Residential segregation and the perinatal health of Asian American subgroups: revealing their heterogeneity through the lens of immigration, racism, and segregation

By

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ABSTRACT

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The monolithic "Asian American" (AsA) group represents over 20 million people with origins from numerous countries in East, South, and Southeast Asia. Despite being the fastest growing racial group in the United States, AsAs are severely overlooked and misunderstood in health research. This dissertation aims to advance current understanding of perinatal health among AsA subgroups and its association with residential segregation, a key driver of racial health inequities. Drawing on scholarships in sociology, ethnic studies, and epidemiology, I proposed a novel framework for understanding AsA heterogeneity shaped by colonialism, immigration, and racism. From this grounding, I produced three papers that address these novel and necessary questions:

1. What is the state of research regarding the perinatal health of disaggregated Asian American groups?
2. How are the ethnic enclaves of each AsA subgroup different from each other based on geographic and socioeconomic contexts?
3. What is the association between residence in an AsA enclave and preterm birth in disaggregated AsA groups, and does enclave type matter?

Paper #1 provides the first comprehensive review of existing literature on the perinatal health of AsA subgroups. It highlights the diversity within AsA populations, identifies trends and

limitations in current research, and advocates for a broader, more nuanced approach to studying AsA health disparities by incorporating structural and cultural contexts.

In Paper #2, I challenge the assumption that all segregated AsA neighborhoods are alike by revealing systematic differences based on geography, socioeconomic status, and nativity contexts of the enclaves of the 6 largest AsA subgroups. By applying an existing theory-informed enclave typology (*immigrant*, *constraint*, *resurgent*), this paper shifts the focus from level of segregation to *type* of segregation, setting the stage for demonstrating that segregation may operate differently for each AsA subgroup.

In Paper #3, I investigate how different types of AsA enclaves are associated with preterm birth across AsA subgroups. This study shows protective associations of *immigrant* and *resurgent enclaves* while identifying potential vulnerabilities in *enclaves of constraint*. The findings challenge the prevailing “poverty paradigm” in segregation-health literature, suggesting that AsA enclaves may provide cultural resources and social support that enhance perinatal health. These insights underscore the importance of recognizing and bolstering culturally specific aspects of ethnic enclaves in public health policies and interventions to promote health equity among racial minority populations.

This dissertation contributes new understanding of the diversity within AsA neighborhoods and their impacts on individual health outcomes. It emphasizes the critical need for systematically disaggregating racial data in research and public health reporting to reveal hidden disparities and inform equitable health strategies.

DEDICATION

To my parents, Trần Thị Cẩm and Trần Văn Tốt, for giving me a safe and loving childhood despite the trauma of war and displacement.

To the love of my life, Brandon, for always being willing to embark on any life adventures with me.

To my children, Sông-Linh and Fox, for inspiring me to live a balanced and purposeful life.

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Among the faculty I had the privilege of learning from during my PhD training, I am especially grateful to **Dr. Ryan J. Petteway** who helped ground my research—and worldview—in a social justice framework, reminding me of the humanity in data. He involved me in a community-led environmental justice project, sent me to present at a conference, and even let me pocket the prize money from our best poster award. I would like to thank **Drs. Jon Snowden**, **Lynn Marshall**, and **Lynne Messer** for instilling in me appreciation of classical and modern epidemiology methods, and for their interest in my work and support in classes and comps.

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POSITIONALITY

This dissertation is inspired by my own lived experience as a Vietnamese refugee, resettled in the United States at the age of 6. Growing up near a vibrant Vietnamese enclave, I found comfort in the sounds of our language, the warmth of our food, the joy of our music, and the power of our stories. I witnessed extraordinary creativity and resilience, but also the pain and trauma of war and displacement that fractured families, distanced children from their parents and elders, and compounded daily struggles.

In my 15 years working in public health, including for state and local governments, I have rarely seen data for Vietnamese people. We are often hidden within the broad "Asian" label, with little attention given to our unique needs. I have even contributed to reports and research that erased my own community and other marginalized populations. By keeping their data invisible, I was blocking vital resources from reaching these groups. This dissertation reflects my commitment to using data purposefully and equitably. Often in public health, what gets measured, gets mentioned, gets attention.

