Maternal and Child Health Journal
https://doi.org/10.1007/s10995-023-03608-5

The Relation of Neighborhood Racial and Income Polarity to Preterm Birth Rates in Chicago

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Accepted: 19 January 2023

Abstract

Objectives To investigate the extent to which spatial social polarization is associated with preterm birth among urban African-American and non-Latinx white women, and whether prenatal care modifies this relationship.

Methods We performed multilevel logistic regression analyses on a 2013–2017 dataset of Chicago vital records (N = 29,179) with appended Index of Concentration at the Extremes (ICE) values for race and income.

Results Women who resided in the bottom ICE quintile neighborhoods had a preterm birth rate of 11.5%, compared to 7.3% for those who live in the top ICE quintile areas; adjusted odds ratio (aOR) equaled 1.72 (95% confidence interval [CI] = 1.39, 2.12). This disparity widened for early (< 34 weeks) preterm birth rates, aOR = 2.60 (1.77, 3.81). These associations persisted among women with adequate prenatal care utilization.

Conclusions for Practice Spatial polarization of race and income in urban African-American and non-Latinx white women's residential environment is strongly associated with preterm birth rates, even among those who receive adequate prenatal care. These findings highlight the benefit of using ICE to contextualize the impact of urban neighborhood-level characteristics on preterm birth rates.

Significance

To better understand the social determinants of preterm birth, research efforts have shifted from women's individual-level characteristics toward their exposure to contextual markers. The Index of Concentration at the Extremes (ICE) is a novel measure of spatial social polarization that quantifies the extremes of both privilege and deprivation. Our population-based study adds to the limited published literature on the relation of ICE to preterm birth rates among African-American and non-Latinx white women. We found that the high degree of both racial and income polarization within communities was associated with preterm birth rates even among those who received adequate prenatal care

Keywords Social polarization · African-American · Urban health · Preterm birth · Prenatal care

Introduction

In the United States, there are significant racial and socioeconomic disparities in access and utilization of healthcare, reflected in different health outcomes between the most privileged and most deprived groups. Preterm birth (< 37 weeks), the leading cause of infant morbidity and mortality, is no exception (Murphy et al., 2017). In the United States, African-American women have a 1.6-fold greater rate of preterm birth, than non-Latinx white women, and similar poor birth outcomes are documented in infants born to impoverished (compared to non-impoverished) women (Collins and David, 2009; Martin et al., 2017; DeFranco et al., 2008; Phillips et al., 2009). Moreover, these disparities

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Published online: 09 February 2023

are widened for the early (< 34 weeks) preterm birth component (Martin et al., 2017; DeFranco et al., 2008; CDC, 2013). In an attempt to better understand and eliminate these phenomena, research efforts are shifting focus from women's individual-level characteristics to contextual markers, such as neighborhood poverty and economic mobility (Chambers et al., 2019; Dwyer, 2010; Huynh et al., 2018; Krieger et al., 2016; Massey, 1996; Shrimali et al., 2020; Walks, 2013).

Over the last several decades, American neighborhoods have undergone a transformation known as spatial social polarization. This term defines the segregation within a society that emerges from income inequality or economic displacements, resulting in differentiation of social groups from high income to low income. Neighborhoods of extreme wealth and extreme poverty have grown exponentially, reducing the size of middle-income neighborhoods. This change has not been distributed evenly by race/ethnicity, as areas experiencing most increases in per capita income have a higher percentage of non-Latinx white residents (CDC, 2013; Massey, 1996; Dwyer, 2010; Walks, 2013). Unfortunately, this transformation did not occur organically but was rather created through legislation and public policy in a complicated process to sanction de facto segregation. Chicago, specifically, has an infamous and exhaustive history regarding these discriminatory practices, such as residential redlining and racially restrictive covenants, dating back to the nineteenth century. Although these practices are no longer legally permissible, similar geographic demarcations still exist throughout the city. These racial delineations were shaped by racism towards African-American residents, then sustained by housing policies, urban planning, and discriminatory financing, all effectively restricting people from similar demographic groups to certain parts of the city (Reiff et al., 2005).

The Index of Concentration at the Extremes (ICE) is a novel measure of spatial social polarization, which quantifies the extremes of both privilege and deprivation. It employs a mathematical equation to compare communities and suggest directional tendency toward either extreme. Most pertinent, the limited available data strongly suggests that the ICE is a useful metric for public health monitoring of adverse birth outcomes (Chambers et al., 2019; Huynh et al., 2018; Krieger et al., 2016; Shrimali et al., 2020). A recent study found that women's early-life and adulthood experiences of neighborhood privilege (as measured by the ICE) were associated with preterm birth rates in California (Shrimali et al., 2020). To our knowledge, no study has determined the relation of spatial social polarization to early preterm birth rates, a subgroup with a high risk of first-year morbidity and mortality (Kramer et al., 2000; Magowan et al., 2005).

