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Inequities in adverse perinatal outcomes among Black women through the lens of maternal nativity

by
Safyer McKenzie-Sampson

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of the
UNIVERSITY OF CALIFORNIA, SAN FRANCISCO

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Dedication

This dissertation would not have been possible without the countless sacrifices of my ancestors. I will always proudly stand on the shoulders of the elders in my community, especially my grandparents, who have always been my academic inspiration. To my entire family and close friends who have supported me through this process, I love and thank you all for always supporting my dreams. I also want to mention all of the doctoral students in the department of Epidemiology and Biostatistics, thank you all for being a part of this harrowing experience, doing a PhD in epidemiology, during a pandemic nonetheless, will bond us together forever.

Many thanks to all the staff and faculty of the Department of Epidemiology and Biostatistics, particularly Dr. Christine Dehlendorf who saw promise in me and invited me to co-direct Epi 222. Eternal thanks is also due to all members of the California Preterm Birth Initiative, who have treated me like family during my time at UCSF. I'm honored to have been able to work alongside such amazing birth justice researchers, especially all of the Black women at PTBi who warmly welcomed me into their sisterhood. I am forever grateful to Laura and Eva who selflessly cared for me like I was their own child for 4 years. Finally, I'd like to thank my dissertation committee, who listened to all my rants, responded to my late-night emails, and believed in me and my research even on the days when I couldn't see the light at the end of the tunnel.

Inequities in adverse perinatal outcomes among Black women through the lens of maternal nativity

Safyer McKenzie-Sampson

ABSTRACT

Black women in the United States (US) have the highest risk of adverse perinatal outcomes, including preterm birth (PTB) and small for gestational age (SGA) birth, compared to women from all other race/ethnicities. Past research using samples of Black women living on the East Coast of the US has found variation in this risk by maternal nativity status, wherein foreign-born Black women are known to have a lower risk of adverse perinatal outcomes than US-born Black women. There is a paucity of research that contextualizes the rates of adverse perinatal outcomes among Black women through the lens of maternal nativity. This is particularly true for women on the West Coast of the US, where the immigrant ethnic composition is primarily African-born, compared to the largely Caribbean-born population on the East Coast. This dissertation utilizes all birth certificate and hospitalization data for singleton non-anomalous live-births to US- and African-born Black women in California from 2011-2020 to conduct three population-based studies examining the rates of PTB and SGA through the lens of maternal nativity, while exploring how African country of origin, exposure to neighborhood-level structural racism, and clinical factors may help to contextualize previously established nativity-based disparities.

In the first chapter, births to all African-born Black women are stratified by African country of origin and compared to the overall rate of adverse perinatal outcomes among US-born Black women, to determine whether the lower risk of adverse outcomes is uniform across all African countries of origin. We also evaluate whether differences in socio-demographic and clinical risk

factors explain the overall disparities in PTB and SGA risk between US- and African-born Black women. We found heterogeneity in the risk of adverse perinatal outcomes among the African-born population, as Cameroonian- and Eritrean-born Black women had larger differences, while Ghanaian-born Black women had smaller differences compared to US-born Black women. Overall, differences in socio-demographic and clinical risk factors between US- and African-born Black women explained a modest proportion of the nativity-based disparities in PTB (14.3%) and SGA (19.5%), although these proportions varied across African countries of origin.

In the second chapter, the aforementioned California birth data were merged with information from the American Community Survey to compute neighborhood-level measures of structural racism, operationalized as racial and economic neighborhood segregation. We assess the relationship between structural racism, maternal nativity, and adverse perinatal outcomes, finding that on average US-born Black women had an 81% greater risk of PTB and a 67% greater risk of SGA, compared to African-born Black women. US-born Black women were also more likely to live in areas with more structural racism than African-born Black women. Structural racism was associated with an increased risk of PTB and SGA for all Black women, however there was variation of this effect by maternal nativity.

In the third chapter, we focus on data pertaining to pregnancy and postpartum co-morbidities as well as clinical procedures within our dataset to assess the relationship between 14 clinical factors and the risk of PTB and SGA by maternal nativity. We found that on average US-born Black women had a higher prevalence of clinical factors associated with adverse perinatal outcomes. However, among African-born Black women, each clinical factor conferred a heightened risk of PTB and SGA compared to US-born Black women, and therefore differences

in the impact of these of clinical factors likely does not explain the heightened risk of PTB and SGA among US-born Black women.

Taken together, these findings emphasize the importance of considering maternal nativity when analyzing adverse perinatal outcome data for Black women. Analyses in California showed that nativity in Black women considered as an aggregate may mask heterogeneity in the risk of PTB and SGA. Future studies should continue to explore differences in the experience of racism across the life course as a core driver of inequities in adverse perinatal outcomes among Black women.

Table of Contents

List of Figures

List of Tables

List of Abbreviations

ARR   Adjusted risk ratio

BMI   Body mass index

CI   Confidence interval

DRC   Democratic Republic of the Congo

ICD   International Classification of Diseases

ICE   Index of Concentration at the Extremes

OSHPD   California Office of Statewide Health Planning and Development

PTB   Preterm birth

RR   Risk ratio

SGA   Small for gestational age birth

US   United States

WIC   Women's Infant and Children Supplemental Nutrition Plan

CHAPTER 1: Risk of adverse perinatal outcomes among African-born Black women in California, 2011-2020

Safyer McKenzie-Sampson, Rebecca J. Baer, Brittany D. Chambers, Laura L. Jelliffe-Pawlowski, Deborah Karasek, Scott P. Oltman, Corinne A. Riddell, Elizabeth E. Rogers, Jacqueline M. Torres, Bridgette Blebu

ABSTRACT

African-born Black women have a lower risk of having a preterm birth (PTB) or a small for gestational age (SGA) infant compared to US-born Black women, although less is known about variation by country of origin. In addition, the extent that nativity disparities in birth outcomes to Black women are explained by socio-demographic and clinical factors has not been characterized. We sought to determine whether the risk of PTB and SGA differs by country of origin for African-born Black women compared to US-born Black women, and to quantify the portion of these disparities explained by differences in socio-demographic and clinical risk factors. Using data on all non-anomalous singleton live births to Black women in California from 2011-2020 (n=194,320), we fit modified Poisson regression models controlling for advanced maternal age. Compared to US-born Black women, Eritrea- and Cameroon-born women had the largest differences, while Ghana-born women had smaller differences. Overall, differences in socio-demographic and clinical risk factors explained 14.4% and 19.6% of the disparities in the risk of PTB and SGA, respectively. Our findings suggest heterogeneity in the risk of adverse perinatal outcomes for African vs. US-born Black women by country of origin, and that disparities in adverse perinatal outcomes are not fully explained by differences in socio-demographic and clinical risk factors.

INTRODUCTION

In 2019, the United States (US) Census Bureau reported that 10 % of all Black Americans were foreign-born, with projections indicating that by the year 2060 Black immigrants would account for approximately a third of the US Black population's growth.[1] The majority of the Black foreign-born population in the US is of Caribbean origin[2], and nativity research to-date has largely focused on comparing health outcomes between US- and Caribbean-born Black populations.[3–5]

Past literature on the health of African-born immigrants in the US has found that they have a lower risk of several adverse health outcomes when compared to their US-born counterparts, including diabetes[6], cardiovascular disease risk factors[7], cancer mortality[8], as well as perinatal outcomes.[9–12] For instance, African-born Black women have been found to have lower risks of preterm birth (PTB), small for gestational age birth (SGA), and low birthweight (LBW), compared to US-born Black women. [9,10,12]

While most studies that have examined the role of nativity in adverse perinatal outcomes in Black women living in the US have done so by region of origin [9,11,13–16], the few that have examined disparities by country of origin have shown that nativity-based disparities between US- and African-born Black populations can vary in magnitude by country.[10,17] For example, a 2014 cross-sectional study by Elo et al. using 2008 birth certificate data found differences in the proportion of PTB among Liberian-born (9.6%) and Ethiopian-born (5.3%) Black women, compared to the average among all US-born Black women (12.4%).[10] This study was limited in scope as the authors did not assess how differences in the distribution of socio-demographic and clinical risk factors between US- and African-born Black women may mediate disparities in the risk of adverse perinatal outcomes.

It is critical to consider country of origin in analyses aimed at better understanding the role of maternal nativity in adverse perinatal outcomes among Black women residing in the US, given that we know that their health is shaped by conditions in the contributing countries of origin.[18] Researchers have shown, for example, that foreign-born health is affected by patterns of health and illness in their home countries as well as by other historical events like colonialism and civil war.[18] Immigration status upon arrival to the US and language barriers may also impact some African-born Black women in the US more than others.[19,20]

Notably, while some previous research has examined patterns of adverse perinatal outcomes among Caribbean- compared to US-born Black women[10], data shows that Caribbean-born Black women tend to have lived in the US for a longer duration than African-born Black women.[10] This means that country of origin factors may be playing a larger role in the health of African-born immigrants – a possibility that it is critical to explore in more detail. Additionally, African-born individuals are the largest growing segment of the foreign-born Black population in the US[2], and they are among the least studied immigrant group in population health research.[21] As such, elucidation of patterns of adverse perinatal outcomes and contributors is essential.

In the present study, we interrogate previously established nativity disparities in the risk of PTB and SGA in US Black populations[22] in a sample of US- and African-born Black women delivering in the state of California. This study addresses an important gap in the literature by examining the risk of PTB and SGA among African-born Black women, and determining the contribution of socio-demographic and clinical factors to the overall disparities the in risk of adverse perinatal outcomes in African-born compared to US-born Black women.

METHODS

We conducted a population-based study of all in-hospital births to African- and US-born Black women residing in California between 2011-2020. We linked birth certificates maintained by California Vital Statistics to hospital discharge, emergency department, and ambulatory surgery records maintained by the California Office of Statewide Health Planning and Development (OSHPD). Hospital discharge, emergency department, and ambulatory surgery files provided diagnoses and procedure codes based on the International Classification of Diseases, Clinical Modification, 9th Revision (ICD-9-CM) and 10th Revision (ICD-10-CM), as reported to OSHPD by the health care facilities. Together, these databases contain detailed information on maternal and infant socio-demographic characteristics, clinical diagnoses, and procedures. We extracted all non-anomalous singleton live-birth data for mother-baby pairs with plausible gestational ages who self-identified as being non-Hispanic Black and gave birth in California from 2011-2020 (n=198,280). Our sample was further limited to all US-born and African-born Black women (n=194,527), and excluded women with an unknown or unclassified country of birth for a final study population of 194,320 women.

Maternal nativity was defined as self-reported country of birth. Women were considered US-born if they were born in Alaska, Hawaii, the District of Columbia, or the 48 contiguous states, and African-born if their country of birth was among the sovereign states and dependent territories of the African continent. The adverse perinatal outcomes of interest were PTB, defined as birth before 37 weeks of gestation (as determined by best obstetric estimate reported on the birth certificate), and SGA defined as birthweight in the bottom 10th percentile by gestational age and sex at birth.[23]

We developed a directed acyclic graph (DAG) guided by Howe et al. [24] (**Figure 1.1**). Through this DAG, we argue that among foreign-born populations migrating from sub-Saharan Africa, exposure to historic and contemporary systems of oppression are intertwined, and shape duration and place of residence in the US, which may result in differential exposure to historic and contemporary structural racism (in all forms) in the US.

Given the robust literature on the impacts of racism on socioeconomic status and the subsequent cascade of pathophysiologic factors (e.g., stress theory), through this DAG we characterize sociodemographic and clinical characteristics as important mediators of nativity disparities in adverse perinatal outcomes, and therefore we do not adjust for them in our regression models. However, these important mediators may shed light on the extent to which country of origin variation in nativity differences is explained by socioeconomic status and clinical characteristics in pregnancy, and thus are the focus of our decomposition analysis further described below. Therefore, in our regression models of overall nativity differences, we only adjust for advanced maternal age at childbirth (i.e., maternal age >35 years), a known risk factor for our outcomes of interest.[25,26]

We included several socio-demographic characteristics in our analysis: highest level of completed education (less than high school, high school diploma, some college or higher), and insurance coverage for childbirth (Medi-Cal or not Medi-Cal), and parity (nulliparous, multiparous). Medi-Cal is California's publicly funded medical health care program, which covers the costs of medical services for individuals with limited resources.[27] We also identified clinical risk factors using ICD-9-CM and ICD-10-CM codes (**Appendix Table 1.1**), including pre-existing or gestational hypertension, pre-existing or gestational diabetes, and infections during pregnancy.

We first computed the crude number and proportion of women from each African country of origin present in the study sample. We found that Black women from the top ten African countries of origin represented 87% of the entire African-born population in our sample. Thus, overall descriptive and regression analyses included all US-born Black women and African-born Black women, while sub-group analyses were restricted to African-born Black women from the top ten countries of origin with large enough populations (n > 350) to ensure statistical precision.

The frequency and proportion of socio-demographic and clinical characteristics were reported for all US-born Black women, all African-born women, and stratified by country of origin for the top ten African countries of origin. Using modified Poisson regression with robust standard errors [28], we fit two models predicting the risk of PTB and SGA for all African-born women, and stratified by country of birth for the top ten countries of origin, with US-born Black women as the referent group. The first model was unadjusted, while the second controlled for advanced maternal age at birth.[29] We report the risk ratio (RR) and 95% confidence intervals (CI) for all African-born women as a group, and for each of the top ten African countries of origin.

Multivariate Blinder-Oaxaca decomposition[30] was used to estimate the relative proportion of the nativity-based disparities in PTB and SGA explained by socio-demographic and clinical risk factors.

In sensitivity analyses, we computed the proportion of the disparities in PTB and SGA explained by socio-demographic and clinical risk factors when comparing African-born women from the top ten countries of origin to US-born Black women. There were no missing data for the exposure or the outcomes, whereas there was between 0.1% to 6% missing data on the covariates which did not differ significantly by maternal nativity, therefore all statistical models were performed using a complete case analysis. All analyses were conducted in Stata statistical

software version 17 (StataCorp LLC, College Station, TX). Our study was approved by Committee for the Protection of Human Subjects within the Health and Human Services Agency of the State of California.

RESULTS

Descriptive statistics

Among the 19,269 African-born Black women in our sample, there was representation from 52 countries (**Figure 1.2**). The top ten countries of origin in descending order were Nigeria, Ethiopia, Somalia, Kenya, Eritrea, Ghana, Sudan, Cameroon, Uganda, and Democratic Republic of the Congo (DRC). Fifty-eight percent (n=11,229) of women in the sample were from Nigeria, Ethiopia, and Somalia.

Compared to US-born Black women, African-born Black women were older, had attained higher levels of education, and were less likely to have used Medi-Cal to pay for childbirth (**Table 1.1**). They were also less likely to have pre-existing or gestational hypertension and infections during pregnancy, but more likely to have pre-existing or gestational diabetes than the US-born Black women.