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LIST OF ABBREVIATIONS & SYMBOLS

ACS	American Community Survey
ABSM	Area-based socioeconomic metrics
API	Asian/Pacific Islander
AsA	Asian American
aSES	Area socioeconomic status
BMI	Body mass index
BRFSS	Behavioral Risk Factor Surveillance System
CI	Confidence interval
COVID-19	COronaVIrus Disease of 2019
CRT	Critical race theory
D_m	Dissimilarity index
EHR	Electronic health records
ETS	Environmental tobacco smoke
GDM	Gestational diabetes mellitus
GWG	Gestational weight gain
HP2030	Healthy People 2030
LBW	Low birth weight (<2,500 grams)
LGA	Large for gestational age
MAUP	Modifiable areal unit problem
NCHS	National Center for Health Statistics
NIH	National Institutes of Health
NH	Non-Hispanic
NHANES	National Health and Nutrition Examination Survey

NHPI	Native Hawaiian/Pacific Islander
NYC	New York City
OR	Odds ratio
$_{m}P_{m}$	Isolation index
PCD	Primary Cesarean delivery
PNC	Prenatal care
PPD	Postpartum depression
PRAMS	Pregnancy Risk Assessment Monitoring System
PRISMA-ScR	Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews
PTB	Preterm birth (<37 weeks of gestation)
SD	Standard deviation
SDOH	Social determinants of health
SES	Socioeconomic status
SGA	Small for gestational age
SMM	Severe maternal morbidity
US	United States
VLBW	Very low birth weight (<1,500 grams)

CHAPTER 1:

INTRODUCTION AND LITERATURE REVIEW

Within the monolithic racial category of “Asian American” (AsA) lies the hidden histories, health determinants, and health inequities of over 20 million people having roots in dozens of countries in East, South, and Southeast Asia with distinct culture, language, and history. AsAs represent 6% of the United States (US) population and is the fastest growing racial group in the US[1]. Growth has been observed in racially diverse states like New York and California, as well as in places where large-scale immigration and racial diversity is new: the AsA population in North Dakota more than doubled; in South Dakota and Nebraska it rose by at least 70% from the year 2010 to 2020. Southern states like South Carolina, Georgia, Alabama, and Arkansas also showed rapid growth in the Asian population in the same period[2]. These demographic changes have implications for institutions and resources that affect population health, as well as for the study of racial inequities in the US.

Despite being the fastest-growing racial group in the US, AsAs are frequently invisible in health research and, consequently, an afterthought in resource allocation decisions. AsAs were the subjects of just 0.2% of federal health-related grants given during 1986-2000 and only 0.01% of published health research during 1966-2000[3]. Over the past 25 years, the National Institutes

of Health (NIH) has invested just 0.17% of its budget in health research that includes AsA participants[4]. A transnational NIH workshop with health scholars and researchers held in March 2021 titled, *Identifying Research Opportunities for Asian American, Native Hawaiian, and Pacific Islander Health*, reported a "general paucity of fundamental epidemiological data on prevalence, incidence, and factors of risk and resilience across most domain areas for these populations." While there is now growing demand for health data for AsAs and their subgroups[5,6], these long-standing under-investments in AsAs have resulted in current severe gaps in our knowledge of the health status of AsAs, greatly hindering our ability to advance health equity in the US.

THE RACIALIZATION OF "ASIAN AMERICAN"

The dominant narrative about AsAs is that they are a "model minority," which frames all Asian people as successful and thriving despite their minority status. However, this narrative obscures a long history of racism against AsAs, designed to maintain a racial hierarchy that upholds white supremacy.

Before the "model minority" stereotype, Asians were depicted as "yellow peril," a demeaning ideology introduced by European imperialists in the 19th century. This ideology portrayed Asian people as uncivilized and justified the colonization of their nations[7,8]. In the US, the "yellow peril" narrative became popular in the 1850s when Chinese male laborers were recruited to help build the Continental Railroad. Their cultural difference and strong work ethic were seen as threats to the livelihoods of working-class White Americans. During the 1976 smallpox epidemic in San Francisco, Chinese immigrants were scapegoated as the source of the disease[9], resulting in violence, including the lynching of Chinese immigrants, and discriminatory policies like the Chinese Exclusion Act of 1882, which severely restricted Chinese immigration and denied citizenship to those already in the US.