A well-established published literature highlights the importance of adequate prenatal care utilization to optimal birth outcomes, particularly among low-risk women (Collins et al., 1997; Cox et al., 2011; Khanani et al., 2010; VanderWeele et al., 2009). Interestingly, a Cochrane Review only studying women at high-risk for preterm birth found no clear evidence that aggressive prenatal care reduced preterm birth rates (Whitworth et al., 2011). The degree to which prenatal care impacts the association of spatial social polarization and preterm birth rates in unknown.

Therefore, we created a multilevel model to analyze Chicago-born infants to determine 1) the extent to which spatial polarization (as measured by the ICE) in race and income is associated with preterm birth (including its' early and late components) rates, and 2) whether prenatal care utilization modifies the relationship between spatial polarization and preterm birth rates. We hypothesized that women who reside in neighborhoods of concentrated African-American (compared to non-Latinx white) populations and low (compared to high) income/economic privilege have a greater risk of preterm birth even among those women who received adequate prenatal care utilization.

Methods

We used the 2013–2017 Illinois Department of Public Health computerized vital records of singleton infants (N = 29,179) born to nulliparous women residing in Chicago at the time of delivery. Only infants born to African-American and non-Latinx white women with complete addresses were analyzed. Multiple gestation births, births with major congenital anomalies, and births with incomplete or missing addresses were excluded. Each birth was geocoded to census tracts within the city boundary. This study qualified as exempt per our organization's Institutional Review Board.

Appended to each birth file were ICE values, constructed from the United States Census American Community Survey five year annualized (2013–2017) estimates of demographic and socioeconomic characteristics at the census tract level. Values were computed using the following formula: $ICE_i = (A_i — P_i) / T_i$, where A_i is the number of persons categorized as belonging to the most privileged extreme, P_i is the number of persons categorized as belonging to the least privileged extreme, and T_i is the total population within the defined geographic area. The calculated ICE value, then, is a continuous measure that ranges from − 1 to + 1, such that − 1 or + 1 correspond to a complete concentration of a variable (i.e. race/ethnicity, income) within the geographic area, and 0 corresponds to a complete mixing of the variable. For example, an ICE value of -1 indicates a complete concentration of African-American residents, all grossing household incomes in the bottom 20th percentile. Each census tract was assigned an ICE value based on its racial and socioeconomic residential composition. Also appended were the 5-year (2013–2017) estimates of census-tract level percentages of

population living below the United States Census definition of poverty (Fisher, 1992; O'Connor, 2001), according to the American Community Survey.

Overall and race-specific preterm birth rates, including its' early (< 34 weeks) and late (34–36 weeks) components, were calculated. Gestational age was based on the obstetrical estimates recorded in the vital records. Subjects missing gestational age were excluded.

Three types of ICE values were constructed: (1) ICE value for race/ethnicity (extreme of African-American populations vs extreme on non-Latinx white populations), (2) ICE value for income (extreme of household income in the bottom 20th percentile vs extreme of household income in the top 20th percentile), and (3) ICE value for combination of race/ethnicity and income (extreme of African-American populations with household incomes in the bottom 20th percentile vs extreme of non-Latinx white populations with household incomes in the top 20th percentile). Given the multifactorial relationship between race and income, authors thought the combined ICE value would best highlight the intertwined polarity between these groups. The values shown in the Results section are those using the ICE value for combination of race/ethnicity and income.

Using Aeronautical Reconnaissance Coverage Geographic Information System software (Version 10, Environmental Systems Research Institute Inc., Redlands, CA), the ICE values were then categorized into quintiles with the Jenks natural breaks classification method. Briefly, natural breaks classes are based on natural groupings inherent in the data, so that breaks are identified that best group similar values and maximize the difference between classes (De Smith, 2006). For all the ICE values, Quintile 1 represents census tracts with the highest concentration of African-American residents with household income in the bottom 20th percentile, and Quintile 5 represents census tracts with the highest concentration of non-Latinx white residents with household income in the top 20th percentile.

Maternal and infant characteristics were compared across the ICE quintiles using Chi-squared testing for categorical variables and one-way analysis of variance testing for continuous variables. Maternal characteristics included race, age, educational attainment, marital status, insurance status, participation in the Special Supplemental Nutrition Program for Women, Infants, and Children during pregnancy, hypertension during pregnancy, cigarette smoking, and prenatal care utilization. To inform model building, we performed the ICE quintile-specific stratified analyses and tested for homogeneity of these stratum-specific ORs (alpha = 0.05) across covariates to identify potential effect modifiers of the ICE-preterm birth relationship.

