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Revealing the Variations in Impact of Economic Segregation on Preterm Birth Among Disaggregated Asian Ethnicities across MSAs in the United States: 2015-2017

By

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Master of Public Health

Epidemiology

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Bachelor of Science
Virginia Polytechnic and State University
2018

Faculty Thesis Advisor: Michael R. Kramer, Ph.D

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Abstract

Revealing the Variations in Impact of Economic Segregation on Preterm Birth Among Disaggregated Asian Ethnicities across MSAs in the United States: 2015-2017
By Nathan Sâm Nguyên Quan

Background: Preterm birth (PTB) accounts for the majority of perinatal morbidity and mortality in developed nations, accounting for 9.63% of all births in the U.S. in 2016. Prior research has been conducted to evaluate the effects of residential segregation, specifically economic segregation, on the risk for preterm birth. Prior research has also evaluated disparities in PTB risk between Black and non-Hispanic White mothers, but no research has been conducted examining the fastest growing population in the U.S., Asian-Americans. This analysis examines how economic segregation modifies risk for PTB among various Asian ethnic groups.
Methods: U.S. natality data were used to identify 134 Metropolitan Statistical Areas (MSA) with greater than 500 Asian births from 2015-2017 (n=766,711). Economic segregation was calculated for each MSA using 2017 income data with the Rank-Order Information Theory Index (H Index). Generalized Estimating Equations were used to assess the association between economic segregation and PTB, allowing for modification by ethnicity and controlling for individual-level risk factors.
Results: This study suggests that there is clear heterogeneity of outcomes by ethnicity and that the effect of economic segregation is non-linear. The risk for PTB follows an upwards opening parabolic relationship as standardized H Index increases for Chinese, Filipino, Japanese, Korean, Vietnamese, and Other Pacific Islander mothers. The risk for PTB follows a downwards opening parabolic relationship as standardized H Index increases for Indian, Hawaiian, Guamanian, and Samoan mothers. Out of the ethnic groups evaluated, Filipino, Hawaiian, Guamanian, and Other Pacific Islander mothers had the highest predicted risk for PTB at mean levels of economic segregation while Chinese mothers had the lowest.
Conclusion: These findings may be explained by different histories of immigration to the U.S. caused by a combination of European colonialism, U.S. imperialism, and globalization. Importantly, the results suggest that current practices of aggregating Asian health data mask disparities in health and how socially stratifying processes like economic segregation may differ by ethnic group.

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I wish to thank my mother, Mai-Tram, and my brother and sister, Dylan and Philana, for their unending support and ability to inspire me.

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Chapter I: Background

Preterm Birth

Preterm birth accounts for the majority of perinatal morbidity and mortality in developed nations (1). Preterm birth is defined as births delivered less than 37 completed weeks of gestation. In 2016, preterm births accounted for 9.63% of all births in the U.S. (2). Although they have steadily declined from 2007 to 2014, they have begun to increase since then. Preterm births can be further classified into several categories based on time of gestation. According to the National Center for Health Statistics (NCHS), late preterm birth occurs between 34 and 36 weeks' gestation and early preterm birth occurs at less than 34 weeks' gestation (3). Since gestational time is important for the development of neonates, early preterm infants have increased rates of mortality and morbidity outcomes compared to late preterm infants, as expected (4). Preterm birth places infants at an increased risk of neurodevelopmental impairments as well as respiratory and gastrointestinal complications (5).

Considering that nearly 1 in 10 births are preterm deliveries, representing about 400,000 preterm births in 2016, it is important to understand the potential causes and risk factors for preterm birth to prevent the mortality and morbidity outcomes that occur due to preterm deliveries (2). Risk factors identified include previous preterm delivery, cigarette smoking, gestational diabetes and preeclampsia, maternal age, socioeconomic status, and segregation. Risk for preterm birth also varies by race/ethnicity. These findings suggest that risk for preterm birth is modifiable and not fixed.

There have been several studies characterizing risk for preterm birth among Asian American ethnic groups. Overall, these studies demonstrate the heterogeneity in risk between Asian American ethnic groups (6–8). This suggests that understanding Asians as a heterogeneous racial category is important to identify disparities in adverse birth outcomes. This study seeks to understand the observed variation in preterm birth rates as it relates to segregation. Using 134 Metropolitan Statistical Areas (MSA) in the U.S. from 2015 to 2017, this analysis examines whether economic segregation increases the risk for preterm birth among Asian and Pacific Islander (API) ethnic groups and how API ethnic groups are at most risk for preterm birth due to racialized economic segregation.

Power and Structural Racism

No discussion on segregation would be complete without considering structural racism as a societal factor that contextualizes the process of segregation. Williams' model for studying racial differences in health, borrowing from Lieberson's idea of "basic causes", argues that "culture, biology, racism, economic structures, and political and legal factors are the fundamental causes of racial differences in health" (9,10). Using this approach, we can understand how differences in health outcomes vary by race and ethnicity through various, historically driven conditions. For example, immigration policy, a form of structural racism, informs how immigrants are perceived by the dominant social group. Gee and Ford cite how historic patterns of non-white exclusionary U.S. immigration policy and the rationales behind them serve to justify segregation of Chinese people (11).

Immigration policy can also serve to elevate the status of minority groups. Zhou, Ocampo, and Gatewood demonstrate that the growth in industries that require skilled labor in the U.S. beginning in the 1980s as well as the United States' position as a premier higher education system facilitated the migration and development of middle- to high-class skilled laborers primarily from Asia (12). At the same time, the elevation of Asian Americans has been used at the expense of African Americans while still maintaining a distinction of "otherness" from white people. Zhou, Ocampo, and Gatewood go on to illustrate that the "model minority" stereotype of Asian Americans served to delegitimize African Americans' claims for equality of outcomes (12). While it is true that Asian Americans as a whole have better socioeconomic and health outcomes compared to other minority groups in the U.S., this "model minority" myth erases the heterogeneity in these outcomes and immigration histories by conceptualizing Asian Americans as a monolithic racial category (12). This erasure manifests as the data collection and methodological issues discussed in the section, *Asians, Preterm Birth, and Income Segregation*. It is in these ways that structural racism, along with other basic causes, can produce health outcomes that further reinforce basic causes of variations in health. The concept of Orientalism is helpful to understand this historic precedence of structural racism. Professor of literature, Edward Said, described Orientalism in his 1978 book *Orientalism* as "a set of constraints upon and limitations of thought" that relies on "the ineradicable distinction between Western superiority and Oriental inferiority" (13, p.42). Importantly, Said argues that Orientalism served to consolidate European "intellectual power" through claims of objective knowledge of the "Other" and used to justify colonialism (13). This concept will guide the discussion of how economic segregation may be embodied in Asian mothers and how pathways of embodiment may differ by ethnicity.

Race, Ethnicity, & Nativity Status

Many studies have observed a large disparity in preterm birth rates for African American mothers compared to their White counterpart. Surveillance data from NCHS have revealed that the rate of preterm births for non-Hispanic blacks is 1.51 times the rate of preterm births for non-Hispanic whites while the rate for Hispanics is only 1.04 times the rate of preterm births for non-Hispanic whites in 2016 (3). Asian ethnic groups also showed variation in odds for preterm birth compared to non-Hispanic whites. Cambodian-, Laotian-, and Vietnamese-born women in Washington state all had higher odds for preterm birth (aOR: 1.21, 2.23, and 1.10, respectively) compared to non-Hispanic white women and even higher odds compared to immigrant Japanese women (aOR: 3.06, 5.20, and 2.70, respectively) (6). These findings suggest that there is likely heterogeneity in preterm birth outcomes between Asian ethnic groups. An important factor related to race/ethnicity is nativity status. Cripe et al. demonstrate that foreign-born Cambodian and Laotian women have a higher risk for preterm deliveries compared to foreign-born Vietnamese or U.S.-born white women (7). Nativity status may be associated with risk for preterm birth in this study because of Cambodian and Laotian women's lower pre-pregnancy weight compared to white women. However, others have suggested that the health of foreign-born racial minorities decrease as time living in the U.S. increases (14,15). Thinking through Said's critique of Orientalism and Williams' model, nativity and migration patterns due to economic, political, and colonial histories may contribute to variations in preterm birth outcomes between Asian ethnic groups living in the U.S. How race is socially constructed and reproduced through contrasts against Europeanness or whiteness is ripe for exploration and discussion.

Risk Factor 1: Previous preterm delivery

History of preterm delivery is one of the strongest risk factors for subsequent preterm deliveries. A prospective cohort study conducted by Mercer *et al.* demonstrate that the risk of preterm delivery for mothers who have had a prior preterm delivery is 2.5 times the risk of preterm delivery for mothers who have never had a prior preterm delivery (16). This same study further demonstrates that risk for preterm delivery increases as gestational age of the prior preterm delivery decreases (16).

Risk Factor 2: Maternal Smoking

Smoking is another maternal risk factor for preterm delivery. A large study utilizing the Swedish Medical Birth Register found a dose response effect of maternal smoking on the odds of preterm delivery; the authors reported the odds of preterm delivery less than or equal to 32 weeks' gestation among women who smoked ten or more cigarettes per day to be 1.6 times the odds among women who were nonsmokers (17). In 2002, the U.S. Surgeon General report on women and smoking echoed this and other findings consistent with a modest increase in risk for preterm delivery (18).

Risk Factor 3: Gestational Diabetes and Preeclampsia

Gestational diabetes and preeclampsia are maternal risk factors for preterm birth. A large cohort study in California found that the risk for spontaneous preterm birth among mothers with gestational diabetes is 1.42 times that among mothers without hyperglycemia (19). Additionally, Cripe *et al.* found that Southeast Asian women with preeclampsia, had increased odds for preterm delivery compared with Japanese and White women with preeclampsia (6).

Risk Factor 4: Maternal Age

Risk for preterm birth appears to be highest among younger mothers and older mothers, following a parabolic shape. Using a large Canadian cohort, one study found that advanced maternal age, defined as 40 years and older, was associated with preterm delivery while a maternal age of 30-34 years had the lowest odds of preterm delivery (20). A meta-analysis found moderate evidence for the effect of very young maternal age, defined as less than 15 years, on preterm birth (21)

Risk Factor 5: Educational Attainment

In general, higher maternal socioeconomic status is associated with lower risk for preterm birth (22). Maternal educational attainment is often used as a proxy for socioeconomic status. Vang *et al*. demonstrate that this observed trend is consistent among Asian ethnic subgroups as well; more importantly, the study reveals that maternal educational attainment does not explain the disparities in preterm birth outcomes between the studied ethnic subgroups (Chinese, Japanese, Korean, Asian Indian, Vietnamese, Hmong, Cambodian, Lao, and Thai) (8).

Segregation

The risk factors discussed above do not entirely explain disparities in risk for preterm birth between populations. Researchers have become increasingly interested in the effects of segregation on perinatal birth outcomes. Various definitions of segregation exist but the most studied form is residential segregation – the sorting of individuals that separates them spatially by residence (23). Studies have generally found racial/ethnic segregation to be detrimental to perinatal birth outcomes for non-Hispanic black people (24–27). Interestingly, a study conducted in New York City found that ethnic density was protective against preterm birth in all racial groups studied except for non-Hispanic blacks (27). Another study also found variation in the association between low birth weight and racial residential segregation; racial residential segregation was protective for Asian Americans, harmful for African Americans, and had no effect for Latino Americans (25). These two studies suggest that certain racial and ethnic minorities may prevent adverse health outcomes through this sorting by race to produce social capital.

Income Segregation

Income inequality has grown throughout the twentieth century and into the twenty-first century in U.S. metropolitan areas and has contributed to a particular form of residential sorting – income segregation (28–30). This term is used by Sean Reardon and Kendra Bischoff to describe the "uneven geographic distribution of income groups within a certain area" that may present itself either as the poorest households segregated from middle- and high-income households or as the most affluent households segregated from the middle- and low-income households (31). This is distinct from income inequality, which is the uneven distribution of income among units (e.g., individuals, families, households). An important consequence of income segregation is that it may affect resource distribution. Susan Mayer shows that income segregation can reduce educational attainment of low-income children while increasing the educational attainment of high-income children (32). Although there is variance by state, a significant proportion of public schools funding are financed through local property tax (33). Because of this, spatial sorting by income may occur and directly affect school quality and thus educational attainment. This observation is consistent with Reardon and Bischoff's finding that income inequality affects income segregation through the segregation of the highest-income household from the rest (31).

Income segregation is implicated in the inequality of other social outcomes as well as health outcomes and has disproportionately grown among African American and Hispanic populations in the U.S. (29).

Measurement

Sociologists have studied trends of income inequality as it relates to the spatial segregation of people (30,31,34,35). As such, various methods have been used to quantify income segregation. These approaches are summarized here but discussed in detail by Reardon *et al.,* 2006. Category-based measures of economic segregation are simple and easy to interpret. However, thresholds used to categorize incomes for households considered poor or affluent may be different depending on the local context and standards of living. Additionally, a low number of categories may remove information about the distribution of income in a given area or population. These disadvantages make category-based measures difficult to compare populations across time and place. Variation-ratio measures of economic segregation defines “segregation as a ratio of the between-neighborhood variation in mean income or wealth to the total population variation in income or wealth” and sometimes the variation in income (36). While these measures in theory utilize income to its fullest extent, as a continuous variable, they often are not able to obtain the distribution of income in a population or area. Instead, they must estimate the distribution from the counts of households categorized into income groups that are more generally available. Spatial autocorrelation measures of economic segregation operate under the idea that a household with a certain level of income will have neighboring households with more similar levels of income than households further away. Though these measures make segregation explicitly spatial, spatial autocorrelation measures are subject to the modifiable areal unit problem.

The Rank-Order Information Theory Index, or H Index, being used in this study is a formal measure of economic segregation that ranges from zero to one and are defined as “a weighted average of the binary income segregation at each point in the income distribution", where the weights are proportional to the entropy of the percentile rank (31). An H Index of zero occurs when the income distribution for a local areal unit (ex. Census tract) matches that of the entire region of interest (ex. Metropolitan Statistical Area). Likewise, an H Index of one occurs when there is no income variation in any local areal unit. The advantage of the H Index lies in the use of rank-order distribution of incomes to calculate the measure. This allows one to compare H Indices across time and place, irrespective of monetary inflation or the actual incomes (31,36). Additionally, the H Index may be calculated separately for race/ethnic groups, allowing one to compare income segregation patterns within a group to the overall segregation pattern. Income segregation has more recently been studied to assess its association with health outcomes.

Income Segregation and Preterm Birth

Studying the effects of income segregation is important because it can differentially affect the morbidity and mortality of populations. Two studies have found positive associations between income segregation and mortality within MSAs, though they do not disaggregate the data by race (34,35). However, a study conducted by Cooper *et al.* found a significant correlation between residential segregation, income inequality, and premature mortality among African Americans and found a weak correlation among whites (37).

As noted earlier, preterm birth represents a major source of morbidity in the U.S. Many studies have employed various related measures to understand how contextual effects produce variances in preterm birth risk between populations. Some studies that have focused on socioeconomic inequality have found strong associations with preterm birth. A large ecological study in the United Kingdom found that those from the most deprived decile of the Index of Multiple Deprivation were twice as likely to be born very preterm compared to those from the least deprived decile (22). Area-level deprivation indices like the one used in the study are not a measure of inequality since it is a measure of deprivation, not affluence (38). The Gini coefficient does measure income inequality and since it is a relative measure, it is useful for comparing areas. However area-level deprivation measures and, as Reardon and Bischoff note, income inequality do not measure the spatial segregation of people (31). While income inequality is necessary for income segregation to occur, an area may have extreme income inequality but anywhere from zero to complete segregation of families by income. These measures are related but differ in what they actually attempt to measure. I argue that understanding how income segregation, a socially stratifying process, is associated with preterm birth could prove useful to identify how different populations are affected by this process and develop interventions to address this public health issue.

Many studies have focused on the effects of racial residential segregation as opposed to income segregation (15,24,26,27). Additionally, Maddali found an association between income segregation and very preterm birth across MSAs that varied by maternal race/ethnicity (39). Similar to studies on racial residential segregation, the effects of economic segregation on risk for preterm birth have primarily been documented between white and African Americans. Residential segregation has been characterized among other races and ethnicities in the U.S. but very few studies have studied the effects of economic residential segregation on birth outcomes (40). This presents a gap in the literature to be filled to understand economic segregation throughout America's largest cities and to identify which racial groups are at most risk for preterm birth due to economic segregation.

Asians, Preterm Birth, and Income Segregation

The author was able to find only one study that evaluates the association between racial residential segregation and birth outcomes among Asian Americans. This study found lower odds of low birth weight among Asian Americans that are segregated, suggesting a possible concentration of social and structural resources in highly-segregated communities (25).

Considering that Asian Americans are the fastest growing major racial group in the U.S., it is important to recognize that Asian Americans are a diverse and heterogeneous racial group (41). National health surveys and health research continue to report Asian-Americans as one racial category, a limited set of categories, or not at all due to data collection and analytical issues (42,43). Because of these reasons, Walton was not able to disaggregate her findings for Asian Americans.

Chapter II: Manuscript

Introduction

Preterm birth (PTB) accounts for the majority of perinatal morbidity and mortality in developed nations (1). Preterm birth is defined as births delivered less than 37 completed weeks of gestation. In 2016, preterm births accounted for 9.63% of all births in the U.S. (2). Although they have steadily declined from 2007 to 2014, they have begun to increase since then. Preterm births can be further classified into several categories based on time of gestation. According to the National Center for Health Statistics (NCHS), late preterm birth occurs between 34 and 36 weeks' gestation and early preterm birth occurs at less than 34 weeks' gestation (3). Since gestational time is important for the development of neonates, early preterm infants have increased rates of mortality and morbidity outcomes compared to late preterm infants, as expected (4). Preterm birth places infants at an increased risk of neurodevelopmental impairments as well as respiratory and gastrointestinal complications (5).