The racialization of Asians continued during World War II when Executive Order 9066 led to the incarceration of Japanese Americans, labeling them as threats to national security. In the subsequent decades, US military actions in Korea, Vietnam, Cambodia, and Laos—especially the extensive bombings in Southeast Asian countries—further reinforced the "yellow peril" narrative. This racialization framed Asian people as an existential threat to Western civilization, a stereotype that resurfaces at various points in US history, including during the COVID-19 pandemic, when president Donald Trump invoked it to foment anti-Asian xenophobia.[10]

In the 1960s, amid the Civil Rights and Black Power movements, a new stereotype emerged for AsAs: the “model minority.” Invented by a White male sociologist and popularized by the nation’s most influential print outlets, *The New York Times*[11] and *U.S. News and World Report*[12], the “model minority” myth casts AsAs as highly educated, upwardly mobile, and self-reliant. Although seemingly positive, this stereotype was strategically used to undermine claims of structural racism and demands for social justice from Civil Rights activists[8]. It conceals significant socioeconomic disparities within AsA subgroups, fosters divisions with Black and Native American communities, and erases the history of racism faced by AsAs.

Together, the "model minority" and "yellow peril" stereotypes help maintain a racial hierarchy in the US, implicitly positioning AsAs above other racially marginalized groups but below White populations. From a public health perspective, this racialization shapes how AsA health is framed and prioritized. The image of success, combined with the lack of disaggregated data, leads many to assume that AsAs do not experience hardship or oppression, influencing their inclusion—or exclusion—in research and policy decisions.

Diversity and Complexity of Asian American Identity

The Office of Management and Budget defines "Asian" as encompassing individuals with origins in the Far East, Southeast Asia, or the Indian subcontinent, including countries such as Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippines, Thailand, and Vietnam[2]. This broad definition covers over 20 distinct ethnic groups, each with unique languages, cultural practices, religious beliefs, and immigration histories. In the US, the largest Asian groups are Chinese (24% of all Asian Americans), Indian (21%), Filipino (19%), Vietnamese (10%), Korean (9%), and Japanese (7%), with other groups including Pakistani, Cambodian, Laotian, Hmong, Thai, and Bhutanese[13].

The term "Asian American" originated in the 1960s during the pan-Asian student movement, which sought to unify various ethnic groups—such as Chinese, Filipino, and Japanese Americans—under a collective identity[14]. This label aimed to reflect a shared history of immigration, labor exploitation, and racism and became a preferable alternative to the outdated and derogatory term "Oriental."[15] Over time, the movement expanded to include groups from Korea, Vietnam, and South Asia. However, limited public discourse and ethnic studies education have lead many Americans to primarily associate "Asian" with East Asian physical features[16],

contributing to misconceptions. For example, a 2016 survey revealed that 42% of White Americans did not consider Asian Indians as "Asian" or “Asian American,” and 45% held the same view of Pakistanis. Among AsA respondents, 15% and 27%, respectively, shared these views.[17] This highlights a disconnect between the recommended reporting of “Asian American” and how AsAs define themselves and each other.

Given this complex history, public health researchers should present data on AsAs in ways that reflect their true diversity, ensuring their unique experiences, health determinants, and disparities are recognized. Researchers should assume subgroup differences exist unless proven otherwise[18]. While disaggregating data for each community is ideal, this may be challenging due to small sample sizes. When broader categories like Southeast Asian (e.g., Lao, Thai, Cambodian, Vietnamese) or East Asian (e.g., Chinese, Japanese, Korean) are used, researchers should specify the groups included and note that aggregated findings may not fully reflect the diversity within these subgroups.

Historical, Cultural, and Socioeconomic Diversity of Asian Americans

Asian Americans are an incredibly diverse group, whose presence in the US can be traced back many generations or just a few months. About 60% of AsAs are foreign-born, though this ranges from 27% in Japanese up to 92% in Bhutanese Americans[19]. The impetus for immigration also differ, including reuniting with family, fulfilling US demand for highly skilled labor, or fleeing war, persecution, and economic hardship[20]. These distinctions often align with ethnic group boundaries and shape their social stratification within US society.

For instance, many Asian Indian and Chinese immigrants today arrive as students or under permits for skilled professionals[20]. Since the 1970s, the Philippines has been the major source of foreign-born healthcare professionals to the US.[21] During the 1980s, South Korea was the third-largest source country of immigrants to the US (after Mexico and the Philippines), with many professional-class individuals leaving to escape poverty and political instability in post-war South Korea[22]. In contrast, Southeast Asians—who comprise Cambodians, Laotians, Hmong, and Vietnamese—overwhelmingly arrived as refugees starting in the late 1970s after the wars in Vietnam, Cambodia, and Laos. Before settling in the US, many Southeast Asian refugees endured upheaval, violence, and prolonged periods in refugee camps under severe conditions[23].

These varied immigration experiences affect each group's baseline physical and mental health upon arrival, as well as their social, spatial, and economic mobility in the US.