Country-level stratification highlighted meaningful differences in the distribution of socio-demographic characteristics among African-born women. For instance, while the proportion of all African-born women who had completed less than a high school diploma was 5.8% (n=1,117), among Somalia-born women the proportion was 23.2% (n=364), nearly double the proportion among US-born Black women (n=29,299; 13.3%). Conversely, Nigeria- and Kenya-born women had large proportions who had completed some college or higher education, 86.9% (n=4,676) and 83.9% (n=986) respectively, compared to 69.6% (n=13,416) of all African-born women.

A large proportion of Somalia-born women (n=1,272; 81.4%) had Medi-Cal coverage for their childbirth, which greatly exceeded the average among all African- (n= 9,007; 46.7%) and US-born Black women (n=102,103; 58.3%). Somalia-born women were also likely to be multiparous (n=1,335; 85.4%), compared to 65.8% (n=12,696) for all African-born women. Women born in Ethiopia (n=700; 16.3%), Somalia (n=243; 15.5%), Ghana (n=131; 15%), Eritrea (n=176; 15.3%) and Sudan (n=122; 17.6%) had proportions of pre-existing and gestational diabetes that surpassed the average among all African-born Black women (n=2,509; 13%), while Uganda-born women had a smaller proportion of pre-existing and gestational diabetes (n=43, 7.1%) than the US-born Black women (n=16,253, 9.2%).

African country of origin and risk of adverse perinatal outcomes

In both unadjusted and advanced maternal age-adjusted regression analyses we estimated a lower risk of PTB among all African-born Black women compared to US-born Black women (adjusted RR 0.54; 95% CI 0.51, 0.58) (**Table 1.2**). The reduction in risk was not uniform across all countries of origin. Compared to US-born Black women, the estimated risk of PTB was lowest among the Eritrea-born women (RR 0.37; 95% CI: 0.28, 0.49), while the magnitude of differences were smaller for Black women born in Ghana (RR 0.85; 95% CI: 0.69, 1.05), Uganda (RR 0.67; 95% CI: 0.50, 0.89), and the DRC (RR 0.65; 95%CI: 0.45, 0.94).

Similarly, both unadjusted and advanced maternal age-adjusted models suggested that African-born women had a lower risk of SGA (RR 0.59; 95%CI :0.56, 0.61) compared to US-born Black women. The age-adjusted risk of SGA was lowest among women born in Cameroon (RR 0.42; 95%CI: 0.31, 0.57), while the magnitude of difference was smallest for Ghana-born (RR 0.86; 95%CI: 0.72, 1.03), Kenya-born (RR 0.80; 95%CI: 0.68, 0.94), and Sudan-born (RR 0.77; 95%CI: 0.62, 0.95) women, all as compared to US-born Black women.

Decomposition analyses

The decomposition analyses revealed that overall differences in socio-demographic and clinical characteristics between US- and African-born Black women explained 14.4% and 19.6% of the disparities in the risk of PTB and SGA, respectively (**Table 1.3**). For PTB, differences in the number of infections during pregnancy between US- and African-born Black women explained the majority (11.1 percentage points) of the total 14.4% explained. Whereas differences insurance coverage for the costs of childbirth was the largest contributor (6.7 percentage points) to the overall 19.6% explained difference in SGA.

At the country-level, we found that -6.2% to 43.2% of PTB and 3.7% to 53.8% of SGA disparities between African-born Black women from the top ten countries of origin and US-born Black women were explained by differences in socio-demographic and clinical risk factors (**Appendix Tables 1.2 & 1.3**). Across the country-level analysis, differences in maternal infections during pregnancy and insurance coverage for the costs of childbirth were among the top factors that explained nativity-based disparities in PTB and SGA.

Uganda-born Black women had the highest percentage (43.2%) of nativity-based PTB disparities explained compared to US-born Black women, of which the majority was from differences in maternal infections during pregnancy (25.7 percentage points). In the context of SGA, 53.8% of the disparities between Ghana- and US-born Black women were explained by differences in socio-demographic and clinical risk factors, the bulk was explained by differences in insurance coverage (32%) and pre-existing or gestational diabetes (14.7%). For both outcomes, DRC-born women had the smallest percentage (-6.2% for PTB and 3.7% for SGA) of nativity-based disparities explained, given that on average they had a higher prevalence of the socio-demographic and clinical risk factors compared to US-born Black women.

DISCUSSION

In this population-based cohort study of African-born and US-born Black women residing in California, we examined the risk of adverse perinatal outcomes and explored how differences in socio-demographic and clinical risk factors may explain nativity-based disparities. While we found that African-born Black women on average had a lower risk of PTB and SGA compared to their US-born counterparts, we also found that the magnitude of risk varied substantially by African country of origin. Compared to US-born Black women, the risk of PTB and SGA was lowest among Eritrea-born and Cameroon-born women, respectively. The risk of PTB and SGA among Ghana-born women was closest to that of US-born Black women. Overall, a relatively small proportion of the reduced risk of adverse perinatal outcomes among African-born Black women was explained by a higher prevalence of socio-demographic and clinical risk factors for PTB and SGA among the US-born Black women, although this also varied by African country of origin.

Our findings align with previous work aimed at studying the risk of adverse perinatal outcomes among African-born and US-born Black women across the US. [10,13,16,17] For example, in a study of New York City birth records from 1998-2002, Howard et al. found that Black women of African ancestry had a lower risk of preterm birth (RR 0.78; 95% CI: 0.71, 0.85), compared to Black American women.[16] Belanoff et al. analyzed birth record data for Black women in Massachusetts from 2011-2015 noting that on average African-born women had a lower odds of PTB (OR 0.71; 95% CI: 0.63, 0.79) compared to US-born Black women.[17] Similar to our results, the country-level analyses by these investigators highlighted that African-born women from Cameroon (OR 0.53; 95% CI: 0.30, 0.93) were among those with the lowest odds of PTB as

compared to US-born Black women.[17] They also reported that Ghana-born (OR 0.80; 95% CI: 0.64, 1.01) women had odds of PTB most similar to US-born Black women.[17]

The overall lower risk of adverse perinatal outcomes among African-born compared to US-born Black women has been attributed to the "immigrant health paradox", which suggests that recent immigrants have lower risks of adverse perinatal outcomes compared to the US-born population with similar socio-economic and demographic profiles, despite their barriers (e.g., language) to integration into US society because they are healthier (e.g. have fewer chronic health problems) upon arrival.[31–34] The contribution of this phenomenon has been attributed, in part, to health selection, wherein, healthier and wealthier Africans with higher levels of education and strong social support networks are more likely to migrate to the US.[31] This framing is supported by a recent study which found that 64% of Nigerians living in the US had a bachelor's degree, compared to only 7% of the general population in Nigeria.[35] US immigration policies strongly impact these observed patterns in that they strongly favor the migration of highly skilled and educated Africans to the US.[20] In fact, following decades of limited legal pathways to the US for African-born individuals, the Immigration Act of 1990 created the diversity visa lottery system, aimed at increasing immigration from countries that were underrepresented in the US at the time.[35] The diversity visa lottery requires applicants to have the equivalent of a high school education, or two years of qualifying work experience to enter the US, and in 2013 it was estimated that 39% of the visas were allocated to immigrants from Africa.[35,36] Overall, this suggests that immigration to the US is more accessible for African-born individuals of high socio-economic status. Nonetheless, it should be noted that self-selection into migration does not account for all of the African-born health advantage, as African women who arrive in the US under refugee status also have lower rates of LBW and PTB than US-born Black women.[37,38]

While our comparison of socio-demographic and clinical characteristics between African- and US-born Black women revealed that on average African-born Black women had fewer risk factors than US-born Black women, there was considerable variation by country of origin. Moreover, differences in socio-demographic and clinical characteristics only explained a modest proportion of the overall disparities in PTB and SGA, but this also varied by African country of origin. This suggests that pre-immigration factors, including socioeconomic status, differ across African countries of origin, and leads to differential selection into migration to the US across the African continent. These country-specific differences in pre-migration factors have also been observed by investigators focused on Caribbean-born Black populations, as a recent investigation found that more than a quarter of Jamaica-born (27%) and Trinidad and Tobago-born (28%) immigrants in the US have at least a bachelor's degree, while in contrast 31% of Dominican Republic-born immigrants have not completed high school.[39]

Although it has been shown that duration of residence in the US can decrease the health advantage of African-born Black women as it relates to adverse perinatal outcomes[40–42], this information was not available in the current dataset. Further exploration of these patterns by African country of origin and years of residence in the US are crucial, as it is possible that increased exposure to stress over time (due to anti-Black racism and other forms of discrimination) may lead to a higher risk of adverse perinatal outcomes among African-born Black women. [43–45] Particularly important will be the examination of age at immigration given findings by Dominguez et al. found that Black pregnant immigrants who arrive in the US before 18 years of age report experiences of racism at similar rates to US-born Black pregnant women.[44] Thus, it follows that the risk of adverse perinatal outcomes among foreign-born Black women who have lived in the US for longer periods mirrors that of US-born Black women.[41]

In future studies, it will also be important to look at historical timing with respect to immigration and adverse perinatal outcomes, given the role that structural oppression plays in shaping the perinatal outcomes of Black immigrant populations.[32] African-born Black women in the US are exposed to unique forms of structural racism including being targets of anti-immigrant policies.[35,46–48] President Donald Trump's 2017 Executive Order #13769 banned travel to the US for individuals from Muslim-majority countries[48], including Somalia and Sudan. This policy has since been associated with increased odds of PTB.[47] Therefore, future nativity studies should consider including measures of exposure to structural racism due to immigration policies as it may help to further explain differences in the risk of adverse perinatal outcomes among African-born women and US-born Black women.

Our study had numerous strengths, including a long and recent study period, and the inclusion of a large sample of African-born Black women from countries that have been excluded from past nativity research (e.g., Eritrea). Limitations include, as discussed, our not having information on the duration of residence in the US and also include our not having information on type of immigration (e.g., asylum seeker, permanent resident, naturalized citizen) for the African-born population. Also, we did not have information on additional important mediators for the decomposition analysis, including household income or marital status due to the clinical nature of our database. While we were able to include maternal education and insurance coverage for childbirth as proxies for socio-economic status in our decomposition analyses (which provides some compensation for the lack of more specific income measures), it will be important that future studies include better measures for income and social support (e.g., marital status and other family and community metrics). In addition, despite the large diversity of the African-born population in the sample, we limited most of our analyses to women from the top 10 countries of

origin because of sample size and power constraints. This practice may have also limited study generalizability and points to a need for future study with a larger sample size.

CONCLUSION

In this study of adverse perinatal outcomes among African- and US-born Black women residing in California, we found that while African-born women overall had a lower risk of PTB and SGA compared to US-born Black women, there was heterogeneity by country of origin. Specifically, we found that the magnitude of differences in the risk of PTB and SGA (as compared to US-born Black women) varied substantially, with the largest differences observed for Eritrea- and Cameroon-born women, and smaller differences for Ghana-born women. While socio-demographic and clinical risk factors (namely infections during pregnancy and insurance coverage for childbirth) explained a relatively small proportion of the overall difference in risk of adverse perinatal outcomes, this also varied by African country of origin. These findings suggest that the combining of all African-born Black women into a homogenous "foreign-born" group in nativity studies may obscure variation in the risk of adverse perinatal outcomes, and limit the ability to study unique migration trajectories, the socio-political climate of the sending country, exposure to racism across the life course, and other structural factors that influence the risk of adverse perinatal outcomes beyond socio-demographic and clinical risk factors. In addition to including country of origin, future studies should include information on age at arrival, duration of residence, and measures of structural racism, with the goal of adequately assessing the complex relationship between maternal nativity and adverse perinatal outcomes by country of origin in Black women.
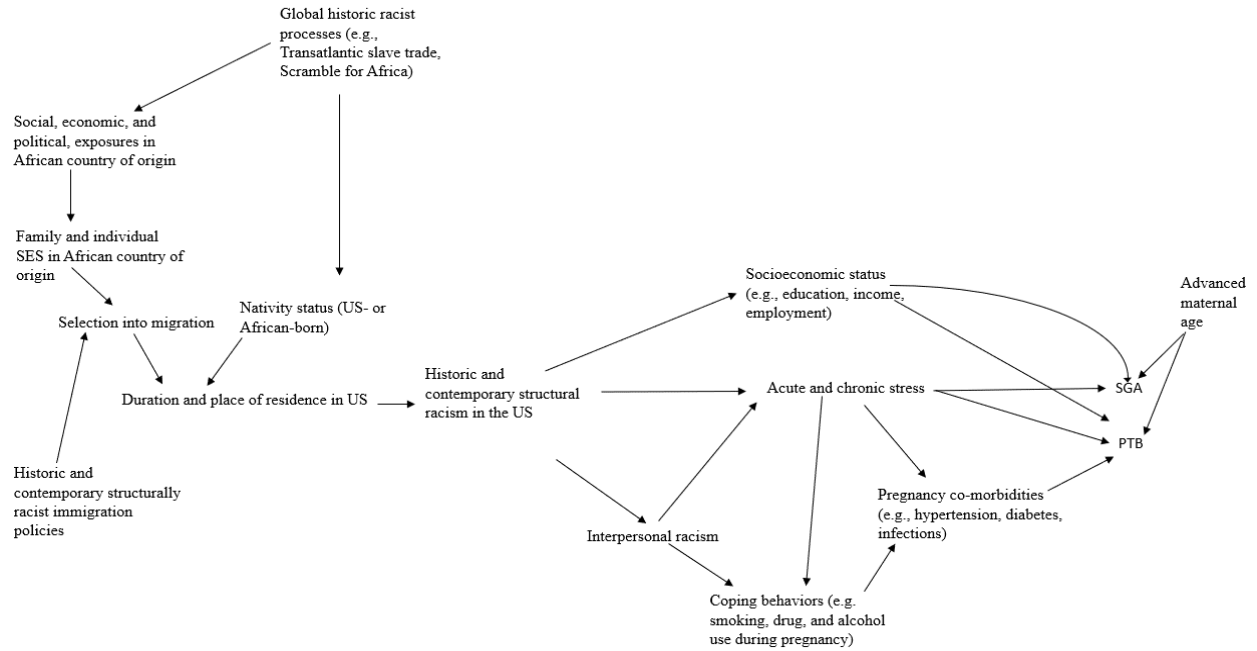
Abbreviations: PTB=preterm birth; SGA=small for gestational age birth; US=United States

