Temporal Trends and Geographic Heterogeneity in Ethnoracial Birth Disparities: Evidence from Natality Records, 1970-2010

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Abstract

Prior research finds associations between birth weight and several health and social outcomes, including mortality and earnings, and scholars have documented disparities in this early-life health marker between ethnic and racial groups in the United States. In this paper, we document for the first time temporal and geographic variation in ethnoracial birth disparities in the United States using restricted-access, population-level natality data for 1970-2009 (n=140,114,151) linked at the county level with data from four decennial censuses (1970-2000). Early state-level descriptive analyses show that the black-white gap in average birth weight is the greatest, relative to other ethnoracial groups compared to whites, but that the magnitude of disparities varies greatly across time and space. Our proposed analysis seeks to use this variation to identify contextual factors that contribute to these disparities and thereby suggest mechanisms of these temporal-spatial inequalities.

Introduction

Sociologists and kindred scholars have long been interested in racial and ethnic disparities in health (Williams and Sternthal 2010). An extensive literature documents well that non-Hispanic whites typically experience better health outcomes than Hispanics and blacks (Gorman 1999; Williams and Collins 1995). However, foreign-born Hispanics exhibit a paradox. Despite their relative lower socioeconomic position, Hispanic immigrants--more specifically, immigrants from Mexico--enjoy health advantages relative to other racial and ethnic groups in the United States, a phenomenon termed the Hispanic health paradox (Markides and Coreil 1986). Research has documented this advantage for a variety of health outcomes, including mortality (Palloni and Arias 2004), birth weight (Acevedo-Garcia et al. 2007; Cobas et al. 1996; Teitler et al. 2017), asthma (Cagney et al. 2007), and smoking (Riosmena et al. 2017).

Many studies have investigated contextual-level determinants of these ethnoracial group health outcomes to determine what mechanisms drive them (see e.g., Gorman 1999; Cagney et al. 2007; Urquia et al. 2009; Kane et al. 2017). The findings of these studies have in many cases been contradictory or have pointed to different factors (Brazil 2015). We argue that this may be due to a focus on trends at high levels of aggregation, such as at the national or state level, that fails to fully explore geographic variation. Moreover, scholars often model average health outcomes for ethnoracial groups rather than explicitly focusing on understanding variation and predictors of the disparity itself. At the same time, few studies have explored another type of variation in health disparities: temporal variation (Hamilton 2015; Kramer and Hogue 2008). Assessment of how health disparities change – or do not change – over time can also shed important light on causes of the disparities.

In this paper, we examine geographic and temporal variation in ethnoracial birth outcome disparities. Rather than model average birth outcomes in our multivariate models, we are substantively interested in the magnitude of difference (or gap) in birth outcomes for four ethnoracial and immigrant groups (detailed below). Thus, our analysis allows us to focus on inequalities in local (county-level) settings. Moreover, we will focus on contextual determinants of temporal changes in the gap, shedding new light on possible mechanisms of ethnoracial health inequalities in America.

Data

Birth weight Disparities by Ethnoracial Group

We use restricted-access birth certificate data for the approximately 140 million births occurring in the United States from 1970-2009 from the National Center for Health Statistics (NCHS). These restricted natality data provide infant birth details, including birth weight, parental characteristics, including mother's race, and geographic information regarding mother's residence, including the state and county. We classify births according to the mother's race and country of origin, and, at this stage, we include births to mothers who are identified as white, black, Hispanic, Asian, and Mexican-born. We use the birth certificate data to calculate average birth weight for births to women of these four ethnoracial groups for four decades – 1970s, 1980s, 1990s, and 2000s – at the state level. We will expand our analysis to the county level in our next steps of analysis but are limited to this decade at the time of the extended abstract submission due to an error in the data provided to us by NCHS. Any decade-state in which fewer than 500 births occurred to mothers of one of the ethnoracial groups was assigned a missing

value for average birth weight for that ethnoracial group. We do this to ensure that our analyses are not affected by very small groups. Next, we calculate the following birth weight disparities by state-decade:

- White-black
- White-Hispanic
- White-Asian
- White-Mexican

Contextual Factors

In order to assess the relationship between contextual social factors and gaps in average ethnoracial birth weights, we merge decennial Census data for 1970, 1980, 1990, and 2000 at the state and county levels to the birth certificate data. We include measures of total population size, ethnoracial group size, ethnoracial poverty rates, ethnoracial education rates, and other factors, including the population proportion rural or foreign born. See Table 6 for the full list of contextual factors included in the analysis.

