, and past fetal death whereas matching was coarsened for age and education so that mothers were paired more flexibly on these covariates. At least one Southern stayer was matched to each migrant. Each migrant had a weight of 1 while Southern stayers had a weight calculated by the ratio of stayers to migrants in the stratum multiplied by the ratio of migrant to stayers in the entire matched dataset (Iacus et al., 2012). Supplemental Tables S1 and S2 evaluated the CEM procedure. There were minimal differences in observed characteristics between treatment and control groups after the matching.

For the PSM, each person received a propensity score indicating the

likelihood of being a migrant, given their covariates, where values ranged from 0 to 1. Individuals were matched by propensity scores that were within a 0.01 standard deviation from each other (also known as “calipers”). Migrating mothers were paired to Southern stayers by the closest propensity score (i.e., nearest neighbor matching). There was no replacement of the control group. Approximately two control units were matched to one treated unit and unmatched mothers were trimmed from the dataset. Supplemental Tables S3 and S4 evaluated the PSM. Compared to CEM, PSM results had larger differences in observed characteristics between treatment and control groups. We used the R package “MatchIt” to perform both CEM and PSM (Ho et al., 2007). Robust clustered standard errors were used to estimate the confidence intervals. Mothers were clustered in their strata if matching was used or the state of birth if matching was not used.

2.4. Sensitivity analyses

We performed an additional CEM analysis where we matched and adjusted for receiving prenatal care during the first trimester. Receiving prenatal care was not included in our main analysis because it may have been influenced by migration. However, we tested for sensitivity to its inclusion because Northern migrants and internal Southern migrants reported receiving more prenatal care than Southern stayers. Similarly, we added medical risks and substance use during pregnancy in an additional CEM analysis. These variables were only available starting in 1989 birth records. We restricted these analyses to mothers born between 1960 and 1969 and excluded mothers born between 1950 and 1959 because most did not have these recorded health risk factors. Lastly, we compared Northern migrants with internal Southern migrants as our reference group. We were unable to add all migration groups to the same model because matching is more fit for binary exposures (Iacus et al., 2012). Instead, we performed this comparison to have a more complete analysis.

3. Results

Table 1 displays the distribution of migration group characteristics and results from tests of group comparisons. Our results showed similar low birth weight prevalence among Southern stayers and Northern migrants (12.7% each) while there was a slightly lower prevalence among internal Southern migrants (11.7%). Sizable differences in marriage and education rates indicated some evidence for positive selection into migration by socioeconomic characteristics. Southern stayers had the lowest marriage rates (31%), compared to 50% of internal Southern migrants and 37% Northern migrants. Likewise, Southern stayers had the lowest proportion of mothers attaining a high school degree or more (26%), compared to 43% internal Southern migrants and 34% of Northern migrants.

While Table 1 shows positive selection on some socioeconomic characteristics, there was a less clear pattern on the pregnancy-related medical risk factors. Migrants had higher rates of receiving prenatal care (70% and 67% for internal Southern migrants and Northern migrants, respectively) compared to Southern stayers (63%). However, migrants had higher rates of experiencing a fetal death before their first live birth (19% for internal Southern migrants and 21% of Northern migrants) compared to 14% of Southern stayers. Migrants also had higher maternal ages. While 8% of Southern stayers were over 30 years old at the time they delivered their first live birth, the percentages were almost doubled for internal Southern and Northern migrants at 15% and 13%, respectively.

Table 2 provides the results from logistic regressions using CEM, PSM, and covariate adjustment-only methods. Overall, the results showed that both groups of migrants had lower odds of delivering an infant with LBW compared to Southern stayers. For the results from the CEM, there was a slight protective relationship between those who migrated North and West compared to those who stayed in the South

Table 1

Descriptive statistics by migration group of mothers born in the South between 1950 and 1969 (n = 1,395,087).