Considering that nearly 1 in 10 births are preterm deliveries, representing about 400,000 preterm births in 2016, it is important to understand the potential causes and risk factors for preterm birth to prevent the mortality and morbidity outcomes that occur due to preterm deliveries (2). Risk factors identified include previous preterm delivery, cigarette smoking, gestational diabetes and preeclampsia, maternal age, socioeconomic status, and segregation (6,8,16–22) Risk for preterm birth also varies by race/ethnicity. These findings suggest that risk for preterm birth is modifiable and not fixed.

Much research into disparities and preterm birth have focused on the large and persistent Black-White disparities, with small to non-existent Hispanic-non-Hispanic disparities. Surveillance data from NCHS have revealed that the rate of preterm births for non-Hispanic blacks is 1.51 times the rate of preterm births for non-Hispanic whites while the rate for Hispanics is only 1.04 times the rate of preterm births for non-Hispanic whites in 2016 (3). Often 'Asians' are omitted altogether because they are not the focus, or because of small numbers; and when they are included (e.g. national NCHS surveillance summaries) they are typically reported as the aggregate racial category Asian Pacific Islander (42,43). In the aggregate this group is often reported to have similar or even better PTB outcomes compared to NH White (2). However, the API 'race' category masks substantial heterogeneity in culture and migration history.

Asian ethnic groups showed variation in odds for preterm birth compared to non-Hispanic whites. Cambodian-, Laotian-, and Vietnamese-born women in Washington state all had higher odds for preterm birth (aOR: 1.21, 2.23, and 1.10, respectively) compared to non-Hispanic white women and even higher odds compared to immigrant Japanese women (aOR: 3.06, 5.20, and 2.70, respectively) (6). These findings suggest that there is likely heterogeneity in preterm birth outcomes between Asian ethnic groups. An important factor related to race/ethnicity is nativity status. Cripe et al. demonstrate that foreign-born Cambodian and Laotian women have a higher risk for preterm deliveries compared to foreign-born Vietnamese or U.S.-born white women (7). Nativity status may be associated with risk for preterm birth in this study because of Cambodian and Laotian women's lower pre-pregnancy weight compared to white women. However, others have suggested that the health of foreign-born racial minorities decrease as time living in the U.S. increases (14,15). Overall, these studies demonstrate the heterogeneity in risk between Asian American ethnic groups, though not enough research has examined plausible reasons why these disparities exist. Understanding Asians as a heterogeneous racial category is important to identify and explain disparities in adverse birth outcomes.

Segregation

The individual risk factors identified above do not entirely explain disparities in risk for preterm birth between populations. Researchers have become increasingly interested in the effects of segregation on perinatal birth outcomes. Various definitions of segregation exist but the most studied form is residential segregation – the sorting of individuals that separates them spatially by residence (23). Studies have generally found racial/ethnic segregation to be detrimental to perinatal birth outcomes for non-Hispanic black people (24–27). Interestingly, a study conducted in New York City found that ethnic density was protective against preterm birth in all racial groups studied except for non-Hispanic blacks (27). Another study also found variation in the association between low birth weight and racial residential segregation; racial residential segregation was protective for Asian Americans, harmful for African Americans, and had no effect for Latino Americans (25). These two studies suggest that certain racial and ethnic minorities may prevent adverse health outcomes through this sorting by race to produce social capital.

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U.S. from 2015 to 2017, this analysis examines whether a plausible metric of structural racism and stratification, economic segregation, is related to preterm birth in each of these disaggregated groups.

Methods

Population

Restricted-access data from all live births from 2015 to 2017 that include county identifiers were obtained from the Centers for Disease Control and Prevention's National Center for Health Statistics (NCHS). Data were restricted to Asian and Pacific Islander mothers whose ethnic categories were defined by NCHS (Asian Indian (only), Chinese (only), Filipino (only), Japanese (only), Vietnamese (only), Other Asian (only), Hawaiian (only), Guamanian (only), Samoan (only), and Other Pacific Islander (only)) and who resided in one of the 50 states. A total of 766,711 observations were eligible. Gestational age is estimated by self-reported last menstrual period. Preterm birth is defined in this analysis as infants born less than 37 weeks' gestation. The inclusion criterion for MSAs were those that had greater than 500 Asian and Pacific Islander births from 2015-2017, yielding 134 MSAs.

Measures

This analysis quantifies income segregation using the Rank-Order Information Theory Index or H Index. This measure ranges from zero to one and is defined as "a weighted average of the binary income segregation at each point in the income distribution", where the weights are proportional to the entropy of the percentile rank (31). An H Index of zero occurs when the income distribution for a local areal unit (e.g. Census tract) matches that of the entire region of interest (e.g. Metropolitan Statistical Area). Likewise, an H Index of one occurs when there is no income variation in any local areal unit. The advantage of the H Index lies in the use of the rank-order distribution of incomes to calculate the measure. This allows one to compare H Indices across time and place, irrespective of monetary inflation or the actual incomes (31,36). The H10 and H90 indices are a variation on the H index. The H10 index measures segregation of poverty, the degree to which the lowest ten percent of incomes within an MSA are segregated from the rest of the income distribution (31). Similarly, the H90 index measures segregation of affluence, the degree to which the highest ten percent of incomes within an MSA are segregated from the rest of the income distribution (31). Tract-level income data were obtained from the 2017 American Community Survey using the R package *tidycensus* version 0.9.6 (44). Tract-level household income data categorized into 16 groups were matched to MSAs and used to calculate MSA-level segregation indices using the R package *OasisR* version 3.0.1 (45). Mother's county of residence, obtained from natality data, were matched to the segregation indices values by MSA code. Covariates (previous preterm delivery, cigarette smoking, gestational diabetes and preeclampsia, maternal age, highest educational attainment) were obtained from NCHS. The outcome, preterm birth, was coded as a dichotomous variable.

Analysis Plan

All statistical analyses were conducted using R version 3.6.1 (46). Population average models were estimated using generalized estimating equations (GEE) using the R package *geepack* version 1.3.1 (47). The analysis using GEE assumes that the number MSAs is sufficiently large for robust estimation of standard errors. Segregation indices standardized to diminish multicollinearity and improve interpretability. Confounders were identified through literature review. Backwards elimination was conducted to remove non-significant terms at α=0.05. Two-way interactions between segregation indices and each covariate were assessed and dropped if non-significant. We hypothesized that the relationship between economic segregation and PTB would be non-linear. Therefore, models were allowed to follow a quadratic relationship to incorporate this non-linearity. Since this analysis is aims to evaluate effect modification by Asian ethnicity, these interaction terms were retained. Model fit was assessed using QIC. Effect modification are visualized using the R package *effects* version 4.1.4 (48,49).

Results

There were 766,711 births and 134 MSAs that met the study inclusion criteria. MSAs ranged in economic segregation (H Index) from 0.0321 (Trenton, NJ) to 0.1500 (Kahului-Wailuku-Lahaina, HI), in segregation of poverty (H10) from 0.2286 (Champaign-Urbana, IL) to 0.0341 (Fayetteville, NC), and in segregation of affluence (H90) from 0.2237 (Trenton, NJ) to 0.0412 (Kahului-Wailuku-Lahaina, HI).

Study Population Characteristics

Study population characteristic distributions are presented by quintiles of exposure (H, H10, H90) in Tables 1a, 1b, and 1c. We first illustrate how to interpret these tables before summarizing key characteristics between and within ethnic groups. Among Asian Indian mothers, the prevalence of achieving a Master's, Doctorate, or professional degree (hereinafter post-Bachelor's degree) followed a downwards opening parabolic relationship with increasing H Index quintiles the prevalence increased from 36.1% in the first quintile to maximum of 49.6% in the second quintile before decreasing to 39.1% by the fifth. The proportion of U.S.-born Asian Indian mothers in the first quintile of the H Index was 10.9%. As H Index increased from the second quintile to the fifth, the proportion of U.S.-born Asian Indian mothers increased from 8.2% to 11.6%.

Education level varied substantially between ethnic groups. Asian Indian, Chinese, and Korean mothers were the most highly educated groups with 41.9%, 34.0%, and 31.7% of mothers having a post-Bachelor's degree, respectively. Japanese (21.4%), Vietnamese (14.3%), Other Asian (13.9%), Filipino (10.4%), Hawaiian (4.8%), Guamanian (3.7%), Other Pacific Islander (2.2%), and Samoan (1.2%) mothers followed. Education level followed a downwards opening parabolic relationship with increasing H Index quintiles for Asian Indian, Chinese, Japanese, and Vietnamese mothers. Education level is positively correlated with economic segregation for

Filipino, Other Asian, Hawaiian, Guamanian, Samoan, and Other Pacific Islander mothers. Korean mothers followed a more complicated relationship with education level.

The proportion of U.S.-born mothers also varied between ethnic groups. Hawaiian and Samoan mothers had the highest proportion of U.S.-born with 90.2% and 53.8%, respectively. Filipino (30.1%), Guamanian (29.5%), Japanese (28.7%), Other Pacific Islander (26.3%), Korean (23.7%), Vietnamese (21.1%), Other Asian (13.9%), Chinese (13.7%), and Asian Indian (10.8%) followed.

Modeling Results

Adjusted odds ratios from the three final multivariable models are displayed by ethnicity in Table 2. Odds ratios contrast standardized economic segregation indices' *Z*-scores: lower than average levels ($Z = -1$ vs $Z = -2$), average levels ($Z = 0$ vs $Z = -1$), and higher than average levels ($Z = 1$ vs $Z = 0$). Three odds ratios for each ethnicity are calculated for each of the three models to demonstrate the non-linear effects of economic segregation. There is a relatively linear positive association between economic segregation and PTB for Asian Indian and Other Asian mothers. For Chinese, Filipino, Vietnamese Hawaiian, and Guamanian mothers, economic segregation exhibited stronger effects at lower and higher than average levels, as compared to average levels. However, for Japanese, Korean, Samoan, and Other Pacific Islander mothers, economic segregation exhibited stronger effects at lower than average and average levels, compared to higher than average levels.

Segregation of poverty (H10) is associated with stronger effects for Hawaiian mothers at lower and higher than average levels, as compared to average levels. By contrast, segregation of poverty exhibited stronger effects at lower than average and average levels compared to higher than average levels for Asian Indian, Chinese, Japanese, Korean, Vietnamese, Other Asian, Guamanian, and Samoan mothers. However, for Filipino and Other Pacific Islander mothers, segregation of poverty is associated with stronger effects at higher than average and average levels, as compared to lower than average levels.

There is a relatively linear positive association between segregation of affluence (H90) and PTB for Other Asian mothers. For Filipino, Japanese, Korean, Vietnamese, Guamanian, and Other Pacific Islander mothers, segregation of affluence is associated with stronger effects at lower than average and average levels, as compared to higher than average levels. By contrast, for Chinese, Hawaiian, and Samoan mothers, segregation of affluence exhibited stronger effects at lower and higher than average levels, as compared to average levels. Segregation of affluence was associated with stronger effects at average and higher than average levels, as compared to lower than average levels for Asian Indian mothers.

Model results are plotted to visualize predicted risk of PTB by standardized economic segregation indices and effect modification by ethnicity (Figures 1-3). The risk for PTB follows an upwards opening parabolic relationship as standardized H Index increases for Chinese, Filipino, Japanese, Korean, Vietnamese, and Other Pacific Islander mothers. The risk for PTB follows a downwards opening parabolic relationship as standardized H Index increases for Indian, Hawaiian, Guamanian, and Samoan mothers. The relationship appears linear for Other Asian mothers. An important feature of the plots that ORs comparing within-group associations do not address (Table 2) is the disparities between ethnicities. The disparity in risk vary dramatically by ethnicity at the extremes of the standardized H Index while the disparity in risk vary by about 0.05 at the mean.

The risk for PTB follows an upward parabolic relationship as standardized H10 increases for Filipino and Guamanian mothers. The risk for PTB follows a downward parabolic relationship as standardized H10 increases for Indian, Chinese, Japanese, Korean, Vietnamese, Other Asian, Hawaiian, Samoan, and Other Pacific Islander mothers. The majority of ethnic groups have a predicted risk of around 0.10 at the mean. However, Chinese mothers notably have a predicted risk of approximately 0.075 and Other Pacific Islander mothers have a predicted risk of approximately 0.125 at the mean. Like in Figure 1, the disparity in risk vary dramatically by ethnicity at the extremes of the standardized H10.

The risk for PTB follows an upward parabolic relationship as standardized H90 increases for Indian, Chinese, Filipino, Japanese, Korean, Vietnamese, and Other Pacific Islander mothers. The risk for PTB follows a downward parabolic relationship for Hawaiian, Guamanian, and Samoan mothers. Other Asian mothers appear to have a positive linear relationship with the standardized H90. Indian, Filipino, Vietnamese, Other Asian, and Samoan mothers have a predicted risk of PTB of about 0.10 at the mean while Chinese, Japanese, and Korean mothers have a predicted risk of PTB approximately 0.075 at the mean. By contrast, Hawaiian, Guamanian, and Other Pacific Islander mothers have a predicted risk of approximately 0.125 at the mean. Like in Figures 1 and 2, the disparity in risk vary dramatically by ethnicity at the extremes of the standardized H90.

Discussion

This analysis demonstrated that considerable heterogeneity in risk for preterm birth exists among ethnic subgroups conventionally aggregated as API in public health reporting. The relationship between a hypothesized structural determinant of population health (economic segregation) and the risk of preterm birth in these API ethnic subgroups is also heterogeneous, suggesting the risk or resilience related to spatial and social stratification may vary as a function of group-specific experiences and histories. To understand why the observed associations between PTB and economic segregation by ethnicity are patterned this way, it is worth examining how colonialism, immigration, assimilation, and racialization are related using two concepts: “basic causes” and Orientalism.

Structural Racism, Orientalism, and Power

No discussion on segregation would be complete without considering structural racism as a societal factor that contextualizes the process of segregation. Williams’ model for studying racial differences in health, borrowing from Lieberson's idea of "basic causes", argues that "culture, biology, racism, economic structures, and political and legal factors are the fundamental causes of racial differences in health" (9,10). Using this approach, we can understand how differences in health outcomes vary by race and ethnicity through various, historically driven conditions. For example, immigration policy, a form of structural racism, informs how immigrants are perceived by the dominant social group. Gee and Ford cite how historic patterns of non-white exclusionary U.S. immigration policy and the rationales behind them serve to justify segregation of Chinese people (11).

Immigration policy can also serve to elevate the status of minority groups. Zhou, Ocampo, and Gatewood demonstrate that the growth in industries that required skilled labor in the U.S. beginning in the 1980s as well as the United States' position as a premier higher education system facilitated the migration and development of middle- to high-class skilled laborers primarily from Asia (12). At the same time, the elevation of APIs has been used at the expense of African Americans while still maintaining a distinction of "otherness" from white people. Zhou, Ocampo, and Gatewood go on to illustrate that the "model minority" stereotype of APIs served to delegitimize African Americans' claims for equality of outcomes (12). While it is true that Asian Americans as a whole have better socioeconomic and health outcomes compared to other minority groups in the U.S., this "model minority" myth erases the heterogeneity in these outcomes and immigration histories by conceptualizing APIs as a monolithic racial category (12). It is in these ways that structural racism, along with other basic causes, can produce health outcomes that further reinforce basic causes of variations in health.

If Williams' model provides a framework to understand the process by which structural forces influence health, Orientalism offers a perspective to understand how these forces came to be. Professor of literature, Edward Said, described Orientalism in his 1978 book *Orientalism* as "a set of constraints upon and limitations of thought" that relies on "the ineradicable distinction between Western superiority and Oriental inferiority" (13, p.42). Orientalism served to consolidate European "intellectual power" through claims of objective knowledge of the Other and used to justify colonialism (13, p.41). This concept will guide the discussion of how economic segregation is embodied in Asian mothers and how pathways of embodiment may differ by ethnicity. Thinking through Said's critique of Orientalism and Williams' model, nativity and migration patterns due to economic, political, and colonial histories may contribute to variations in preterm birth outcomes between API ethnic groups living in the U.S. How race is socially constructed and reproduced through contrasts against Europeanness or whiteness is ripe for exploration and discussion.

It is clear from Table 2 and Figures 1-3 that aggregation of Asian health data, as is the norm, could obfuscate differences in the risk profiles for PTB as economic segregation increases (42,43,50,51). Additionally, these data presented in Figures 1-3 suggest that aggregation of Asian health data mask disparities by ethnicity. Adia, Nazareno, et al. have also explored the issue of API health data aggregation using 7 years of data from the California Health Interview Survey; they concluded that aggregated data hides ethnic disparities and could lead to inaccurate interventions (52). I argue that the present-day norm of aggregating Asian health data is grounded in colonial histories tied to racializing non-white persons. Race is socially constructed and, in many cases, created by those in power. Said asserts that non-white persons are "*contained* and *represented* by dominating frameworks" through Orientalism (13, p.40). In other words, non-white individuals, populations, and cultures only exist through European epistemologies. The consequence of this is that Orientalism can essentialize the Other (i.e. Non-whites) as "almost everywhere nearly the same" (13, p.38).