Analytic Plan

**Note: This analytic plan has only partially been carried out, as shown in the results sections that follow. We have so far conducted the first of our three stages of analysis, and we have done so at the state level. As the analysis plan details, we aim to conduct our analysis primarily at the county level; however, the restricted birth certificate data we obtained had errors in the county codes, which has delayed our analysis at the county level. We now have corrected data in hand and will complete the plan detailed below by the March PAA deadline.*

Our analysis has three stages, two descriptive and one inferential. The birth outcome that we will assess is birth weight measured in grams. Other characteristics of mothers and their babies provided in the natality data will serve as important controls in our inferential models. We will conduct our primary analysis at the state and county levels; however, we will also replicate our analyses at the city level for large cities to test the sensitivity of our findings to the level of geographic aggregation used.

Our analysis focuses on four groups to assess three types of gaps among foreign- and U.S.-born ethnoracial groups. Specifically, we will compare births to the following types of mothers relative to births to non-Hispanic white mothers (hereafter white):

- Non-Hispanic black mothers (hereafter black)
- Hispanic mothers (hereafter Hispanic)
- Non-Hispanic Asian mothers (hereafter Asian)
- Mexican-born Hispanic mothers[1] (hereafter Mexican)

[1] We focus on Mexican-born Hispanic mothers for substantive and data-related reasons. First, the Hispanic health advantage is consistently found among Mexican-born Hispanics, while for other groups, such as Puerto Ricans, evidence of advantage is mixed (Palloni and Arias 2004; Lara et al. 2005). Second, birth certificates have included "Mexico" as an answer option for mother's place of birth throughout our study period, while many other Hispanic countries have been included as options for only some of the years.

Thus, we will assess four types of gaps in birth outcomes: black-white, Hispanic-white, Asian-white, and Mexican-white. In the first stage of our analysis, we will calculate birth weight disparities for our four comparison pairs at the county level for each decade in our study period. This first-stage descriptive assessment will allow us to answer the following questions:

- How do ethnoracial and immigrant birth disparities vary over time?
- How do ethnoracial and immigrant birth disparities vary geographically across counties?

For our second stage of descriptive analysis, we will identify temporal patterns in ethnoracial and immigrant birth gaps. Specifically, we seek to answer the following question:

- What kinds of temporal trajectories are apparent for the various types of birth weight gaps?

Using growth mixture models, we can identify common patterns in birth weight gaps across counties. For instance, are the birth disparities in some counties stable over time while in others they increase? Are there some counties in which one gap, such as the white-black, is stable while at the same time another gap, such as the white-Mexican, increases? This analysis will allow us to identify and group counties with similar trajectories. An extension of both growth curve models and latent class analyses, growth mixture models can detect common trajectories of change in birth outcome gaps across counties and group similar counties together. This approach allows us to identify differences while at the same time provides substantively similar groups of counties that can be further assessed (Preacher et al. 2008).

The final stage of our analysis is inferential and will answer the following questions:

- What contextual factors are associated with average changes in each type of birth weight gap over time?
- What contextual features predict the trajectories identified by the growth mixture models in stage 2?

We will deploy fixed effects models to understand how county-level changes in demographic characteristics are associated with county-level changes in disparities in birth outcomes. In this part of our analysis, we will deploy panel methods outlined in equation (1) for county, *i*, at decade, *t*.

$$y_{it} = \beta \boldsymbol{C}_{it} + \gamma \boldsymbol{Z}_{it} + \mu_i + \theta_t + \varepsilon_{it} \quad (1)$$

where y_{it} represents an ethnoracial birth weight gap in county *i* at decade *t.* C is a vector measuring county-level demographic characteristics, such as percent foreign-born, median family income, and percent poverty. To disentangle the effect of measured mechanisms from unobserved characteristics, μ_i is a county-fixed effects term and θ_t is decade-fixed effects. $\boldsymbol{Z}_{it}$ represents time-varying covariates to produce more precise estimates of β.

Below, we present preliminary results from the beginning stages of the analysis plan described above. We show that there is significant temporal and spatial variation in ethnoracial birth weight disparities, as well as important variations in disparities across ethnoracial groups. These preliminary results provide evidence that assessing ethnoracial disparities from this perspective is a fruitful approach. After presenting our preliminary findings, we detail our next steps.

Preliminary Descriptive Results

The first stage of our analysis is descriptive. We document the extent of variation in ethnoracial birth weight disparities across time and space. We first assess temporal variation. Table 1 presents mean state-level ethnoracial birth weight disparities by decade. Across the study period, the average black-white birth weight disparity is the largest: Even at its lowest in the 2000s, 227g, it is 1.7 times greater than the second-greatest disparity, white-Asian. That same decade, the black-white disparity was 5 times greater than the white-Hispanic disparity and 28 times greater than the white-Mexican disparity. For each decade, the same pattern appears: The black-white disparity is greatest, followed by white-Asian, white-Hispanic, and white-Mexican.

Looking within each ethnoracial disparity, a monotonic trend is not apparent. Instead, the disparities for all groups increased in either the 1980s or 1990s and returned to levels similar to their 1970s values in the 2000s. The exception to this trend is the white-black disparity, which shows a decrease in the 2000s well below its 1970s mean. Across groups, the magnitude and exact timing of shifts vary and warrant further investigation. Our future analyses (outlined above) seek to understand these temporal variations.