Figure 1.1 Directed acyclic graph depicting the hypothesized relationship between all variables under study.
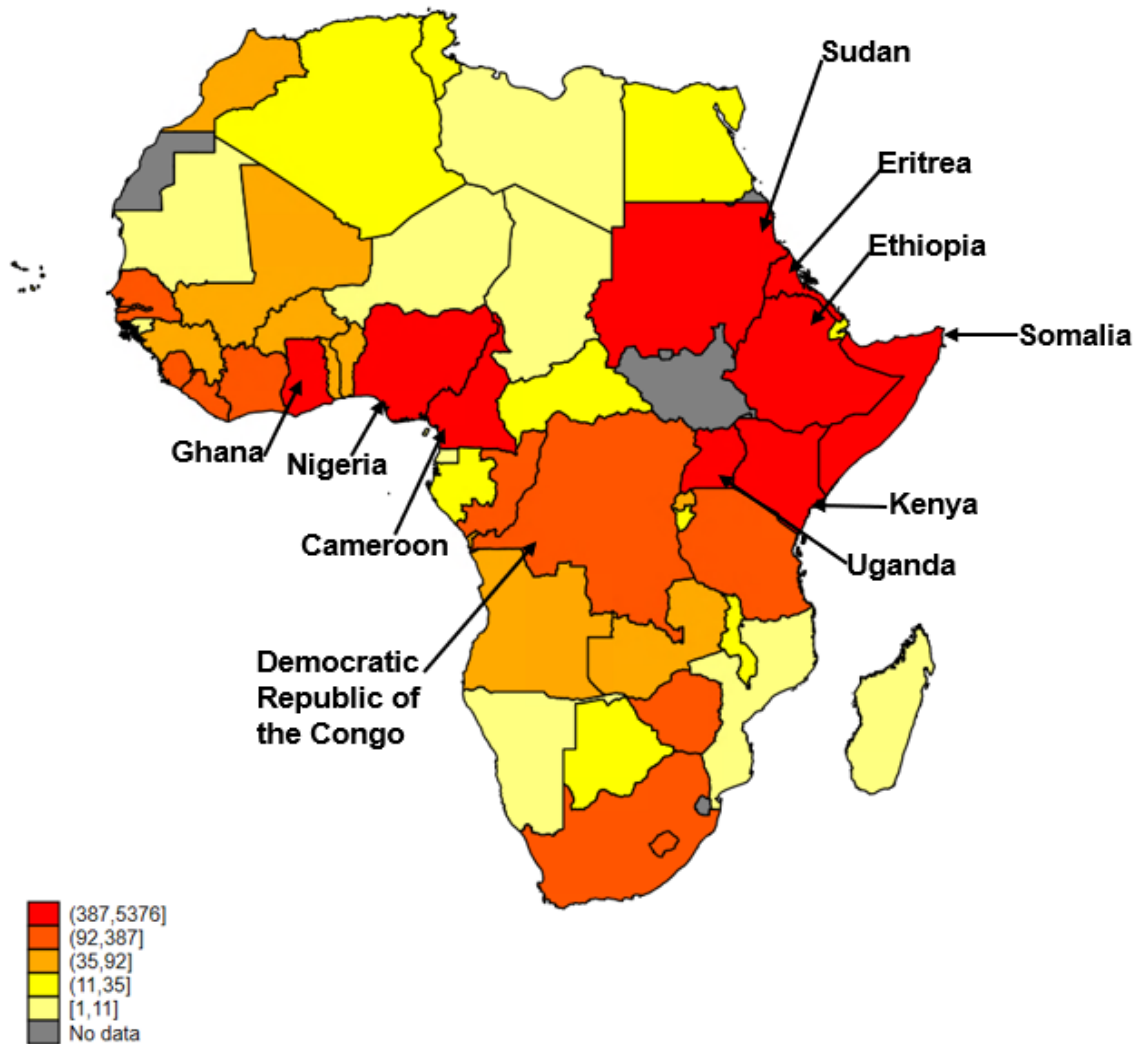
Figure 1.2. Heat map of African countries of origin in the study sample. The top ten countries of origin, which constituted 87% of all African-born Black women in our sample are labeled.

Table 1.1 Socio-demographic and clinical factors by maternal country of origin for African- and US-born Black women in California, 2011-2020

	US-born	All African-born	Nigeria	Ethiopia	Somalia	Kenya	Eritrea	Ghana	Sudan	Cameroon	Uganda	DRC
N (%)	n=175,051	n=19,269	n=5,376	n=4,291	n=1,562	n=1,175	n=1,145	n=870	n=691	n=659	n=601	n=387
Maternal age												
<18 years	3,905 (2.33)	20 (0.10)	-	-	-	-	-	-	-	-	-	-
18-34 years	145,985 (83.4)	12,688 (65.85)	3,531 (65.68)	2,685 (62.57)	1,160 (74.26)	693 (58.98)	641 (55.98)	567 (65.17)	500 (72.36)	476 (72.23)	378 (62.90)	283 (73.13)
>34 years	25,155 (14.37)	6,561 (34.05)	1,843 (34.28)	1,605 (37.40)	400 (25.61)	479 (40.77)	504 (44.02)	303 (34.83)	191 (27.64)	181 (27.47)	223 (37.10)	103 (26.61)
Education												
Less than high school	23,299 (13.31)	1,117 (5.80)	36 (0.67)	259 (6.04)	364 (23.20)	21 (1.79)	148 (12.93)	24 (2.76)	47 (6.80)	14 (2.12)	12 (2.00)	44 (11.37)
High school diploma	58,670 (33.52)	3,754 (19.45)	505 (9.39)	1,243 (28.97)	438 (28.04)	133 (11.32)	426 (37.21)	134 (15.40)	156 (22.58)	97 (14.72)	56 (9.32)	91 (23.51)
Some college or more	88,360 (50.48)	13,416 (69.62)	4,676 (86.98)	2,554 (59.52)	517 (33.10)	986 (83.91)	505 (44.10)	681 (78.28)	437 (63.24)	525 (79.67)	520 (86.52)	219 (56.59)
Insurance												
Not Medi-Cal	72,948 (41.67)	10,262 (53.26)	3,489 (64.90)	2,097 (48.87)	290 (18.57)	766 (65.19)	545 (47.60)	558 (64.14)	308 (44.57)	380 (57.66)	283 (47.09)	141 (36.43)
Medi-Cal	102,103 (58.33)	9,007 (46.74)	1,887 (35.10)	2,194 (51.13)	1,272 (81.43)	409 (34.81)	600 (52.40)	312 (35.86)	383 (55.43)	279 (42.34)	318 (52.91)	246 (63.57)
Parity												
Nulliparous	66,081 (37.75)	6,555 (34.02)	1,746 (32.48)	1,642 (38.27)	225 (14.40)	511 (43.49)	374 (32.66)	335 (38.51)	221 (31.98)	240 (36.42)	222 (36.94)	119 (30.75)
Multiparous	108,794 (62.15)	12,696 (65.89)	3,626 (67.45)	2,643 (61.59)	1,335 (85.47)	663 (56.43)	769 (67.16)	533 (61.26)	470 (68.02)	419 (63.58)	379 (63.06)	267 (68.99)
Hypertension	19,240 (10.99)	1,715 (8.90)	490 (9.11)	380 (8.86)	83 (5.31)	108 (9.19)	80 (6.99)	114 (13.10)	44 (6.37)	86 (13.05)	53 (8.82)	51 (13.18)
Diabetes	16,253 (9.28)	2,509 (13.02)	554 (10.31)	700 (16.31)	243 (15.56)	133 (11.32)	176 (15.37)	131 (15.06)	122 (17.66)	70 (10.62)	43 (7.15)	40 (10.34)
Infection	37,203 (21.25)	1,892 (9.82)	459 (8.54)	371 (8.65)	213 (13.64)	113 (9.62)	74 (6.46)	93 (10.69)	70 (10.13)	98 (14.87)	53 (8.82)	57 (14.73)

Abbreviations: DRC= Democratic Republic of the Congo; Data is suppressed when n<5.

17

Table 1.2. Risk ratios and 95% confidence intervals from modified Poisson regression models predicting preterm birth and small for gestational age births among African-born Black women in California, 2011-2020

Maternal nativity	Preterm birth			Small for gestational age birth		
	N (%)	RR (95% CI)		N (%)	RR (95%CI)	
		Model 1[a]	Model 2[b]		Model 1[a]	Model 2[b]
US-born	17,205 (9.83)	Reference	Reference	25,493 (14.56)	Reference	Reference
All African born	1,110 (5.76)	0.58 (0.55, 0.62)	0.54 (0.51, 0.58)	1,607 (8.34)	0.57 (0.54, 0.60)	0.59 (0.56, 0.61)
Nigeria-born	317 (5.90)	0.59 (0.53,0.66)	0.55 (0.50, 0.62)	388 (7.22)	0.49 (0.44, 0.54)	0.51 (0.46, 0.56)
Ethiopia-born	214 (4.99)	0.50 (0.44, 0.57)	0.46 (0.40, 0.53)	268 (6.25)	0.42 (0.38, 0.48)	0.44 (0.39, 0.49)
Somalia-born	76 (4.87)	0.49 (0.39, 0.61)	0.47 (0.38, 0.59)	167 (10.69)	0.73 (0.63, 0.84)	0.74 (0.64, 0.86)
Kenya-born	69 (5.87)	0.59 (0.47, 0.75)	0.54 (0.43, 0.68)	133 (11.32)	0.77 (0.66, 0.91)	0.80 (0.68, 0.94)
Eritrea-born	47 (4.10)	0.41 (0.31, 0.52)	0.37 (0.28, 0.49)	79 (6.90)	0.47 (0.38, 0.58)	0.49 (0.39, 0.61)
Ghana-born	79 (9.08)	0.92 (0.74, 1.14)	0.85 (0.69, 1.05)	106 (12.18)	0.83 (0.69, 1.00)	0.86 (0.72, 1.03)
Sudan-born	31 (4.49)	0.45 (0.32, 0.64)	0.43 (0.30, 0.61)	76 (11.00)	0.75 (0.61, 0.93)	0.77 (0.62, 0.95)
Cameroon-born	33 (5.01)	0.50 (0.36, 0.71)	0.48 (0.34, 0.67)	40 (6.07)	0.41 (0.30, 0.56)	0.42 (0.31, 0.57)
Uganda-born	43 (7.15)	0.72 (0.54, 0.97)	0.67 (0.50, 0.89)	49 (8.15)	0.55 (0.42, 0.73)	0.57 (0.44, 0.75)
DRC-born	26 (6.72)	0.68 (0.47, 0.99)	0.65 (0.45, 0.94)	30 (7.75)	0.53 (0.37, 0.75)	0.54 (0.38, 0.76)

Abbreviations: RR=Risk ratio; CI=Confidence interval; DRC=Democratic Republic of Congo
[a]Model 1 unadjusted
[b]Model 2 adjusted for advanced maternal age at birth

Table 1.3. Blinder-Oaxaca decomposition of maternal socio-demographic and clinical risk factors associated with maternal nativity and adverse perinatal outcomes among US- and African-born Black women in California, 2011-2020

	Preterm birth	Small for gestational age
Total percent explained	14.4	19.6
Total percent unexplained	85.6	80.4
Maternal characteristics		
Education	-0.5	2.2
Insurance coverage for childbirth	3.6	6.7
Parity	-1.7	2.7
Pre-existing or gestational hypertension	6.0	1.9
Pre-existing or gestational diabetes	-4.1	4.2
Infections during pregnancy	11.1	1.9

CHAPTER 1 APPENDIX

Appendix Table 1.1 Diagnosis codes for clinical risk factors among all US-born and African-born Black women and their infants residing in California, 2011-2020

	Diagnosis code	
	ICD-9[a]	ICD-10[b]
Hypertension	642.0, 642.1, 642.2, 642.3, 642.4, 642.5, 642.6, 642.7, 642.9, 760.0	O10, O11, O13, O14.0, O14.1, O14.2, O14.9, O15, O16, P00.0
Diabetes	648.0, 648.8, 249, 250	E10, E11, E12, E13, E14, O24.0, O24.1, O24.2, O24.3, O24.4, O24.9, P70.0, P70.1
Infections	646.5, 646.6, 647, 760.1, 760.2	O23.0, O23.1, O23.2, O23.3, O23.4, O98, P00.1, P00.2

Abbreviations: ICD=International Classification of Disease;
[a]ICD-9 codes used for data from 2011-2015.
[b]ICD-10 codes used for data from 2016-2020.

Appendix Table 1.2. Decomposition of maternal socio-demographic and clinical risk factors associated with maternal nativity and preterm birth among Black women in California by African country of origin, 2011-2020

	Total % unexplained	Total % explained	Education	Insurance	Parity	Hypertension	Diabetes	Infections
Nigeria-born	82.2	17.8	-0.5	6.4	-2.0	4.5	-1.4	10.8
Ethiopia-born	87.9	12.1	-0.3	2.1	-0.2	5.9	-6.7	11.3
Somalia-born	97.7	2.3	1.3	11.3	15.0	-23.5	10.1	-11.9
Kenya-born	79.9	20.1	-0.5	6.4	1.8	4.4	-1.8	9.6
Eritrea-born	85.4	14.6	-0.1	1.5	-2.0	8.9	-5.4	11.6
Ghana-born	82.7	17.3	-1.5	21.8	-1.1	-14.3	-18.3	30.7
Sudan-born	87.2	12.8	-0.5	1.0	-2.1	11.9	-7.7	10.2
Cameroon-born	96.3	3.7	-0.4	3.9	-0.4	-3.1	-1.3	4.9
Uganda-born	56.8	43.2	-1.1	3.6	-0.4	13.6	1.8	25.7
DRC-born	106.2	-6.2	-0.8	-2.1	-4.3	-5.9	-1.3	8.1

Abbreviations: DRC= Democratic Republic of the Congo.

Appendix Table 1.3. Decomposition of maternal socio-demographic and clinical risk factors associated with maternal nativity and small for gestational age birth among Black women in California by African country of origin, 2011-2020

	Total % unexplained	Total % explained	Education	Insurance	Parity	Hypertension	Diabetes	Infections
Nigeria-born	79.1	20.9	2.2	11.3	3.1	1.4	1.3	1.7
Ethiopia-born	87.2	12.8	1.1	3.0	0.3	1.5	5.4	1.5
Somalia-born	68.2	31.8	6.5	-23.1	26.6	8.3	11.3	2.2
Kenya-born	68.0	32.0	4.2	24.0	-6.0	2.9	3.7	3.2
Eritrea-born	83.2	16.8	0.5	2.8	3.3	2.9	5.5	1.9
Ghana-born	46.2	53.8	5.3	32.0	1.4	-3.6	14.7	4.1
Sudan-born	60.4	39.6	4.5	3.6	6.3	7.2	14.7	3.2
Cameroon-born	89.9	10.1	1.6	6.9	0.6	-0.9	1.2	0.8
Uganda-born	89.5	10.5	2.7	3.7	0.4	2.4	-1.0	2.3
DRC-born	96.3	3.7	1.8	-1.9	3.4	-0.9	0.6	0.7

Abbreviations: DRC= Democratic Republic of the Congo.

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Chapter 2: Structural racism, nativity, and risk of adverse perinatal outcomes among Black women in California

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ABSTRACT

Objective*:* To evaluate the relationship between structural racism, nativity, preterm birth (PTB), and small for gestational age birth (SGA) among American- and African-born Black women in California.

Methods*:* We conducted a population-based study of singleton births to American- and African-born Black women in California between 2011-2017 (n=131,191). The risk of PTB and SGA was examined by nativity and by residence in census tracts with differing levels of structural racism, as measured by the Index of Concentration at the Extremes (ICE) (e.g., the proportion of high-income non-Hispanic White (privileged) versus low-income non-Hispanic Black (marginalized) individuals living in a neighborhood). Birth certificate and hospital discharge data were combined with data from the American Community Survey to evaluate relationships using generalized estimating equations, reporting risk ratios (RRs) and 95% confidence intervals (CIs).