Multilevel regression analyses were performed to account for geographic clustering of birth outcomes. Using census tract-level (level 1) and individual-level (level 2) data, we built two-level hierarchical models to investigate the relationship between preterm birth and ICE measures, at both levels. Using Statistical Analytic Systems software (Version 9.4, SAS Institute, Cary, NC) procedures for generalized linear mixed models, our models were fit to assess the association between the ICE values, race/ethnicity, household income, and preterm birth. Multilevel logistic regression models incorporated randomly distributed census tract-specific intercepts, assuming a binary distribution and a logit link function. Bivariate analyses were performed to examine the association between the ICE quintiles and each birth outcome. Adjustments for confounders were made when the crude OR differed from the adjusted OR for each confounder by 10% or more in bivariate analyses (Maldonado and Greenland 1993). Odds ratios (OR) with 95% confidence intervals (CI) were calculated for all models. A total of three multilevel regression models were computed for each birth outcome, adjusting for the following covariates: Model 1 – None; Model 2 – Neighborhood-level markers, using the ICE as a metric to quantify polarization of race/ethnicity and household income; Model 3—All markers from Model 2, in addition to individual-level covariates. In order to study the potential modifying effect of prenatal care on the ICE-preterm birth association, we stratified the sample into adequate and inadequate prenatal care, as defined by the Adequacy of Prenatal Care Utilization Index (Kotelchuck, 1994).

Results

The overall preterm birth rate was 10.6 per 100 live births (N = 29,179), ranging from 1 to 33%, per census tract. The median household income was $54,148, ranging from $10,471 to $160,833, per census tract. Approximately 14% of women lived in Quintile 1 neighborhoods, or census tracts with the highest concentration of African-American residents with household income in the bottom 20th percentile, while 28% of women lived in Quintile 5 neighborhoods, or census tracts with the highest concentration of non-Latinx white residents with household income in the tope 20th percentile.

Table 1 shows the demographic characteristics or the study population. ICE Quintile 1 (compared to Quintile 5) had a greater percentage of women with selected individual-level risk markers, including African-American race, age < 20 years, < 12 years of educational attainment, and possession of Medicaid insurance.

African-American (n = 10,439) and non-Latinx white (n = 18,740) women had preterm birth rates of 14.1% and 8.5%, respectively; relative risk (RR) 1.66 (1.60, 1.71). Neighborhoods in ICE Quintile 1 and Quintile 5 had preterm birth rates of 11.5% and 7.3%, respectively; RR 1.58 (1.41, 1.77). This disparity was wider for the early (< 34 weeks)

Table 1 Distribution of maternal characteristics by index of concentration at the extremes quintiles; Chicago, IL, 2013–2017

		Q1 n = 4,134	Q2 n = 4,668	Q3 n = 3,202	Q4 n = 9,127	Q5 n = 8,048
Preterm birth, % (N)		11.5 (471)	11.7 (542)	8.9 (284)	7.6 (696)	7.3 (583)
Early preterm birth, % (N)		4.0 (165)	4.1 (190)	3.0 (95)	2.2 (200)	1.8 (148)
Maternal race/ethnicity	African-American	97.3 (4022)	96.0 (4483)	35.8 (1145)	6.8 (618)	2.1 (171)
	Non-Latinx White	2.7 (112)	4.0 (185)	64.2 (2057)	93.2 (8509)	97.9 (7877)
Maternal age	< 20 years	33.2 (1371)	30.9 (1440)	6.0 (193)	2.3 (212)	0.4 (31)
	20–34 years	63.6 (2628)	65.1 (3040)	77.7 (2489)	77.9 (7108)	78.8 (6342)
	≥ 35 years	3.3 (135)	4.0 (188)	16.2 (520)	19.8 (1807)	20.8 (1675)
Maternal education	No High School Grad	25.6 (1038)	21.9 (1003)	5.3 (168)	2.2 (197)	0.3 (22)
	High School Grad	60.9 (2470)	60.9 (2794)	27.6 (868)	15.6 (1400)	4.9 (395)
	College Grad	13.6 (551)	17.2 (791)	67.1 (2108)	82.3 (7400)	94.8 (7574)
Marital status	Single	92.4 (3817)	90.6 (4226)	34.1 (1091)	16.6 (1510)	6.6 (529)
	Married	7.6 (314)	9.4 (440)	65.9 (2111)	83.5 (7612)	93.4 (7516)
Insurance	Government	77.5 (3150)	72.5 (3332)	33.7 (1071)	15.9 (1437)	2.8 (221)
	Private	22.5 (916)	27.5 (1265)	66.3 (2108)	84.2 (7629)	97.3 (7809)
Special supplemental nutrition program for women, infants, and children (WIC)	Yes	63.8 (2636)	59.7 (2787)	21.2 (679)	8.6 (785)	1.4 (113)
	No	33.9 (1402)	37.2 (1738)	72.6 (2324)	88.6 (8082)	97.6 (7857)
Adequate prenatal care	Yes	57.0 (2038)	57.2 (2310)	71.8 (1982)	79.9 (6369)	82.6 (5513)
	No	43.0 (1540)	42.9 (1732)	28.2 (780)	20.2 (1607)	17.4 (1164)
Hypertension	Yes	1.8 (76)	2.0 (94)	1.5 (49)	1.2 (109)	0.9 (75)
	No	97.2 (4020)	97.2 (4539)	98.3 (3146)	98.6 (8997)	99.0 (7964)
Cigarette smoking	Yes	3.9 (161)	2.9 (137)	1.5 (47)	1.1 (97)	0.4 (28)
	No	95.2 (3937)	96.3 (4495)	97.9 (3136)	98.6 (8997)	99.6 (8013)