US Census data show that AsAs occupy extreme positions on the income and education spectrum. The highest-earning AsAs (those in the top decile) earn 10.7 times more than the lowest-earning AsAs (lowest decile), marking the greatest disparity among all racial groups[24]. While the overall poverty rate for AsAs (10%) is lower than the US average (13%), 12 of the 19 AsA subgroups have poverty rates at or above the national average[13]. Educational attainment also varies widely: half of AsA individuals aged 25 and older hold a college degree, but this ranges from 15% among Bhutanese to 75% among Asian Indians[19].

Linguistic isolation further underscores these disparities. Over 1 in 3 Vietnamese households are linguistically isolated (where no one over age 14 speaks English proficiently), compared to 1 in 10 Asian Indian households[25]. Such differences in linguistic isolation can lead to differences in earning potential, occupational mobility, access to quality healthcare, and participation in civic and political life[25]. Despite these historical, cultural, and socioeconomic complexities, few health research studies adequately account for these nuances when examining outcomes for AsA.

Challenges of Disaggregating Health Data for Asian American Populations

While inclusive labels like "Asian American" and "Asian/Pacific Islanders" are important for building political unity to challenge systems that oppress, marginalize, and homogenize AsAs, their use by government agencies and institutions to allocate funds and set research priorities can sometimes impede progress. Aggregating data under these broad labels obscures significant differences among AsA subgroups, which can result in a lack of targeted policy attention and resources for groups with higher disease burdens. This aggregation can contribute to the social production of health inequities.

Disaggregated data on race is essential for identifying the unique health needs and disparities faced by racialized groups. Tailoring supports and interventions to specific affected communities not only optimizes public health investments, but also promotes ethnical representation. Disaggregated data enables communities to see themselves reflected in the information they have contributed, whether knowingly or unknowingly. This visibility can empower

communities to make informed decisions, advocate for policy changes, and push for a more equitable distribution of resources[26].

However, significant barriers hinder the disaggregation of public health data for AsAs. National health surveys often lack specific Asian subgroup categories; for example, the National Health and Nutrition Examination Survey (NHANES) uses only a general "Asian" category for racial identity information[27]. Additionally, limited data collection in Asian languages is problematic for a population where more than a quarter of adults have limited English proficiency[13]. Key surveys like the Behavioral Risk Factor Surveillance System (BRFSS)[28] and the Pregnancy Risk Assessment Monitoring System (PRAMS)[29] are conducted only in English or Spanish. These surveys are used by state and local public health institutions for planning and implementing health promotion activities. Furthermore, the lack of oversampling of AsA populations results in insufficient sample sizes, making detailed subgroup analyses difficult.

Perinatal Health Disparities in Asian American Subgroups

Studies on the developmental origins of health and disease have highlighted how the fetal environment, including maternal stress during pregnancy, impacts long-term health outcomes, such as the risk for coronary artery disease and hypertension[30]. The social, physical, and environmental contexts where individuals live, work, grow, and learn can accentuate or attenuate these risks. Thus, addressing the root causes of poor birth outcomes is crucial for promoting population health throughout the life course.

Disparities in maternal and neonatal health among AsA subgroups are notable. Since the 1980s, AsA mothers have exhibited higher rates of low birthweight (LBW) deliveries (<2500 g) compared to most major US racial groups, except for Black mothers[31]. The risk of inadequate gestational weight gain and gestational diabetes mellitus (GDM) are higher in AsA women than in non-Hispanic White women[32,33]. When examining specific AsA subgroups, there are wide disparities in health outcomes. For example, pre-pregnancy obesity/overweight prevalence ranges from 13.6% in Chinese to 35.9% in Asian Indian women[34]. Age-specific incidence rates of GDM also vary considerably, from 53.8 per 1,000 live singleton births in Japanese women to 129.1 per 1,000 in Asian Indian women[35]. Other differences have been observed in the incidence of gestational hypertension/preeclampsia, severe maternal morbidity, and birth outcomes like preterm birth (PTB) and macrosomia[36–38]. Despite these findings, research on perinatal health

within AsA subgroups is sparse and often lacks a focus on the broader social determinants of these disparities, beyond individual behavior and medical risk factors.