Results*:* American-born Black women had a higher risk of PTB (RR 1.81, 95% CI 1.67-1.95) and SGA (RR 1.67, 95% CI 1.57-1.77), compared to African-born Black women. American-born Black women were nearly twice as likely (20.9% of American-born versus 11.6% of African-born) to live in the census tracts with the highest structural racism. Increasing levels of structural racism were associated with a higher risk of PTB and SGA, however there was significant heterogeneity by nativity status (*P*<.001).

Conclusion: Structural racism predicts disparities in PTB and SGA between American- and African-born Black women in California. Clinical providers should consider how structural racism shapes the lives of Black women in America and affects the risk of PTB and SGA.

INTRODUCTION

In the United States (US), racism is a fundamental cause of health irrespective of socioeconomic status.[1] Racism can be defined as an organized hierarchical system built through White supremacist ideology, which categorizes people into racial groups, and uses its' power to oppress and marginalize racial groups deemed inferior than White people.[2] Racism operates in multiple forms including, interpersonal, internalized, and structural racism.[3,4] The latter is defined by Bailey et al. as all the ways that societies embed discrimination into the fabric of mutually reinforcing social structures including benefits, credit, criminal justice, earnings, education, employment, health care, housing and media.[5]

Structural racism is associated with adverse perinatal outcomes among Black women and their infants including preterm birth (PTB), small for gestational age (SGA) birth, severe maternal morbidity, and maternal and infant mortality.[6–9] However, disparities have been found by nativity—as foreign-born Black women have significantly lower risks of PTB and SGA, even after accounting for socio-demographic and clinical risk factors.[10–12] Scholars have considered differences in social support and health behaviors as explanations for nativity-based disparities in PTB and SGA, however they these factors do not completely explain the disparities.[13,14] The stark differences in adverse perinatal outcomes among these two groups who are similarly racialized as Black in the US may shed light on the role of foreign-born status as a buffer to the experiences of racism.[15] Exposure to US-based structural racism across the entire life course has been purported as an important factor which may increase the risk of PTB and SGA among US-born Black women compared to foreign-born Black women, whose life courses include time outside the US.[16] Rates of adverse perinatal outcomes of foreign-born Black women more closely align with those of US-born Black women as duration of residence in the US increases,

suggesting that the stress of cumulative exposure to anti-Black structural racism in the US drives the risk of PTB and SGA.[17]

While the association between structural racism and adverse perinatal outcomes among US-born Black women has been studied, few studies investigate how structural racism, as measured by residential segregation, affects the relationship between nativity and adverse perinatal outcomes, particularly using samples of Black women on the West coast of the US where the Black immigrant community is predominantly African-born in contrast to the largely Caribbean-born Black population on the Northeast coast.[12] On average, Caribbean-born immigrants have resided in the US for a longer duration, therefore it is possible that their experiences of structural racism differ from the more recently arrived African-born population.[18] Studies of residential segregation among Caribbean-born immigrants living on the Northeast coast have found an increased risk of adverse perinatal outcomes, yet less is known about how these patterns emerge among African-born immigrants.[19] The objectives of this study were: i) to estimate the relationship between nativity, PTB and SGA, ii) to examine whether US- and African-born Black women live in areas with differential exposure to structural racism, and iii) to estimate whether living in areas with increasing structural racism was associated with an increasing pattern in the perinatal outcomes for both US- and African born- Black women in California. We hypothesized that US-born Black women are exposed to more structural racism, and that this exposure modifies the relationship between structural racism and PTB and SGA by nativity status.

METHODS

Birth certificates, maintained by California Vital Statistics, were linked to hospital discharge, ambulatory surgery, and emergency department records maintained by the California Office of

Statewide Health Planning and Development.[20] The sample was a population-based retrospective cohort of all births to self-identified US- and African-born non-Hispanic Black women in California between 2011-2017. These data are routinely used for perinatal research, and have high validity and reliability.[6,9,11,12] Excluded were all records with implausible gestational age (≤19 weeks or >44 weeks), as well as multiple gestations and pregnancies resulting in chromosomal or congenital anomalies. Further excluded was data for women with missing or invalid information on their census tract of residence at the time of birth, as well as those whose residential address at the time of childbirth was not within California. Our final sample included 131,491 US- and African-born Black women with live singleton births (**Figure 2.1**). These data were merged with information from the American Community Survey (ACS) to compute neighborhood-based measures of structural racism. The ACS data for 2011-2017 were used to compute three versions of the Index of Concentration at the Extremes (ICE) within the census tracts included in our sample: a) ICE race, b) ICE income, and c) ICE race+income, which measured racial, economic, and racialized economic segregation, respectively. ICE quantifies spatial polarization of privilege and marginalization within a given census tract and has been previously used a proxy for structural racism in studies of adverse perinatal outcomes.[5,916]

ICE race computes the relative difference between the proportion of non-Hispanic White (privileged) and non-Hispanic Black (marginalized) individuals within a census tract, whereas ICE income compares the proportion of people who earned ≥ $100,000 (privileged) to those who earned <$25,000 (marginalized) in annual household income within a census tract. ICE race+income reflects the combination of racial and economic segregation, comparing the proportion of non-Hispanic White individuals earning ≥$100,000 in annual household income to

the number of Black individuals earning <$25,000 in annual household income within a census tract (see **Appendix Text 2.1** for additional details on ICE measure calculations).

We chose to operationalize these measures at the census tract-level as this has been found to be a sensitive neighborhood unit of analysis for ICE measures.[21] Once computed, ICE measures are continuous for each census tract, ranging from -1 (complete marginalization) to +1 (complete privilege). In line with previous research, we computed 5 quintiles of each ICE measure, whereby the 1st quintile contains census tracts with the most marginalization and the 5th quintile contains census tracts with the most privilege.[6,21]

Nativity was operationalized as a binary variable, where all women whose place of birth corresponded to a location within in the contiguous US, Hawaii, District of Columbia, or Alaska were considered US-born, and all women born within the African continent were considered African-born. PTB was defined as birth before 37 weeks of gestation and computed using best obstetric estimate. SGA was defined as gestational age at birth in lower than the 10th percentile for a given gestational age and sex.[22]

Using the Howe et al. framework for drawing directed acyclic graphs (DAG) in racial health disparities research, we demonstrated our underlying assumptions regarding the relationship between all variables under study (**Appendix Figure 2.2**).[23] We hypothesized that selection into migration for African-born Black women is influenced by the historic and contemporary US immigration policies. This dictates the lawful number of African-born immigrants granted admission to the US, as well as their duration and place of residence in the US. Historic and contemporary forms of structural racism including chattel slavery, residential segregation, and mass incarceration, influence the conditions in which US-born women are born and raised, therefore shaping their individual adult level of educational attainment, employment status,

access to and quality of health insurance. Depending on age at arrival in the US, African-born women may be similarly or less exposed to the aforementioned forms of structural racism in US society.

Individual-level socio-demographic and clinical risk factors were measured including maternal age at birth (less than 35 years, or 35+ years), parity (nulliparous or multiparous), highest level of completed education (less than high school, high school diploma, and some college or higher), expected payer for childbirth (Medi-Cal or not Medi-Cal), pre-existing or gestational hypertension, and pre-existing or gestational diabetes. We also included a measure of neighborhood poverty, operationalized as the percent of the census tract population living below the federal poverty level. However, as demonstrated in the DAG, we believe that individual-level factors are the result of structural racism, mediating the relationship between structural racism and adverse perinatal outcomes. Thus, they should not be controlled for in regression analyses as they are on the causal pathway between our exposure and outcomes.[24]

We computed descriptive statistics for the entire sample stratified by nativity. Moreover, we computed the proportion of women by nativity group that resided within each quintile of the ICE variables. In regression analyses, to account for clustering by census tract, we fit two generalized estimating equation (GEE) models using a Poisson distribution with robust standard errors to predict the risk of PTB and SGA as a function of nativity status, using African-born Black women as the reference group. The first model was unadjusted. The second model was adjusted for maternal age at childbirth. The risk ratios (RR) and 95% confidence intervals (95% CI) were reported.

Additional unadjusted GEE models were fit to estimate the risk of PTB and SGA within quintiles of each ICE measure with interaction terms for each ICE measure and nativity, to assess whether

37

the effect of structural racism on PTB and SGA risk is modified by nativity. We reported the RR

and 95% CI for each ICE measure. Following each regression model, we plotted the predicted

probabilities of PTB and SGA by nativity status to visually inspect the presence of interaction

between nativity and structural racism.

In sensitivity analyses, we stratified the African-born population by country of origin for

pregnancies from the top three countries of origin. Nigeria-, Ethiopia-, and Somalia-born Black

women were compared to US-born Black women in our sample to evaluate whether the

associations between structural racism, nativity, PTB and SGA differed by country of origin. We

also computed the mean percentage of Black foreign-born residents within quintiles of the ICE

measures to understand how Black immigrant neighborhood density may relate to structural

racism. Missing data on all variables was less than 5%, and not significantly different by nativity.

The study was approved by the Committee for the Protection of Human Subjects within the

Health and Human Services Agency of the State of California in accordance with the Declaration

of Helsinki. Statistical analyses were conducted using Stata statistical software version 17

(StataCorp LLC, College Station, TX).

RESULTS

There were 118,780 US-born and 12,711 African-born Black women included in our study

sample (**Table 2.1**). There was a wide range of African countries of origin in our study

population (**Appendix Table 2.3**), however, the majority of African-born Black women were

from Nigeria (n=4,612; 28%), Ethiopia (n=3,629; 22.5%) and Somalia (n=1,314; 8.7%).

On average, US-born Black women were younger at the time of childbirth (n=102,783 86.5%

less than 35 years old vs. n=8,597, 67.6% among African-born Black women), used Medi-Cal

more often to cover the costs of childbirth (n=70,011; 58.9% vs. n=5,925, 46.6% of African-born Black women), and lived in areas with higher neighborhood poverty (n=12,635, 10.6%) than African-born Black women (n=574, 4.5%) (**Table 2.1**). US-born Black women had a larger proportion of PTB (n=11,537 9.7%) and SGA (n=17,278, 14.5%) than did African-born Black women (n=721, 5.6% for PTB; n=1,067, 8.3% for SGA).

The majority of African-born Black women lived in neighborhoods with the most privilege across all ICE measures of structural racism (**Figure 2.2**). For example, 35.9% of African-born Black women lived in the most privileged quintile of ICE race+income (i.e., quintile 5), compared to only 18.2% of US-born Black women.

The unadjusted regression model for PTB indicated that US-born Black women had 1.70 (95% CI 1.57-1.83) times the risk of PTB, compared to African-born Black women (**Table 2.2**). After adjustment for advanced maternal age at childbirth, the RR increased to 1.80 (95% CI 1.67-1.95). Likewise, the unadjusted risk of SGA among US-born Black women was 1.70 (95% CI 1.60-1.81) times greater than for African-born Black women. After adjustment, the RR was similar (RR 1.67, 95% CI 1.57-1.77).

Among all Black women, the risk of PTB and SGA increased with decreasing ICE quintiles (i.e., more structural racism) (**Table 2.4**). For instance, in the model for ICE income predicting PTB, Black women living in the 1st quintile of ICE income (i.e., the areas with the most economic segregation) were 1.18 (95% CI 1.12-1.25) times more likely to have a PTB, than those living in the 5th quintile (i.e., the areas with the least economic segregation). The RR decreased in each subsequent ICE income quintile as structural economic privilege increased: quintile 2 (RR 1.14, 95% CI 1.07-1.20), quintile 3 (RR 1.09, 95% CI 1.03-1.16), and quintile 4 (RR 1.04, 95% CI 0.98-1.11). There was a significant interaction (*P*<.001) between nativity and all ICE measures,

suggesting that nativity modifies the relationship between structural racism and adverse perinatal outcomes (**Figure 2.3**).

The results of the sensitivity analyses (**Appendix Tables 2.4 - 2.7**) showed that among Nigerian-, and Ethiopian-born Black women the results were generally similar to the results in the aggregate African-born population, in that US-born Black women had a higher risk of PTB and SGA compared to each country-specific population. However, there was a large proportion of the Somalia-born women residing in neighborhoods with the second highest quintile of racial (n=442; 40.1%), economic (n=243, 22%), and racialized economic segregation (n=307; 27.8%). We also found that the mean percentage of Black immigrants per neighborhood, while relatively small, was highest in areas with the most structural racism across all ICE measures (**Appendix Table 2.8**).

DISCUSSION

In this population-based study of nativity, neighborhood-level structural racism and adverse perinatal outcomes, we found that US-born Black women had a higher risk of PTB and SGA compared to their African-born counterparts. US-born Black women also were more likely to reside in a neighborhood with high structural racism as measured by ICE within the domains of racial, economic, and racialized-economic segregation than African-born Black women. Structural racism was associated with an increased risk of PTB and SGA, however there was heterogeneity in this relationship by nativity.

These findings are generally consistent with previous studies which have found that neighborhood segregation increases the risk of adverse perinatal outcomes in US-born Black women, but not their foreign-born Black counterparts.[25,26] In their study of perinatal outcomes among Black immigrants in New York City, Planey et al. similarly found that US-born women

resided in areas with high racial segregation, increasing the likelihood of PTB, whereas they found no clear relationship between racial segregation and PTB for African-born Black women.[25] In contrast, our results differ from the work of Margerison-Zilko et al., who found that increased residential segregation was associated with increased odds of PTB for US- and foreign-born Black women.[27] However, their sample was not disaggregated by country or region of origin and it is unclear if their results were partly driven by a foreign-born population with less African-born women or their use of a different measure of structural racism.

Our results support the hypothesis that US-born Black women are more likely to be exposed to structural racism than African-born Black women in the US, and that the relationship between structural racism and adverse perinatal outcomes may be heterogeneous by nativity status. These findings point to the importance of measuring contemporary exposure to neighborhood-level structural racism when examining the relationship between nativity and adverse perinatal outcomes. Given that current exposure to structural racism in the US is inextricably linked to historical structurally racist residential housing policies such as redlining (which devalued homes in Black communities by deeming them hazardous investments in the 1930-1960s), and has been previously associated with increased risks of adverse perinatal outcomes,[28,29] it is important to consider how historical patterns of structural racism are currently impacting the rates of perinatal outcomes Black women – particularly US born Black women.

The formulae used to compute ICE race and ICE race+income measures compare all Black and White individuals in a census tract, ignoring the immigrant ethnic composition of the Black population. In our sensitivity analyses, we found that larger proportions of Black immigrants lived in the areas identified by ICE as more structurally racist, and it is possible that the higher

Black immigrant density in these areas promotes social cohesion and buffers against the negative effects of overall neighborhood Black-White racial segregation.[30,31]

Our results support the work of scholars who have found that that lifelong exposure to racism increases the risk of PTB and SGA in Black populations, particularly in US-born Black women, who are more likely to have experienced anti-Black racism throughout their lifetime.[32,33] Given these known associations, our work should be viewed in the context of understanding patterns and addressing impacts. A number of investigators have proposed approaches to addressing the impacts of structural racism on adverse perinatal outcomes including providing unconditional cash supplements to Black women during pregnancy.[34,35] Given that ICE measures represent economic exclusion that results from structural racism, our data point to the importance of such interventions and suggests that US-born Black women may particularly benefit.