Analyses of variance (ANOVA) reveled significant differences between quintiles for all individual-level categories ($p < 0.0001$)

component: 4% versus 1.8%, respectively; RR 2.23 (1.79, 2.77), compared to the late (34–36 weeks) component: 7.4% versus 5.4%, respectively; RR 1.41 (1.22, 1.62).

Figure 1 shows the geographic distribution of ICE values (race/ethnicity and income combined) in Chicago, ranging from − 0.84 to 0.55. ICE values were asymmetrically distributed throughout the city. Neighborhoods with low ICE values (i.e. high concentration of African-American populations with low household income) were located on the south and west sides, while neighborhoods with high ICE values (i.e. high concentration of non-Latinx white populations with high household income) were located on the north side and along the lakefront of Chicago. Separate maps for race/ethnicity ICE values and household income ICE values showed similar geographic distributions (Figs. 2 and 3).

Table 2 shows the results of our multilevel regression models. The adjusted odds (aOR) of preterm birth among women who resided in Quintile 1 (compared to Quintile 5) equaled 1.72 (1.39, 2.12). The aOR for early and late preterm birth among women who lived in Quintile 1 (compared to Quintile 5) equaled 2.60 (1.77, 3.81) and 1.50 (1.17, 1.92), respectively.

Lastly, we investigated the potential mediating effect of prenatal care utilization on preterm birth rates (Table 3). Among women who received adequate prenatal care, the aOR of preterm birth for those women who resided in Quintile 1 (compared to Quintile 5) equaled 1.67 (1.31, 2.12). Among women who received adequate prenatal care, the aOR of early and late preterm birth for those women who resided in Quintile 1 (compared to Quintile 5) equaled 2.84 (1.87, 4.32) and 1.39 (1.05, 1.83), respectively.

Discussion

This present population-based study provides pertinent information on the association between spatial social polarization (as measured by the ICE) and preterm birth rates in Chicago. We found that women residing in neighborhoods with both concentrated African-American (compared to non-Latinx white) populations and low (compared to high) income/economic privilege have nearly a two-fold greater risk of preterm birth independent of well-known individual-level demographic, medical, and behavioral risk markers. This disparity is most prominent for the early component of preterm birth. Notably, these phenomena persist among women who receive adequate prenatal care. These intriguing findings strongly suggest that local measures of racial