[Insert Table 1 here]

We next assess both geographic and temporal variation by analyzing the ethnoracial disparities by state and across decades. We present evidence of geographic and temporal variation at the state level in two ways. First, Tables 2-6 show the five states with the smallest disparities ("Top 5") and the five states with the greatest disparities ("Bottom 5") for each decade for each ethnoracial group. Second, Figures 1-4 map ethnoracial disparities for the first and last decades of our analysis, 1970-1979 and 2000-2009, by quintile. Together, these tables and maps present evidence of significant spatial and temporal variation in ethnoracial birth weight disparities. We briefly comment on each ethnoracial disparity in turn, noting similarities and differences as we progress.

[Insert Table 2 here]
[Insert Figure 1 here]

Table 2 presents states with the smallest and largest white-black birth weight disparities over time. Across the decades, the minimum disparity decreases – from 187g in Hawaii in the 1970s to 111 in Maine in the 2000s – though the maximum value increases then decreases. In addition, though some states have consistently high or low disparities, there is significant movement into and out of the rankings. For instance, New Mexico is among the top five smallest disparity states for three out of four decades, while Massachusetts only appears in this group once. This suggests both stability and meaningful variation across space and time. This change over time is apparent when comparing the two maps in Figure 1. In the 1970s, we see the greatest disparities in the Midwest and Northwest, though in the 2000s the greatest disparities are in the Midwest and Southeast. The Midwest remains a place of high disparities, while other spatial changes occur.

[Insert Table 3 here]

[Insert Figure 2 here]

Table 3 shows states with the smallest and greatest white-Hispanic disparities in the 1980s and 1990s. Because birth certificates did not begin to ask about Hispanic or Latino origin until 1989, we begin measurement of Hispanic births in the 1990s. Across the two decades, the birth weight disparity decreases such that by the 2000s the five smallest disparities are negative, meaning that in those states Hispanic babies on average weigh more than white babies. Figure 2 maps the disparities for the 1990s and 2000s. For both decades, the greatest disparities occur in northern states and New England, and the smallest occur in the Ozarks, Mississippi Delta, and Appalachian regions. Comparing the Hispanic-white disparities to the black-white disparities, we note that the distributions barely overlap. The greatest Hispanic-white disparities are similar to or lower than the lowest black-white disparities.

[Insert Table 4 here]
[Insert Figure 3 here]

Table 4 presents white-Asian disparities. As with other ethnoracial groups, some states remain in the top or bottom groups for multiple decades (see Rhode Island and New Mexico) while others fluctuate in and out. There is not a clear time trend for the white-Asian disparities, although for each decade, the disparities remain the second highest in magnitude after white-Black. Figure 3 reveals significant changes in white-Asian disparities across space. While in the 1970s the greatest disparities were found in the Midwest, South, and Appalachian regions, in the 2000s they were in the Midwest, California, and some New England states. Significantly, southern states had some of the smallest disparities in the 2000s.[2]

[Insert Table 5 here]
[Insert Figure 4 here]

Finally, Table 5 shows white-Mexican disparities in birth weight. Across the entire time series, babies born to Mexican-born mothers weigh more on average than white infants in the states with the smallest disparities. Thus, in every decade there are states in which babies of Mexican-born mothers have a birth weight advantage and states in which babies born to white mothers have a birth weight advantage. Figure 4 compares the spatial distribution of disparities in the 1970s and 2000s. Many states did not have enough births for analysis in the 1970s, but by 2000, 45 states had enough births (over 500) to be included. The maps show consistency and change. First, the Midwestern region has consistently large disparities, while some states switched ends of the distribution. This is true for California, which was in the bottom quintile for disparities in the 1970s but the top quintile in the 2000s.

Preliminary Results: Associations with Contextual Factors

In addition to describing how ethnoracial birth weight disparities vary temporally and spatially, we also seek to identify contextual factors associated with these disparities in hopes of discovering mechanisms that drive them. In order to assess the association of basic demographic

[2] In future county-level analyses, we plan to separate native-born and foreign-born Asian births.

factors with ethnoracial birth weight disparities, we ran a series of bivariate regressions with each contextual factor predicting each ethnoracial disparity in a given decade. Table 6 shows the results. We stress that these regressions are preliminary and only meant to establish whether basic demographic factors are at all associated with birth weight disparities. As we described in our analysis plan, we will conduct analyses in the coming months that simultaneously include the entire time series and not only predict the magnitude of disparities but also predict changes in disparities. Thus, we briefly comment on a few insights from Table 6 that will inform our future analyses.