This study has the following strengths: use of a large population-based dataset with linked birth certificate, hospital discharge, and census tract data that allowed for a robust investigation of patterns of PTB and SGA in US- and African-born women. Limitations include our inability to account for the immigration status or years of residence in the US for the African-born population in our sample and the fact that we were only able to consider exposure to neighborhood-level structural racism at the time of childbirth. Additional research is needed to study how of other forms structural racism (e.g., exposure to environmental racism and criminal injustice) are associated with the risk of PTB and SGA for Black women longitudinally and across geographies as they move to and within the US.

CONCLUSION

In conclusion, findings from the current study provide further evidence of the effect of structural racism on PTB and SGA in Black women – particularly among those born in the US. Results suggest that researchers, public health professionals, and health providers should consider how structural racism differentially shapes the lives and perinatal outcomes of Black women in the US by nativity.
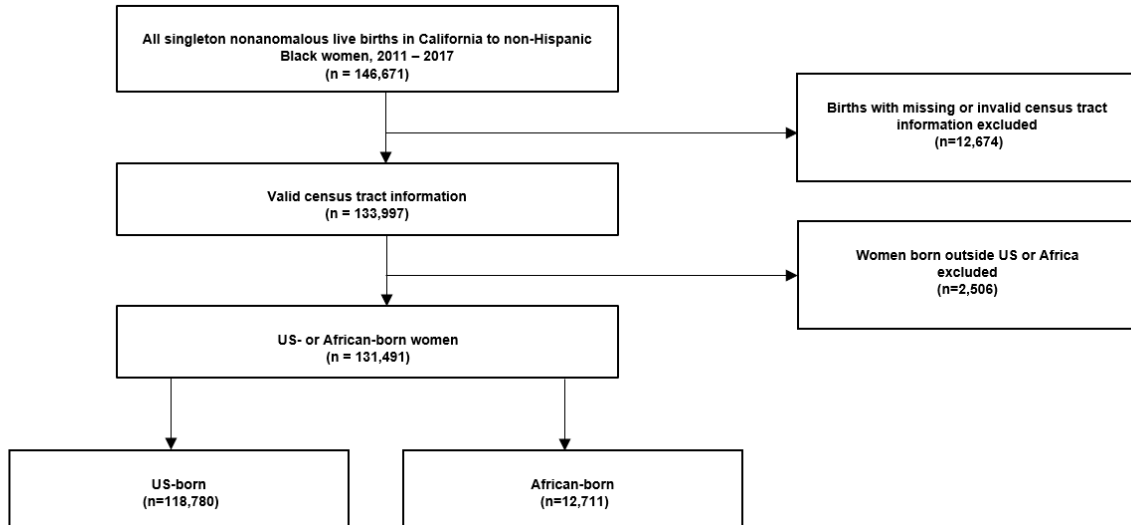
Figure 2.1. Study sample selection flow diagram
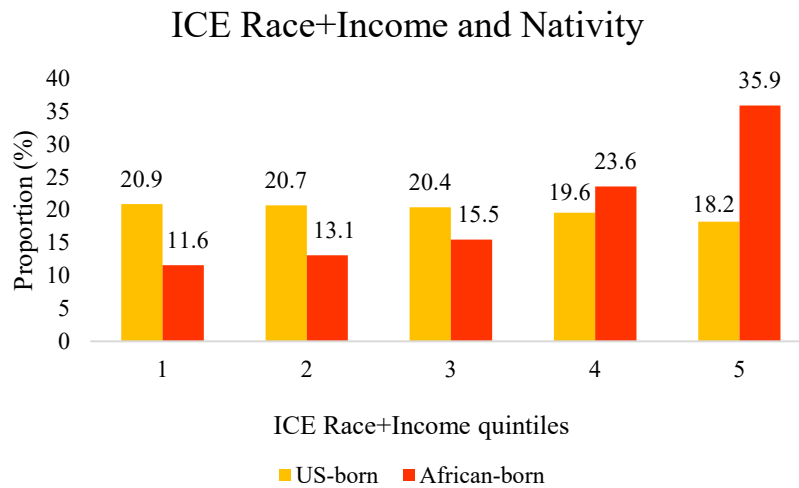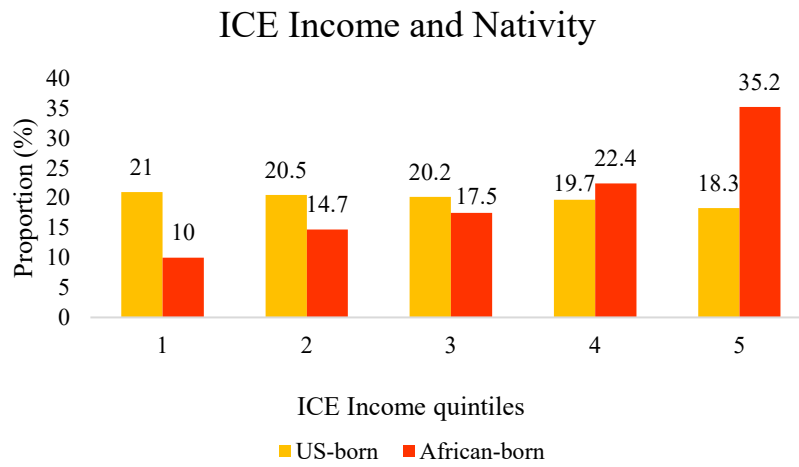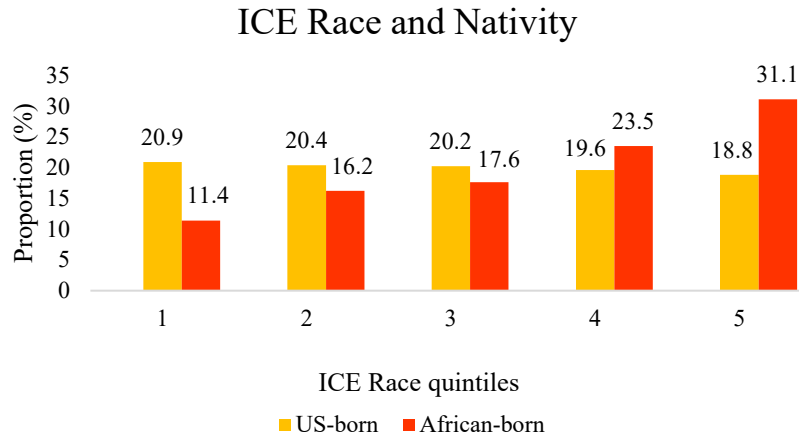
Figure 2.2. Proportion of population residing within each quintile of ICE Race, ICE Income, and ICE Race+Income stratified by nativity. Within each ICE measure, quintiles range from 1 (highest marginalization) to 5 (highest privilege)
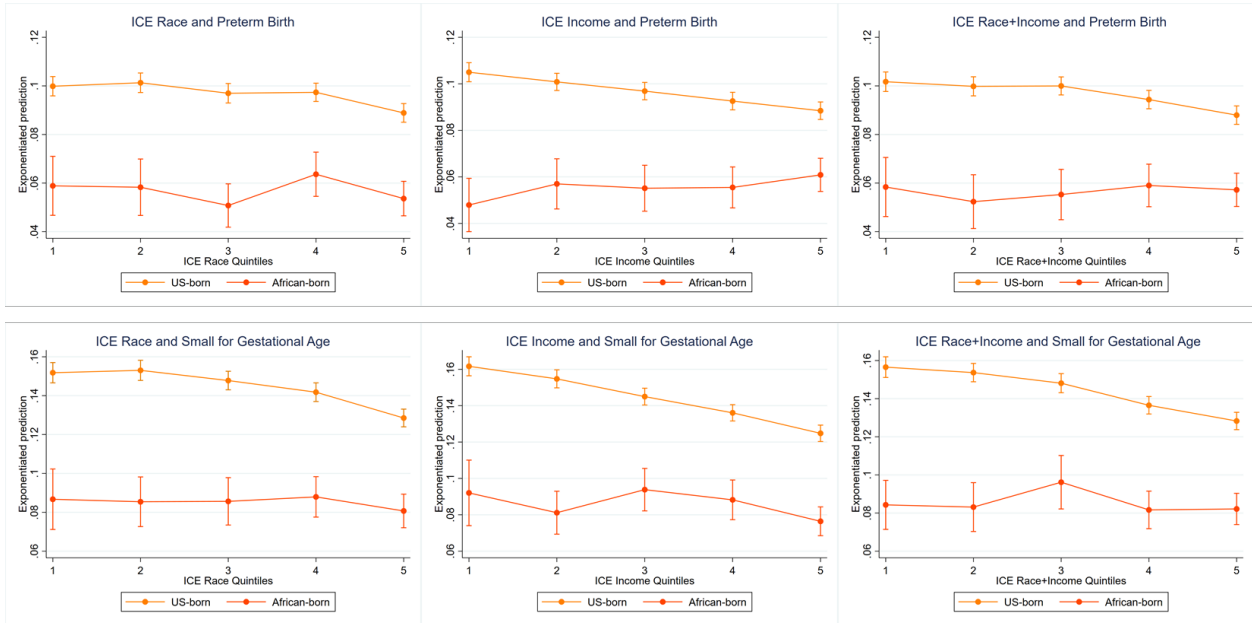
Figure 2.3. Predicted probabilty of preterm birth and small for gestational age birth by nativity within each ICE measure

Table 2.1. Descriptive statistics of the analytical sample stratified by nativity of Black women in California, 2011-2017

	US-born (n=118,780)		African-born (n=12,711)	
	n	%[b]	n	%[b]
Age at childbirth				
Less than 35 years	102,783	86.5	8,597	67.6
35+ years	15,997	13.4	4,114	32.3
Parity				
Nulliparous	45,451	38.2	4,370	34.3
Multiparous	73,211	61.6	8,327	65.5
Highest level of completed education				
Less than high school	16,856	14.1	741	5.8
High school diploma	39,550	33.3	2,526	19.8
Some college or higher	59,518	50.1	8,757	68.8
Expected payer for childbirth				
Not Medi-Cal	48,769	41	6,786	53.3
Medi-Cal	70,011	58.9	5,925	46.6
Pre-existing or gestational hypertension	11,489	10.3	969	7.85
Pre-existing or gestational diabetes	10,675	8.9	1,589	12.5
Percent of neighborhood in high poverty[a]	12,635	10.6	574	4.5
Preterm birth	11,537	9.7	721	5.6
Small for gestational age	17,278	14.5	1,067	8.3

[a]High poverty is defined as living in an area ≥ 90th percentile of all tracts living below the federal poverty line
[b]Proportions may not add to 100% due to omission of missing data

Table 2.2. Risk ratios and 95%CI for generalized estimating equation models predicting the risk of preterm birth and small for gestational age birth among US-born and African-born Black women, 2011-2017

Maternal nativity	Preterm birth		Small for gestational age	
	Model 1[a]	Model 2[b]	Model 1[a]	Model 2[b]
US-born	1.70 (1.57, 1.83)	1.81 (1.67-1.95)	1.70 (1.60-1.81)	1.67 (1.57-1.77)
African-born	Ref.	Ref.	Ref.	Ref.

[a] Model 1 unadjusted
[b] Model 2 adjusted for advanced maternal age at childbirth

Table 2.3. Risk ratios and 95% confidence intervals from generalized estimating equation models predicting preterm birth and small for gestational age among all Black women within measures of structural racism, 2011-2017

	ICE Race		ICE Income		ICE Race+Income	
	Preterm birth	Small for gestational age	Preterm birth	Small for gestational age	Preterm birth	Small for gestational age
Q1 (highest marginalization)	1.12 (1.05-1.19)	1.18 (1.12-1.24)	1.18 (1.12-1.25)	1.29 (1.23-1.35)	1.15 (1.09-1.22)	1.22 (1.16-1.28)
Q2	1.13 (1.07-1.20)	1.19 (1.13-1.25)	1.14 (1.07-1.20)	1.23 (1.18-1.30)	1.13 (1.07-1.20)	1.19 (1.14-1.25)
Q3	1.09 (1.02-1.15)	1.14 (1.09-1.20)	1.09 (1.03-1.16)	1.16 (1.10-1.21)	1.13 (1.07-1.20)	1.15 (1.09-1.21)
Q4	1.09 (1.03-1.16)	1.10 (1.05-1.15)	1.04 (0.98-1.11)	1.09 (1.03-1.14)	1.07 (1.01-1.13)	1.06 (1.01-1.11)
Q5 (highest privilege)	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
ICE Race*Nativity					-	-
Q1 (highest marginalization)	0.58 (0.47-0.72)	0.57 (0.47-0.68)	-	-	-	-
Q2	0.57 (0.46-0.70)	0.55 (0.48-0.64)	-	-	-	-
Q3	0.52 (0.43-0.62)	0.57 (0.50-0.67)	-	-	-	-
Q4	0.65 (0.56-0.75)	0.62 (0.54-0.70)	-	-	-	-
Q5 (highest privilege)	0.60 (0.52-0.69)	0.62 (0.56-0.70)	-	-	-	-
ICE Income*Nativity	-	-				
Q1 (highest marginalization)	-	-	0.45 (0.35-0.58)	0.56 (0.46-0.69)	-	-
Q2	-	-	0.56 (0.46-0.68)	0.52 (0.45-0.60)	-	-
Q3	-	-	0.56 (0.47-0.68)	0.64 (0.56-0.73)	-	-
Q4	-	-	0.59 (0.50-0.70)	0.64 (0.57-0.73)	-	-
Q5 (highest privilege)	-	-	0.68 (0.60-0.77)	0.61 (0.54-0.68)	-	-
ICE Race+Income*Nativity						
Q1 (highest marginalization)	-	-	-	-	0.57 (0.46-0.71)	0.53 (0.46-0.62)
Q2	-	-	-	-	0.52 (0.42-0.65)	0.54 (0.46-0.63)
Q3	-	-	-	-	0.55 (0.45-0.66)	0.64 (0.55-0.75)
Q4	-	-	-	-	0.62 (0.53-0.73)	0.59 (0.52-0.67)
Q5 (highest privilege)	-	-	-	-	0.65 (0.57-0.73)	0.64 (0.57-0.71)

Appendix Text 2.1.ICE measures calculations

ICE is computed as the ratio of the difference between the privileged and marginalized extremes divided by the total population within the census tract. For every i^{th} census tract, ICE is computed as:

$$ICE_i = \frac{A_i - P_i}{T_i}$$

The table below provides the definition of A_i, P_i, and T_i for each ICE measure. The data used to compute all ICE measures were obtained from the American Community Survey.