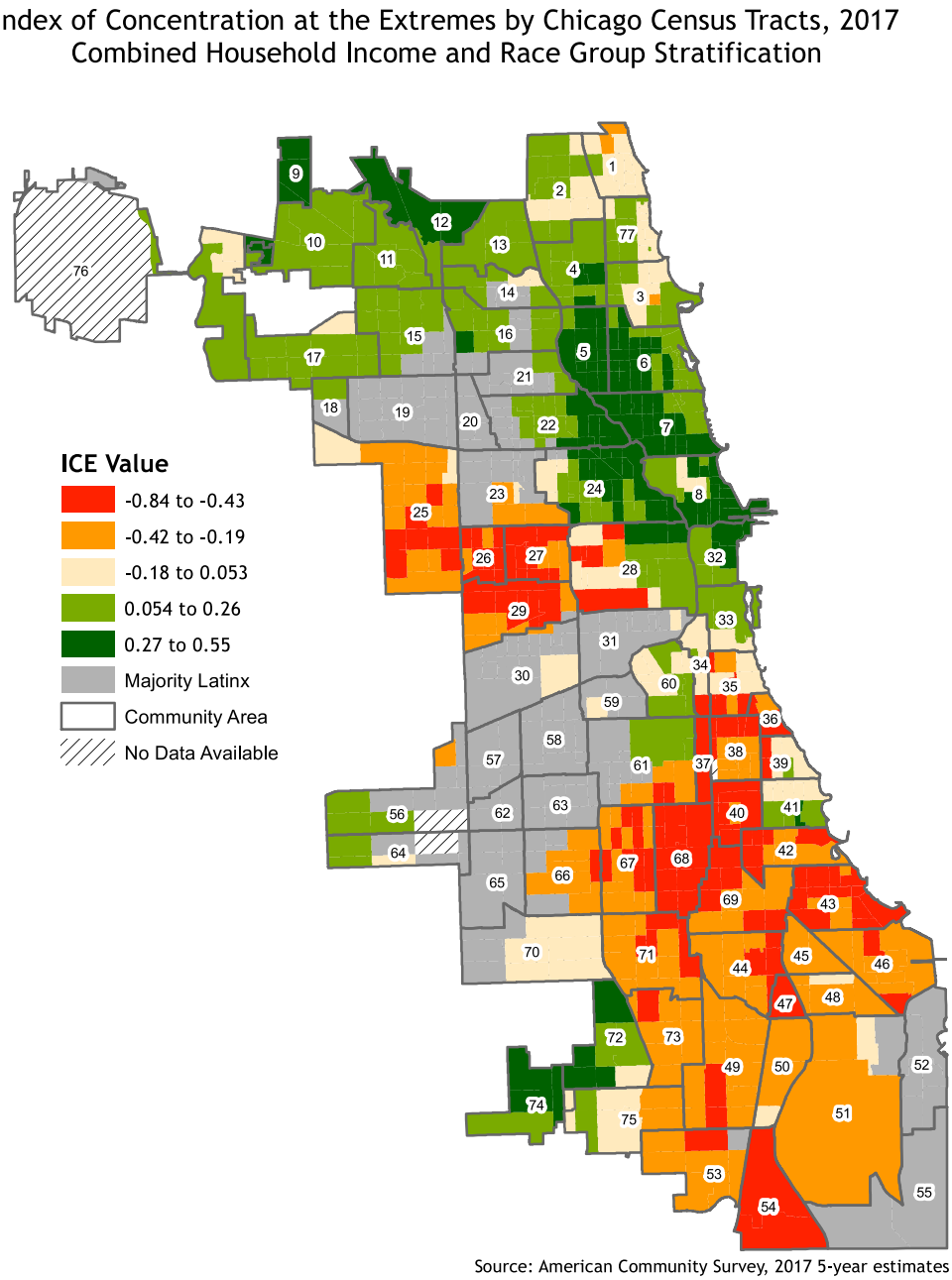

Fig. 1 Geographic distribution of ICE values (race/ethnicity and income combined) in Chicago, demarcated by city neighborhood and Census tract

and economic segregation are indeed major determinants of preterm birth.

The ICE measures spatial social polarization by quantifying the extremes of deprived and privileged social groups using a single metric (Chambers et al., 2019; Huynh et al., 2018; Krieger et al., 2016; Shrimali et al., 2020). A prior study found the ICE combined for both race/ethnicity and income had a stronger association with preterm birth than ICE defined by either race/ethnicity or income alone (Shrimali et al., 2020). The present study shows that women who reside in neighborhoods of low (compared to high) ICE values (as defined by both race/ethnicity and income) have a greater prevalence of traditional individual-level risk markers for preterm birth. However, the association of the ICE and preterm birth persists when these variables are mathematically controlled. This relationship provides additional evidence that social polarization contributes to health disparities in birth outcomes at the neighborhood level. More detailed studies are needed to identify the underlying causal pathways.

Structural racism involves systematic processes that differentiate access to services, goods, and opportunities by racial groups (Bailey et al., 2017). Redlining is the practice of denying or charging more for services, such as banking, to residents in often racially-determined areas. The term refers to the practice of marking a red line on a