The racialization of legal identities is another legacy of colonialism that is in use today. Legal identities formed by colonial nation-state building projects, such as for those in French Indochina (Vietnamese, etc.) are the general basis of what the U.S. Standard Certificate of Live Birth defines as ethnicities. Legal identities are what is recognized under nation-state/colonial governmentality, not necessarily ethnic identities. A cursory review of ethnic categories such as

Asian Indian on the U.S. Standard Certificate of Live Birth reveal that there are many ethnic groups recognized by India. Zhou, Ocampo, Gatewood echo Said's argument of dominating frameworks to say that "the emergence and persistence of ethnicity depends on the structural conditions of the host society and the position that the immigrant groups occupies in that social structure" (12). In American society, from which they anchor their perspectives, ethnicity emerges and persists due to contrasts against whiteness. This is a product of the Orientalist framework that permeated European colonialism and continues to permeate how the U.S. racializes non-whiteness.

Orientalism does more than offer explanations of how racialization of the Other continues to this day and how it can mask health disparities. It also partially explains the differences in immigration histories. These histories may explain the observed differences in preterm birth risk between and within ethnic groups in this study. The immigration histories for many of the ethnic groups in this study are intimately linked to 20th century U.S. imperialism and anti-communist U.S. foreign policy. It is important to remember that, "colonial rule was justified in advance by Orientalism, rather than after the fact" (13, p.39). Take for example Lyndon B. Johnson's speech on the Vietnam War delivered 31 March 1968 where he states,

> "let it never be forgotten: peace will come also because America sent her sons to help secure it…the heart of our involvement in South Vietnam under three different presidents, three separate Administrations, has always been America's own security" (53).

This speech exemplifies two attitudes of Orientalism. First, Lyndon B. Johnson asserts that America (the West) is responsible for the peace that may come to Vietnam and Southeast Asia. This rhetoric implies Western superiority and Western society's ability to reason. Implicit in this statement is the Orient's inability to reason and its proclivity for violence. Second, the rationale for intervention for the security of America and Western society as a whole is consistent with a history of viewing Oriental societies as dangerous (13, p.57). This Orientalist thinking explains the immigration history of over one million refugees comprised of Vietnamese and at least some Other Asians since 1975 (12). U.S. immigration policy, specifically the Hart-Cellar Act of 1965, facilitated this movement by allowing family-sponsored immigration.

Asian Indian, Chinese, Japanese, Korean, Vietnamese mothers' risk for PTB were patterned together for all three indices (Figures 1-3). An average level of economic segregation and segregation of affluence predicted the lowest risk for PTB for each of these ethnic groups. An average level of segregation of poverty predicted the highest risk for PTB for each of these ethnic groups. These suggests that these ethnic groups may experience similar opportunity structures that define their risk profiles. This grouped patterning of risk profiles may be explained by globalization of the U.S. economy as well as international and domestic pressure for the U.S. Congress to abolish discriminatory immigration laws. Sassen argues that the migration flows from various Asian countries observed in the 1970s to the 1980s have not solely been due to poverty or U.S. military intervention. The U.S. immigration patterns observed are also a result of U.S. foreign investment in export production and labor demand in the U.S. (54). The Hart-Cellar Act of 1965 eliminated national origins quotas in order to reunite refugee families due to failed U.S. interventions in Southeast Asia and to meet labor market demands for skilled labor (12). Zhou, Ocampo, and Gatewood build on this argument by also suggesting that skilled labor immigration is also due to the interaction between the opportunity structure in this group of immigrant's homelands and the globalization of higher education (12). This is evidenced by both the proportion of U.S.-born mothers and the distribution of educational attainment within this large group of mothers. Among Asian Indian mothers in the study population, 41.9% of them have a post-Bachelor's degree and 10.8% were born in the U.S. Among Chinese mothers in the study population, 34.0% of them have a post-Bachelor's degree and 13.7% were born in the U.S. Among Japanese mothers in the study population, 21.4% of them have a post-Bachelor's degree and 28.7% were born in the U.S. Among Korean mothers in the study population, 31.7% of them have a post-Bachelor's degree and 23.7% were born in the U.S. These statistics provide evidence to support the argument that Asian Indian, Chinese, Japanese, and Korean mothers immigrated to the U.S. due to globalization and U.S. demand for skilled labor. Among Vietnamese mothers in the study population, 14.3% of them have a post-Bachelor's degree and 21.1% were born in the U.S. Vietnamese mothers stand out from the other ethnic groups analyzed because of their relatively lower educational attainment. This may be explained by the family-sponsored immigration that the Hart-Cellar Act of 1965 allowed. Overall, these forces might explain the similar patterning of these mothers' risk profiles. These forces may also explain why these ethnic groups do not have more than a 10% risk for PTB at an average level of economic segregation. Ethnic groups that are highly educated may be protected from the harmful effects of economic segregation.

Filipino mothers deviate from the other ethnic groups discussed in that they have an upwards opening parabolic shape to their risk profile for all three indices. Only 10.4% of them have a post-Bachelor's degree but they are still highly educated (42.6% hold a Bachelor's degree as their highest education); 30.1% of them were born in the U.S. This is consistent with Zhou, Ocampo, and Gatewood's observation that "many Filipino immigrants to the United States are college graduates with transferable job skills" (12). Why Filipino mothers' risk profile is different from other ethnic groups that immigrated due skilled labor demand in the U.S. is not clear.

The Hawaiian, Guamanian, Samoan mothers' risk for PTB had more complex patterns across the three indices. These ethnic groups are marked by histories of colonization and U.S. imperialism. These histories of colonization and continued U.S. imperialism may explain why these Pacific Islander groups have a higher risk for preterm birth at an average level of economic segregation than Asian ethnic groups. Among Hawaiian mothers in the study population, 4.8% of them have a post-Bachelor's degree and 90.2% were born in the U.S. Among Guamanian mothers in the study population, 3.7% of them have a post-Bachelor's degree and 29.5% were born in the U.S. Among Samoan mothers in the study population, 1.2% of them have a post-Bachelor's degree and 53.8% were born in the U.S. Low educational attainment may explain why

Guamanian and Samoan mothers are more affected by segregation of poverty than segregation of affluence.

Strengths and Limitations

This analysis did not have information on length of exposure to economic segregation; mothers with longer exposure to MSAs of high economic segregation may have a different risk for PTB compared to women who have been exposed for a shorter duration. Additionally, this analysis was not able to take into account individual-level income data. This data, in combination with educational attainment data, would provide more information on how populations are exposed to economic segregation. For example, relatively higher income populations living in an MSA with high segregation of affluence may have a different risk for PTB than another population with lower income. Individual-level income data could explain this difference more accurately than educational attainment data. Finally, the ethnic composition of Other Asian and Other Pacific Islander categories is unknown. As argued earlier, different ethnicities have histories that may shape their risk for PTB when exposed to economic segregation. Aggregating ethnic groups into Other Asian and Other Pacific Islander categories makes it difficult to understand why their risk for PTB are patterned as observed.

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Tables

Table 1a. Demographics & Risk Factors for Asian Mothers of Live Births in MSAs in the U.S., by Ethnicity & Economic Segregation

	Overall H Index				
	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
Covariate by ethnicity	*Mean (SD) or n (%)*				
MSA (n=134)					
Asian Indian (only)					
Preterm	571 (10.2%)	2,596 (8.8%)	2,057 (9.4%)	3,941 (9.1%)	12,261 (10.4%)
Maternal age, years	30.38 (4.50)	31.12 (4.10)	31.01 (4.34)	31.22 (4.26)	30.87 (4.52)
Mother smoked during pregnancy					
Yes	16 (0.3%)	39 (0.1%)	40 (0.2%)	51 (0.1%)	142 (0.2%)
Previous preterm delivery					
Yes	120 (2.1%)	382 (1.3%)	307 (1.4%)	493 (1.1%)	2,426 (2.1%)
Gestational diabetes					
Yes	775 (13.8%)	3,523 (12.0%)	2,811 (12.8%)	4,996 (11.6%)	16,049 (13.9%)
Preeclampsia					
Yes	262 (4.7%)	1,106 (3.8%)	733 (3.3%)	1,452 (3.4%)	4,627 (4.0%)
Highest maternal education					
Less than high school graduate	354 (6.4%)	652 (2.4%)	859 (4.1%)	1,325 (3.2%)	7,874 (6.8%)
High school graduate or GED completed	703 (12.7%)	1,328 (4.8%)	1,481 (7.0%)	2,391 (5.7%)	11,349 (9.9%)
Associate degree or Some College	811 (14.7%)	1,665 (6.0%)	1,790 (8.5%)	3,004 (7.2%)	11,593 (10.1%)
Bachelor’s degree	1,663 (30.1%)	10,273 (37.2%)	7,216 (34.1%)	16,926 (40.7%)	39,256 (34.1%)
Master’s, Doctorate, or Professional Degree	1,993 (36.1%)	13,700 (49.6%)	9,794 (46.3%)	17,971 (43.2%)	44,944 (39.1%)
Mother's Nativity					
Born in the U.S. (50 US States)	610 (10.9%)	2,394 (8.2%)	2,127 (9.7%)	4,712 (10.9%)	13,609 (11.6%)
Chinese (only)					

Preterm	232 (7.9%)	1,363 (6.9%)	1,193 (7.7%)	4,800 (6.4%)	5,251 (8.1%)
Maternal age, years	32.11 (5.32)	32.59 (4.63)	32.29 (4.79)	32.53 (4.69)	31.65 (4.99)
Mother smoked during pregnancy					
Yes	19 (0.6%)	40 (0.2%)	43 (0.3%)	126 (0.2%)	142 (0.2%)
Previous preterm delivery					
Yes	51 (1.7%)	208 (1.1%)	171 (1.1%)	358 (0.5%)	1,091 (1.7%)
Gestational diabetes					
Yes	385 (13.1%)	2,017 (10.3%)	1,648 (10.7%)	5,780 (7.7%)	7,638 (11.9%)
Preeclampsia					
Yes	96 (3.3%)	471 (2.4%)	349 (2.3%)	1,335 (1.8%)	1,745 (2.7%)
Highest maternal education					
Less than high school graduate	163 (5.7%)	811 (4.4%)	793 (5.5%)	1,623 (2.3%)	8,566 (13.4%)
High school graduate or GED completed	360 (12.6%)	1,087 (5.9%)	1,318 (9.1%)	5,837 (8.2%)	9,696 (15.2%)
Associate degree or Some College	502 (17.6%)	1,825 (9.9%)	1,465 (10.1%)	11,881 (16.7%)	8,950 (14.0%)
Bachelor’s degree	865 (30.3%)	6,201 (33.6%)	4,215 (29.1%)	30,185 (42.4%)	16,379 (25.7%)
Master’s, Doctorate, or Professional Degree	967 (33.8%)	8,537 (46.2%)	6,709 (46.3%)	21,699 (30.5%)	20,183 (31.6%)
Mother's Nativity					
Born in the U.S. (50 US States)	572 (19.4%)	2,853 (14.5%)	2,545 (16.5%)	9,137 (12.2%)	9,144 (14.2%)
Filipino (only)					
Preterm	568 (13.2%)	2,046 (12.3%)	1,456 (11.6%)	3,671 (12.1%)	3,200 (13.1%)
Maternal age, years	30.63 (5.54)	31.20 (5.54)	31.54 (5.42)	32.17 (5.30)	32.32 (5.43)
Mother smoked during pregnancy					
Yes	70 (1.6%)	181 (1.1%)	113 (0.9%)	224 (0.7%)	200 (0.8%)
Previous preterm delivery					
Yes	103 (2.4%)	587 (3.5%)	274 (2.2%)	507 (1.7%)	701 (2.9%)
Gestational diabetes					
Yes	518 (12.0%)	2,273 (13.7%)	1,422 (11.3%)	2,978 (9.8%)	2,863 (11.9%)
Preeclampsia					

Yes	252 (5.9%)	1,135 (6.8%)	760 (6.1%)	1,782 (5.9%)	1,634 (6.8%)
Highest maternal education					
Less than high school graduate	186 (4.4%)	1,203 (7.5%)	246 (2.1%)	690 (2.4%)	862 (3.6%)
High school graduate or GED completed	874 (20.7%)	1,911 (12.0%)	1,599 (13.5%)	3,099 (10.6%)	2,460 (10.3%)
Associate degree or Some College	1,612 (38.1%)	5,727 (35.8%)	4,038 (34.0%)	9,469 (32.3%)	5,979 (25.1%)
Bachelor's degree	1,336 (31.6%)	5,927 (37.1%)	4,845 (40.8%)	12,982 (44.3%)	11,236 (47.3%)
Master's, Doctorate, or Professional Degree	221 (5.2%)	1,207 (7.6%)	1,143 (9.6%)	3,092 (10.5%)	3,237 (13.6%)
Mother's Nativity					
Born in the U.S. (50 US States)	1,165 (27.1%)	5,177 (31.2%)	4,219 (33.7%)	9,660 (31.8%)	6,322 (25.9%)
Japanese (only)					
Preterm	72 (8.8%)	510 (10.3%)	184 (8.4%)	491 (8.2%)	523 (9.1%)
Maternal age, years	33.28 (5.12)	34.13 (4.77)	33.76 (5.09)	34.55 (4.82)	34.26 (4.88)
Mother smoked during pregnancy					
Yes	17 (2.1%)	59 (1.2%)	15 (0.7%)	51 (0.9%)	39 (0.7%)
Previous preterm delivery					
Yes	15 (1.8%)	87 (1.8%)	30 (1.4%)	64 (1.1%)	104 (1.8%)
Gestational diabetes					
Yes	59 (7.2%)	481 (9.7%)	145 (6.6%)	328 (5.5%)	356 (6.2%)
Preeclampsia					
Yes	32 (3.9%)	181 (3.7%)	62 (2.8%)	169 (2.8%)	153 (2.7%)
Highest maternal education					
Less than high school graduate	19 (2.3%)	214 (4.5%)	37 (1.8%)	67 (1.2%)	180 (3.2%)
High school graduate or GED completed	78 (9.6%)	249 (5.2%)	212 (10.2%)	496 (8.6%)	528 (9.3%)
Associate degree or Some College	219 (27.0%)	1,155 (24.0%)	463 (22.2%)	1,273 (22.0%)	1,117 (19.7%)
Bachelor's degree	354 (43.6%)	2,149 (44.7%)	892 (42.8%)	2,723 (47.1%)	2,638 (46.5%)
Master's, Doctorate, or Professional Degree	141 (17.4%)	1,037 (21.6%)	481 (23.1%)	1,224 (21.2%)	1,214 (21.4%)
Mother's Nativity					
Born in the U.S. (50 US States)	314 (38.3%)	2,117 (42.9%)	482 (21.9%)	1,863 (31.0%)	886 (15.3%)

Korean (only)					
Preterm	157 (11.0%)	404 (8.0%)	319 (8.4%)	1,150 (7.6%)	1,556 (8.5%)
Maternal age, years	32.45 (4.82)	33.21 (4.49)	32.90 (4.39)	33.53 (4.43)	33.34 (4.47)
Mother smoked during pregnancy					
Yes	21 (1.5%)	69 (1.4%)	48 (1.3%)	128 (0.8%)	142 (0.8%)
Previous preterm delivery					
Yes	41 (2.9%)	65 (1.3%)	69 (1.8%)	123 (0.8%)	314 (1.7%)
Gestational diabetes					
Yes	122 (8.6%)	528 (10.4%)	307 (8.1%)	923 (6.1%)	1,526 (8.4%)
Preeclampsia					
Yes	65 (4.6%)	182 (3.6%)	135 (3.6%)	469 (3.1%)	548 (3.0%)
Highest maternal education					
Highest maternal education	27 (1.9%)	75 (1.5%)	55 (1.5%)	286 (1.9%)	540 (3.0%)
Less than high school graduate	122 (8.6%)	267 (5.5%)	176 (4.8%)	740 (5.0%)	1,045 (5.8%)
High school graduate or GED completed	350 (24.7%)	854 (17.6%)	519 (14.2%)	2,295 (15.6%)	2,550 (14.2%)
Associate degree or Some College	578 (40.8%)	2,217 (45.6%)	1,613 (44.2%)	7,195 (49.0%)	7,592 (42.2%)
Bachelor's degree	338 (23.9%)	1,452 (29.8%)	1,286 (35.2%)	4,178 (28.4%)	6,248 (34.8%)
Mother's Nativity					
Born in the U.S. (50 US States)	286 (20.5%)	1,120 (22.3%)	767 (21.0%)	3,711 (24.6%)	4,289 (24.3%)
Vietnamese (only)					
Preterm	292 (11.4%)	1,041 (10.1%)	845 (10.7%)	1,845 (9.4%)	2,043 (11.1%)
Maternal age, years	31.14 (5.44)	31.86 (5.16)	31.52 (5.28)	32.11 (5.17)	31.59 (5.22)
Mother smoked during pregnancy					
Yes	21 (0.8%)	42 (0.4%)	51 (0.7%)	93 (0.5%)	61 (0.3%)
Previous preterm delivery					
Yes	63 (2.5%)	143 (1.4%)	135 (1.7%)	254 (1.3%)	299 (1.6%)
Gestational diabetes					
Yes	367 (14.3%)	1,337 (13.0%)	998 (12.7%)	2,125 (10.8%)	1,930 (10.5%)