	ICE Race	ICE Income	ICE Race+Income
Ai	Number of White individuals	Number of individuals with household income ≥ $100,000	Number of White individuals with household income ≥ $100,000
Pi	Number of Black individuals	Number of individuals with household income ≤ $25,000	Number of Black individuals with household income ≤ $25,000
Ti	Total census tract population	Total census tract population	Total census tract population

Appendix Figure 2.2. Directed Acyclic Graph
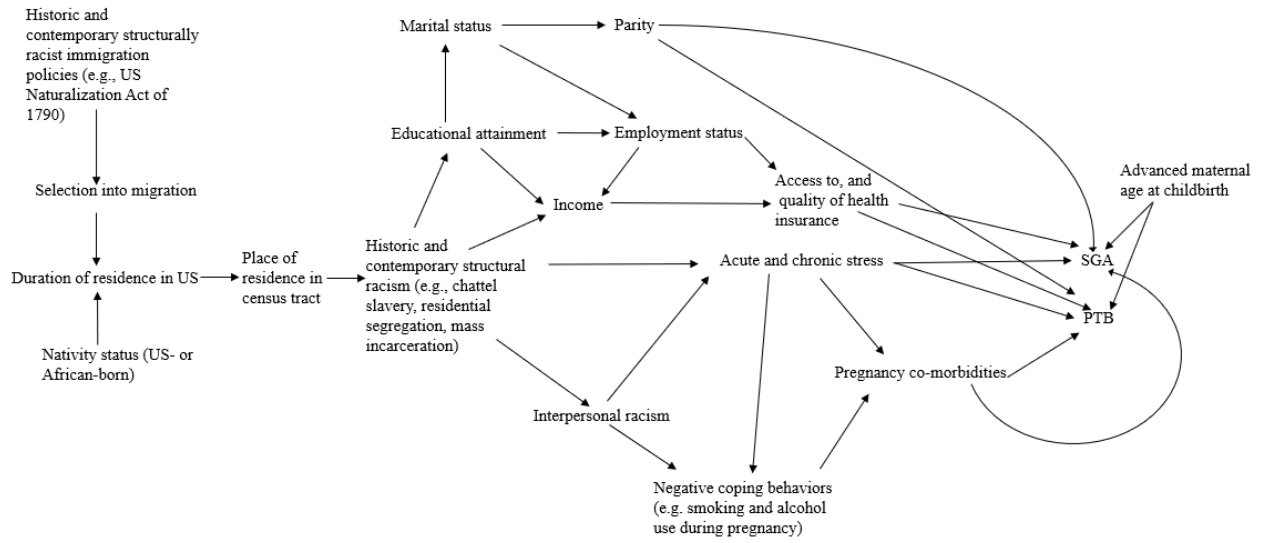
Abbreviations: PTB=Preterm birth; SGA=Small for gestational age; US: United States.

Appendix Table 2.3. Country of origin for African-born women in the sample

Country of birth	Frequency	Percent
NIGERIA	3,559	28.0
ETHIOPIA	2,854	22.5
SOMALIA	1,102	8.7
KENYA	759	6.0
ERITREA	754	5.9
GHANA	541	4.3
SUDAN	490	3.9
CAMEROON	397	3.1
UGANDA	390	3.1
DR CONGO	265	2.1
LIBERIA	225	1.8
SIERRA LEONE	223	1.8
IVORY COAST	111	0.9
SENEGAL	101	0.8
SOUTH AFRICA	97	0.8
TANZANIA	95	0.8
COMOROS	67	0.5
ZIMBABWE	67	0.5
GAMBIA	58	0.5
ZAMBIA	57	0.5
RWANDA	45	0.4
MALI	44	0.4
CONGO	41	0.3
GUINEA	36	0.3
TOGO	34	0.3
BENIN	32	0.3
MOROCCO	26	0.2
ANGOLA	25	0.2
BURKINA FASO	25	0.2
TUNISIA	22	0.2
BURUNDI	21	0.2
MALAWI	18	0.1
DJIBOUTI	16	0.1
EGYPT	15	0.1
CAPE VERDE	12	0.1
ALGERIA	11	0.1
CENTRAL AFRICAN REPUBLIC	10	0.1
GABON	10	0.1
BOTSWANA	9	0.1
NAMIBIA	8	0.1
CHAD	7	0.1

Country of birth	Frequency	Percent	
NIGER	7	0.1	
MOZAMBIQUE	6	0.1	
MADAGASCAR	5	0.0	
GUINEA-BISSAU	<5	0.0	
EQUATORIAL GUINEA	<5	0.0	
MAURITANIA	<5	0.0	
SEYCHELLES	<5	0.0	
LESOTHO	<5	0.0	
MAURITIUS	<5	0.0	
SAO TOME	<5	0.0	
Total	12,711		100

Appendix Table 2.4. Results of descriptive and inferential statistical analyses stratified by top three countries of origin

	Nigeria-born		Ethiopia-born		Somalia-born	
	n	%[+]	n	%[+]	n	%[+]
Age at childbirth						
Less than 35	2,406	67.6	1,850	64.8	837	75.9
35+ years	1,153	32.4	1,004	35.1	265	24
Parity						
Nulliparous	1,140	32	1,131	39.6	178	16.1
Multiparous	2,416	67.8	1,718	60.2	922	83.6
Highest level of completed education						
Less than high school	22	0.6	162	5.6	260	23.5
High school diploma	335	9.4	847	29.6	312	28.3
Some college or higher	3,093	86.9	1,684	59	347	31.4
Expected payer for childbirth						
Not Medi-Cal	2,368	66.5	1,396	48.9	207	18.7
Medi-Cal	1,191	33.4	1,458	51	895	81.2
Pre-existing or gestational hypertension	272	7.9	220	7.8	51	4.7
Pre-existing or gestational diabetes	330	9.2	434	15.2	168	15.2
Percent of neighborhood in high poverty*	84	2.3	143	5	155	14
Preterm birth	205	5.7	144	5	50	4.5
Small for gestational age	249	7	185	6.4	114	10.3

*High poverty is defined as living in an area ≥ 90th percentile of all tracts living below the federal poverty line
+Proportions may not add to 100% due to omission of missing data

Appendix Table 2.5. Risk ratios and 95%CI for models predicting the risk of preterm birth and small for gestational age birth among US-, Nigeria-, Ethiopia-, and Somalia-born Black women, 2011-2017

	Preterm birth	Small for gestational age birth
Nigeria-born	0.59 (0.52-0.68)	0.49 (0.43-0.55)
Ethiopia-born	0.52 (0.44-0.61)	0.45 (0.39-0.52)
Somalia-born	0.46 (0.34-0.61)	0.72 (0.61-0.84)
US-born	Ref.	Ref.

Appendix Table 2.6. Categorical distribution of ICE variables within each African country of origin

	Nigeria-born		Ethiopia-born		Somalia-born	
	n	%	n	%	n	%
ICE race quintile						
1 (highest marginalization)	607	17	373	13	53	4.8
2	581	16.3	413	14.4	442	40.1
3	685	19.2	444	15.5	185	16.7
4	771	21.6	671	23.5	252	22.8
5 (highest privilege)	913	25.6	953	33.3	170	15.4
ICE income quintile						
1 (highest marginalization)	219	6.2	369	12.9	237	21.5
2	550	15.5	420	14.7	243	22.05
3	649	18.3	461	16.1	208	18.8
4	756	21.3	635	22.2	200	18.1
5 (highest privilege)	1,360	38.4	969	33.9	214	19.4
ICE race+income quintile						
1 (highest marginalization)	491	13.8	393	13.7	160	14.5
2	456	12.9	386	13.5	307	27.86
3	608	17.2	372	13	165	14.9
4	782	22.1	652	22.8	250	22.6
5 (highest privilege)	1,197	33.8	1,051	36.8	220	19.9

Appendix Table 2.7. Mean percentage of Black foreign-born residents by quintiles of structural racism, stratified by African country of origin

	Nigeria-born Mean±SD	Ethiopia-born Mean±SD	Somalia-born Mean±SD
ICE Race			
Q1 (highest marginalization)	3.71 ±2.73	5.32 ±4.79	5.92 ±4.5
Q2	1.97 ±1.91	4.42 ±4.40	5.38 ±4.19
Q3	0.88 ±1.21	2.03 ±2.63	2.77 ±2.65
Q4	0.81 ±1.20	1.72 ±2.19	1.33 ±1.88
Q5 (highest privilege)	0.51 ±0.84	1.08 ±1.64	0.91 ±1.64
ICE Income			
Q1 (highest marginalization)	2.15 ±2.25	5.79 ±5.59	5.68 ±4.54
Q2	2.42 ±2.65	3.28 ±3.49	5.40 ±3.87
Q3	1.53 ±1.87	2.37 ±2.50	3.00 ±2.83
Q4	1.09 ±1.54	1.88 ±2.19	1.38 ±1.84
Q5 (highest privilege)	1.05 ±1.71	1.13 ±1.88	0.62 ±0.89
ICE Race+Income			
Q1 (highest marginalization)	3.42 ±2.78	5.70 ±4.97	6.45 ±3.72
Q2	1.97 ±1.85	3.86 ±4.11	5.52 ±4.30
Q3	1.57 ±2.20	2.03 ±2.36	2.47 ±2.49
Q4	0.91 ±1.35	1.82 ±2.25	1.66 ±2.12
Q5 (highest privilege)	0.67 ±1.02	1.16 ±1.88	0.66 ±1.18

Appendix Table 2.8. Mean percentage of Black foreign-born residents by quintiles of structural racism

ICE Race	Mean±SD
Q1 (highest marginalization)	2.06 ±2.37
Q2	1.22 ±1.86
Q3	0.67 ±1.14
Q4	0.62 ±1.10
Q5 (highest privilege)	0.48 ±0.90
ICE Income	
Q1 (highest marginalization)	1.15 ±2.21
Q2	1.08 ±1.78
Q3	0.98 ±1.42
Q4	0.90 ±1.31
Q5 (highest privilege)	0.92 ±1.50
ICE Race+Income	
Q1 (highest marginalization)	1.79 ±2.37
Q2	1.10 ±1.72
Q3	0.79 ±1.41
Q4	0.70 ±1.20
Q5 (highest privilege)	0.65 ±1.10

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Chapter 3: Clinical risk factors and adverse perinatal outcomes for U.S. and African-born Black women in California

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ABSTRACT

Objective

To examine the association between clinical risk factors for preterm birth (PTB) and small for gestational age childbirth (SGA) among US- and African-born Black women.

Study design

Population-based cohort study of singleton non-anomalous live births to 171,051 US- and 19,269 African-born Black women living in California in 2011-2020. Associations of PTB and SGA with preexisting and gestational diabetes, preexisting and gestational hypertension, infections, anemia, sickle cell anemia, mental disorders, alcohol/drug use, tobacco use, asthma, and history of PTB were examined. Poisson regression models were fit adjusted for socio-demographic characteristics to estimate the association between clinical factors and outcomes while assessing interaction by maternal nativity.

Results

The prevalence of PTB, SGA, and all clinical risk factors was greater among US-born Black women, with the exception of gestational diabetes where the prevalence was 11.8% (95%CI 11.3-12.3) compared to 7.7 % (95%CI 7.6-7.8) (African- compared to US-born Black women).

On average, the risk of PTB and SGA among women with each clinical factor was significantly higher for African- compared to US-born Black women.

Conclusion

The prevalence of clinical risk factors for PTB and SGA was generally higher among US-born Black women, however associations between each clinical risk factor and adverse perinatal outcomes were higher for African-born Black women suggesting that clinical factors do not explain nativity-based disparities in adverse perinatal outcomes. Differences in non-clinical factors by maternal nativity, such as experiences of racism across the life course should be further explored as drivers of disparities in adverse perinatal outcomes in Black women.

INTRODUCTION

Globally, preterm birth (PTB) and small for gestational age (SGA) birth are major contributors to neonatal and infant death, and are associated with several long-term health consequences, including learning disabilities, cerebral palsy, and chronic disease in adulthood.[1–4] In the United States (US), there are stark racial disparities in the rates of PTB and SGA wherein Black women are up to 1.5 times as likely to have a PTB or give birth to a SGA infant compared to white women.[5,6]

Stratification of the rates of PTB and SGA among Black women by maternal nativity reveals a higher risk of these outcomes among US-born Black women compared to foreign-born Black women.[7,8] In particular, Sub-Saharan African-born Black women have the lowest risk compared to US-born Black women.[8,9] It has been suggested that the maternal nativity-based inequities may be explained by differences in the prevalence of clinical factors for PTB and SGA.[8,10]

Past research has found that the prevalence of clinical risk factors differs significantly by maternal nativity, as US-born Black women are generally found to have a higher prevalence of clinical risk factors than foreign-born Black women.[8,11,12] However, the majority of these studies were conducted using small study samples, were limited in terms of the scope of clinical factors, and were conducted using samples of US-born and primarily Caribbean-born immigrants.[10–13] As such, the previous findings may not generalize to samples where the Black immigrant population is largely African-born.[9,14] Moreover, it is unclear whether the effect of clinical factors on the risk of adverse perinatal outcomes is uniform across maternal nativity. In the present study, we examine the association between a wide range of clinical factors for PTB and SGA among African- and US-born Black women residing in California at the time of birth.

METHODS

We took a population-based approach, utilizing data for births to all Black women in the state of California from 2011-2020 (n=239,931). We limited our sample to all singleton non-anomalous live births with viable gestational age (i.e., between 20-43 weeks) to Black women with maternal nativity information for a final sample of 194,320 women. Birth certificate data was linked to hospital discharge and emergency department admission data maintained by the California Office of Statewide Health Planning and Development (OSHPD) to ascertain clinical diagnoses and procedures occurring before or during pregnancy, childbirth, and the postpartum period.

We identified 14 clinical factors previously associated an increased risk of PTB and SGA: preexisting diabetes mellitus, gestational diabetes, preexisting hypertension with and without progression to preeclampsia, gestational hypertension with and without progression to preeclampsia, infections complicating pregnancy, anemia, sickle cell anemia, mental disorders complicating pregnancy, alcohol or illicit substance use, tobacco use, asthma, and history of PTB using diagnosis and procedural codes from the 9th and 10th edition of the International Classification of Diseases (ICD-9 and ICD-10) (**Appendix table 3.1**).

PTB was defined as birth at less than 37 weeks of gestation, and SGA was defined per Talge et al. as a birthweight in less than the 10th percentile for an infant's sex and gestational age at birth.[15] Maternal nativity was identified on the infant birth certificate as either US-born if maternal birthplace was among the 48 adjoining states, Alaska, the District of Columbia, or Hawaii, and African-born if their birthplace was a country on the African continent.

We included several socio-demographic characteristics in our analysis including maternal age (less than 18 years, 18-34 years, 34+ years), maternal highest level of completed education (less than high school, high school diploma, some college or higher), as well as insurance coverage for

childbirth (Medi-Cal or not Medi-Cal). Medi-Cal is California's governmental Medicaid health care program which covers the cost of medical care for low-income families.[16] Moreover, we considered maternal participation in the federal Special Supplemental Nutrition Program for Women, Infant and Children (WIC), parity (nulliparous or multiparous), and adequacy of prenatal care was assessed using the Kotelchuck categories: inadequate, intermediate, adequate, and adequate plus.[17]

We computed the prevalence and 95% confidence intervals (95%CI) of the outcomes, clinical factors and socio-demographic characteristics, stratified by maternal nativity. We then computed prevalence differences (PD), comparing the prevalence of each factor among US-born Black women to African-born Black women. In addition, we computed the proportion of PTB and SGA among those with and without each clinical risk factor in the US- and African-born populations, respectively.