N	Southern Stayers	Internal Southern Migrants	Northern Migrants
	1,033,098	131,555	230,434
Low birth weight			
yes (%)	130667 (12.7)	15408 (11.7)	29138 (12.7)
no (%)	901072 (87.3)	115983 (88.3)	200868 (87.3)
missing (%)	1359 (0.1)	164 (0.1)	428 (0.2)
Age category			
age <15 (%)	18894 (1.8)	1420 (1.1)	2496 (1.1)
age 15–19 (%)	416497 (40.3)	33506 (25.5)	67938 (29.5)
age 20–24 (%)	351127 (34.0)	45771 (34.8)	79078 (34.3)
age 25–29 (%)	165304 (16.0)	31641 (24.1)	50043 (21.7)
age 30–34 (%)	63252 (6.1)	14687 (11.2)	22851 (9.9)
age 35–39 (%)	16050 (1.6)	4039 (3.1)	7053 (3.1)
age 40+ (%)	1974 (0.2)	491 (0.4)	975 (0.4)
	0 (0.0)	0 (0.0)	0 (0.0)
Married			
yes	313202 (30.9)	65239 (50.4)	75067 (36.7)
no	700571 (69.1)	64176 (49.6)	129256 (63.3)
missing (%)	19325 (1.9)	2140 (1.6)	26111 (11.3)
Maternal education			
less than high school (%)	43186 (4.2)	3161 (2.4)	5109 (2.3)
some high school (%)	707360 (69.5)	71506 (55.0)	140446 (63.6)
high school (%)	68283 (6.7)	10541 (8.1)	17343 (7.8)
some college (%)	112594 (11.1)	19535 (15.0)	29033 (13.1)
college + (%)	87005 (8.5)	25326 (19.5)	29017 (13.1)
missing (%)	14670 (1.4)	1486 (1.1)	9486 (4.1)
Mother's state of birth			
AL (%)	103259 (10.0)	15798 (12.0)	27872 (12.1)
AR (%)	31928 (3.1)	4305 (3.3)	15729 (6.8)
FL (%)	125607 (12.2)	10646 (8.1)	12684 (5.5)
GA (%)	98375 (9.5)	19980 (15.2)	16957 (7.4)
KY (%)	22471 (2.2)	2617 (2.0)	5034 (2.2)
LA (%)	145090 (14.0)	6740 (5.1)	11670 (5.1)
MS (%)	85733 (8.3)	19197 (14.6)	40763 (17.7)
NC (%)	129884 (12.6)	13037 (9.9)	27679 (12.0)
OK (%)	18134 (1.8)	1046 (0.8)	2862 (1.2)
SC (%)	99537 (9.6)	15064 (11.5)	23001 (10.0)
TN (%)	72709 (7.0)	6461 (4.9)	14399 (6.2)
TX (%)	0 (0.)	8184 (6.2)	8703 (3.8)
VA (%)	95815 (9.3)	7147 (5.4)	18986 (8.2)
WV (%)	4556 (0.4)	1333 (1.0)	4095 (1.8)
Prenatal care in first trimester			
received (%)	627587 (63.2)	89247 (70.3)	148543 (67.1)
not received (%)	364976 (36.8)	37794 (29.7)	72897 (32.9)
missing (%)	40535 (3.9)	4514 (3.4)	8994 (3.9)
Ever had fetal death			
yes (%)	141272 (13.9)	24141 (18.5)	48932 (21.4)
no (%)	878710 (86.1)	106495 (81.5)	179426 (78.6)
missing (%)	13116 (1.3)	919 (0.7)	2076 (0.9)
Substance use during pregnancy^a			
yes (%)	17419 (1.7)	2461 (1.9)	4497 (2.0)
no (%)	165266 (16.0)	33339 (25.3)	34544 (15.0)
missing (%)	850413 (82.3)	95755 (72.8)	191393 (83.1)

Table 1 (continued)

N	Southern Stayers	Internal Southern Migrants	Northern Migrants
	1,033,098	131,555	230,434
At least one pregnancy risk factor^a			
yes (%)	27436 (2.7)	5193 (4.0)	6531 (2.8)
no (%)	155182 (15.0)	30496 (23.2)	36141 (15.7)
missing (%)	850480 (82.3)	95866 (72.8)	187762 (81.5)

^a Reported starting from 1989 birth files.

across all birth years after adjusting for demographics, socioeconomic characteristics, and past fetal death. For instance, among mothers born between 1950 and 1954, Northern migrants had 9% lower odds (OR 0.91 95% CI 0.86 to 0.97) of having a low birth weight infant relative to Southern stayers even after covariate adjustment. Table 2 results from the covariate adjustment-only models showed a similar, minor protective relationship between migration and low birth weight. While the PSM estimates also confirmed a protective relationship, the results were less statistically significant compared to the CEM and covariate adjustment models.