Racial Residential Segregation in Asian Americans

Racial residential segregation (hereafter: segregation) is a fundamental cause of racial health inequities in the US[39]. Defined as the physical separation of a racially minoritized group from the majority group within a geographic area, residential segregation is known to affect the social, physical, and mental well-being of minoritized groups. The bulk of this evidence comes from research in Black urban segregated neighborhoods that generally show associations with deleterious exposures such as poverty, lower housing quality, and disadvantaged neighborhood physical environments[39,40]. These exposures can contribute to psychosocial stress and allostatic load[41] (the "wear and tear" on the body that arises from chronic, prolonged, or persistent stress response process), which have been linked to poor birth outcomes in pregnant people[42]. We know less about these associations for AsA, despite nearly 95% live in urban centers, with some subgroups (Chinese, Asian Indians, and Vietnamese) who as residentially segregated as Blacks and Hispanics[43]. Recent evidence from the American Community Survey showed Asian-White segregation (measured using the dissimilarity index) has increased slightly from 2005-2009 to 2015-2019, even while Black-White and Hispanic-White segregation have declined modestly, though the latter two groups have greater magnitudes of segregation than for AsAs[44].

The segregation of Black communities is well-documented as stemming from a history of racist policies and discrimination, leading to detrimental neighborhood conditions[39]. In contrast, the segregation of AsA often intersects with immigration dynamics. Over the past decade, nearly 75% of the AsA population growth was driven by immigration[45]. Evidence indicates that Asian immigrants tend to settle in places with existing Asian populations, suggesting a preference to live among co-ethnics. Today, AsA residents are more likely to live in concentrated AsA neighborhoods than compared to 20 years ago[44], particularly in immigrant gateway cities like New York and Los Angeles.

Additionally, racial discrimination plays an important role in AsA residential segregation. Research by the Urban Institute across 11 US metropolitan areas found that Asians and Pacific Islanders face significant levels of housing discrimination, on par with that experienced by Black and Hispanic renters[46]. A nationally representative survey revealed that 1 in 4 AsA adults

encountered discrimination when trying to rent or buy a house, compared to just 1 in 20 White adults. This disparity persisted even after adjusting for key sociodemographic factors[47]. Such discrimination can force ethnic minorities to settle in less-desirable neighborhoods.

While the prevailing view is that segregation generally harms health, segregated Asian enclaves may present some unique advantages. Asian enclaves can serve as a refuge from racism, reduce linguistic barriers, and facilitate important exchanges of social and economic resources, while also allowing ethnic groups to maintain cultural ties[48,49]. However, research on the impact of Asian enclaves on health is still limited and inconclusive.

Some studies show that living in AsA enclaves is associated with healthier behaviors and outcomes. For example, a study in California found that AsA women in areas with higher Asian populations were less likely to smoke compared to those in more integrated areas[50]. In New York City, census tracts with greater Asian ethnic density was associated with lower risk of preterm birth (PTB; <37 weeks of gestation) among South and East Asians[51]. Additionally, recent research reported that AsA people who gave birth in a hospital located in an Asian enclave had lower odds of some adverse perinatal health outcomes, including gestational diabetes mellitus (GDM), PTB, and small for gestational age delivery[52], compared to births in hospitals located in non-enclaves.

However, other studies present a contrasting view. For some foreign-born AsA adolescents, such as those from Chinese and Vietnamese backgrounds, living in predominantly Asian neighborhoods was associated with less healthcare access and use[53], which could impact their reproductive health and access to family planning services. Additionally, a national sample of AsA adults living in ethnic enclaves reported higher prevalence of mental health problems compared to those in neighborhoods with fewer Asian residents[54]. Moreover, US census tracts with higher Asian populations are disproportionately exposed to carcinogenic hazardous air pollutants, especially in areas where many residents speak a foreign language[55]. In a separate study using a difference-in-difference analysis, reductions in pollution from power plant retirements in California was associated with lower rates of PTB among nearby non-Hispanic Black and Asian residents[56]. These findings suggest that despite the generally high socioeconomic status of AsAs, they face significant environmental injustices and health disparities, underscoring the influence of broader socio-environmental power dynamics[57].

In the literature on AsA ethnic enclaves, there is a noticeable lack of analysis that breaks down findings by specific AsA subgroups. This gap may contribute to conflicting results, as some researchers treat all AsA neighborhoods as equal, implying AsA communities are homogenous. One such example is a study by Williams et al.[52] that combined Asian Americans with Native Hawaiian/Pacific Islander (NHPI) groups—a practice that contradicts guidelines set by the Office of Management and Budget since 1997 in response to major NHPI grassroots advocacy[58]. This approach overlooks the distinct sociopolitical histories of AsAs and NHPIs, which uniquely shape their residential settings and health outcomes. Failing to account for AsA diversity can distort our understanding of how neighborhood resources and opportunities are distributed among different AsA subgroups.