We fit two modified Poisson regression models with robust standard errors[18] predicting the risk of PTB and SGA uniquely among US- and African-born Black women as a function of each of the 14 clinical risk factors. The regression models were stratified by nativity to evaluate potential heterogeneity for US and African-born groups. Furthermore, we re-fit the adjusted model for each clinical factor in the entire sample, including an interaction term between each clinical factor and maternal nativity to test for potential significant heterogeneity in the risk of the PTB and SGA. The first model was crude, while the second adjusted for all socio-demographic characteristics. We report the risk ratios (RR) and 95%CI for both models.

All statistical analyses were carried out in Stata v17.1 (StataCorp LLC, College Station, TX) This study was approved by the Committee for the Protection of Human Subjects within the Health and Human Services Agency of the State of California.

RESULTS

Our study included 171,051 US-Born and 19,269 African-born Black women. The prevalence of PTB was 9.8% (95%CI 9.6-9.9) among US-born Black women and 5.7% (95%CI 5.4-6.0) among African-born Black women (**Table 3.1**).

Clinical outcomes

The most prevalent clinical factor in the study population was anemia, as it was observed in nearly a quarter of the US-born (24.6%; 95%CI 24.4-24.8) and African-born pregnancies (22.8%; 95%CI 22.2-23.4). The least prevalent clinical risk factor for US-born Black women was sickle cell anemia (0.5%; 95%CI 0.4-0.5), while among African-born Black women sickle cell anemia (0.4%; 95%CI 0.4-0.6) and alcohol or illicit drug use during pregnancy (0.4%; 95%CI 0.3-0.5) were the two least prevalent factors. On average, US-born Black women had a higher prevalence of clinical risk factors. For example, the prevalence of infections complicating pregnancy was 11.4 (95%CI 10.9, 11.8) percentage points higher among US-born Black women compared to African-born Black women (21.2% versus 9.8%). There was one exception as US-born Black women had a lower prevalence of gestational diabetes (-4.1 (95%CI -4.5, -3.6) percentage points in US- compared to African-born Black women (7.7% versus 11.8%).

Socio-demographic characteristics

Among both US- and African-born Black women, there were high proportions of women aged 18-34 years, who had completed some college or higher, were multiparous, had normal weight before pregnancy and had adequate prenatal care (**Table 3.2**). Compared to US-born Black women, less African-born Black women had Medi-Cal cover the costs of childbirth (46.7

compared to 58.3%; PD 11.6 (95%CI 10.8, 12.3) and a smaller proportion were WIC recipients (48.6 compared to 69.5%, PD 20.9 (95%CI 20.0, 21.6)).

Risk of PTB

The proportion of PTB was higher among US-born Black women with each clinical factor, compared to US-born Black women without the clinical factor (**Appendix Table 3.2**). Among US-born Black women, we found that each clinical risk factor was associated with an increased risk for PTB (comparing those with and without the clinical risk factor) (**Table 3.3**). For instance, US-born Black women with preexisting diabetes mellitus had 2.3 (95%CI 2.1-2.5) times the risk of PTB, compared to US-born Black women who did not have preexisting diabetes mellitus. Overall, increased risk of PTB was highest for US-born Black women who had preexisting hypertension with progression to preeclampsia aRR 4.7 (95%CI 4.4-4.9).

An analogous pattern was observed among the African-born Black women, as the presence of each clinical factor led to an increased risk of PTB, compared to African-born Black women without each clinical factor (**Table 3.3**). In all of the unadjusted and adjusted regression models, the risk of PTB was significantly higher among African-born Black women with each clinical factor, compared to those who did not have each clinical factor. Similar to the findings among US-born Black women, preexisting hypertension with progression to preeclampsia incurred the highest risk of PTB (aRR 6.3; 95%CI 4.9-8.1) among African-born Black women.

While the aRRs for PTB among US- and African-born Black women overall indicated that each clinical factor increased the risk of PTB, the results of the test for interaction between maternal nativity and each clinical factor revealed that that the risk of preexisting hypertension with progression to preeclampsia (*p*<0.001), gestational hypertension with and without progression to

preeclampsia (both *p*<0.001), infections complicating pregnancy (*p*=0.01), sickle cell anemia (*p* =0.02), tobacco use (*p*=0.004), and previous PTB (*p*<0.001) were all significantly higher among African-born Black women, compared to US-born Black women.

Risk of SGA

On average, the proportion of SGA was higher for US- and African-born Black women with each clinical factor compared to US- and African-born Black women without each clinical factor respectively, with the exception of preexisting diabetes mellitus, gestational diabetes, and anemia (**Appendix Table 3.3**). Accordingly, the presence of preexisting diabetes mellitus, gestational diabetes, and anemia were linked to slightly reduced risks of the outcomes among US- and African-born Black women (**Table 3.4**).

Among US-born Black women, preexisting hypertension (aRR 1.7; 95%CI 1.5,1.8) and gestational hypertension with progression to preeclampsia (aRR 1.7; 95%CI 1.6-1.8) were both associated with the highest adjusted risks of SGA, compared to US-born Black women who did not have these clinical factors. A comparable trend was observed among African-born Black women, wherein those who had preexisting hypertension with progression to preeclampsia had the highest risk (aRR 2.8; 95%CI 2.0, 3.9) of SGA, compared to African-born Black women who did not have this clinical factor.

In the fully adjusted model predicting the risk of SGA among all women in the sample, we found significant interactions between the following clinical exposures and maternal nativity: preexisting (*p*=0.002) hypertension and gestational hypertension with progression to preeclampsia (*p*<0.001), mental disorders complicating pregnancy (*p*=0.004), and previous PTB (*p*=0.01).

DISCUSSION

In this population-based study, we found that the prevalence of PTB and SGA was higher among US-born Black women compared to African-born Black women. Similarly, on average, US-born Black women had a higher prevalence of clinical factors associated with PTB and SGA, compared to African-born Black women. Generally, the clinical factors were associated with larger heightened risks among African-born compared to US-born Black women as estimated through their larger RR point estimates. This finding persisted after adjustment for socio-demographic characteristics.

Our work echoes previously published nativity studies of adverse perinatal outcomes, which have found that, on average, foreign-born Black women have a lower prevalence of clinical risk factors for PTB and SGA, with the exception of gestational diabetes.[8,19–22] For example, Kwapong et al. studied factors related to PTB among US- and foreign-born Non-Hispanic Black women in the Boston Birth Cohort (1998-2016) and found that the foreign-born Black women had a higher prevalence of gestational diabetes (7.3%) than their US-born counterparts (4.8%).[19] Elo et al. used 2008 birth certificate data from 27 states and found a lower prevalence (4.8%) of preexisting or gestational hypertension among African-born Black women compared to 7.3% among US-born Black women.[8]

Some of our findings contrast with previous research. In their 1999-2004 Philadelphia-based study of health behaviors among US-, African-, and Caribbean-born Black women, Elo and Culhane found that African-born Black women had a slightly higher prevalence (22.6%) of depressive symptoms than US-born Black women (21.7%).[11] This divergence from our results may be due in part to their study sample which had a smaller sample of African-born Black women (n=106), and their administration of the Center for Epidemiologic Studies Depression

72

Scale to measure depressive symptoms, whereas we defined the presence of mental disorders complicating pregnancy using a clinical diagnosis which is likely an underestimate.

Past research suggests that the lower prevalence of clinical risk factors for PTB and SGA among African-born Black women may be due in part to the healthy immigrant effect and self-selection into migration.[24,25] The healthy immigrant effect occurs when African immigrant populations are healthier, wealthier, and more resilient than their peers in their country of origin, which allows them to self-select into migration and will in turn lead to lower risks of adverse health outcomes compared to their Black counterparts in the US, despite the risks associated with migration and initial barriers to health care access upon arrival in the US.[23,24] Selection into migration is highly probable in our sample as the prevalence of clinical risk factors was higher on average in Sub-Saharan African countries than in our study population. For example, it is estimated that preexisting hypertension occurs in approximately 8% of pregnancies in Sub-Saharan Africa[25], compared to 1.7% (without progression to preeclampsia) and 1.3% (with progression to preeclampsia) in our study population, suggesting that on average the African-born Black women in our sample are healthier than their counterparts who still reside in Africa.

Nativity differences in the prevalence of clinical risk factors in US- compared to African-born women may also be the result of cumulative exposure to racism across the life course, which is thought to increase acute and chronic stress, leading to "wear and tear" on the bodies of Black women, and has been previously linked to an increased risk of PTB and SGA.[26–30] It has been proposed that higher lifetime exposure to anti-Black racism in the US may lead to higher stress levels and consequently a higher prevalence of clinical risk factors among US-born Black women, compared to African-born Black women.[10,12] Scholars have found that the prevalence of clinical risk factors increases among foreign-born Black women as time in the US increases,

73

eventually mirroring the prevalence among US-born Black women, which may be due in part to additional exposure to anti-Black racism in the US over time.[10,12] Our data suggest that exposure to racism should be studied as a core driver of differences in the prevalence of clinical risk factors for adverse perinatal outcomes between US- and African-born Black women.

Although the prevalence of clinical factors was lower on average for African-born Black women as compared to US-born Black women in our study, the associations between clinical factors and the increased risk of adverse perinatal outcomes were stronger among African-born Black women. This may reflect higher experiences of racial discrimination during pregnancy among African-born Black women who have high risk pregnancies. Further studies are needed to document experiences of racial discrimination among high-risk pregnant and postpartum African-born Black women in the US to further explore this hypothesis. Overall, our findings suggest that differences in the estimated impact of clinical factors alone cannot explain the differences in adverse perinatal outcomes between US-born and African-born Black women.

This study had several strengths, including use of a large population-based cohort with high-quality diagnostic and clinical procedure data to study clinical factors such as anemia and asthma which have been understudied in the context of maternal nativity and adverse perinatal outcomes.[31,32] Several limitations also deserve consideration, including the inability to account for years since immigration to the US and naturalization status for the African-born Black women, which are known effect modifiers of the relationship between maternal nativity and adverse perinatal outcomes.[12,24] Furthermore, we were unable to conduct stratified analyses by spontaneous or provider-initiated PTB due to small cell sizes in the African-born population.

CONCLUSION

In summary, in this retrospective population-based cohort study of clinical factors associated with the risk of PTB and SGA among Black women in California from 2011-2020, we found that US-born Black women had a higher prevalence of clinical risk factors than did African-born Black women, with the exception of gestational diabetes. The presence of each clinical factor had a stronger influence on the risk of PTB and SGA for African-born Black women, suggesting the presence of other factors (e.g., structural racism) may heighten the risk of PTB and SGA among US-born Black women. Future studies of the role of maternal nativity and clinical factors for adverse perinatal outcomes among Black women should aim to include measures of racial discrimination across the life course as they may help to contextualize findings.

Table 3.1. Prevalence of preterm birth, small for gestational age birth, and clinical factors of the sample stratified by maternal nativity, 2011-2020

	US-born (n=175,051)		African-born (n=19,269)		Prevalence difference (95%CI)
	n	% (95%CI)	n	% (95%CI)	
Clinical outcomes					
Preterm birth	17,205	9.8 (9.6, 9.9)	1,110	5.7 (5.4, 6.0)	4.1 (3.7, 4.4)
Small for gestational age birth	24,493	14.5 (14.3, 14.7)	1,607	8.3 (7.9, 8.7)	6.2 (5.7, 6.6)
Clinical factors					
Preexisting diabetes mellitus	2,949	1.8 (1.7, 1.8)	258	1.5 (1.3, 1.7)	0.3 (0.1, 0.5)
Gestational diabetes	13,304	7.7 (7.6, 7.8)	2,251	11.8 (11.3, 12.3)	-4.1 (-4.5, -3.6)
Preexisting hypertension without progression to preeclampsia	6,599	4.3 (4.2, 4.4)	303	1.7 (1.5, 1.9)	2.6 (2.4, 2.8)
Preexisting hypertension with progression to preeclampsia	3,781	2.5 (2.4, 2.6)	235	1.3 (1.2, 1.5)	1.2 (1.0, 1.3
Gestational hypertension without progression to preeclampsia	9,389	6.1 (6.0, 6.2)	671	3.8 (3.5, 4.1)	2.3 (2.0, 2.6)
Gestational hypertension with progression to preeclampsia	9,904	6.4 (6.3, 6.5)	1,052	5.8 (5.5, 6.2)	0.6 (0.2, 0.9)
Infections complicating pregnancy	37,203	21.2 (21.0, 21.4)	1,892	9.8 (9.4, 10.2)	11.4 (10.9, 11.8)
Anemia	43,099	24.6 (24.4, 24.8)	4,395	22.8 (22.2, 23.4)	1.8 (1.1, 2.4)
Sickle cell anemia	887	0.5 (0.4, 0.5)	95	0.4 (0.4, 0.6)	0.01 (-0.01, 0.01)
Mental disorder complicating pregnancy	25,762	14.7 (14.5, 14.8)	638	3.3 (3.0, 3.5)	11.4 (11.1, 11.7)
Alcohol or illicit drug use	12,820	7.3 (7.2, 7.4)	86	0.4 (0.3, 0.5)	6.9 (6.7, 7.0)
Tobacco use	14,954	8.5 (8.4, 8.6)	101	0.5 (0.4, 0.6)	8.0 (7.8, 8.1)
Asthma	25,934	14.8 (14.6, 14.9)	515	2.6 (2.4, 2.9)	12.2 (11.8, 12.4)
Previous preterm birth *	3,744	3.4 (3.3, 3.5)	213	1.6 (1.4, 1.9)	1.8 (1.5, 1.9)

Abbreviations: CI=Confidence Interval;
* Proportions are computed uniquely among multiparous women

Table 3.2. Prevalence of socio-demographic factors of the sample stratified by maternal nativity, 2011-2020