[Insert Table 6 here]

Table 6 presents the results of a series of bivariate linear regressions predicting each ethnoracial birth weight disparity within each decade. Positive coefficients represent that a contextual factor is associated with increases in the disparity, whereas negative coefficients represent an association with decreases in the disparity. These regressions provide two main takeaways. First, associations between contextual factors and disparities vary across decade and ethnoracial group. For instance, the percent of a state that is white is negatively associated with the black-white disparity in the 1970s and 2000s but for no other groups or decades. In addition, population density is positively associated with Hispanic, Asian, and Mexican disparities in later decades but never the black-white disparity. Second, disparities are more consistently predicted by characteristics of the white population (size, poverty, education) than characteristics of the comparison group. This suggests investigation into whether variation in disparities is more driven by variation in average white birth weight than by variation in the comparison group average birth weight.

Next Steps

Now that we have county-level birth certificate data spanning 1970-2009, we will conduct the analyses described in our plan above at the county level. We believe that counties are more appropriate geographic units at which to assess trends in and drivers of ethnoracial birth disparities than the state level. Our first look at our newly acquired county data shows significantly more variation in disparities at the county level. For all disparities, the range is significantly greater within ethnoracial groups. For example, in some decades the white-black birth weight disparity ranges from 117g to 450g; this is much greater variation than at the state level. In addition, in some counties Asians have a higher average birth weight than whites, showing an Asian advantage. We believe that description of these local disparities and assessment of what contextual factors drive them will shed light on spatial mechanisms that shape ethnoracial inequality from the very start of life.

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Table 1. Means and Standard Deviations of State- and Decade-Level Ethnoracial Birth Weight Disparities, 1970-2009

	White-Black		White-Hispanic		White-Asian		White-Mexican	
Disparity	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
1970s	266.017	31.39	--	--	136.86	38.32	8.06	35.79
1980s	278.23	45.73	--	--	135.43	31.23	30.66	34.76
1990s	267.93	37.63	71.64	41.94	154.55	35.82	40.73	34.98
2000s	227.26	44.07	44.12	38.32	136.38	36.07	8.17	31.56

Table 2. White-Black Disparities in Birth Weight (in grams) by State and Decade, 1970-2009

	1970s		1980s		1990s		2000s	
	State	**WB Gap**	**State**	**WB Gap**	**State**	**WB Gap**	**State**	**WB Gap**
Top 5	Hawaii	187	New Hampshire	158	Maine	156	Maine	111
	Colorado	210	New Mexico	174	New Hampshire	188	North Dakota	123
	New Mexico	211	Maine	192	New Mexico	206	Vermont	143
	Massachusetts	214	North Dakota	198	Idaho	210	Idaho	154
	Alaska	221	Hawaii	214	Rhode Island	212	New Hampshire	159
Bottom 5	Oregon	309	Michigan	335	Delaware	313	Nebraska	272
	Wisconsin	309	Delaware	343	Iowa	314	South Carolina	285
	Delaware	309	Illinois	345	Michigan	322	Michigan	286
	Nebraska	312	Minnesota	358	Illinois	336	Illinois	289
	Iowa	313	Wisconsin	360	Wisconsin	351	Wisconsin	313
N (states)	42		47		47		49	

Table 3. White-Hispanic Disparities in Birth Weight (in grams) by State and Decade, 1970-2009

	1970s*		1980s*		1990s		2000s	
	State	**WH Gap**	**State**	**WH Gap**	**State**	**WH Gap**	**State**	**WH Gap**
Top 5					Nevada	5	West Virginia	-19
					Arkansas	10	Tennessee	-17
					Tennessee	13	Arkansas	-16
					Mississippi	14	Louisiana	-16
					West Virginia	17	Oklahoma	-11
Bottom 5					Delaware	123	New York	85
					Massachusetts	152	Massachusetts	120
					Hawaii	163	Connecticut	125
					Pennsylvania	168	Pennsylvania	128
					Connecticut	180	Hawaii	144
N (states)					48		50	

*Note: Birth certificates did not include a question regarding Hispanic/Latino origin until 1989.

Table 4. White-Asian Disparities in Birth Weight (in grams) by State and Decade, 1970-2009

	1970s		1980s		1990s		2000s	
	State	**WA Gap**	**State**	**WA Gap**	**State**	**WA Gap**	**State**	**WA Gap**
Top 5	Vermont	28	New Mexico	54	Utah	75	West Virginia	41
	New Mexico	37	Colorado	90	West Virginia	78	Utah	68
	New Hampshire	64	Oklahoma	91	Kentucky	92	Kentucky	85
	Colorado	84	North Carolina	95	Montana	103	Wyoming	87
	Maine	86	Mississippi	103	New Mexico	113	Mississippi	87
Bottom 5	Hawaii	172	Connecticut	177	Massachusetts	202	Connecticut	176
	Illinois	185	Oregon	178	Connecticut	203	Hawaii	178
	Iowa	200	Illinois	182	Iowa	222	Wisconsin	182
	Arkansas	202	Wisconsin	191	Rhode Island	224	Rhode Island	206
	Rhode Island	233	Rhode Island	215	Minnesota	233	Minnesota	210
N (states)	46		43		49		50	