OPERATIONALIZATION OF ASIAN ETHNIC NEIGHBORHOODS

Types of Measures

Viewing of AsA neighborhoods as ethnic enclaves or racial residential segregation is informed by two separate literatures, each with its own limitations. Ethnographic studies define ethnic enclaves as "geographic areas with high concentration of racial/ethnic minorities and immigrants that have cultural, social, and economic identity that is distinct from the majority group"[59]. Portes and Rumbaut[60] also describe them as hubs of "concentrated immigrant entrepreneurship," shaped by complex social and economic factors. However, quantitative research has struggled to define ethnic enclaves consistently, with customized measures varying based on researchers' aims and available data. For example, the California Neighborhoods Data System[61] created a composite index for "ethnic enclave" using principal component analysis on census tract data on race/ethnicity, language, nativity, and recency of immigration. Others define enclaves simply by high proportions of a target racial group, using thresholds ranging from the 10th to the 25th percentiles[48,62,63].

In quantitative epidemiologic studies, ethnic enclaves are most commonly measured using segregation indexes like dissimilarity and isolation (**Equations 1, 2**). The index of dissimilarity (D) represents how evenly two racial groups are distributed across areal units (e.g., census tracts) within a macro area (e.g., county). The more uneven the distribution of the minority group compared to the majority group, the more segregated is the minority group. In addition to being relatively easy to calculate and interpret, D is considered suitable for investigating unhealthy

environments and exposures[40,64], such as birth outcomes and obesity primarily in Black-White segregation contexts. The isolation index ($_mP_m$) measures how isolated a minority group is from the majority group. This index represents the likelihood that members of the minority will interact with others from the same group. Isolation often reflects geographic separation from economic and educational opportunities and resources, which is relevant to health[65]. Calculating the dissimilarity and isolation indexes require data at two geographic levels, such as census tracts that aggregate up to the county-level measures.

Equation 1. County-level dissimilarity index using census tract-level measures describing the segregation of a racial minority group *m* from the dominant White population

$$D = \frac{1}{2}\sum_{i=1}^{J} \left| \frac{m_i}{M} - \frac{w_i}{W} \right|$$

Equation 2. County-level isolation index using census tract-level measures describing the isolation of a racial minority group *m*

$$_mP_m = \sum_{i=1}^{J} \left(\frac{m_i}{M} * \frac{m_i}{t_i} \right)$$

M= total population of m in county
T= total population in county
W = number of White pop. in county
i = index for census tract
J = total census tracts in county
m_i *= number of group m in tract i*
w_i *= number of White pop. in tract i*
t_i = total population in tract *i*

Melding ethnographic theory with quantitative methods for a nuanced view of AsA enclaves is the pioneering work of Emily Walton[20], who developed a novel neighborhood typology based on features of AsA diversity that align with sociologic theories on immigration, assimilation, place stratification, and resurgent ethnicity (the tendency of high-SES minority groups to form their own distinct communities rather than integrate with White populations)[66]. Walton proposed three types of Asian ethnic neighborhoods: *immigrant enclave* (high foreign-born composition, low neighborhood SES), *enclave of constraint* (high U.S.-born, low SES), and *resurgent enclave* (high SES, regardless of foreign-born composition). Applying this typology to Chinese, Filipino, Korean, and Vietnamese enclaves in California, Walton found systematic differences: Filipino and Vietnamese enclaves were more likely *enclaves of constraint* and *immigrant enclaves*, while Chinese and Korean enclaves were bimodally distributed into *immigrant enclaves* and *resurgent enclaves*. When linked with data from the California Health Interview Study, Walton showed that residents in high-SES *resurgent enclaves* were more likely to rate their health as "good" or better than residents of other neighborhood types, though this association varied by subgroup. Walton's typology brings some order to the range of enclave types that could emerge from the complex differences among AsA subgroups. By elucidating how ethnic neighborhood type influence health, this typology can provide valuable insights into perinatal health disparities within these communities.

Unit of Analysis

The most common way that Asian ethnic enclaves are operationalized in quantitative epidemiologic studies is through single dimensions of racial concentration at the census tract level[48,62,63]. These exposure measures are either treated as continuous variables or categorized as binary (e.g., enclave vs. non-enclave), using thresholds that vary depending on the relative concentration of the Asian group in an area. While census tracts align well with the idea of enclaves as small neighborhoods, this approach has limitations. First, ethnic concentration alone does not capture segregation. Second, defining enclaves at a small geographic scale like census tract can misclassify people who do not live in an enclave-tract but reside near one and benefit from its proximity. Third, using a single measure risks oversimplifying ethnic enclaves and the diversity of Asian enclaves. A recent study by Williams and colleagues[52] addressed these issues by combining ethnic concentration, dissimilarity, and isolation indexes to classify areas as Asian/Pacific Islander (API) enclaves. They found that API people who gave birth in a hospital located in API enclaves had better birth outcomes than those in non-enclaves. However, the study classified enclaves by hospital location, not where the birthing individuals lived. In addition,