Preeclampsia					
Yes	71 (2.8%)	307 (3.0%)	231 (2.9%)	490 (2.5%)	534 (2.9%)
Highest maternal education					
Less than high school graduate	293 (11.7%)	896 (9.3%)	838 (11.3%)	1,540 (8.2%)	2,177 (12.0%)
High school graduate or GED completed	618 (24.6%)	2,130 (22.2%)	1,684 (22.8%)	4,419 (23.4%)	3,930 (21.7%)
Associate degree or Some College	781 (31.1%)	2,538 (26.5%)	1,872 (25.3%)	4,582 (24.3%)	4,528 (25.0%)
Bachelor's degree	591 (23.5%)	2,787 (29.1%)	1,883 (25.5%)	5,553 (29.4%)	4,769 (26.3%)
Master's, Doctorate, or Professional Degree	227 (9.0%)	1,239 (12.9%)	1,108 (15.0%)	2,777 (14.7%)	2,725 (15.0%)
Mother's Nativity					
Born in the U.S. (50 US States)	618 (24.1%)	1,860 (18.1%)	1,863 (23.7%)	3,974 (20.3%)	4,042 (22.0%)
Other Asian (only)					
Preterm	867 (11.0%)	1,651 (11.2%)	2,215 (11.2%)	4,112 (11.0%)	5,541 (11.0%)
Maternal age, years	28.94 (5.56)	30.26 (5.50)	29.55 (5.51)	30.13 (5.70)	29.95 (5.35)
Mother smoked during pregnancy					
Yes	192 (2.5%)	261 (1.8%)	241 (1.2%)	439 (1.2%)	313 (0.6%)
Previous preterm delivery					
Yes	267 (3.4%)	487 (3.3%)	521 (2.6%)	1,035 (2.8%)	1,251 (2.5%)
Gestational diabetes					
Yes	843 (10.7%)	1,668 (11.3%)	2,052 (10.4%)	3,368 (9.0%)	5,865 (11.6%)
Preeclampsia					
Yes	280 (3.6%)	587 (4.0%)	696 (3.5%)	1,410 (3.8%)	2,074 (4.1%)
Highest maternal education					
Less than high school graduate	1,486 (19.4%)	2,265 (15.9%)	3,702 (19.7%)	7,114 (19.5%)	8,827 (17.8%)
High school graduate or GED completed	2,191 (28.5%)	3,056 (21.5%)	5,070 (26.9%)	7,556 (20.7%)	10,301 (20.8%)
Associate degree or Some College	2,204 (28.7%)	3,276 (23.0%)	4,251 (22.6%)	8,341 (22.9%)	9,752 (19.7%)
Bachelor's degree	1,273 (16.6%)	3,529 (24.8%)	3,606 (19.1%)	8,672 (23.8%)	12,639 (25.5%)
Master's, Doctorate, or Professional Degree	523 (6.8%)	2,108 (14.8%)	2,203 (11.7%)	4,748 (13.0%)	8,090 (16.3%)
Mother's Nativity					

Born in the U.S. (50 US States)	3,095 (39.4%)	5,325 (36.5%)	6,958 (35.3%)	12,634 (33.9%)	9,730 (19.4%)
Hawaiian (only)					
Preterm	33 (10.7%)	101 (16.1%)	40 (13.7%)	98 (14.9%)	57 (10.6%)
Maternal age, years	27.84 (5.63)	28.84 (6.08)	27.94 (5.72)	28.37 (6.22)	28.39 (5.85)
Mother smoked during pregnancy					
Yes	25 (8.3%)	60 (10.0%)	14 (4.8%)	38 (5.8%)	26 (4.9%)
Previous preterm delivery					
Yes	8 (2.6%)	44 (7.0%)	19 (6.5%)	34 (5.2%)	23 (4.3%)
Gestational diabetes					
Yes	22 (7.1%)	70 (11.1%)	14 (4.8%)	41 (6.2%)	26 (4.9%)
Preeclampsia					
Yes	22 (7.1%)	46 (7.3%)	26 (8.9%)	32 (4.9%)	27 (5.1%)
Highest maternal education					
Less than high school graduate	37 (12.0%)	139 (22.6%)	31 (11.0%)	82 (12.9%)	64 (12.1%)
High school graduate or GED completed	125 (40.6%)	181 (29.5%)	104 (36.9%)	225 (35.5%)	156 (29.5%)
Associate degree or Some College	87 (28.2%)	191 (31.1%)	102 (36.2%)	217 (34.2%)	187 (35.4%)
Bachelor’s degree	45 (14.6%)	80 (13.0%)	32 (11.3%)	78 (12.3%)	89 (16.9%)
Master’s, Doctorate, or Professional Degree	14 (4.5%)	23 (3.7%)	13 (4.6%)	32 (5.0%)	32 (6.1%)
Mother's Nativity					
Born in the U.S. (50 US States)	290 (94.8%)	551 (88.7%)	270 (93.4%)	589 (90.3%)	469 (87.3%)
Guamanian (only)					
Preterm	68 (14.4%)	89 (11.0%)	63 (13.9%)	109 (16.3%)	78 (11.5%)
Maternal age, years	27.05 (5.54)	27.78 (6.08)	28.59 (6.02)	27.93 (6.08)	27.86 (6.08)
Mother smoked during pregnancy					
Yes	48 (10.3%)	66 (8.4%)	11 (2.4%)	37 (5.6%)	20 (3.0%)
Previous preterm delivery					
Yes	18 (3.8%)	37 (4.6%)	17 (3.8%)	11 (1.7%)	28 (4.1%)
Gestational diabetes					

Yes	54 (11.4%)	83 (10.3%)	43 (9.5%)	41 (6.2%)	54 (8.0%)
Preeclampsia					
Yes	44 (9.3%)	52 (6.4%)	38 (8.4%)	35 (5.3%)	43 (6.3%)
Highest maternal education					
Less than high school graduate	64 (13.6%)	187 (23.6%)	65 (15.3%)	107 (16.3%)	151 (22.5%)
High school graduate or GED completed	168 (35.7%)	274 (34.5%)	134 (31.6%)	251 (38.3%)	212 (31.6%)
Associate degree or Some College	173 (36.7%)	226 (28.5%)	151 (35.6%)	224 (34.1%)	204 (30.4%)
Bachelor's degree	55 (11.7%)	82 (10.3%)	51 (12.0%)	53 (8.1%)	72 (10.7%)
Master's, Doctorate, or Professional Degree	11 (2.3%)	25 (3.1%)	23 (5.4%)	21 (3.2%)	32 (4.8%)
Mother's Nativity					
Born in the U.S. (50 US States)	131 (28.5%)	213 (26.5%)	156 (34.7%)	228 (34.7%)	167 (25.1%)
Samoan (only)					
Preterm	43 (11.9%)	387 (14.6%)	167 (14.1%)	189 (11.1%)	67 (14.8%)
Maternal age, years	27.06 (5.46)	27.26 (5.49)	27.74 (5.37)	28.16 (5.61)	28.33 (5.86)
Mother smoked during pregnancy					
Yes	24 (6.7%)	240 (9.3%)	44 (3.7%)	55 (3.3%)	28 (6.2%)
Previous preterm delivery					
Yes	20 (5.6%)	164 (6.2%)	70 (5.9%)	42 (2.5%)	14 (3.1%)
Gestational diabetes					
Yes	30 (8.3%)	280 (10.6%)	112 (9.4%)	102 (6.0%)	42 (9.2%)
Preeclampsia					
Yes	24 (6.7%)	209 (7.9%)	94 (7.9%)	118 (7.0%)	16 (3.5%)
Highest maternal education					
Less than high school graduate	39 (11.0%)	538 (20.5%)	88 (7.7%)	150 (9.1%)	43 (9.6%)
High school graduate or GED completed	171 (48.0%)	1,095 (41.8%)	534 (46.5%)	749 (45.6%)	178 (39.6%)
Associate degree or Some College	121 (34.0%)	822 (31.4%)	433 (37.7%)	618 (37.6%)	188 (41.8%)
Bachelor's degree	24 (6.7%)	137 (5.2%)	79 (6.9%)	111 (6.8%)	29 (6.4%)
Master's, Doctorate, or Professional Degree	1 (0.3%)	30 (1.1%)	14 (1.2%)	15 (0.9%)	12 (2.7%)

Mother's Nativity					
Born in the U.S. (50 US States)	162 (46.8%)	1,194 (45.3%)	702 (59.1%)	1,103 (65.1%)	233 (52.5%)
Other Pacific Islander (only)					
Preterm	334 (17.4%)	1,137 (18.8%)	277 (13.0%)	551 (12.1%)	515 (13.1%)
Maternal age, years	27.63 (5.69)	27.55 (5.86)	28.66 (5.70)	29.66 (5.62)	29.20 (5.91)
Mother smoked during pregnancy					
Yes	62 (3.2%)	112 (1.9%)	45 (2.1%)	75 (2.3%)	63 (2.2%)
Previous preterm delivery					
Yes	78 (4.1%)	319 (5.3%)	80 (3.8%)	76 (2.3%)	88 (3.1%)
Gestational diabetes					
Yes	184 (9.6%)	466 (7.7%)	198 (9.3%)	266 (8.2%)	216 (7.5%)
Preeclampsia					
Yes	106 (5.5%)	315 (5.2%)	79 (3.7%)	173 (5.3%)	168 (5.8%)
Highest maternal education					
Less than high school graduate	479 (25.2%)	2,679 (45.5%)	390 (19.6%)	517 (17.0%)	741 (26.2%)
High school graduate or GED completed	754 (39.6%)	1,499 (25.4%)	746 (37.5%)	1,130 (37.1%)	1,018 (35.9%)
Associate degree or Some College	563 (29.6%)	1,396 (23.7%)	620 (31.1%)	971 (31.9%)	706 (24.9%)
Bachelor’s degree	88 (4.6%)	256 (4.3%)	174 (8.7%)	330 (10.8%)	268 (9.5%)
Master’s, Doctorate, or Professional Degree	18 (0.9%)	62 (1.1%)	61 (3.1%)	100 (3.3%)	100 (3.5%)
Mother's Nativity					
Born in the U.S. (50 US States)	434 (22.8%)	1,073 (17.9%)	636 (30.8%)	1,621 (35.8%)	1,075 (27.5%)

Table 1b. Demographics & Risk Factors for Asian Mothers of Live Births in MSAs in the U.S., by Ethnicity & Segregation of Poverty

Covariate by ethnicity	H10 1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
	Mean (SD) or n (%)				
MSA (n=134)					
Asian Indian (only) - (04)					
Preterm	1,850 (8.8%)	2,763 (9.6%)	4,377 (9.7%)	8,527 (10.1%)	3,909 (10.1%)
Maternal age, years	31.27 (4.17)	30.92 (4.41)	31.16 (4.25)	30.82 (4.54)	30.98 (4.34)
Mother smoked during pregnancy					
Yes	32 (0.2%)	29 (0.1%)	55 (0.1%)	93 (0.1%)	79 (0.2%)
Previous preterm delivery					
Yes	168 (0.8%)	319 (1.1%)	622 (1.4%)	1,887 (2.3%)	732 (1.9%)
Gestational diabetes					
Yes	2,326 (11.0%)	2,982 (10.3%)	5,490 (12.2%)	12,063 (14.6%)	5,293 (13.8%)
Preeclampsia					
Yes	800 (3.8%)	867 (3.0%)	1,520 (3.4%)	3,513 (4.3%)	1,480 (3.9%)
Highest maternal education					
Less than high school graduate (1)	327 (1.7%)	1,237 (4.4%)	1,461 (3.4%)	6,240 (7.6%)	1,799 (4.7%)
High school graduate or GED completed (2)	1,064 (5.5%)	2,541 (9.1%)	2,607 (6.0%)	8,515 (10.4%)	2,525 (6.6%)
Associate degree or Some College (3)	1,393 (7.3%)	2,739 (9.8%)	3,517 (8.1%)	8,242 (10.1%)	2,972 (7.8%)
Bachelor's degree (4)	6,834 (35.6%)	11,523 (41.0%)	15,864 (36.4%)	27,525 (33.6%)	13,588 (35.6%)
Master's, Doctorate, or Professional Degree (5)	9,570 (49.9%)	10,034 (35.7%)	20,123 (46.2%)	31,377 (38.3%)	17,298 (45.3%)
Mother's Nativity					

Born in the U.S. (50 US States) (1)	2,199 (10.4%)	3,289 (11.4%)	4,718 (10.5%)	9,258 (11.0%)	3,988 (10.4%)
Chinese (only) - (05)					
Preterm	1,035 (6.9%)	3,394 (6.1%)	2,738 (7.8%)	4,437 (8.1%)	1,235 (7.5%)
Maternal age, years	32.90 (4.69)	32.46 (4.69)	32.58 (4.81)	31.50 (4.97)	32.09 (4.78)
Mother smoked during pregnancy					
Yes	29 (0.2%)	91 (0.2%)	72 (0.2%)	131 (0.2%)	47 (0.3%)
Previous preterm delivery					
Yes	110 (0.7%)	217 (0.4%)	387 (1.1)	941 (1.7%)	224 (1.4%)
Gestational diabetes					
Yes	1,452 (9.7%)	3,827 (6.9%)	3,728 (10.6%)	6,716 (12.3%)	1,745 (10.7%)
Preeclampsia					
Yes	370 (2.5%)	846 (1.5%)	887 (2.5%)	1,466 (2.7%)	427 (2.6%)
Highest maternal education					
Less than high school graduate (1)	250 (1.9%)	1,091 (2.1%)	1,319 (3.9%)	8,319 (15.3%)	977 (6.1%)
High school graduate or GED completed (2)	826 (6.2%)	4,118 (7.7%)	3,323 (9.8%)	8,697 (16.0%)	1,334 (8.3%)
Associate degree or Some College (3)	1,266 (9.4%)	9,524 (17.9%)	4,489 (13.3%)	7,763 (14.3%)	1,581 (9.8%)
Bachelor's degree (4)	4,672 (34.8%)	23,477 (44.2%)	11,852 (35.1%)	13,644 (25.1%)	4,200 (26.0%)
Master's, Doctorate, or Professional Degree (5)	6,403 (47.7%)	14,959 (28.1%)	12,786 (37.9%)	15,894 (29.3%)	8,053 (49.9%)
Mother's Nativity					
Born in the U.S. (50 US States) (1)	2,415 (16.1%)	5,160 (9.3%)	6,638 (18.9%)	7,647 (13.9%)	2,391 (14.6%)
Filipino (only) - (06)					
Preterm	1,610 (11.6%)	2,766 (11.7%)	2,869 (12.5%)	2,637 (13.0%)	1,059 (14.1%)
Maternal age, years	31.56 (5.36)	32.03 (5.33)	31.68 (5.48)	31.93 (5.54)	32.30 (5.42)
Mother smoked during pregnancy					
Yes	117 (0.8%)	156 (0.7%)	228 (1.0%)	184 (0.9%)	103 (1.4%)
Previous preterm delivery					

Yes	221 (1.6%)	420 (1.8%)	555 (2.4%)	761 (3.8%)	215 (2.9%)
Gestational diabetes					
Yes	1,647 (11.8%)	2,124 (9.0%)	2,705 (11.8%)	2,656 (13.3%)	922 (12.4%)
Preeclampsia					
Yes	889 (6.4%)	1,386 (5.8%)	1,410 (6.2%)	1,360 (6.8%)	518 (7.0%)
Highest maternal education					
Less than high school graduate (1)	288 (2.2%)	506 (2.2%)	707 (3.2%)	1,381 (7.0%)	305 (4.1%)
High school graduate or GED completed (2)	1,853 (14.4%)	2,619 (11.3%)	3,012 (13.6%)	1,671 (8.5%)	788 (10.7%)
Associate degree or Some College (3)	4,484 (34.9%)	7,503 (32.5%)	7,430 (33.6%)	5,479 (27.7%)	1,929 (26.1%)
Bachelor's degree (4)	5,144 (40.1%)	10,171 (44.0%)	8,896 (40.3%)	8,855 (44.8%)	3,260 (44.1%)
Master's, Doctorate, or Professional Degree (5)	1,073 (8.4%)	2,310 (10.0%)	2,047 (9.3%)	2,366 (12.0%)	1,104 (14.9%)
Mother's Nativity					
Born in the U.S. (50 US States) (1)	4,458 (32.1%)	7,351 (31.0%)	7,172 (31.4%)	5,652 (27.9%)	1,910 (25.5%)
Japanese (only) - (07)					
Preterm	209 (8.3%)	340 (8.0%)	364 (9.5%)	669 (9.7%)	198 (9.0%)
Maternal age, years	33.92 (4.90)	34.53 (4.85)	33.94 (4.97)	34.38 (4.83)	33.94 (4.86)
Mother smoked during pregnancy					
Yes	28 (1.1%)	36 (0.8%)	37 (1.0%)	63 (0.9%)	17 (0.8%)
Previous preterm delivery					
Yes	24 (0.9%)	33 (0.8%)	60 (1.6%)	135 (2.0%)	48 (2.2%)
Gestational diabetes					
Yes	169 (6.7%)	196 (4.6%)	311 (8.1%)	570 (8.3%)	123 (5.7%)
Preeclampsia					
Yes	80 (3.2%)	119 (2.8%)	114 (3.0%)	231 (3.4%)	53 (2.4%)
Highest maternal education					
Less than high school graduate (1)	29 (1.2%)	55 (1.3%)	94 (2.5%)	278 (4.1%)	61 (2.8%)