Table 5. White-Mexican Disparities in Birth Weight (in grams) by State and Decade, 1970-2009

	1970s		1980s		1990s		2000s	
	State	**WM Gap**	**State**	**WM Gap**	**State**	**WM Gap**	**State**	**WM Gap**
Top 5	New Mexico	-105	New Mexico	-58	New Mexico	-26	Louisiana	-58
	Colorado	-44	Louisiana	-28	Oklahoma	-18	Tennessee	-40
	Texas	-30	Indiana	-23	Louisiana	-15	Nevada	-39
	Nevada	-18	Colorado	-21	Nevada	-10	Oklahoma	-37
	California	-10	Pennsylvania	2	Colorado	-3	Arkansas	-35
Bottom 5	New York	27	Utah	72	Connecticut	91	Washington	57
	Oregon	28	Iowa	79	Maryland	92	New York	57
	Iowa	34	New York	87	Minnesota	107	Connecticut	58
	Utah	66	New Jersey	89	New York	112	New Jersey	69
	Nebraska	71	Minnesota	90	New Jersey	116	Minnesota	76
N (states)	23		33		42		45	

Table 6. Bivariate Linear Regression Results of Contextual Factors Predicting Ethnoracial Birth Weight Disparities, 1970-2009

	White-Black Birth Weight Disparity				White-Hispanic Birth Weight Disparity			
Contextual Factor	**1970s**	**1980s**	**1990s**	**2000s**	**1970s**	**1980s**	**1990s**	**2000s**
Total pop.	ns	.000*	.000*	.000*	--	--	ns	ns
White pop.	ns	.000*	.000*	.000*	--	--	ns	ns
Comp. group pop.	ns	ns	.000*	.000*	--	--	ns	ns
% white pop	1.235**	ns	ns	-1.274**	--	--	ns	ns
% comp. group pop	ns	ns	1.537**	2.607***	--	--	ns	ns
Population density	ns	ns	ns	ns	--	--	.091***	.074***
% renters	-3.025***	ns	ns	ns	--	--	2.427*	3.180**
% foreign born	ns	ns	ns	ns	--	--	3.395**	2.676**
% rural	--	ns	ns	ns	--	--	-.012**	-.011**
% white poverty	ns	-8.052**	-4.232*	ns	--	--	-8.128***	-7.347**
% comp. group poverty	ns	2.326**	1.407*	ns	--	--	ns	ns
% white - HS or less	.021*	ns	ns	ns	--	--	ns	-.023**
% white - BA plus	-4.720**	ns	ns	ns	--	--	3.257**	4.382***
% comp. group - HS or less	ns	1.899**	1.403**	2.769***	--	--	ns	ns
% comp. group - BA plus	ns	-5.450**	-5.131**	-6.645***	--	--	ns	ns
N (states)	42	47	47	49	--	--	48	50

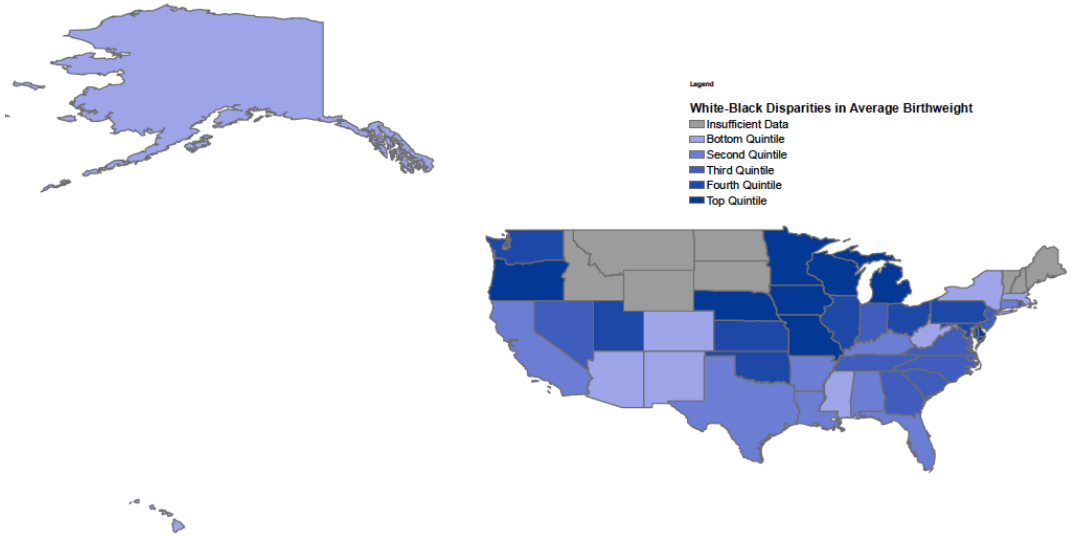
Table 6 cont.