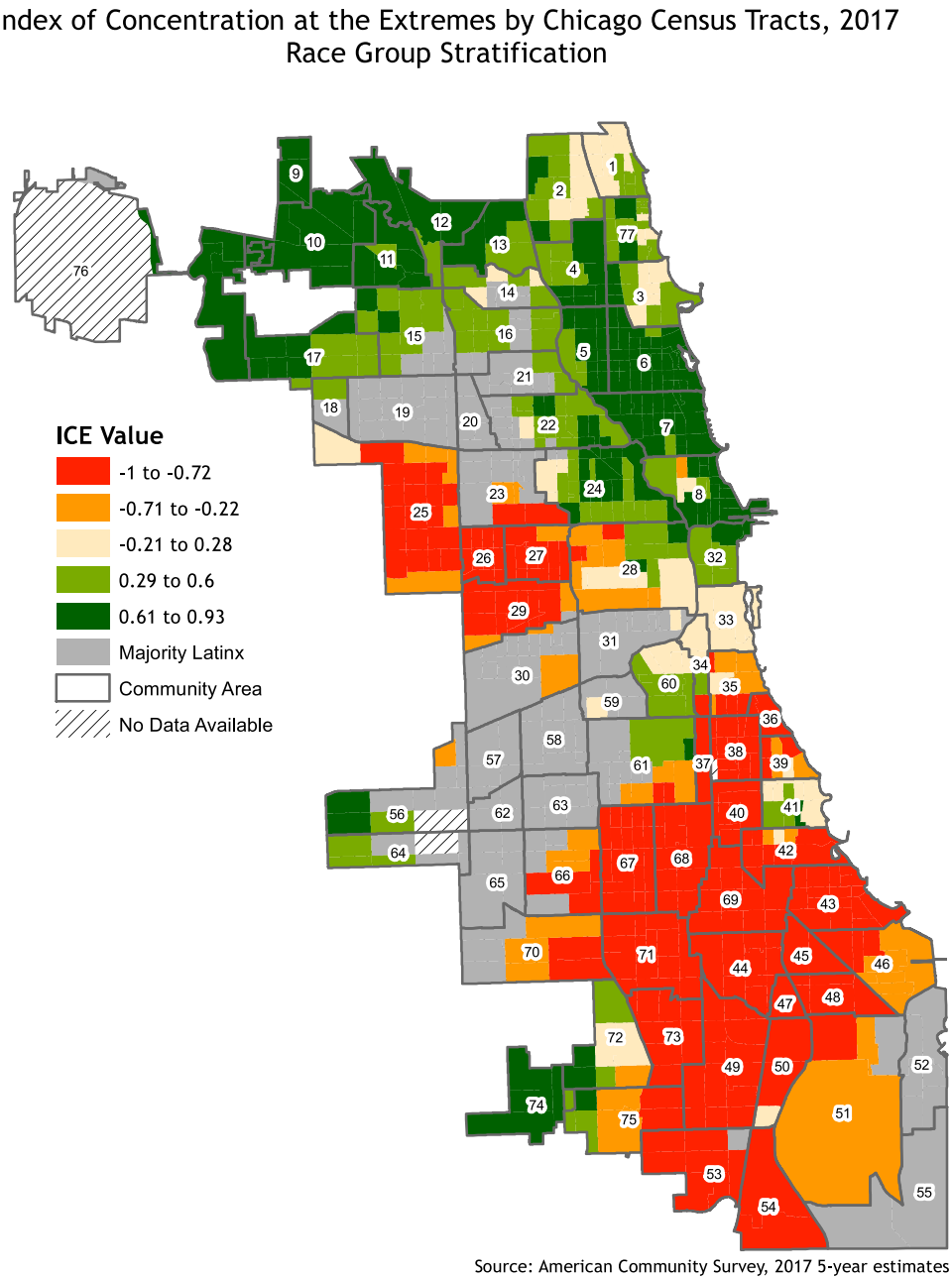

Fig. 2 Geographic distribution of ICE values (race/ethnicity) in Chicago, demarcated by city neighborhood and Census tract

map to delineate the area where banks would not invest (Aaronson et al., 2017; Massey and Denton, 1988). The ultimate consequence is perpetuation of geographic racial segregation and economic decline (Kollmann et al., 2018). Investigators recently reported that African-Americans in Philadelphia were twice as likely to be denied a mortgage loan compared with non-Latinx white applicants independent of annual income, loan amount, and gender; they were also more likely to live in redlined neighborhoods (Mendez et al., 2011). Most pertinent, a recent study found that African-American women's residence in redlined neighborhoods was a risk marker for preterm birth in Chicago (Matoba et al., 2019). The relation of institutional mortgage discrimination to spatial social polarization merits investigation.

Since late preterm births are the principal driver of overall preterm birth rates, the traditional epidemiologic approach of combining preterm birth into a single pathologic category may mask an underlying association between the ICE and early preterm birth rates. This understanding is particularly important because of early preterm infant's heightened first-year morbidity and mortality risk. Our data highlight that the independent impact of the ICE is indeed stronger for the early (compared to the late) component of preterm birth. Moreover, this finding persists among women who receive adequate prenatal care and strongly suggests that