High school graduate or GED completed (2)	218 (9.3%)	393 (9.5%)	301 (8.1%)	711 (5.3%)	206 (9.5%)
Associate degree or Some College (3)	553 (23.7%)	965 (23.4%)	850 (22.8%)	1,871 (14.0%)	399 (18.4%)
Bachelor's degree (4)	1,078 (46.2%)	1,905 (46.2%)	1,691 (45.4%)	5,830 (43.7%)	980 (45.3%)
Master's, Doctorate, or Professional Degree (5)	457 (19.6%)	809 (19.6%)	791 (21.2%)	4,652 (34.9%)	519 (24.0%)
Mother's Nativity					
Born in the U.S. (50 US States) (1)	725 (28.7%)	1,394 (32.6%)	1,130 (29.5%)	2,116 (30.6%)	297 (13.5%)
Korean (only) - (08)					
Preterm	275 (8.0%)	835 (7.2%)	664 (8.9%)	1,154 (8.4%)	658 (8.6%)
Maternal age, years	33.21 (4.45)	33.45 (4.43)	33.24 (4.62)	33.50 (4.36)	32.94 (4.57)
Mother smoked during pregnancy					
Yes	23 (0.7%)	80 (0.7%)	90 (1.2%)	134 (1.0%)	81 (1.1%)
Previous preterm delivery					
Yes	44 (1.3%)	75 (0.6%)	115 (1.5%)	228 (1.7%)	150 (2.0%)
Gestational diabetes					
Yes	255 (7.4%)	607 (5.2%)	708 (9.5%)	1,184 (8.8%)	652 (8.6%)
Preeclampsia					
Yes	119 (3.5%)	323 (2.8%)	283 (3.8%)	418 (3.1%)	256 (3.4%)
Highest maternal education					
Less than high school graduate (1)	21 (0.7%)	233 (2.1%)	156 (2.2%)	284 (2.1%)	289 (3.8%)
High school graduate or GED completed (2)	181 (5.7%)	659 (5.8%)	361 (5.0%)	711 (5.3%)	438 (5.8%)
Associate degree or Some College (3)	524 (16.4%)	1,848 (16.4%)	1,272 (17.6%)	1,871 (14.0%)	1,053 (13.9%)
Bachelor's degree (4)	1,564 (48.9%)	5,625 (49.9%)	3,146 (43.6%)	5,830 (43.7%)	3,030 (40.1%)
Master's, Doctorate, or Professional Degree (5)	908 (28.4%)	2,907 (25.8%)	2,288 (31.7%)	4,652 (34.9%)	2,747 (36.4%)
Mother's Nativity					
Born in the U.S. (50 US States) (1)	751 (22.1%)	2,801 (24.3%)	1,964 (26.8%)	2,953 (22.2%)	1,704 (23.4%)

Vietnamese (only) - (09)					
Preterm	871 (9.6%)	1,440 (9.2%)	1,703 (11.0%)	1,260 (10.8%)	792 (11.4%)
Maternal age, years	32.12 (5.11)	32.02 (5.16)	31.60 (5.27)	31.54 (5.22)	31.62 (5.30)
Mother smoked during pregnancy					
Yes	25 (0.3%)	57 (0.4%)	82 (0.5%)	65 (0.6%)	39 (0.6%)
Previous preterm delivery					
Yes	86 (1.0%)	170 (1.1%)	272 (1.8%)	227 (2.0%)	139 (2.0%)
Gestational diabetes					
Yes	1,147 (12.7%)	1,681 (10.8%)	1,715 (11.1%)	1,306 (11.2%)	908 (13.2%)
Preeclampsia					
Yes	280 (3.1%)	362 (2.3%)	467 (3.0%)	338 (2.9%)	186 (2.7%)
Highest maternal education					
Less than high school graduate (1)	492 (6.1%)	1,208 (8.1%)	1,686 (11.2%)	1,435 (12.5%)	923 (13.5%)
High school graduate or GED completed (2)	1,785 (22.0%)	3,699 (24.7%)	3,108 (20.6%)	2,666 (23.2%)	1,523 (22.3%)
Associate degree or Some College (3)	2,211 (27.3%)	3,637 (24.3%)	4,063 (26.9%)	2,823 (24.6%)	1,567 (23.0%)
Bachelor's degree (4)	2,481 (30.6%)	4,333 (28.9%)	4,095 (27.1%)	2,866 (25.0%)	1,808 (26.5%)
Master's, Doctorate, or Professional Degree (5)	1,131 (14.0%)	2,107 (14.1%)	2,152 (14.2%)	1,688 (14.7%)	998 (14.6%)
Mother's Nativity					
Born in the U.S. (50 US States) (1)	1,854 (20.5%)	3,075 (19.7%)	3,580 (23.2%)	2,556 (21.9%)	1,292 (18.7%)
Other Asian (only) - (10)					
Preterm	1,105 (9.9%)	2,970 (11.0%)	3,036 (11.1%)	4,565 (11.3%)	2,710 (11.1%)
Maternal age, years	30.13 (5.58)	30.04 (5.66)	30.14 (5.48)	29.71 (5.51)	29.78 (5.34)
Mother smoked during pregnancy					
Yes	200 (1.8%)	210 (0.8%)	296 (1.1%)	509 (1.3%)	231 (1.0%)
Previous preterm delivery					
Yes	279 (2.5%)	523 (1.9%)	627 (2.3%)	1,492 (3.7%)	640 (2.6%)
Gestational diabetes					

Yes	1,128 (10.1%)	2,298 (8.5%)	2,519 (9.2%)	5,135 (12.7%)	2,716 (11.1%)
Preeclampsia					
Yes	436 (3.9%)	817 (3.0%)	1,016 (3.7%)	1,789 (4.4%)	989 (4.0%)
Highest maternal education					
Less than high school graduate (1)	1,125 (10.6%)	4,625 (17.9%)	4,048 (15.3%)	8,463 (21.3%)	5,133 (21.3%)
High school graduate or GED completed (2)	2,524 (23.9%)	6,606 (25.5%)	5,463 (20.7%)	8,260 (20.7%)	5,321 (22.1%)
Associate degree or Some College (3)	2,937 (27.8%)	5,860 (22.6%)	6,273 (23.8%)	8,520 (21.4%)	4,234 (17.6%)
Bachelor's degree (4)	2,549 (24.1%)	5,843 (22.6%)	6,685 (25.3%)	9,158 (23.0%)	5,484 (22.8%)
Master's, Doctorate, or Professional Degree (5)	1,442 (13.6%)	2,971 (11.5%)	3,922 (14.9%)	5,422 (13.6%)	3,915 (16.3%)
Mother's Nativity					
Born in the U.S. (50 US States) (1)	5,159 (46.3%)	10,390 (38.6%)	8,871 (32.6%)	9,327 (23.2%)	3,995 (16.5%)
Hawaiian (only) - (11)					
Preterm	51 (10.8%)	57 (14.0%)	116 (15.1%)	84 (14.4%)	21 (10.8%)
Maternal age, years	28.25 (5.60)	28.23 (6.19)	27.78 (5.82)	28.89 (6.23)	29.75 (5.93)
Mother smoked during pregnancy					
Yes	31 (6.7%)	23 (5.8%)	45 (5.9%)	51 (9.1%)	13 (6.7%)
Previous preterm delivery					
Yes	13 (2.8%)	9 (2.2%)	42 (5.5%)	50 (8.6%)	14 (7.2%)
Gestational diabetes					
Yes	38 (8.1%)	19 (4.7%)	53 (6.9%)	54 (9.3%)	9 (4.6%)
Preeclampsia					
Yes	32 (6.8%)	26 (6.4%)	43 (5.6%)	44 (7.6%)	8 (4.1%)
Highest maternal education					
Less than high school graduate (1)	41 (8.8%)	54 (13.8%)	91 (12.2%)	151 (26.5%)	16 (8.3%)
High school graduate or GED completed (2)	173 (37.1%)	144 (36.8%)	293 (39.2%)	126 (22.1%)	55 (28.5%)

Associate degree or Some College (3)	156 (33.5%)	139 (35.5%)	244 (32.7%)	189 (33.2%)	56 (29.0%)
Bachelor's degree (4)	67 (14.4%)	38 (9.7%)	93 (12.4%)	78 (13.7%)	48 (24.9%)
Master's, Doctorate, or Professional Degree (5)	29 (6.2%)	16 (4.1%)	26 (3.5%)	25 (4.4%)	18 (9.3%)
Mother's Nativity					
Born in the U.S. (50 US States) (1)	435 (93.1%)	345 (85.6%)	689 (90.2%)	533 (92.4%)	167 (86.1%)
Guamanian (only) - (12)					
Preterm	94 (13.7%)	85 (15.7%)	152 (13.2%)	43 (9.7%)	33 (13.0%)
Maternal age, years	27.85 (5.82)	28.09 (6.08)	27.59 (6.06)	27.91 (6.08)	28.28 (5.95)
Mother smoked during pregnancy					
Yes	55 (8.1%)	21 (3.9%)	79 (6.9%)	18 (4.3%)	9 (3.6%)
Previous preterm delivery					
Yes	20 (2.9%)	14 (2.6%)	55 (4.8%)	10 (2.3%)	12 (4.7%)
Gestational diabetes					
Yes	79 (11.5%)	36 (6.7%)	103 (8.9%)	38 (8.6%)	19 (7.5%)
Preeclampsia					
Yes	51 (7.4%)	36 (6.7%)	79 (6.8%)	30 (6.8%)	16 (6.3%)
Highest maternal education					
Less than high school graduate (1)	75 (11.4%)	77 (14.5%)	241 (21.1%)	99 (22.6%)	82 (33.2%)
High school graduate or GED completed (2)	231 (35.1%)	174 (32.8%)	406 (35.5%)	160 (36.5%)	68 (28.5%)
Associate degree or Some College (3)	242 (36.8%)	203 (38.3%)	361 (31.6%)	117 (26.7%)	56 (29.0%)
Bachelor's degree (4)	81 (12.3%)	58 (10.9%)	99 (8.7%)	50 (11.4%)	48 (24.9%)
Master's, Doctorate, or Professional Degree (5)	29 (4.4%)	18 (3.4%)	36 (3.1%)	12 (2.7%)	18 (9.3%)
Mother's Nativity					
Born in the U.S. (50 US States) (1)	234 (34.8%)	202 (37.8%)	298 (25.9%)	107 (24.4%)	54 (22.4%)
Samoan (only) - (13)					
Preterm	67 (10.3%)	224 (12.2%)	389 (14.4%)	136 (15.2%)	37 (13.6%)

Maternal age, years	27.61 (5.44)	27.61 (5.73)	27.65 (5.46)	27.58 (5.51)	28.34 (5.36)
Mother smoked during pregnancy					
Yes	28 (4.3%)	88 (4.9%)	207 (7.7%)	53 (6.2%)	15 (5.6%)
Previous preterm delivery					
Yes	26 (4.0%)	71 (3.9%)	149 (5.5%)	49 (5.5%)	15 (5.5%)
Gestational diabetes					
Yes	57 (8.7%)	153 (8.3%)	261 (9.7%)	73 (8.2%)	22 (8.1%)
Preeclampsia					
Yes	47 (7.2%)	114 (6.2%)	216 (8.0%)	63 (7.0%)	21 (7.7%)
Highest maternal education					
Less than high school graduate (1)	44 (7.1%)	165 (9.2%)	283 (10.7%)	344 (38.9%)	22 (8.3%)
High school graduate or GED completed (2)	314 (50.6%)	896 (50.1%)	1,287 (48.4%)	149 (16.8%)	81 (30.5%)
Associate degree or Some College (3)	212 (34.1%)	615 (34.4%)	927 (34.9%)	303 (34.2%)	125 (47.0%)
Bachelor's degree (4)	47 (7.6%)	92 (5.1%)	136 (5.1%)	73 (8.2%)	32 (12.0%)
Master's, Doctorate, or Professional Degree (5)	4 (0.6%)	22 (1.2%)	24 (0.9%)	16 (1.8%)	6 (2.3%)
Mother's Nativity					
Born in the U.S. (50 US States) (1)	377 (59.5%)	996 (54.1%)	1,429 (53.3%)	454 (51.2%)	138 (52.9%)
Other Pacific Islander (only) - (14)					
Preterm	382 (16.1%)	713 (16.9%)	586 (14.2%)	808 (15.6%)	325 (12.1%)
Maternal age, years	28.10 (5.74)	28.21 (5.80)	28.49 (5.89)	28.54 (5.96)	29.60 (5.58)
Mother smoked during pregnancy					
Yes	65 (2.7%)	76 (1.8%)	117 (2.9%)	63 (1.6%)	36 (2.7%)
Previous preterm delivery					
Yes	77 (3.2%)	122 (2.9%)	148 (3.6%)	249 (6.0%)	45 (3.3%)
Gestational diabetes					
Yes	215 (9.0%)	337 (8.0%)	364 (8.9%)	314 (7.5%)	100 (7.4%)
Preeclampsia					

Yes	129 (5.4%)	164 (3.9%)	266 (6.5%)	215 (5.2%)	67 (5.0%)
Highest maternal education					
Less than high school graduate (1)	474 (20.6%)	1,130 (27.8%)	755 (19.5%)	2,031 (49.4%)	416 (31.7%)
High school graduate or GED completed (2)	905 (39.4%)	1,538 (37.8%)	1,536 (39.6%)	790 (19.2%)	378 (28.8%)
Associate degree or Some College (3)	711 (31.0%)	1,071 (26.3%)	1,205 (31.0%)	947 (23.0%)	322 (24.5%)
Bachelor's degree (4)	156 (6.8%)	261 (6.4%)	283 (7.3%)	268 (6.5%)	148 (11.3%)
Master's, Doctorate, or Professional Degree (5)	50 (2.2%)	65 (1.6%)	102 (2.6%)	74 (1.8%)	50 (3.8%)
Mother's Nativity					
Born in the U.S. (50 US States) (1)	666 (28.4%)	1,166 (27.9%)	1,472 (35.9%)	1,026 (20.1%)	509 (19.1%)

Table 1c. Demographics & Risk Factors for Asian Mothers of Live Births in MSAs in the U.S., by Ethnicity & Segregation of Affluence

			H90		
	1st Quintile	**2nd Quintile**	**3rd Quintile**	**4th Quintile**	**5th Quintile**
Covariate by ethnicity			*Mean (SD) or n (%)*		
MSA (n=134)					
Asian Indian (only) - (04)					
Preterm	504 (9.7%)	1,742 (8.8%)	2,804 (9.4%)	2,661 (9.1%)	13,715 (10.3%)
Maternal age, years	30.34 (4.55)	31.03 (4.15)	31.04 (4.25)	31.28 (4.23)	30.91 (4.49)
Mother smoked during pregnancy					
Yes	15 (0.3%)	24 (0.1%)	55 (0.2%)	38 (0.1%)	156 (0.1%)
Previous preterm delivery					
Yes	104 (2.0%)	220 (1.1%)	505 (1.7%)	402 (1.4%)	2,497 (1.9%)
Gestational diabetes					
Yes	732 (14.2%)	2,157 (10.9%)	4,179 (14.0%)	3,719 (12.6%)	17,367 (13.2%)

Preeclampsia					
Yes	222 (4.3%)	760 (3.8%)	1,082 (3.6%)	976 (3.3%)	5,140 (3.9%)
Highest maternal education					
Less than high school graduate (1)	297 (5.8%)	664 (3.7%)	947 (3.2%)	820 (2.9%)	8,336 (6.4%)
High school graduate or GED completed (2)	718 (14.1%)	1,045 (5.8%)	1,847 (6.3%)	1,338 (4.8%)	12,304 (9.4%)
Associate degree or Some College (3)	774 (15.2%)	1,089 (6.0%)	2,475 (8.4%)	1,835 (6.5%)	12,690 (9.7%)
Bachelor's degree (4)	1,562 (30.7%)	6,329 (34.9%)	10,731 (36.6%)	10,149 (36.2%)	46,563 (35.7%)
Master's, Doctorate, or Professional Degree (5)	1,733 (34.1%)	9,017 (49.7%)	13,333 (45.5%)	13,894 (49.6%)	50,425 (38.7%)
Mother's Nativity					
Born in the U.S. (50 US States) (1)	533 (10.3%)	1,574 (8.0%)	4,718 (10.5%)	3,035 (10.3%)	15,484 (11.6%)
Chinese (only) - (05)					
Preterm	297 (7.5%)	846 (6.7%)	1,913 (7.0%)	2,028 (7.7%)	7,755 (7.2%)
Maternal age, years	31.62 (5.16)	32.77 (4.54)	32.27 (4.70)	32.79 (4.81)	31.97 (4.88)
Mother smoked during pregnancy					
Yes	16 (0.4%)	30 (0.2%)	65 (0.2%)	60 (0.2%)	199 (0.2%)
Previous preterm delivery					
Yes	56 (1.4%)	95 (0.8%)	256 (0.9%)	285 (1.1%)	1,187 (1.1%)
Gestational diabetes					
Yes	445 (11.3%)	1,231 (9.8%)	2,628 (9.6%)	2,819 (10.7%)	10,345 (9.7%)
Preeclampsia					
Yes	94 (2.4%)	300 (2.4%)	564 (2.1%)	692 (2.6%)	2,346 (2.2%)
Highest maternal education					
Less than high school graduate (1)	436 (11.3%)	330 (2.9%)	1,080 (4.1%)	894 (3.6%)	9,216 (8.8%)
High school graduate or GED completed (2)	328 (8.5%)	622 (5.4%)	2,228 (8.5%)	2,369 (9.6%)	12,751 (12.2%)
Associate degree or Some College (3)	616 (16.0%)	974 (8.4%)	3,408 (13.0%)	2,977 (12.1%)	16,648 (15.9%)
Bachelor's degree (4)	1,107 (28.8%)	3,881 (33.6%)	9,439 (36.0%)	8,651 (35.1%)	34,767 (33.2%)
Master's, Doctorate, or Professional Degree (5)	1,357 (35.3%)	5,731 (49.7%)	10,055 (38.4%)	9,722 (39.5%)	31,230 (29.9%)
Mother's Nativity					