enclave status was based on hospital referral regions used to define healthcare market for tertiary medical care[67], which sometimes combine multiple counties. Past studies have also measured ethnic enclaves or Asian segregation at the county[68], zip code[59], and metropolitan statistical area[69] levels. Analysis at the macro-level geography has the benefit of capturing ethnic enclaves that exist outside of urban centers.

Limitations of Aspatial Measures

A key limitation of using quantitative measures to define segregated neighborhoods or ethnic enclaves is that they rely on statistically defined areas (e.g., county, zip code), assuming people and resources are confined within these boundaries. However, many studies have shown that people's daily health-related activities and exposures often occur outside their residential neighborhood[64,70–72]. Another limitation is that statistically defined areas can change (e.g., due to redistricting), which would alter segregation indices even if residential patterns stay the same. This issue is known as the modifiable areal unit problem (MAUP), referring to a statistical bias that arise when research findings are tied to changes in the scale, size, and/or shape of areal units chosen for analysis[73]. Even when MAUP is minimized, relying on a single measure to define ethnic enclaves can oversimplify and misrepresent the effects of ethnic enclaves on health outcomes, especially in diverse populations like AsAs, who differ substantially by country-of-origin, SES, and immigration history.

THEORETICAL FRAMEWORKS

The overarching framework for this dissertation is the **ecosocial theory of disease distribution**, which offers a comprehensive, multi-level approach to understanding health disparities. This framework integrates social and biological reasoning with a dynamic, historical and ecological perspective to explain patterns of disease and social inequities in health[74,75]. A central notion of the ecosocial theory is that people literally embody and biologically express their experiences of economic and social inequality throughout the life course, contributing to social disparities in population health. This framework can be applied to understand inequities among AsA national-origin groups. For instance, the immigration history of AsAs-- as either refugees with trauma from war, voluntary migrants seeking better opportunities, or US-born individuals—shape their baseline health status, pace of acculturation, and potential for social and economic mobility. Variations in social position among AsA groups result in differential exposures to risk factors

related to occupation, economic circumstances, residential conditions, and physical environments. These differential exposures contribute to varying levels of vulnerability to illness and disease[76].

The ecosocial theory also informs our understanding of racial inequities experienced by AsAs, who face dual stereotypes as economically successful minorities who are "perpetual foreigners" (an evolution of "yellow peril") in the US. The model minority myth elevates AsA as the "desirable" minority who are hard-working, non-threatening, and law-abiding. Simultaneously, the "perpetual foreigner" stereotype frames AsA as unassimilable and inherently foreign, despite their successes and significant contributions to US society. This dichotomy reinforces the notion that being "American" is equated with whiteness[77], positioning AsAs as intermediaries in the racial hierarchy: above Black, Hispanic, and Indigenous populations, but below White populations. This positioning perpetuates racial inequities in power, resources, opportunities, and health outcomes.

I also draw upon **classic assimilation, place stratification,** and **resurgent ethnicity** theories to frame my research on residential segregation and health outcomes in AsAs. Classic assimilation theory suggests that immigrants often cluster in enclaves for mutual support—social cultural, economic, or language—which can have positive effects on health by providing a supportive community environment. Place stratification, on the other hand, posits that low SES position is maintained through institutional and interpersonal discrimination, leading to the formation of immigrant ghettos or enclaves of constraint. This theory links such segregation with negative health outcomes[20,78]. Resurgent ethnicity theory suggests that affluent racial minorities, regardless of nativity status, may choose to live with their own ethnic communities not out of economic constraint but to preserve ethnic and cultural identities[20,79]. The neighborhood typology used in this dissertation integrates these theories to capture the diverse experiences and health outcomes in AsA segregated neighborhoods. This approach advances understanding of the complex ways in which these communities manifest and affect health.

DISSERTATION OBJECTIVES

The overall objective of this dissertation is to advance current understanding of the perinatal health of AsAs and AsA subgroups and its relationship to residential segregation, a root cause of health inequities. I pursued the following specific aims:

Aim 1. Conduct a scoping review to understand the state of perinatal health research for Asian American subgroups.

Aim 2. Characterize the ethnic enclaves of each Asian subgroups according to county-level socioeconomic and nativity status.