	US-born (n=175,051)		African-born (n=19,269)		Prevalence difference (95%CI)
	n	% (95%CI)	n	% (95%CI)	
Maternal age					
Less than 18 years	3,905	2.2 (2.1, 2.3)	20	0.1 (0.0, 0.1)	2.1 (2.0, 2.2)
18-34 years	145,984	83.3 (83.2, 83.5)	12,688	65.8 (65.1, 66.5)	17.5 (16.8, 18.2)
34+ years	25,155	14.3 (14.2, 14.5)	6,561	34.0 (33.3, 34.7)	-19.7 (-20.3, -18.9)
Maternal education					
Less than high school	23,299	13.6 (13.5, 13.8)	1,117	6.1 (5.7, 6.4)	7.5 (7.1, 7.9)
High school diploma	58,670	34.4 (34.2, 34.6)	3,747	20.4 (19.9, 21.0)	14.0 (13.3, 14.5)
Some college or higher	88,359	51.8 (51.6, 52.1)	13,416	73.3 (72.7, 74.0)	-21.5 (-22.1, -20.8)
Insurance coverage for childbirth					
Not Medi-Cal	72,948	41.6 (41.4, 41.9)	10,262	53.2 (52.5, 53.9)	-11.6 (-12.3, -10.8)
Medi-Cal	102,102	58.3 (58.0, 58.5)	9,007	46.7 (46.0, 47.4)	11.6 (10.8, 12.3)
WIC recipient	100,554	69.5 (69.2, 69.7)	7,671	48.6 (47.8, 49.4)	20.9 (20.0, 21.6)
Parity					
Nulliparous	66,080	37.7 (37.5, 38.0)	6,555	34.0 (33.3, 34.7)	3.7 (3.0, 4.4)
Multiparous	108,794	62.2 (61.9, 62.4)	12,696	65.9 (65.2, 66.6)	-3.7 (-4.4, -3.0)
Pre-pregnancy BMI					
Underweight	6,201	3.7 (3.6, 3.7)	705	3.8 (3.5, 4.1)	-0.1 (-0.4, 0.1)
Normal weight	60,641	36.2 (35.9, 36.4)	8,228	45.1 (44.4, 45.8)	-8.9 (-9.7, -8.1)
Overweight	43,798	26.1 (25.9, 26.3)	5,845	32.0 (31.4, 32.7)	-5.9 (-6.6, -5.2)
Obese	56,812	33.9 (33.7, 34.1)	3,443	18.9 (18.3, 19.4)	15.0 (14.4, 15.6)
Adequacy of prenatal care					
Inadequate	27,492	16.2 (16.0, 16.4)	2,988	15.9 (15.4, 16.5)	0.3 (-0.2, 0.8)
Intermediate	29,093	17.2 (17.0, 17.3)	3,573	19.1 (18.5, 19.7)	-1.9 (-2.5, -1.3)
Adequate	68,490	40.5 (40.2, 40.7)	7,691	41.1 (40.4, 41.8)	-0.6 (-0.1, 0.1)
Adequate plus	43,912	25.9 (25.7, 26.1)	4,425	23.6 (23.0, 24.3)	2.3 (1.6, 2.9)

Abbreviations: BMI=Body Mass Index; WIC: Women's Infant and Children Supplemental Nutrition Plan

Table 3.3. Risk ratios and 95%CI from modified Poisson regression models predicting preterm birth among US- and African-born Black women in California, 2011-2020

	US-born		African-born		
	RR (95%CI)	aRR[a] (95%CI)	RR (95%CI)	aRR[a] (95%CI)	P-value[b]
Preexisting diabetes mellitus	2.8 (2.6, 2.9)	2.3 (2.1, 2.5)	2.7 (2.0, 3.7)	2.0 (1.3, 3.1)	0.84
Gestational diabetes	1.5 (1.4, 1.6)	1.4 (1.3, 1.5)	1.4 (1.2, 1.7)	1.1 (0.9, 1.4)	0.32
Preexisting hypertension without progression to preeclampsia	1.8 (1.6, 1.9)	1.5 (1.4, 1.7)	2.6 (1.9, 3.7)	1.9 (1.2, 3.0)	0.14
Preexisting hypertension with progression to preeclampsia	5.5 (5.3, 5.7)	4.7 (4.4, 4.9)	8.9 (7.3, 10.6)	6.3 (4.9, 8.1)	<0.001
Gestational hypertension without progression to preeclampsia	1.2 (1.1, 1.2)	1.2 (1.1, 1.3)	2.0 (1.6, 2.6)	2.3 (1.7, 3.0)	<0.001
Gestational hypertension with progression to preeclampsia	3.3 (3.1, 3.4)	3.3 (3.1, 3.4)	5.3 (4.6, 6.0)	4.7 (4.0, 5.5)	<0.001
Infections complicating pregnancy	1.5 (1.4, 1.5)	1.4 (1.4, 1.5)	1.8 (1.6, 2.1)	1.8 (1.5, 2.1)	0.01
Anemia	1.2 (1.2, 1.3)	1.2 (1.2, 1.3)	1.4 (1.2, 1.6)	1.4 (1.2, 1.6)	0.09
Sickle cell anemia	1.7 (1.5, 2.0)	1.6 (1.3, 1.9)	2.4 (1.4, 4.0)	2.8 (1.6, 4.7)	0.02
Mental disorder complicating pregnancy	1.7 (1.6, 1.8)	1.6 (1.5, 1.6)	1.7 (1.3, 2.2)	1.5 (1.1, 2.1)	0.74
Alcohol or drug use during pregnancy	1.9 (1.8, 2.0)	1.7 (1.6, 1.8)	2.0 (1.1, 3.6)	2.0 (0.9, 4.2)	0.59
Tobacco use	1.6 (1.5, 1.7)	1.4 (1.4, 1.5)	2.6 (1.6, 4.2)	2.9 (1.8, 4.9)	0.004
Asthma	1.2 (1.2, 1.3)	1.2 (1.1, 1.2)	1.6 (1.2, 2.1)	1.3 (0.9, 1.9)	0.33
Previous preterm birth	3.2 (3.1, 3.4)	2.9 (2.7, 3.1)	5.4 (4.2, 6.8)	4.6 (3.5, 6.0)	<0.001

Abbreviations: ARR=Adjusted risk ratio; BMI=Body Mass Index; WIC: Women's Infant and Children Supplemental Nutrition Plan
[a]Models adjusted for advanced maternal age at childbirth, maternal education, insurance coverage for childbirth, pre-pregnancy BMI, adequacy of prenatal care, and WIC
[b]P-value for interaction between maternal nativity and each clinical factor

Table 3.4. Risk ratios and 95%CI from modified Poisson regression models predicting small for gestational age birth among US- and African-born Black women in California, 2011-2020

	US-born		African-born		
	RR (95%CI)	aRR[a] (95%CI)	RR (95%CI)	aRR[a] (95%CI)	*P*-value[b]
Preexisting diabetes mellitus	0.7 (0.7, 0.8)	0.8 (0.7, 0.9)	0.9 (0.6, 1.3)	0.8 (0.4, 1.6)	0.98
Gestational diabetes	0.7 (0.7, 0.7)	0.7 (0.7, 0.8)	0.8 (0.7, 0.9)	0.8 (0.7, 1.0)	0.36
Preexisting hypertension without progression to preeclampsia	1.2 (1.1, 1.3)	1.4 (1.3, 1.5)	1.5 (1.1, 2.0)	1.8 (1.2, 2.7)	0.10
Preexisting hypertension with progression to preeclampsia	1.4 (1.3, 1.5)	1.7 (1.5, 1.8)	2.5 (1.9, 3.3)	2.8 (2.0, 3.9)	0.002
Gestational hypertension without progression to preeclampsia	1.2 (1.2, 1.3)	1.3 (1.2, 1.4)	1.7 (1.4, 2.1)	1.7 (1.3, 2.2)	0.06
Gestational hypertension with progression to preeclampsia	1.6 (1.5, 1.6)	1.7 (1.6, 1.8)	2.4 (2.1, 2.8)	2.4 (2.0, 2.8)	<0.001
Infections complicating pregnancy	1.1 (1.1, 1.1)	1.0 (1.0, 1.1)	1.2 (1.0, 1.4)	1.2 (1.0, 1.4)	0.23
Anemia	0.9 (0.9, 0.9)	0.9 (0.9, 0.9)	0.9 (0.8, 1.0)	0.8 (0.7, 1.0)	0.56
Sickle cell anemia	1.4 (1.2, 1.6)	1.2 (1.0, 1.4)	1.9 (1.2, 3.0)	1.3 (0.6, 2.5)	0.79
Mental disorder complicating pregnancy	1.2 (1.2, 1.3)	1.2 (1.1, 1.2)	1.6 (1.3, 2.0)	1.7 (1.3, 2.2)	0.004
Alcohol or drug use during pregnancy	1.5 (1.5, 1.6)	1.4 (1.3, 1.4)	2.0 (1.2, 3.1)	1.6 (0.7, 3.4)	0.80
Tobacco use	1.5 (1.4, 1.5)	1.3 (1.3, 1.4)	2.4 (1.6, 3.6)	2.1 (1.2, 3.6)	0.11
Asthma	1.1 (1.0, 1.1)	1.0 (1.0, 1.1)	1.2 (0.9, 1.5)	1.2 (0.9, 1.7)	0.34
Previous preterm birth	1.3 (1.2, 1.4)	1.3 (1.2, 1.4)	1.8 (1.2, 2.6)	2.1 (1.4, 3.3)	0.01

Abbreviations: ARR=Adjusted risk ratio; BMI=Body Mass Index; WIC: Women's Infant and Children Supplemental Nutrition Plan
[a]Models adjusted for advanced maternal age at childbirth, maternal education, insurance coverage for childbirth, pre-pregnancy BMI, adequacy of prenatal care, and WIC
[b]*P*-value for interaction between maternal nativity and each clinical factor

Appendix Table 3.1. Diagnosis and procedural codes for clinical factors

	ICD-9 codes[a]	ICD-10 codes[b]
Preexisting diabetes mellitus	648.0; 250	O24.0, O24.1, O24.2, O24.3, E10, E11, E12, E13, E14
Gestational diabetes	648.8	O24.4
Preexisting hypertension without progression to preeclampsia	642.0; 642.1; 642.2	O11
Preexisting hypertension with progression to preeclampsia	642.7	O10
Gestational hypertension without progression to preeclampsia	642.3	O13
Gestational hypertension with progression to preeclampsia	642.4; 642.5; 642.6	O14.0, O14.1, O14.3, O14.9, O15
Infections complicating pregnancy	647, 646.5, 646.6	O98, O23.0, O23.1, O23.2, O23.3, O23.4
Anemia	648.2	O99.0
Sickle cell anemia	282.6, 282.41, 282.42	D57.0, D57.1, D57.2
Mental disorder complicating pregnancy	648.4	O99.3
Alcohol or drug use during pregnancy	303; 648.3, 305; 304, 648.3	F10, F11, F12, F13, F14, F15, F16, F18, F19
Smoking	649.0, 305.1	Z72.0, F17.2
Asthma	493	J45

Abbreviations=ICD: International Classification of Diseases.
[a]ICD-9 codes used for data from 2011-2015.
[b]ICD-10 codes used for data from 2016-2020.

Appendix Table 3.2. Proportion of preterm birth by clinical factor and nativity

	US-born		African-born	
	% Preterm birth		% Preterm birth	
	With risk factor	Without risk factor	With risk factor	Without risk factor
Clinical factors				
Preexisting diabetes mellitus	749/2,949 (25.4)	14,607/158,867 (9.1)	38/258 (14.7)	903/16,781 (5.3)
Gestational diabetes	1,859/13,304 (13.9)	14,604/158,829 (9.1)	172/2,251 (7.6)	900/16,763 (5.3)
Preexisting hypertension without progression to preeclampsia	915/6,599 (13.8)	11,183/143,688 (7.7)	33/303 (10.8)	701/16,927 (4.1)
Preexisting hypertension with progression to preeclampsia	1,614/3,781 (42.6)	11,176/143,703 (7.7)	86/235 (36.6)	700/16,930 (4.1)
Gestational hypertension without progression to preeclampsia	845/9,389 (9.0)	11,186/143,679 (7.7)	56/671 (8.3)	701/16,926 (4.1)
Gestational hypertension with progression to preeclampsia	2,512/9,904 (25.3)	11,173/143,658 (7.7)	230/1,052 (21.8)	700/16,916 (4.1)
Infections complicating pregnancy	4,885/37,203 (13.1)	12,320/137,847 (8.9)	183/1,892 (9.6)	927/17,377 (5.3)
Anemia	4,944/43,099 (11.4)	12,261/131,951 (9.2)	325/4,395 (7.3)	785/14,874 (5.2)
Sickle cell anemia	149/887 (16.8)	17,056/174,163 (9.7)	13/95 (13.6)	1,067/19,174 (5.7)
Mental disorder complicating pregnancy	3,896/25,762 (15.1)	13,309/149,288 (8.9)	61/638 (9.5)	1,049/18,631 (5.6)
Alcohol or drug use during pregnancy	2,227/12,820 (17.3)	14,978/162,230 (9.2)	10/86 (11.6)	1,100/19,183 (5.7)
Tobacco use	2,229/14,954 (14.9)	14,976/160,096 (9.3)	15/101 (14.8)	1,095/19,168 (5.7)
Asthma	3,044/25,934 (11.7)	14,161/149,116 (9.5)	47/515 (9.1)	1,063/18,754 (5.6)
Previous preterm birth	1,171/3,744 (31.2)	16,034/171,306 (9.3)	56/213 (26.2)	1,054/19,056 (5.5)

Appendix Table 3.3. Proportion of small for gestational age birth by clinical factor and maternal nativity

	US-born		African-born	
	% SGA		% SGA	
	With risk factor	Without risk factor	With risk factor	Without risk factor
Clinical factors				
Preexisting diabetes mellitus	325/2,949 (11.0)	23,787/158,867 (14.9)	19/258 (7.3)	1,442/16,781 (8.5)
Gestational diabetes	1,389/13,304 (10.4)	23,784/158,829 (14.9)	149/2,251 (6.6)	1,440/16,763 (8.5)
Preexisting hypertension without progression to preeclampsia	1,069/6,599 (16.2)	19,683/143,688 (13.7)	33/303 (10.8)	1,256/16,927 (7.4)
Preexisting hypertension with progression to preeclampsia	737/3,781 (19.4)	19,686/143,703 (13.7)	44/235 (18.7)	1,256/16,930 (7.4)
Gestational hypertension without progression to preeclampsia	1,606/9,389 (17.1)	19,678/143,679 (13.7)	83/671 (12.3)	1,256/16,926 (7.4)
Gestational hypertension with progression to preeclampsia	2,145/9,904 (21.6)	19,676/143,658 (13.7)	187/1,052 (17.7)	1,255/16,916 (7.4)
Infections complicating pregnancy	5,878/37,203 (15.8)	19,615/137,847 (14.2)	186/1,892 (9.8)	1,421/17,377 (8.1)
Anemia	5,874/43,099 (13.6)	19,619/131,951 (14.8)	334/4,395 (7.6)	1,273/14,874 (8.5)
Sickle cell anemia	176/887 (19.8)	25,317/174,163 (14.5)	15/95 (15.7)	1,592/19,174 (8.3)
Mental disorder complicating pregnancy	4,471/25,762 (17.3)	21,022/149,288 (14.0)	84/638 (13.1)	1,523/18,631 (8.1)
Alcohol or drug use during pregnancy	2,771/12,820 (21.6)	22,722/162,230 (14.0)	14/86 (16.2)	1,593/19,183 (8.3)
Tobacco use	3,090/14,954 (20.6)	22,403/160,096 (13.9)	20/101 (19.8)	1,587/19,168 (8.2)
Asthma	4,020/25,934 (15.5)	21,473/149,116 (14.4)	50/515 (9.7)	1,557/18,754 (8.3)
Previous preterm birth	621/3,744 (16.5)	24,872/171,306 (14.5)	25/213 (11.7)	1,582/19,056 (8.3)

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