Born in the U.S. (50 US States) (1)	721 (18.3%)	1,813 (14.4%)	6,638 (18.9%)	5,341 (20.3%)	12,978 (12.1%)
Filipino (only) - (06)					
Preterm	1,151 (14.0%)	1,092 (11.7%)	1,914 (12.3%)	2,204 (11.8%)	4,580 (12.6%)
Maternal age, years	30.27 (5.69)	31.38 (5.44)	31.55 (5.44)	31.96 (5.36)	32.44 (5.31)
Mother smoked during pregnancy					
Yes	111 (1.4%)	104 (1.1%)	185 (1.2%)	149 (0.8%)	239 (0.7%)
Previous preterm delivery					
Yes	326 (4.0%)	210 (2.3%)	454 (2.9%)	368 (2.0%)	814 (2.3%)
Gestational diabetes					
Yes	1,089 (13.2%)	1,115 (12.0%)	1,884 (12.1%)	2,244 (12.0%)	3,722 (10.3%)
Preeclampsia					
Yes	478 (5.8%)	607 (6.5%)	911 (5.9%)	1,277 (6.8%)	2,290 (6.4%)
Highest maternal education					
Less than high school graduate (1)	1,041 (12.8%)	235 (2.7%)	445 (2.9%)	382 (2.2%)	1,084 (3.1%)
High school graduate or GED completed (2)	1,089 (13.4%)	1,256 (14.4%)	2,165 (14.2%)	2,085 (11.9%)	3,348 (9.4%)
Associate degree or Some College (3)	3,105 (38.2%)	3,190 (36.6%)	5,315 (34.8%)	5,689 (32.5%)	9,526 (26.8%)
Bachelor's degree (4)	2,496 (30.7%)	3,347 (38.4%)	5,971 (39.1%)	7,542 (43.1%)	16,970 (47.8%)
Master's, Doctorate, or Professional Degree (5)	404 (5.0%)	691 (7.9%)	1,389 (9.1%)	1,820 (10.4%)	4,596 (12.9%)
Mother's Nativity					
Born in the U.S. (50 US States) (1)	2,653 (32.3%)	2,918 (31.4%)	7,172 (31.4%)	6,292 (33.7%)	9,941 (27.3%)
Japanese (only) - (07)					
Preterm	351 (11.4%)	149 (8.7%)	258 (9.0%)	255 (8.6%)	767 (8.4%)
Maternal age, years	33.95 (4.91)	34.12 (4.81)	33.69 (5.07)	34.26 (4.92)	34.49 (4.79)
Mother smoked during pregnancy					
Yes	48 (1.6%)	16 (0.9%)	29 (1.0%)	24 (0.8%)	64 (0.7%)
Previous preterm delivery					
Yes	70 (2.3%)	15 (0.9%)	50 (1.7%)	40 (1.4%)	125 (1.4%)
Gestational diabetes					

Yes	325 (10.6%)	106 (6.2%)	222 (7.8%)	220 (7.4%)	496 (5.5%)
Preeclampsia					
Yes	124 (4.0%)	50 (2.9%)	87 (3.0%)	83 (2.8%)	253 (2.8%)
Highest maternal education					
Less than high school graduate (1)	183 (6.0%)	23 (1.4%)	61 (2.2%)	47 (1.7%)	203 (2.3%)
High school graduate or GED completed (2)	149 (4.9%)	142 (8.8%)	217 (7.7%)	246 (8.8%)	809 (9.1%)
Associate degree or Some College (3)	783 (25.7%)	367 (22.8%)	685 (24.4%)	581 (20.8%)	1,811 (20.3%)
Bachelor's degree (4)	1,288 (42.3%)	747 (46.3%)	1,187 (42.2%)	1,302 (46.7%)	4,232 (47.5%)
Master's, Doctorate, or Professional Degree (5)	643 (21.1%)	333 (20.7%)	660 (23.5%)	612 (22.0%)	1,849 (20.8%)
Mother's Nativity					
Born in the U.S. (50 US States) (1)	1,695 (55.2%)	444 (25.9%)	1,130 (29.5%)	748 (25.3%)	1,970 (21.6%)
Korean (only) - (08)					
Preterm	165 (10.5%)	253 (8.4%)	530 (8.6%)	511 (8.8%)	2,127 (7.8%)
Maternal age, years	32.82 (4.91)	32.93 (4.39)	32.93 (4.44)	33.37 (4.50)	33.47 (4.45)
Mother smoked during pregnancy					
Yes	19 (1.3%)	53 (1.8%)	86 (1.4%)	76 (1.3%)	174 (0.6%)
Previous preterm delivery					
Yes	32 (2.0%)	60 (2.0%)	107 (1.7%)	84 (1.4%)	329 (1.2%)
Gestational diabetes					
Yes	156 (9.9%)	240 (7.9%)	632 (10.3%)	475 (8.2%)	1,903 (7.1%)
Preeclampsia					
Yes	50 (3.2%)	124 (4.1%)	235 (3.8%)	225 (3.9%)	765 (2.8%)
Highest maternal education					
Less than high school graduate (1)	55 (3.5%)	27 (0.9%)	94 (1.6%)	87 (1.6%)	720 (2.7%)
High school graduate or GED completed (2)	119 (7.6%)	160 (5.6%)	306 (5.0%)	265 (4.8%)	1,500 (5.6%)
Associate degree or Some College (3)	348 (22.4%)	486 (17.0%)	1,035 (17.1%)	826 (14.9%)	3,873 (14.6%)
Bachelor's degree (4)	634 (40.7%)	1,271 (44.5%)	2,724 (44.9%)	2,400 (43.3%)	12,166 (45.8%)
Master's, Doctorate, or Professional Degree (5)	401 (25.8%)	914 (32.0%)	1,905 (31.4%)	1,971 (35.5%)	8,311 (31.3%)

Mother's Nativity					
Born in the U.S. (50 US States) (1)	281 (18.4%)	595 (19.9%)	1,964 (26.8%)	1,507 (26.6%)	6,471 (24.4%)
Vietnamese (only) - (09)					
Preterm	232 (11.7%)	707 (9.5%)	1,220 (11.1%)	897 (10.2%)	3,010 (10.2%)
Maternal age, years	30.75 (5.48)	31.95 (5.09)	31.60 (5.23)	31.78 (5.35)	31.88 (5.18)
Mother smoked during pregnancy					
Yes	18 (0.9%)	28 (0.4%)	73 (0.7%)	60 (0.7%)	89 (0.3%)
Previous preterm delivery					
Yes	43 (2.2%)	85 (1.1%)	223 (2.0%)	166 (1.9%)	377 (1.3%)
Gestational diabetes					
Yes	259 (13.0%)	936 (12.6%)	1,429 (13.0%)	1,053 (12.0%)	3,080 (10.5%)
Preeclampsia					
Yes	53 (2.7%)	208 (2.8%)	318 (2.9%)	275 (3.1%)	779 (2.6%)
Highest maternal education					
Less than high school graduate (1)	309 (15.9%)	515 (7.6%)	1,216 (11.4%)	809 (9.8%)	2,895 (10.0%)
High school graduate or GED completed (2)	524 (27.0%)	1,547 (22.8%)	2,400 (22.5%)	1,758 (21.2%)	6,552 (22.7%)
Associate degree or Some College (3)	521 (26.9%)	1,865 (27.5%)	2,839 (26.6%)	2,063 (24.9%)	7,013 (24.3%)
Bachelor's degree (4)	397 (20.5%)	2,063 (30.4%)	2,740 (25.7%)	2,313 (27.9%)	8,070 (28.0%)
Master's, Doctorate, or Professional Degree (5)	187 (9.6%)	790 (11.7%)	1,473 (13.8%)	1,341 (16.2%)	4,285 (14.9%)
Mother's Nativity					
Born in the U.S. (50 US States) (1)	544 (27.4%)	1,315 (17.7%)	3,580 (23.2%)	2,042 (23.2%)	6,109 (20.7%)
Other Asian (only) - (10)					
Preterm	910 (11.0%)	1,253 (11.6%)	3,467 (11.2%)	2,093 (10.8%)	6,663 (11.0%)
Maternal age, years	29.19 (5.58)	29.57 (5.70)	29.34 (5.58)	30.38 (5.45)	30.22 (5.42)
Mother smoked during pregnancy					
Yes	207 (2.5%)	157 (1.5%)	578 (1.9%)	184 (1.0%)	320 (0.5%)
Previous preterm delivery					
Yes	302 (3.6%)	307 (2.8%)	1,179 (3.8%)	552 (2.9%)	1,221 (2.0%)

Gestational diabetes					
Yes	890 (10.7%)	1,111 (10.3%)	3,443 (11.1%)	1,932 (10.0%)	6,420 (10.6%)
Preeclampsia					
Yes	305 (3.7%)	376 (3.5%)	1,185 (3.8%)	740 (3.8%)	2,441 (4.0%)
Highest maternal education					
Less than high school graduate (1)	1,423 (17.6%)	2,365 (22.9%)	5,622 (18.6%)	3,365 (18.1%)	10,619 (17.8%)
High school graduate or GED completed (2)	2,103 (26.0%)	2,681 (26.0%)	7,520 (24.9%)	3,772 (20.3%)	12,098 (20.3%)
Associate degree or Some College (3)	2,263 (27.9%)	2,194 (21.2%)	8,121 (26.9%)	3,666 (19.7%)	11,580 (19.4%)
Bachelor's degree (4)	1,578 (19.5%)	1,916 (18.6%)	5,918 (19.6%)	4,620 (24.9%)	15,687 (26.3%)
Master's, Doctorate, or Professional Degree (5)	730 (9.0%)	1,169 (11.3%)	2,982 (9.9%)	3,141 (16.9%)	9,650 (16.2%)
Mother's Nativity					
Born in the U.S. (50 US States) (1)	3,696 (44.6%)	3,653 (17.7%)	8,871 (32.6%)	5,747 (29.9%)	13,603 (22.6%)
Hawaiian (only) - (11)					
Preterm	72 (14.7%)	27 (11.0%)	115 (16.5%)	48 (13.0%)	67 (10.8%)
Maternal age, years	28.62 (6.18)	28.48 (5.38)	28.12 (6.12)	28.02 (5.77)	28.64 (5.98)
Mother smoked during pregnancy					
Yes	48 (10.2%)	18 (7.6%)	44 (6.3%)	24 (6.5%)	29 (4.7%)
Previous preterm delivery					
Yes	32 (2.0%)	16 (6.5%)	46 (6.6%)	14 (3.8%)	20 (3.2%)
Gestational diabetes					
Yes	45 (9.2%)	22 (9.0%)	60 (8.6%)	14 (3.8%)	32 (5.2%)
Preeclampsia					
Yes	35 (7.1%)	23 (9.4%)	41 (5.9%)	22 (6.0%)	32 (5.2%)
Highest maternal education					
Less than high school graduate (1)	130 (26.7%)	25 (10.4%)	82 (12.2%)	41 (11.3%)	75 (12.4%)
High school graduate or GED completed (2)	144 (29.6%)	92 (38.2%)	269 (40.0%)	113 (31.1%)	173 (28.6%)
Associate degree or Some College (3)	139 (28.6%)	75 (31.1%)	221 (32.9%)	129 (35.5%)	220 (36.4%)
Bachelor's degree (4)	55 (11.3%)	38 (15.8%)	77 (11.5%)	56 (15.4%)	98 (16.2%)

Master's, Doctorate, or Professional Degree (5)	18 (3.7%)	11 (4.6%)	23 (3.4%)	24 (6.6%)	38 (6.3%)
Mother's Nativity					
Born in the U.S. (50 US States) (1)	471 (96.9)	220 (89.8%)	689 (90.2%)	340 (93.4%)	528 (85.0%)
Guamanian (only) - (12)					
Preterm	46 (12.3%)	57 (12.5%)	110 (12.1%)	94 (16.5%)	100 (13.0%)
Maternal age, years	27.31 (5.84)	27.67 (5.68)	27.77 (6.07)	27.90 (6.11)	28.23 (6.09)
Mother smoked during pregnancy					
Yes	28 (7.9%)	38 (8.4%)	71 (7.8%)	23 (4.0%)	22 (2.9%)
Previous preterm delivery					
Yes	12 (3.2%)	16 (3.5%)	38 (4.2%)	19 (3.3%)	26 (3.4%)
Gestational diabetes					
Yes	36 (9.6%)	55 (12.1%)	79 (8.7%)	45 (7.9%)	60 (7.8%)
Preeclampsia					
Yes	19 (5.1%)	38 (8.3%)	59 (6.5%)	41 (7.2%)	55 (7.2%)
Highest maternal education					
Less than high school graduate (1)	44 (11.7%)	77 (17.3%)	212 (23.7%)	88 (16.2%)	153 (20.2%)
High school graduate or GED completed (2)	148 (39.5%)	134 (30.0%)	314 (35.1%)	192 (35.4%)	251 (33.2%)
Associate degree or Some College (3)	126 (33.6%)	159 (35.7%)	283 (31.6%)	178 (32.8%)	232 (30.6%)
Bachelor's degree (4)	46 (12.3%)	60 (13.5%)	69 (7.7%)	54 (9.9%)	84 (11.1%)
Master's, Doctorate, or Professional Degree (5)	11 (2.9%)	16 (3.6%)	17 (1.9%)	31 (5.7%)	37 (4.9%)
Mother's Nativity					
Born in the U.S. (50 US States) (1)	87 (24.0%)	154 (34.1%)	298 (25.9%)	204 (36.4%)	205 (27.2%)
Samoan (only) - (13)					
Preterm	134 (14.0%)	140 (13.8%)	371 (14.7%)	91 (11.1%)	117 (11.2%)
Maternal age, years	27.19 (5.38)	27.28 (5.69)	27.56 (5.45)	28.06 (5.45)	28.34 (5.75)
Mother smoked during pregnancy					
Yes	62 (6.7%)	65 (6.6%)	190 (7.6%)	40 (4.9%)	34 (3.3%)
Previous preterm delivery					

Yes	50 (5.2%)	76 (7.5%)	143 (5.7%)	20 (2.4%)	21 (2.0%)
Gestational diabetes					
Yes	67 (7.0%)	112 (11.0%)	251 (10.0%)	65 (8.0%)	71 (6.8%)
Preeclampsia					
Yes	65 (6.8%)	74 (7.3%)	202 (8.0%)	62 (7.6%)	58 (5.6%)
Highest maternal education					
Less than high school graduate (1)	346 (36.7%)	99 (10.0%)	264 (10.6%)	52 (6.7%)	97 (9.5%)
High school graduate or GED completed (2)	207 (21.9%)	535 (53.9%)	1,174 (47.3%)	383 (49.4%)	428 (41.8%)
Associate degree or Some College (3)	304 (32.2%)	296 (29.8%)	894 (36.0%)	272 (35.1%)	416 (40.7%)
Bachelor's degree (4)	77 (8.2%)	55 (5.5%)	124 (5.0%)	56 (7.2%)	68 (6.6%)
Master's, Doctorate, or Professional Degree (5)	10 (1.1%)	7 (0.7%)	28 (1.1%)	13 (1.7%)	14 (1.4%)
Mother's Nativity					
Born in the U.S. (50 US States) (1)	469 (50.2%)	433 (42.7%)	1,429 (53.3%)	496 (60.8%)	652 (63.2%)
Other Pacific Islander (only) - (14)					
Preterm	706 (18.4%)	292 (15.0%)	846 (15.5%)	356 (13.5%)	614 (13.0%)
Maternal age, years	27.40 (5.87)	27.92 (5.64)	28.74 (5.66)	28.89 (5.80)	29.35 (5.98)
Mother smoked during pregnancy					
Yes	73 (2.0%)	64 (3.4%)	97 (2.4%)	53 (2.0%)	70 (1.9%)
Previous preterm delivery					
Yes	242 (6.3%)	66 (3.4%)	165 (4.0%)	79 (3.0%)	89 (2.4%)
Gestational diabetes					
Yes	275 (7.2%)	178 (9.2%)	376 (9.1%)	224 (8.5%)	277 (7.5%)
Preeclampsia					
Yes	190 (5.0%)	102 (5.3%)	206 (5.0%)	135 (5.1%)	208 (5.7%)
Highest maternal education					
Less than high school graduate (1)	1,919 (50.8%)	474 (25.4%)	1,067 (26.8%)	451 (18.5%)	895 (24.9%)
High school graduate or GED completed (2)	714 (18.9%)	713 (38.2%)	1,537 (38.5%)	944 (38.8%)	1,239 (34.4%)
Associate degree or Some College (3)	947 (25.1%)	528 (28.3%)	1,097 (27.5%)	722 (29.7%)	962 (26.7%)

Bachelor's degree (4)	168 (4.4%)	112 (6.0%)	233 (5.8%)	228 (9.4%)	375 (10.4%)
Master's, Doctorate, or Professional Degree (5)	30 (0.8%)	40 (2.1%)	54 (1.4%)	87 (3.6%)	130 (3.6%)
Mother's Nativity					
Born in the U.S. (50 US States) (1)	676 (17.8%)	544 (28.2%)	1,472 (35.9%)	1,007 (39.2%)	1,471 (31.3%)

Table 2. Strengths of Associations by Ethnicity and Standardized Segregation Index