	White-Mexican Birth Weight Disparity*				Asian-White Birth Weight Disparity			
Contextual Factor	**1970s**	**1980s**	**1990s**	**2000s**	**1970s**	**1980s**	**1990s**	**2000s**
Total pop.	ns	ns	ns	ns	ns	ns	.000*	ns
White pop.	ns	ns	ns	ns	ns	ns	.000*	ns
Comp. group pop.	--	ns	ns	ns	--	ns	ns	ns
% white pop	ns	ns	ns	ns	ns	ns	ns	ns
% comp. group pop	--	-2.163**	ns	ns	--	ns	ns	1.449*
Population density	ns	ns	.052*	.0417*	ns	.056**	.076***	.067**
% renters	ns	ns	ns	ns	ns	1.824*	ns	3.046**
% foreign born	ns	ns	ns	1.862*	ns	2.818*	2.970**	2.941**
% rural	--	ns	ns	-.008*	--	-.007*	-.001**	-.012***
% white poverty	-6.135*	ns	-7.304***	-7.897***	ns	-7.852***	-7.091***	-9.596***
% comp. group poverty	--	ns	ns	ns	--	ns	ns	ns
% white - HS or less	ns	ns	ns	-.014*	.025*	ns	ns	-.018**
% white - BA plus	ns	ns	3.257**	2.531**	ns	ns	3.238**	3.520***
% comp. group - HS or less	--	ns	ns	ns	--	ns	ns	ns
% comp. group - BA plus	--	ns	ns	ns	--	ns	ns	ns
N (states)	23	33	42	45	46	43	49	50

*Note: We use Hispanic as the comparison group for white-Mexican models because the Census Bureau does not offer statistics specific to Mexican-born residents.

Figure 1: White-Black Disparities in Average Birth Weight from the 1970s to the 2000s

Panel 1: White-Black Disparities in Average Birth Weight, 1970-1979



Panel 2: White-Black Disparities in Average Birth Weight, 2000-2009

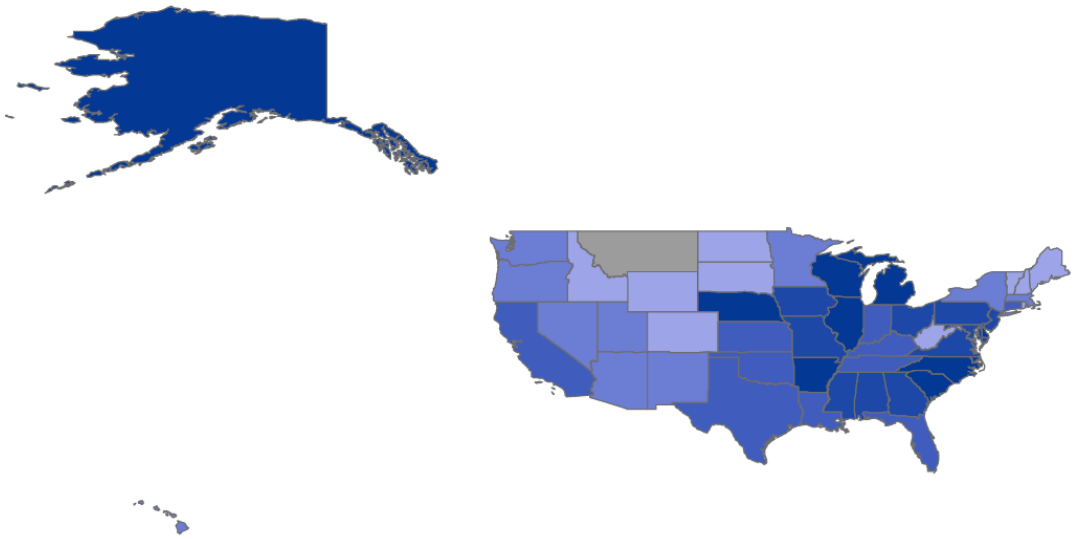
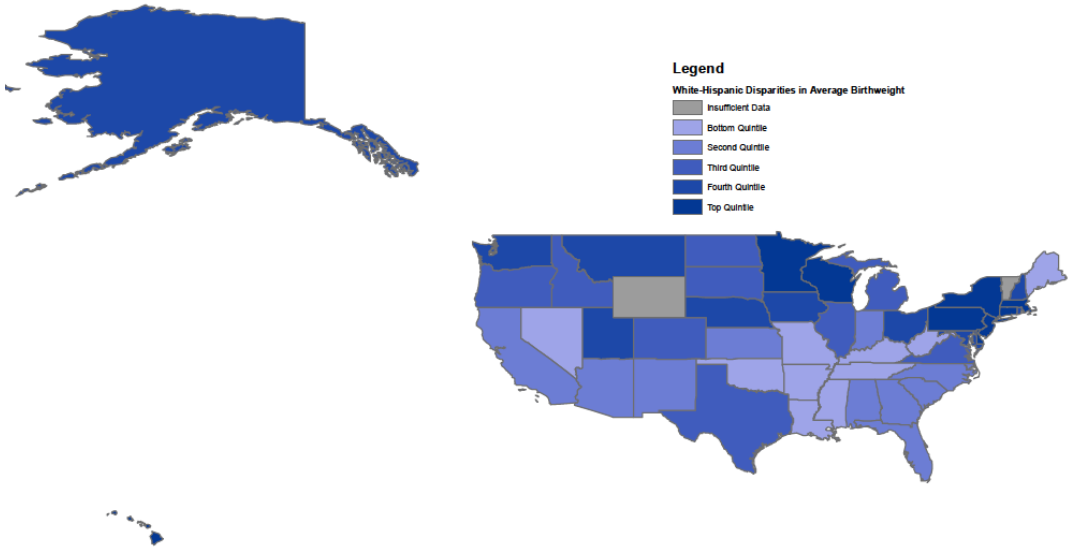