Similarly, the results from Table 3 show that internal Southern migrants had lower odds of having a LBW infant compared to Southern stayers during most birth-year cohorts using CEM, PSM, and covariate adjustment only methods. Mothers born between 1950 to 1954 and 1965 to 1969 experienced decreased odds of low birth weight relative to Southern stayers, with migrants born between 1965 and 1969 seeing 8% lower odds of the outcome (OR 0.92 95% CI 0.88 to 0.97). The covariate adjustment results also confirmed the lowered odds ratios. The results from PSM overall achieved less statistically significant odds ratios. There were no substantial differences in the odds ratios of LBW between migrants to the North and migrants moving within the South.

In our sensitivity analyses, we used CEM further adjusting for receiving prenatal care during the first trimester. Comparing Northern migrants and internal Southern migrants to Southern stayers, we found that the odds ratios of low birth weight were similar to those in the main analyses (Supplemental Table S5). In addition, we added pregnancy-related medical conditions and substance use during pregnancy for mothers born between 1960 and 1969. Our results showed a protective association for LBW among mothers born between 1965 and 1969 (Supplemental Table S6). Lastly, we found that the low birth weight outcomes for Northern migrants were no different than those of internal Southern migrants using CEM (Supplemental Table S7).

4. Discussion

The purpose of this study was to examine the association between migration and LBW among mothers during the Second Great Migration. To separate the roles of the healthy migrant bias and place-based opportunity outside the South, we compared both migrants moving to the North and West and migrants who moved within the South to Southern stayers. The study showed that migration was associated with lower odds of LBW, regardless of the regional destination, lending evidence in support of the healthy migrant bias. We did not find that the odds ratio for LBW among migrants to the North were lower than those of migrants within the South, suggesting challenges to opportunity for all Black migrants regardless of destinations. In this study, we used PSM and CEM to match. Matching created more comparable groups by reducing the positive socioeconomic status selection among migrants. PSM yielded wider group differences compared to CEM, which may be due to residual confounding (lower covariate balance between groups) in PSM.

Our results on the healthy migrant bias among migrants during the Second Great Migration are consistent with results from previous examinations of health selection among migrants in other US internal

Table 2

Odds ratio of low birth weight comparing Northern migrants to Southern stayers.

	Coarsened Exact Matching				Propensity Score Matching				Covariate Adjustment			
	N	OR	95% CI		N	OR	95% CI		N	OR	95% CI	
1950–54	73238	0.91	0.86	0.97	52559	0.93	0.88	0.98	77972	0.94	0.88	1.01
1955–59	59769	0.95	0.92	0.99	117247	0.97	0.93	1.00	238141	0.94	0.89	0.99
1960–64	351250	0.96	0.93	0.99	157240	0.98	0.95	1.01	358774	0.96	0.93	0.99
1965–69	266454	0.94	0.91	0.98	102099	0.98	0.94	1.02	272634	0.95	0.92	0.98

Table 3

Odds ratio of low birth weight comparing internal Southern migrants to Southern stayers.

	Coarsened Exact Matching				Propensity Score Matching				Covariate Adjustment			
	N	OR	95% CI		N	OR	95% CI		N	OR	95% CI	
1950–54	58794	0.86	0.79	0.95	29099	0.88	0.82	0.95	66761	0.88	0.83	0.94
1955–59	209246	0.97	0.92	1.02	91664	0.98	0.94	1.03	221148	0.96	0.93	0.98
1960–64	327649	0.97	0.92	1.02	97583	0.98	0.94	1.02	338361	0.97	0.93	1.01
1965–69	256185	0.92	0.88	0.97	75096	0.96	0.91	1.00	263983	0.93	0.88	0.98

migrations. Wingate et al. (2009) found evidence of a healthy migrant bias of infant health outcomes among internal US migrants regardless of region. Birth records of Black mothers delivering from 1995 to 2001 showed that mothers who moved to another state had lower risks of infant low infant birthweight and small-for-gestational-age outcomes compared to non-migrants. Additionally, our findings of positive selection on education and marriage are consistent with the results from demographic research on the Great Migration (Black et al., 2015; Boustan, 2016; Margo, 1988; Tolnay, 1997, 1998).

In contrast to prior studies on migration and adult survival rates and infant mortality during the First Great Migration, our study did not find an adverse relationship between migration and health (Black et al., 2015; Eriksson and Niemesh, 2016). Our study period may have been one reason for the different findings. Destination cities were more established with migrant networks by the latter half of the Great Migration, potentially lessening the stress from isolation and navigating new environments (Tolnay, 2003). Group resources available during the Second Great Migration, such as job placement support, community newspapers, and churches, may have aided migrants' transition (Price-Spratlen, 2008).