	***Z*=-1 vs. *Z*=-2**	***Z*=0 vs. *Z*=-1**	***Z*=1 vs. *Z*=0**	
		Odds Ratio (95% CI)		*H^2 * Ethnicity p-value*
H Index				
Indian	1.08 (0.99-1.17)	1.06 (1.01-1.12)	1.05 (1.03-1.07)	*Reference*
Chinese	0.90 (0.80-1.00)	0.98 (0.93-1.05)	1.08 (1.05-1.11)	**0.001**
Filipino	0.92 (0.86-0.98)	0.98 (0.95-1.01)	1.04 (1.01-1.07)	**0.004**
Japanese	0.84 (0.72-0.99)	0.91 (0.84-1.00)	0.99 (0.92-1.06)	0.053
Korean	0.75 (0.65-0.87)	0.86 (0.79-0.94)	0.99 (0.95-1.04)	**<0.001**
Vietnamese	0.94 (0.83-1.06)	0.98 (0.92-1.05)	1.02 (0.99-1.06)	0.116
Other Asian	1.03 (0.96-1.09)	1.02 (0.99-1.06)	1.02 (1.00-1.05)	0.693
Hawaiian	1.26 (0.97-1.64)	1.02 (0.87-1.19)	0.82 (0.68-0.99)	**0.021**
Guamanian	1.08 (0.80-1.46)	1.02 (0.87-1.20)	0.96 (0.84-1.11)	0.622
Samoan	1.15 (0.84-1.59)	1.08 (0.92-1.27)	1.02 (0.86-1.21)	0.627
Other Pacific Islander	0.86 (0.79-0.94)	0.89 (0.85-0.94)	0.92 (0.86-0.98)	0.223
Segregation of Poverty (H10)				
Indian	1.09 (1.02-1.16)	1.06 (1.02-1.10)	1.03 (1.01-1.05)	*Reference*
Chinese	1.29 (1.19-1.41)	1.20 (1.14-1.26)	1.11 (1.08-1.15)	0.094
Filipino	1.00 (0.93-1.08)	1.04 (0.99-1.08)	1.07 (1.04-1.11)	**0.024**
Japanese	1.10 (0.88-1.38)	1.07 (0.95-1.20)	1.03 (0.95-1.12)	0.951
Korean	1.12 (0.99-1.27)	1.09 (1.01-1.17)	1.06 (1.01-1.11)	0.967
Vietnamese	1.17 (1.05-1.30)	1.12 (1.05-1.19)	1.07 (1.02-1.12)	0.602
Other Asian	1.08 (0.99-1.18)	1.05 (1.01-1.10)	1.02 (0.99-1.06)	0.994
Hawaiian	1.06 (0.61-1.84)	1.00 (0.80-1.25)	0.94 (0.67-1.33)	0.871
Guamanian	0.77 (0.56-1.05)	0.88 (0.73-1.04)	1.00 (0.82-1.20)	0.108
Samoan	1.31 (0.75-2.28)	1.27 (1.03-1.56)	1.23 (0.89-1.70)	0.988
Other Pacific Islander	1.06 (0.87-1.28)	0.93 (0.86-1.02)	0.82 (0.73-0.93)	0.17
Segregation of Affluence (H90)				
Indian	1.01 (0.92-1.11)	1.03 (0.98-1.09)	1.06 (1.04-1.08)	*Reference*
Chinese	0.87 (0.77-0.99)	0.95 (0.89-1.02)	1.04 (1.01-1.07)	0.082
Filipino	0.91 (0.85-0.97)	0.96 (0.93-0.99)	1.02 (0.99-1.05)	0.271
Japanese	0.75 (0.64-0.88)	0.85 (0.79-0.92)	0.96 (0.90-1.03)	0.058

Korean	0.74 (0.62-0.88)	0.84 (0.76-0.92)	0.95 (0.90-1.00)	**0.048**
Vietnamese	0.86 (0.75-0.99)	0.93 (0.86-1.00)	1.00 (0.97-1.04)	0.185
Other Asian	1.01 (0.94-1.08)	1.02 (0.98-1.05)	1.02 (1.00-1.05)	0.548
Hawaiian	1.32 (0.99-1.75)	1.05 (0.90-1.22)	0.83 (0.70-0.99)	**0.007**
Guamanian	1.12 (0.79-1.59)	1.06 (0.88-1.26)	1.00 (0.86-1.16)	0.444
Samoan	1.24 (0.89-1.73)	1.08 (0.93-1.26)	0.94 (0.81-1.09)	0.125
Other Pacific Islander	0.85 (0.77-0.94)	0.90 (0.86-0.95)	0.96 (0.90-1.02)	0.335

Figures

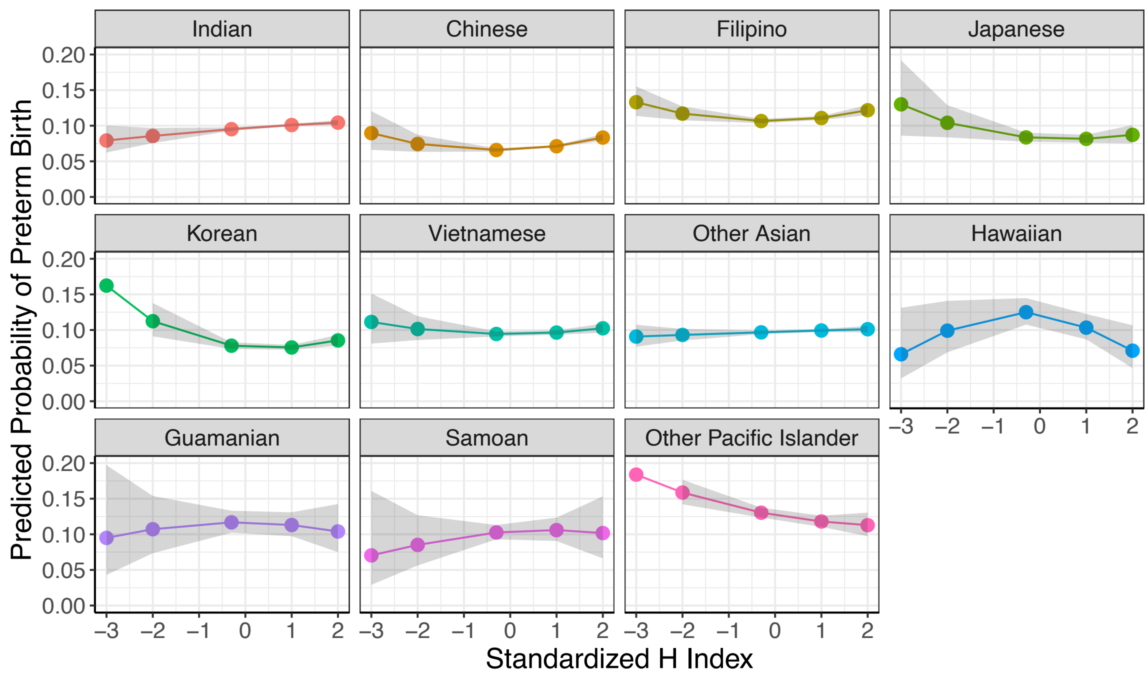

Figure 1 Model-predicted association between standardized economic segregation and probability of preterm birth by Asian from 2015-2017 in 134 MSAs

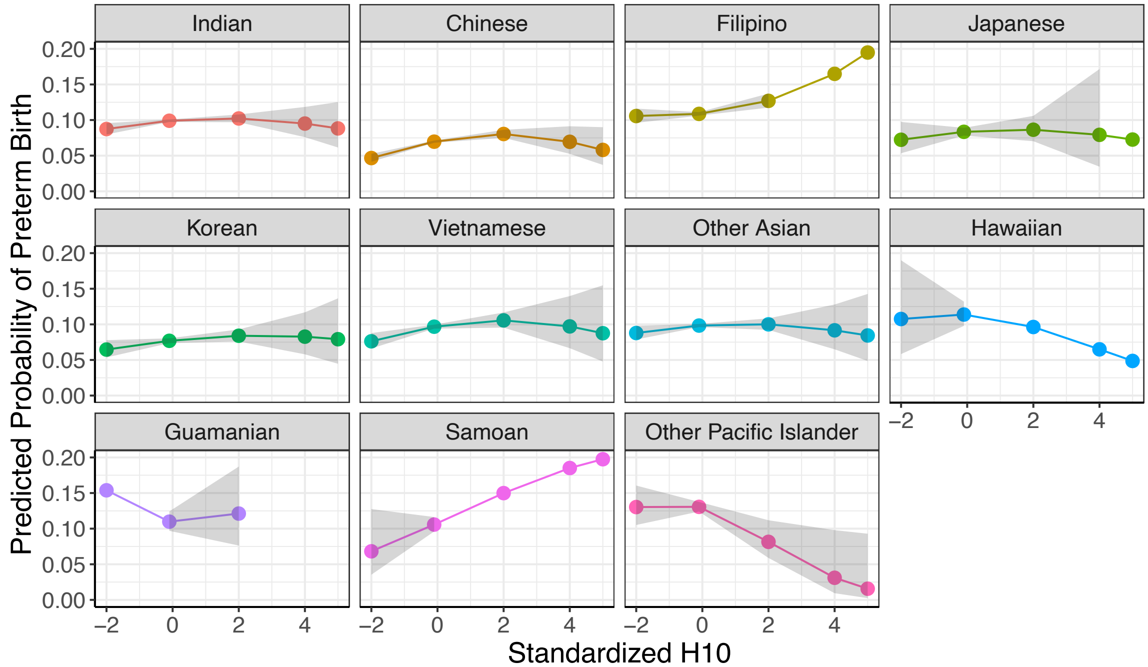

Figure 2 Model-predicted association between standardized segregation of poverty and probability of preterm birth by Asian ethnicity from 2015-2017 in 134 MSAs

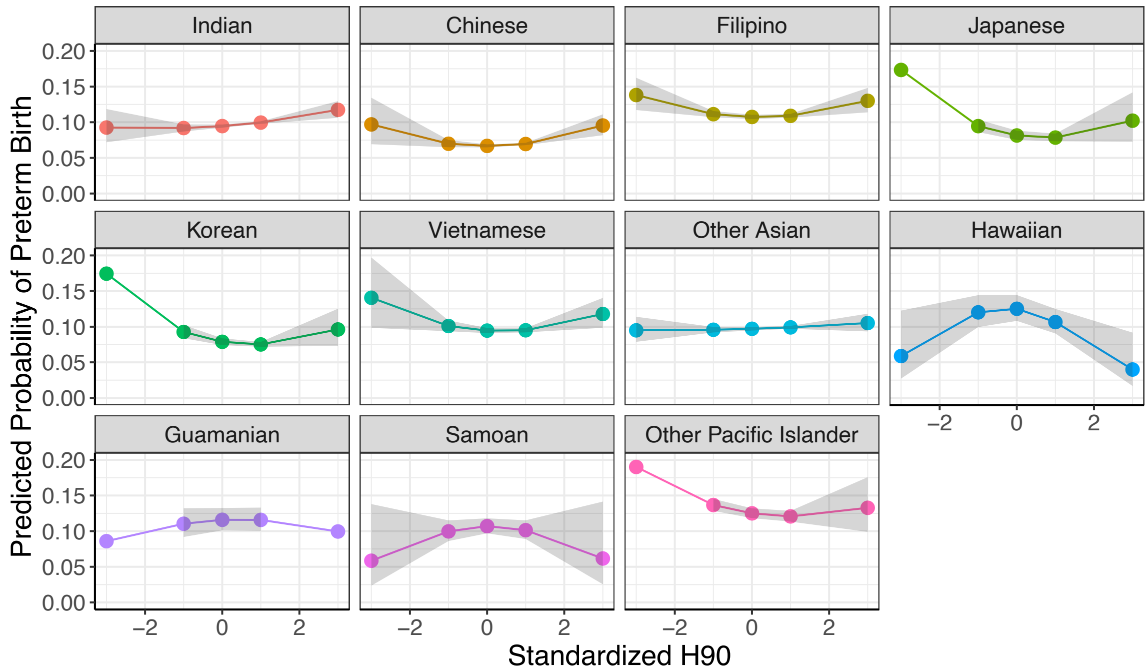

Figure 3 Model-predicted association between standardized segregation of affluence and probability of preterm birth by Asian ethnicity from 2015-2017 in 134 MSAs

Chapter III: Summary, Public Health Implications, & Future Directions

To conclude, this multilevel analysis was interested in how MSA-level economic segregation modifies the association between Asian ethnicities and risk for preterm birth across 134 MSAs from 2015-2017. The results show that there is heterogeneity in risk for preterm birth by Asian and Pacific Islander ethnicity with Pacific Islander ethnic mothers (Hawaiian, Guamanian, Samoan, and Other Pacific Islander) exhibiting generally greater risk for preterm birth compared to Asian ethnic mothers (Indian, Chinese, Filipino, Japanese, Korean, Vietnamese, and Other Asian). Additionally, the risk profile as economic segregation increased was non-linear and varied by ethnicity. Asian ethnic groups' risk profiles were similar in shape while Pacific Islander ethnic groups' risk profiles were more varied. These results may be linked to the historic and ongoing Orientalist perceptions of Western society on the Other. I argue that Orientalism is a consistent feature throughout a timeline of colonial and imperialist intervention in Asia and the Pacific that shapes and produces immigration histories of these ethnicities as well as selects subpopulations of these ethnicities to be more likely to immigrate to the U.S. Histories of colonialism and U.S. imperialism may offer an explanation for the selection mechanisms that occur to produce the risk profiles observed.

This analysis makes clear the health disparities that are masked when aggregating Asian and Pacific Islander (API) health data. This and other analyses provide a strong argument for the disaggregation of API health data during data collection and analysis (52). Developing public health interventions based on aggregated data could result in ineffective or harmful interventions for certain API groups.

Future analyses could expand on this research to explore the possible relationship between racial and economic segregation; it is unclear how the joint effect of racial segregation and income segregation could affect Asian and Pacific Islander mothers. Because this analysis was cross-sectional, future longitudinal analyses could expand on this research to account for different lengths of exposure to economic segregation. These analyses could also include individual-level income and neighborhood-level income data to provide richer, three-level analyses. Future analyses could also focus on the composition of Other Asian and Other Pacific Islander categories. The Other Asian category's risk profiles appeared to be unaffected by economic segregation relative to other categories. Additionally, the Other Pacific Islander category's risk profiles were very different from Hawaiian, Guamanian, and Samoan ethnic groups' risk profiles. Further disaggregation of these categories could reveal disparities similarly found in this analysis.

Appendices

Appendix A. Top Ten and Bottom Ten MSAs by Economic Segregation Index

	Top 10 MSAs		Bottom 10 MSAs
H Index			
0.1500	Trenton, NJ	0.0321	Kahului-Wailuku-Lahaina, HI
0.1466	Washington-Arlington-Alexandria, DC-VA-MD-WV	0.0405	Hickory-Lenoir-Morganton, NC
0.1380	Houston-The Woodlands-Sugar Land, TX	0.0458	Santa Rosa, CA
0.1375	Detroit-Warren-Dearborn, MI	0.0460	Lancaster, PA
0.1374	Dallas-Fort Worth-Arlington, TX	0.0476	Olympia-Tumwater, WA
0.1366	Bridgeport-Stamford-Norwalk, CT	0.0492	Fayetteville, NC
0.1358	Champaign-Urbana, IL	0.0505	Salem, OR
0.1342	Ann Arbor, MI	0.0514	Wausau, WI
0.1338	Cleveland-Elyria, OH	0.0540	Scranton--Wilkes-Barre--Hazleton, PA
0.1331	Columbus, OH	0.0576	Merced, CA
H10			
0.2286	Champaign-Urbana, IL	0.0341	Fayetteville, NC
0.1560	Lafayette-West Lafayette, IN	0.0393	Boise City, ID
0.1529	Cleveland-Elyria, OH	0.0401	Santa Rosa, CA
0.1378	Ann Arbor, MI	0.0415	Hickory-Lenoir-Morganton, NC
0.1346	Trenton, NJ	0.0424	Wausau, WI
0.1311	Detroit-Warren-Dearborn, MI	0.0446	Salem, OR
0.1221	Richmond, VA	0.0448	Kahului-Wailuku-Lahaina, HI
0.1212	Washington-Arlington-Alexandria, DC-VA-MD-WV	0.0453	Visalia-Porterville, CA
0.1177	Columbus, OH	0.0459	Merced, CA
0.1154	Gainesville, FL	0.0460	Salinas, CA
H90			
0.2237	Trenton, NJ	0.0412	Kahului-Wailuku-Lahaina, HI
0.2219	Bridgeport-Stamford-Norwalk, CT	0.0567	Wausau, WI
0.1960	Houston-The Woodlands-Sugar Land, TX	0.0629	Lancaster, PA
0.1931	Dallas-Fort Worth-Arlington, TX	0.0657	Olympia-Tumwater, WA
0.1871	Columbus, OH	0.0676	Salem, OR
0.1866	Detroit-Warren-Dearborn, MI	0.0681	Hickory-Lenoir-Morganton, NC
0.1829	New York-Newark-Jersey City, NY-NJ-PA	0.0759	Santa Rosa, CA

0.1822	Miami-Fort Lauderdale-West Palm Beach, FL	0.0762	Atlantic City-Hammonton, NJ
0.1802	Charlotte-Concord-Gastonia, NC-SC	0.0778	Scranton--Wilkes-Barre--Hazleton, PA
0.1790	Washington-Arlington-Alexandria, DC-VA-MD-WV	0.0789	Fayetteville, NC

Appendix B. H Index Modelling Coefficients

	M0: H Index and Ethnicity Interaction (n=766,335)			M1: Individual-level variables (n=733,239)			M3: Full with SES variable (n=733,239)		
Predictors	*Log-Odds*	*std. Error*	*p*	*Log-Odds*	*std. Error*	*p*	*Log-Odds*	*std. Error*	*p*
(Intercept)	-2.26	0.01	**<0.001**	0.04	0.12	0.722	-0.31	0.12	**0.009**
H Index	0.07	0.02	**<0.001**	0.06	0.02	**<0.001**	0.05	0.02	**0.001**
H Index Squared	0	0.01	0.719	-0.01	0.01	0.571	-0.01	0.01	0.55
Maternal Ethnicity									
Indian	*Reference*			*Reference*			*Reference*		
Chinese	-0.35	0.02	**<0.001**	-0.27	0.09	**0.002**	-0.34	0.09	**<0.001**
Filipino	0.28	0.02	**<0.001**	0.48	0.09	**<0.001**	0.36	0.09	**<0.001**
Japanese	-0.06	0.04	0.107	0.45	0.2	**0.024**	0.33	0.2	0.098
Korean	-0.17	0.03	**<0.001**	0.16	0.15	0.287	0.07	0.15	0.627
Vietnamese	0.08	0.02	**<0.001**	0.56	0.1	**<0.001**	0.49	0.1	**<0.001**
Other Asian	0.18	0.02	**<0.001**	0.66	0.08	**<0.001**	0.54	0.08	**<0.001**
Hawaiian	0.55	0.07	**<0.001**	0.35	0.32	0.278	0.25	0.32	0.434
Guamanian	0.42	0.07	**<0.001**	0.12	0.27	0.662	0.06	0.27	0.811
Samoan	0.4	0.04	**<0.001**	0.79	0.21	**<0.001**	0.76	0.21	**<0.001**
Other Pacific Islander	0.57	0.03	**<0.001**	1.17	0.12	**<0.001**	1.12	0.12	**<0.001**
H Index * Maternal Ethnicity									
Indian	*Reference*			*Reference*			*Reference*		
Chinese	-0.05	0.03	**0.043**	-0.02	0.03	0.555	-0.02	0.03	0.371