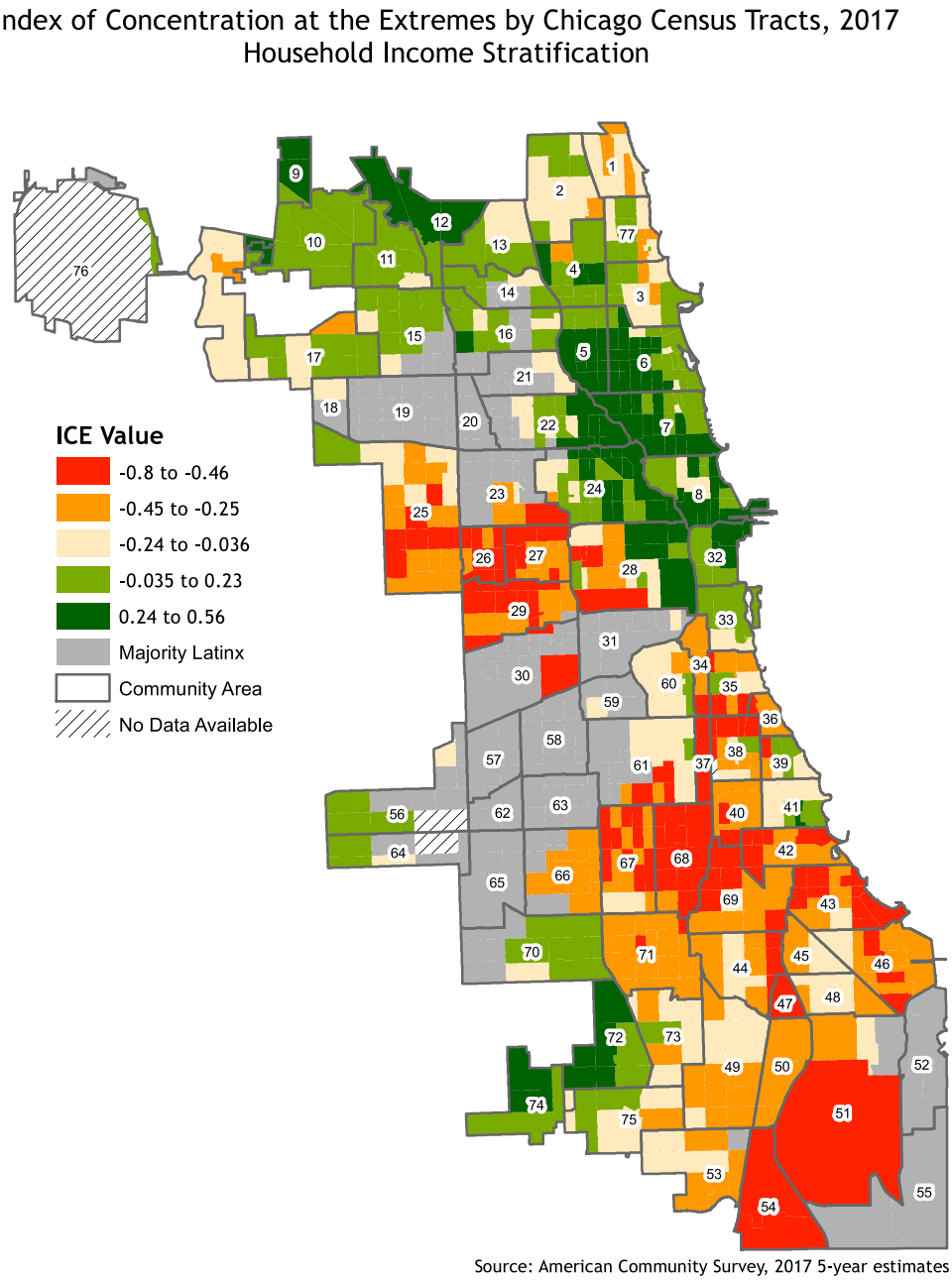

Fig. 3 Geographic distribution of ICE values (income) in Chicago, demarcated by city neighborhood and Census tract

Table 2 The rates and adjusted odds of preterm birth by index of concentration at the extremes quintiles; Chicago, IL, 2013–2017

	Preterm Birth (< 37 weeks)		Late Preterm Birth (34–36 weeks)		Early Preterm Birth (< 34 weeks)	
ICE Quintile	**Rate**	**aOR (95% CI)**	**Rate**	**aOR (95% CI)**	**Rate**	**aOR (95%CI)**
Q1 (low)	11.5	**1.72 (1.39, 2.12)**	7.4	**1.50 (1.17, 1.92)**	4.0	**2.60 (1.77, 3.81)**
Q2	11.7	**1.74 (1.41, 2.14)**	7.6	**1.49 (1.17, 1.90)**	4.1	**2.72 (1.88, 3.94)**
Q3	8.9	**1.35 (1.11, 1.64)**	5.9	1.18 (0.94, 1.48)	3.0	**2.09 (1.48, 2.95)**
Q4	7.6	1.11 (0.95, 1.29)	5.4	1.03 (0.87, 1.22)	2.2	**1.43 (1.07, 1.90)**
Q5 (high)	7.3	Ref	5.4	Ref	1.8	Ref

Bold values indicate statistically significant aOR

Covariates: Marital status, Maternal age, Maternal education, Hypertension, Smoking

Results of Multivariate, Multilevel Regression Analyses

aOR: Adjusted odds ratio; CI: Confidence interval; ICE: Index of Concentration at the Extremes; Q: Quintile; Ref: Reference

Table 3 adjusted odds of preterm birth by index of concentration at the extremes quintiles, modified by prenatal care utilization; Chicago, IL, 2013–2017