Figure 2: White-Hispanic Disparities in Average Birth Weight from the 1990s to the 2000s

Panel 1: White-Hispanic Disparities in Average Birth Weight, 1990-1999



Panel 2: White-Hispanic Disparities in Average Birth Weight, 2000-2009

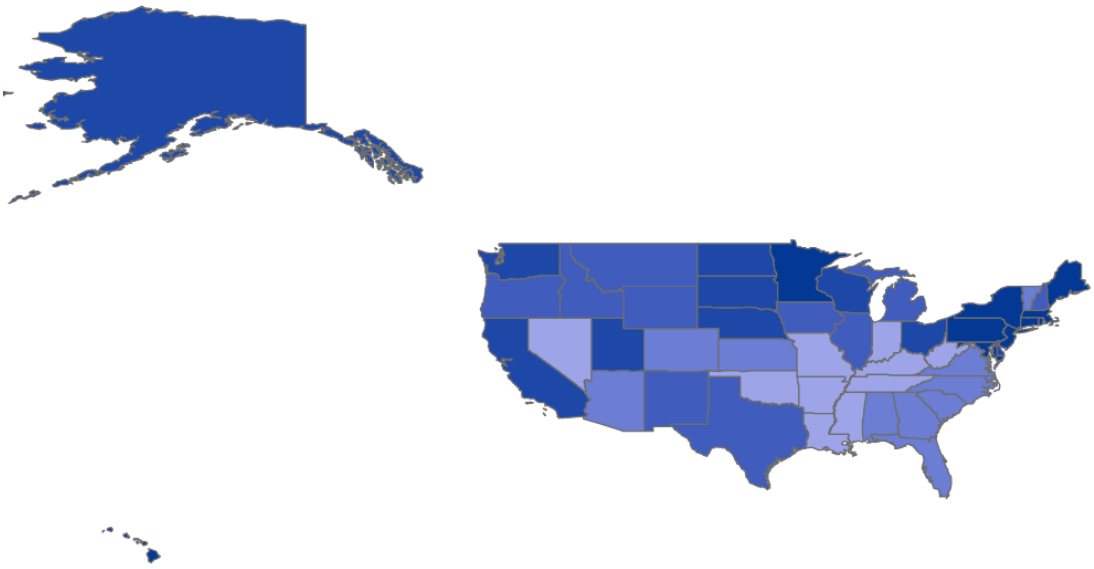
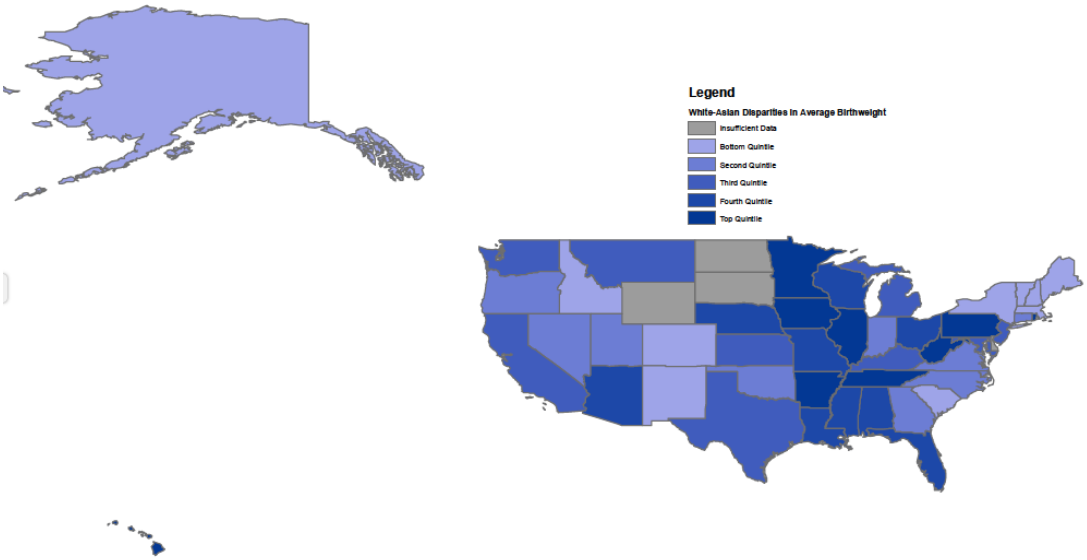