Filipino	-0.06	0.02	**0.006**	-0.06	0.02	**0.003**	-0.04	0.02	**0.042**
Japanese	-0.11	0.04	**0.003**	-0.12	0.04	**0.002**	-0.1	0.04	**0.006**
Korean	-0.14	0.03	**<0.001**	-0.14	0.03	**<0.001**	-0.13	0.03	**<0.001**
Vietnamese	-0.06	0.03	**0.028**	-0.06	0.03	**0.027**	-0.05	0.03	0.064
Other Asian	-0.06	0.02	**0.002**	-0.05	0.02	**0.02**	-0.03	0.02	0.122
Hawaiian	-0.19	0.08	**0.016**	-0.16	0.08	**0.039**	-0.15	0.08	0.064
Guamanian	-0.08	0.06	0.206	-0.07	0.06	0.306	-0.06	0.06	0.331
Samoan	-0.12	0.07	0.079	-0.02	0.07	0.81	-0.01	0.07	0.939
Other Pacific Islander	-0.24	0.03	**<0.001**	-0.17	0.03	**<0.001**	-0.15	0.03	**<0.001**
H Index Square * Maternal Ethnicity									
Indian	*Reference*			*Reference*			*Reference*		
Chinese	0.06	0.02	**<0.001**	0.05	0.02	**0.003**	0.05	0.02	**0.001**
Filipino	0.03	0.01	**0.011**	0.04	0.01	**0.004**	0.04	0.01	**0.004**
Japanese	0.03	0.02	0.151	0.05	0.02	0.056	0.05	0.02	0.053
Korean	0.07	0.02	**0.001**	0.08	0.02	**<0.001**	0.08	0.02	**<0.001**
Vietnamese	0.02	0.02	0.188	0.03	0.02	0.101	0.03	0.02	0.116
Other Asian	0	0.01	0.739	0	0.01	0.87	0.01	0.01	0.693
Hawaiian	-0.14	0.04	**0.001**	-0.1	0.04	**0.019**	-0.1	0.04	**0.021**
Guamanian	-0.04	0.04	0.325	-0.03	0.05	0.572	-0.02	0.05	0.622
Samoan	-0.03	0.05	0.494	-0.03	0.05	0.541	-0.03	0.05	0.627
Other Pacific Islander	-0.01	0.02	0.698	0.02	0.02	0.296	0.02	0.02	0.223
Maternal Age, years				-0.19	0.01	**<0.001**	-0.15	0.01	**<0.001**
Maternal Age Squared, years				0	0	**<0.001**	0	0	**<0.001**

Mother smoked during pregnancy	0.33	0.04	**<0.001**	0.27	0.04	**<0.001**
Gestational Diabetes	0.23	0.01	**<0.001**	0.22	0.01	**<0.001**
Preeclampsia	1.1	0.02	**<0.001**	1.09	0.02	**<0.001**
Prior Preterm Birth	1.2	0.02	**<0.001**	1.17	0.02	**<0.001**
Born outside the U.S.	-0.01	0.01	0.278	-0.04	0.01	**<0.001**
Maternal Ethnicity * Maternal Age, years						
Indian	*Reference*			*Reference*		
Chinese	0	0	0.152	0	0	0.379
Filipino	-0.01	0	**<0.001**	-0.01	0	**0.003**
Japanese	-0.02	0.01	**0.001**	-0.02	0.01	**0.005**
Korean	-0.01	0	**0.004**	-0.01	0	**0.017**
Vietnamese	-0.02	0	**<0.001**	-0.02	0	**<0.001**
Other Asian	-0.02	0	**<0.001**	-0.02	0	**<0.001**
Hawaiian	0	0.01	0.865	0	0.01	0.95
Guamanian	0.01	0.01	0.438	0	0.01	0.608
Samoan	-0.02	0.01	**0.014**	-0.02	0.01	**0.003**
Other Pacific Islander	-0.02	0	**<0.001**	-0.03	0	**<0.001**
Maternal Education						
Less than high school graduate				*Reference*		

High school graduate or GED completed							-0.14	0.02	**<0.001**
Associate degree or some college							-0.19	0.02	**<0.001**
Bachelor's Degree							-0.34	0.02	**<0.001**
Master's, Doctorate, or Professional Degree							-0.35	0.02	**<0.001**
QIC	489,636			454,852			454,214		

Appendix C. H10 Modelling Coefficients

Predictors	M0: H10 and Ethnicity Interaction			M1: Individual-level variables			M2: Full with SES variable		
	Log-Odds	*std. Error*	*p*	*Log-Odds*	*std. Error*	*p*	*Log-Odds*	*std. Error*	*p*
(Intercept)	-2.23	0.01	**<0.001**	0.08	0.12	0.502	-0.28	0.12	**0.019**
H10	0.07	0.01	**<0.001**	0.05	**0.01**	**<0.001**	0.04	0.01	**0.001**
H10 Squared	-0.02	0.01	**0.039**	-0.02	**0.01**	0.063	-0.01	0.01	0.117
Maternal Ethnicity									
Indian	*Reference*			*Reference*			*Reference*		
Chinese	-0.31	0.01	**<0.001**	-0.25	0.08	**0.003**	-0.32	0.08	**<0.001**
Filipino	0.27	0.02	**<0.001**	0.48	0.09	**<0.001**	0.36	0.09	**<0.001**
Japanese	-0.08	0.03	**0.024**	0.46	0.2	**0.022**	0.34	0.2	0.087
Korean	-0.2	0.02	**<0.001**	0.17	0.15	0.281	0.08	0.15	0.613
Vietnamese	0.08	0.02	**<0.001**	0.55	0.1	**<0.001**	0.48	0.1	**<0.001**
Other Asian	0.14	0.01	**<0.001**	0.63	0.08	**<0.001**	0.52	0.08	**<0.001**
Hawaiian	0.4	0.08	**<0.001**	0.2	0.32	0.532	0.11	0.32	0.729
Guamanian	0.31	0.06	**<0.001**	0.01	0.27	0.975	-0.04	0.27	0.885
Samoan	0.39	0.05	**<0.001**	0.8	0.21	**<0.001**	0.77	0.21	**<0.001**
Other Pacific Islander	0.53	0.03	**<0.001**	1.18	0.12	**<0.001**	1.14	0.12	**<0.001**
H10* Maternal Ethnicity									
Indian	*Reference*			*Reference*			*Reference*		
Chinese	0.08	0.02	**<0.001**	0.11	0.02	**<0.001**	0.1	0.02	**<0.001**
Filipino	0.01	0.02	0.773	-0.01	0.02	0.722	0.01	0.02	0.674
Japanese	-0.01	0.04	0.741	-0.01	0.04	0.821	0	0.04	0.91
Korean	0	0.03	0.88	0.02	0.03	0.61	0.03	0.03	0.396
Vietnamese	0.04	0.02	0.119	0.05	0.03	0.068	0.05	0.03	0.07
Other Asian	-0.03	0.02	0.104	-0.02	0.02	0.374	-0.01	0.02	0.694

Hawaiian	-0.05	0.11	0.615	-0.09	0.11	0.423	-0.07	0.11	0.494
Guamanian	-0.13	0.08	0.088	-0.11	0.08	0.188	-0.11	0.08	0.169
Samoan	0.13	0.08	0.134	0.17	0.09	0.067	0.18	0.09	0.058
Other Pacific Islander	-0.26	0.04	**<0.001**	-0.18	0.04	**<0.001**	-0.17	0.04	**<0.001**
H10 Squared * Maternal Ethnicity									
Indian	*Reference*			*Reference*			*Reference*		
Chinese	-0.03	0.01	0.062	-0.03	0.01	**0.043**	-0.02	0.01	0.094
Filipino	0.02	0.01	0.062	0.03	0.01	**0.013**	0.03	0.01	**0.024**
Japanese	-0.01	0.03	0.718	0	0.03	0.992	0	0.03	0.951
Korean	0	0.02	0.957	0	0.02	0.831	0	0.02	0.967
Vietnamese	-0.01	0.02	0.642	-0.01	0.02	0.624	-0.01	0.02	0.602
Other Asian	0	0.02	0.856	0	0.02	0.906	0	0.02	0.994
Hawaiian	-0.04	0.11	0.719	-0.02	0.1	0.845	-0.02	0.1	0.871
Guamanian	0.05	0.05	0.251	0.08	0.05	0.114	0.08	0.05	0.108
Samoan	0.01	0.09	0.88	-0.01	0.11	0.923	0	0.1	0.988
Other Pacific Islander	-0.07	0.03	**0.028**	-0.05	0.04	0.145	-0.05	0.04	0.17
Maternal Age, years				-0.19	0.01	**<0.001**	-0.15	0.01	**<0.001**
Maternal Age Squared, years				0	0	**<0.001**	0	0	**<0.001**
Mother smoked during pregnancy				0.33	0.04	**<0.001**	0.27	0.04	**<0.001**
Gestational Diabetes				0.22	0.01	**<0.001**	0.22	0.01	**<0.001**
Preeclampsia				1.1	0.02	**<0.001**	1.09	0.02	**<0.001**
Prior Preterm Birth				1.2	0.02	**<0.001**	1.17	0.02	**<0.001**
Born outside the U.S.				-0.01	0.01	0.295	-0.04	0.01	**<0.001**
Maternal Ethnicity * Maternal Age,				*Reference*			*Reference*		

years									
Indian									
Chinese				0	0	0.235	0	0	0.508
Filipino				-0.01	0	**<0.001**	-0.01	0	**0.002**
Japanese				-0.02	0.01	**0.001**	-0.02	0.01	**0.003**
Korean				-0.01	0	**0.003**	-0.01	0	**0.013**
Vietnamese				-0.02	0	**<0.001**	-0.02	0	**<0.001**
Other Asian				-0.02	0	**<0.001**	-0.02	0	**<0.001**
Hawaiian				0	0.01	0.831	0	0.01	0.915
Guamanian				0.01	0.01	0.445	0	0.01	0.62
Samoan				-0.02	0.01	**0.013**	-0.02	0.01	**0.003**
Other Pacific Islander				-0.02	0	**<0.001**	-0.03	0	**<0.001**
Maternal Education									
Less than high school graduate							*Reference*		
High school graduate or GED completed							-0.13	0.02	**<0.001**
Associate degree or some college							-0.18	0.02	**<0.001**
Bachelor's Degree							-0.33	0.02	**<0.001**
Master's, Doctorate, or Professional Degree							-0.35	0.02	**<0.001**
QIC		489,569		454,820			454,198		

Appendix D. H90 Modelling Coefficients

	M0: H90 and Ethnicity Interaction			**M1: Individual-level variables**			**M2: Full with SES variable**		
Predictors	*Log-Odds*	*std. Error*	*p*	*Log-Odds*	*std. Error*	*p*	*Log-Odds*	*std. Error*	*p*
(Intercept)	-2.29	0.01	**<0.001**	0.01	0.12	0.923	-0.34	0.12	**0.005**
H90	0.04	0.02	**0.015**	0.04	0.02	**0.015**	0.04	0.02	**0.01**
H90 Squared	0.02	0.01	**0.03**	0.02	0.01	0.061	0.01	0.01	0.26
Maternal Ethnicity									
Indian	*Reference*			*Reference*			*Reference*		
Chinese	-0.31	0.02	**<0.001**	-0.24	0.09	**0.006**	-0.3	0.09	**<0.001**
Filipino	0.31	0.02	**<0.001**	0.51	0.09	**<0.001**	0.38	0.09	**<0.001**
Japanese	-0.04	0.04	0.321	0.46	0.2	**0.023**	0.34	0.2	0.097
Korean	-0.1	0.03	**0.003**	0.24	0.15	0.124	0.14	0.15	0.352
Vietnamese	0.11	0.02	**<0.001**	0.59	0.1	**<0.001**	0.51	0.1	**<0.001**
Other Asian	0.2	0.02	**<0.001**	0.69	0.08	**<0.001**	0.56	0.08	**<0.001**
Hawaiian	0.6	0.07	**<0.001**	0.4	0.32	0.209	0.3	0.32	0.349
Guamanian	0.44	0.07	**<0.001**	0.15	0.27	0.591	0.09	0.27	0.754
Samoan	0.46	0.05	**<0.001**	0.83	0.21	**<0.001**	0.8	0.21	**<0.001**
Other Pacific Islander	0.58	0.03	**<0.001**	1.18	0.12	**<0.001**	1.12	0.13	**<0.001**
H90* Maternal Ethnicity									
Indian	*Reference*			*Reference*			*Reference*		
Chinese	-0.06	0.03	**0.017**	-0.04	0.03	0.14	-0.05	0.03	0.091
Filipino	-0.06	0.02	**0.003**	-0.07	0.02	**0.002**	-0.06	0.02	**0.009**
Japanese	-0.15	0.03	**<0.001**	-0.15	0.03	**<0.001**	-0.15	0.03	**<0.001**
Korean	-0.16	0.03	**<0.001**	-0.16	0.04	**<0.001**	-0.16	0.04	**<0.001**
Vietnamese	-0.07	0.03	**0.012**	-0.08	0.03	**0.006**	-0.08	0.03	**0.009**
Other Asian	-0.05	0.02	**0.023**	-0.03	0.02	0.111	-0.03	0.02	0.236

Hawaiian	-0.16	0.07	**0.025**	-0.12	0.07	0.088	-0.11	0.07	0.121
Guamanian	0.01	0.07	0.89	-0.01	0.07	0.873	-0.02	0.07	0.798
Samoan	-0.11	0.06	**0.048**	-0.04	0.06	0.468	-0.04	0.06	0.55
Other Pacific Islander	-0.18	0.03	**<0.001**	-0.13	0.03	**<0.001**	-0.12	0.03	**<0.001**
H90 Squared * Maternal Ethnicity									
Indian	*Reference*			*Reference*			*Reference*		
Chinese	0.03	0.02	0.122	0.03	0.02	0.093	0.03	0.02	0.082
Filipino	0.01	0.01	0.546	0.01	0.01	0.579	0.02	0.01	0.271
Japanese	0.03	0.03	0.172	0.04	0.03	0.105	0.05	0.03	0.058
Korean	0.03	0.02	0.3	0.05	0.03	0.072	0.05	0.03	**0.048**
Vietnamese	0.01	0.02	0.649	0.02	0.02	0.265	0.03	0.02	0.185
Other Asian	-0.02	0.01	0.103	-0.02	0.01	0.183	-0.01	0.01	0.548
Hawaiian	-0.17	0.05	**<0.001**	-0.13	0.05	**0.004**	-0.13	0.05	**0.007**
Guamanian	-0.08	0.05	0.107	-0.05	0.05	0.311	-0.04	0.05	0.444
Samoan	-0.11	0.05	**0.029**	-0.09	0.05	0.101	-0.08	0.05	0.125
Other Pacific Islander	-0.03	0.02	0.096	0.01	0.02	0.624	0.02	0.02	0.335
Maternal Age, years				-0.19	0.01	**<0.001**	-0.15	0.01	**<0.001**
Maternal Age Squared, years				0	0	**<0.001**	0	0	**<0.001**
Mother smoked during pregnancy				0.33	0.04	**<0.001**	0.27	0.04	**<0.001**
Gestational Diabetes				0.23	0.01	**<0.001**	0.22	0.01	**<0.001**
Preeclampsia				1.1	0.02	**<0.001**	1.09	0.02	**<0.001**
Prior Preterm Birth				1.2	0.02	**<0.001**	1.17	0.02	**<0.001**
Born outside the U.S.				-0.01	0.01	0.322	-0.04	0.01	**<0.001**
Maternal Ethnicity * Maternal Age,									

years									
Indian				*Reference*			*Reference*		
Chinese				0	0	0.142	0	0	0.361
Filipino				-0.01	0	**<0.001**	-0.01	0	**0.004**
Japanese				-0.02	0.01	**0.001**	-0.02	0.01	**0.006**
Korean				-0.01	0	**0.003**	-0.01	0	**0.015**
Vietnamese				-0.02	0	**<0.001**	-0.02	0	**<0.001**
Other Asian				-0.02	0	**<0.001**	-0.02	0	**<0.001**
Hawaiian				0	0.01	0.894	0	0.01	0.967
Guamanian				0.01	0.01	0.459	0	0.01	0.622
Samoan				-0.02	0.01	**0.015**	-0.02	0.01	**0.004**
Other Pacific Islander				-0.02	0	**<0.001**	-0.03	0	**<0.001**
Maternal Education									
Less than high school graduate							*Reference*		
High school graduate or GED completed							-0.13	0.02	**<0.001**
Associate degree or some college							-0.19	0.02	**<0.001**
Bachelor's Degree							-0.34	0.02	**<0.001**
Master's, Doctorate, or Professional Degree							-0.35	0.02	**<0.001**
QIC	489,648			454,858			454,230		