	Preterm Birth (< 37 weeks) aOR (95% CI)		Late Preterm Birth (34–36 weeks) aOR (95% CI)		Early Preterm Birth (< 34 weeks) aOR (95% CI)	
ICE Quintile	**Inadequate PNC n = 432**	**Adequate PNC n = 1,534**	**Inadequate PNC n = 312**	**Adequate PNC n = 1,095**	**Inadequate PNC n = 120**	**Adequate PNC n = 439**
Q1 (low)	**2.38 (1.41, 4.01)**	**1.67 (1.31, 2.13)**	**2.56 (1.40, 4.65)**	**1.39 (1.05, 1.83)**	1.84 (0.65, 5.27)	**2.84 (1.87, 4.32**
Q2	**2.88 (1.72, 4.83)**	**1.53 (1.21, 1.93)**	**3.13 (1.74, 5.64)**	1.21 (0.92, 1.59)	2.25 (0.80, 6.35)	**2.81 (1.87, 4.21)**
Q3	**1.94 (1.17, 3.22)**	**1.30 (1.05, 1.61)**	**1.90 (1.06, 3.40)**	1.14 (0.89, 1.44)	2.01 (0.72, 5.57)	**2.09 (1.44, 3.03)**
Q4	1.33 (0.84, 2.10)	1.10 (0.93, 1.28)	1.35 (0.79, 2.28)	1.01 (0.85, 1.21)	1.20 (0.47, 3.09)	1.20 (0.47, 3.09)
Q5 (high)	Ref	Ref	Ref	Ref	Ref	Ref

Bold values indicate statistically significant aOR

Covariates: Marital status, Maternal age, Maternal education, Hypertension, Smoking

Results of multivariate, multilevel regression analyses

aOR: Adjusted odds ratio; CI: Confidence interval; ICE: Index of Concentration at the Extremes; PNC: Prenatal care; Q: Quintile; Ref: Reference

public health interventions designed to improve women's prenatal care usage are unlikely to overcome the upstream birth outcome disadvantages of residence in low-income, predominantly African-American urban neighborhoods.

We encourage policy makers to develop and support urban initiatives aimed at achieving neighborhood equity with the long-term objective of improving birth outcomes for women who reside in the highest risk environments. The combined ICE for race/ethnicity and income is a metric that public health agencies could use to assess the success of interventions designed to improve health equity.

The present study has important intrinsic limitations. First, the ICE can only be utilized to relate two levels of one variable at a time. We empirically restricted the study sample to African-American and non-Latinx white women. Thus, our findings may not be generalizable to other racial/ethnic groups. Second, we measured the ICE at each women's time of delivery, and data are from one point in time. It is impossible to document their upbringing nor potential for economic mobility. An established published literature provides evidence that early-life and adulthood place of residence are independently associated with adverse birth outcomes (Collins et al., 2011, 2015, 2018). Moreover, recent literature found an independent effect of ICE measured during women's early childhood and preterm birth rates (Shrimali et al., 2020). Thirdly, we had no information on each women's duration of census tract residence. We speculate that it is strongly correlated with preterm birth rates. Lastly, a priori we chose to classify prenatal care utilization into two groups for our analysis. According to the Adequacy of Prenatal Care Utilization Index (Kotelchuck, 1994), prenatal care falls into one of four categories, including (1) Inadequate, (2) Intermediate, (3) Adequate, and (4) Adequate Plus. Authors chose to combine the Intermediate and Adequate groups (classified as "adequate") and compared outcomes to those from the Inadequate group. Adequate Plus denotes excessive obstetric visits, typically recommended for a fetus with a congenital anomaly. These cases were excluded, as authors thought they were outliers from the overall study sample.

In summary, the combined ICE value for race and income is associated with preterm birth (particularly its' early component) rates among urban African-American and non-Latinx white women independent of the adequacy of prenatal care usage.

Author Contributions Aaron Weiss was responsible for developing the research idea, creating the Index of Concentration at the Extremes (ICE) quintiles, and linking that dataset with Chicago vital records. Using SAS software, he created multilevel logistic regression models to assess the relationship between preterm birth and ICE quintiles. He was the primary author of the manuscript, including the tables and figures. Margarita Reina was responsible for creating the ICE-specific census tract maps of Chicago with ArcGIS and assisted with SAS programming. Nana Matoba assisted with the regression analysis and edited the manuscript. Nik Prachand helped develop the research idea and created/organized the vital records. James Collins was the primary mentor for this project. He assisted with developing the research idea, creating the project timeline, and edited the manuscript.

Funding Not applicable.

Data Availability The maternal-infant raw data used for this study is not deidentified. The raw data is therefore protected on-site within the City of Chicago Department of Health, requiring clearance to access and analyze.

Code Availability The code, processed using Statistical Analytic Systems software, is also protected on-site within the City of Chicago Department of Health, requiring clearance to access and analyze.

Declarations

Conflicts of interest The authors declare that they have no conflicts of interest.

Ethical Approval This study qualified as exempt per the Institutional Review Board at the Ann & Robert H. Lurie Children's Hospital of Chicago.

Consent to Participate Not applicable.

Consent for Publication Not applicable.

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