One surprising study finding was the similar odds ratios of LBW among both groups of migrants. Given the positive economic and education benefits found among migrants settling in the North (Baran et al., 2022; Boustan, 2016), it would be reasonable to expect an even stronger protective association for LBW among migrants to the North compared to internal Southern migrants. Yet, our results suggest that migrants continued facing challenges that may have been harmful to infant health both within and outside of the South. Considerable evidence has indicated that migrants encountered racism in the North (Boustan, 2016; Derenoncourt, 2022; Eriksson, 2019; Sugrue, 2005). For instance, Northern Black communities faced various housing discrimination. The typical Northern Black resident during the 1960s and 1970s lived in highly racially segregated neighborhoods (Boustan, 2016). Black residents who moved outside city boundaries were often intimidated by White neighbors. In 1963, Detroit recorded 63 violent incidents targeted at newly arrived Black residents moving into majority White neighborhoods (Sugrue, 2005). The intensity of racial residential segregation in the North and West persists to this day, exceeding segregation levels in the US South. Once popular Great Migration destinations disproportionately make up cities with the highest racial segregation nationwide in 2020 (Menendian et al., 2021).

Racism that Northern migrants experienced may have contributed to poorer birth outcomes. Residential segregation shapes access to socioeconomic opportunities and wealth accumulation (Williams and Mohammed, 2013). Segregation patterns the presence of community

resources including housing quality, access to healthcare systems, and exposure to environmental harm which are factors potentially associated with adverse pregnancy outcomes (Matoba and Collins, 2017). Racial discrimination is also a type of psychosocial stressor. Coping with racial discrimination throughout the life course has been linked to unhealthy behaviors that can potentially harm fetal development (Matoba and Collins, 2017; Bower et al., 2018; J. W. Collins et al., 2004; Slaughter-Acey et al., 2016).

There are some limitations to keep in mind when interpreting these study findings. First, we did not have the age when mothers moved from their state of birth to their state of adult residence. This may be important in two ways. More years spent in high economic opportunity may have a protective association with birth outcomes (J. W. Collins et al., 2011; Pearl et al., 2018). Conversely, prolonged exposure to life course racial discrimination may predict low birth weight (J. W. Collins et al., 2004). Second, it was possible that marriage and completion of education occurred post-migration, obviating the need to control for them as confounders in the association between moving and low birth weight. However, most newly arrived Southerners to the North were already married (Gregory, 2005). The typical age of moving out of the South occurred between ages 15 and 29, potentially coinciding with the age of completing education (Gregory, 2005). Last, we were unable to capture a more precise location of mothers' places of birth. Such information could have fine-tuned the pairing of migrating and non-migrating mothers so that they were exposed to similar contexts (e.g., racial terror and high poverty).

Even with these limitations, there were notable strengths of this paper. First, this study's comparisons of both migrants to the North and migrants within the South better separated the role of the destination from the role of the healthy migrant bias. If we had not examined these comparisons, we might have overlooked the healthy migrant bias and may have falsely concluded that Northward migration was protective of LBW among Black mothers. Second, the comparison of matching and non-matching techniques built confidence in these findings (Vable et al., 2019). Finally, the study's large dataset, the universe of birth records, strengthened the study's power and increased the geographical representation of the Great Migration.

Although prior research has suggested that migration to the North provided some economic and education benefits to migrants, our findings suggest that residing in the North and West was not associated with additional protection for low birth weight for Southern Black mothers. Even with a historical study period, this study carries contemporary significance by underscoring the need for addressing structural racism everywhere rather than solely in states with histories of slavery and Jim Crow. We believe this study adds to the growing literature on the Great

Migration that highlights a pivotal, yet understudied US demographic event. To expand on this research, future studies should examine the ways in which economic opportunity and racism shaped infant health for migrants moving outside the US South.

Credit author statement

Cecilia Vu: Conceptualization; Formal analysis; Methodology; Roles/ Writing - original draft. Mariana Arcaya: Conceptualization; Methodology; Writing - review & editing. Ichiro Kawachi: Conceptualization; Methodology; Writing - review & editing. David Williams: Conceptualization; Methodology; Writing - review & editing; Supervision.

Data availability

The data is available for public use through the US National Center for Health Statistics.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.socscimed.2023.115983>.

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