Figure 3: White-Asian Disparities in Average Birth Weight from the 1970s to the 2000s

Panel 1: White-Asian Disparities in Average Birth Weight, 1970-1979



Panel 2: White-Asian Disparities in Average Birth Weight, 2000-2009

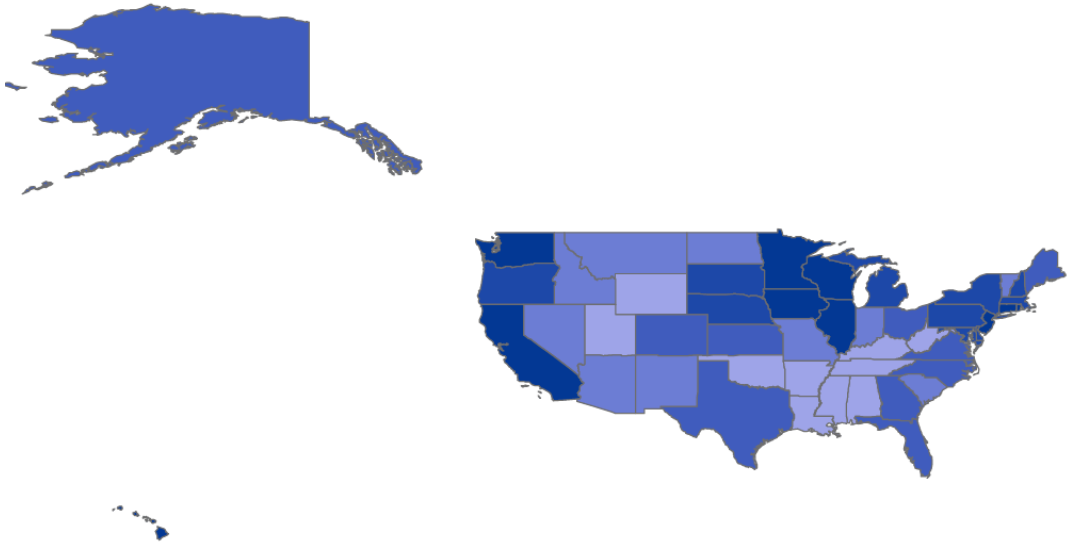
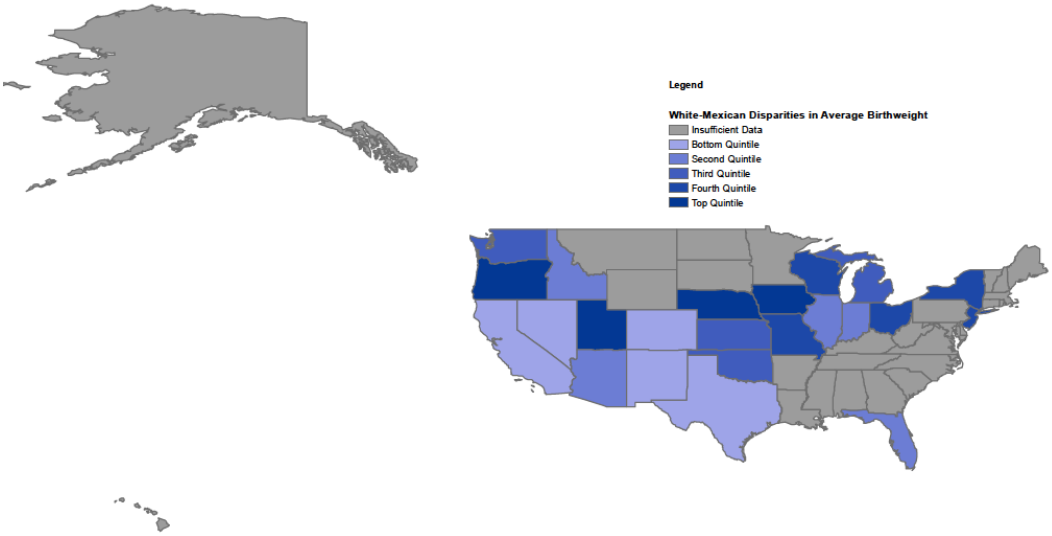


Figure 4: White-Mexican Disparities in Average Birth Weight from the 1970s to the 2000s

Panel 1: White-Mexican Disparities in Average Birth Weight, 1970-1979



Panel 2: White-Mexican Disparities in Average Birth Weight, 2000-2009