Aim 3. Estimate the association between ethnic enclave type on PTB for each AsA subgroup.

Findings from these aims reiterate the urgent need to systematically disaggregate data on race in research and public health reports, provide a foundation for defining what segregation looks like in AsAs, and contribute empirical evidence on how segregation affects PTB in disaggregated AsA groups.

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CHAPTER 2 - PAPER #1:

MATERNAL, PERINATAL, AND INFANT HEALTH OF DISAGGREGATED ASIAN AMERICAN SUBGROUPS: A SCOPING REVIEW

Sarah-Truclinh Tran, Sarah B. Andrea, Ryan J. Petteway, Betty T. Izumi, Ava L. Kupperman, Miguel Marino, and Janne Boone-Heinonen

ABSTRACT

Purpose of review: We present a conceptual framework for understanding Asian American (AsA) heterogeneity and conducted a scoping review to identify trends and gaps in research regarding perinatal health for disaggregated AsA groups.

Recent findings: We reviewed 50 articles published since 2010, which show substantial heterogeneity of health status, causes of disparities, and exposure-outcome associations by AsA subgroups. Chinese, Filipino, and Indian subgroups were the most reported and Southeast Asian subgroups were the least. Birth outcomes were frequently studied while preconception and postpartum health outcomes were sparsely examined. Existing studies focus on individual-level risk factors, were based almost exclusively in US coastal locations, and rarely engaged theories of upstream determinants of health.

Summary: Current perinatal health studies for AsA subgroups represent a narrow population, geography, and research scope. Future research should frame AsA disparities in the context of immigration history, systemic racism, and cultural specificity.

Totaling nearly 20 million people, Asian Americans (AsAs) are the fastest-growing segment of the United States (US) population[1]. Yet, their health continues to be severely understudied[2,3] and underinvested[2,4]. The frequent omission of AsA in epidemiologic studies, pooling of all Asian national-origin groups into a broad racial label[5], and misconception that AsA are a "model minority" with few health problems[6] have contributed to the paucity of fundamental epidemiological data on prevalence, incidence, and factors of risk and resilience across multiple health topics for this population[7].

Asian American Diversity

AsAs include over 20 ethnic groups, each having distinct language, cultural practices, and immigration history (2). The most populous Asian subgroups in America are Chinese (24% of all AsA), Asian Indian (21%), Filipino (19%), Vietnamese (10%), Korean (9%), and Japanese (7%)[8]. The remaining identify as Pakistani, Cambodian, Laotian, Hmong, Thai, Bhutanese, and more[9].

AsA subgroups greatly differ by immigration history. While the arrival of Asians in the US was accelerated by the Immigration and Nationality Act of 1965, distinct subgroup patterns have been dictated by war, poverty, and changing demands for human capital to power the US economy. For example, Korean immigration peaked in the 1980s, driven by poverty and political instability in post-war Korea[10]. Likewise, Cambodian, Laotian, Hmong, and Vietnamese refugees began arriving in the 1970s following the wars in Southeast Asia. In contrast, many of today's foreign-born Asian Indian and Chinese individuals immigrate voluntarily as students or under permits for skilled professionals[10,11]. Similarly, Filipino immigrants comprise the largest share of foreign-born healthcare professionals in the US[10,12]. These varied experiences have implications regarding each group's baseline health, skills, and resources upon arrival in the US, and their subsequent social stratification in US society. For example, 34% of Vietnamese and 29% of Korean households are linguistically isolated, compared to 10% of Indian households[13]. The poverty rate for all AsA (10%) is less than the US average (13%), but 12 AsA subgroups have rates that exceed the US average[8]. Likewise, while half of all AsA adults have a college degree, this ranges from 15% for Bhutanese to 75% for Asian Indians[8]. Few research studies appreciate these cultural, historical, and socioeconomic nuances when examining outcomes for AsA

subgroups, who show substantial disparities in myriad health outcomes, such as colorectal cancer[14], depression[15], and breast cancer[16].

Despite their diversity, AsA subgroups continue to be aggregated in epidemiologic research. Disaggregating data on race and ethnicity is a key step toward providing clarity on the unique needs and disparities faced by marginalized populations, giving insights to support culturally appropriate interventions in the pursuit of health equity[17]. Ethically, disaggregating data enables communities to see themselves reflected in data, enabling them to make decisions, inform policy, and advocate for a more just distribution of resources[18]. The alternative—combining dissimilar populations—contributes to the social production of health inequities by obscuring meaningful disparities and detracting from policy attention to those who need it most.

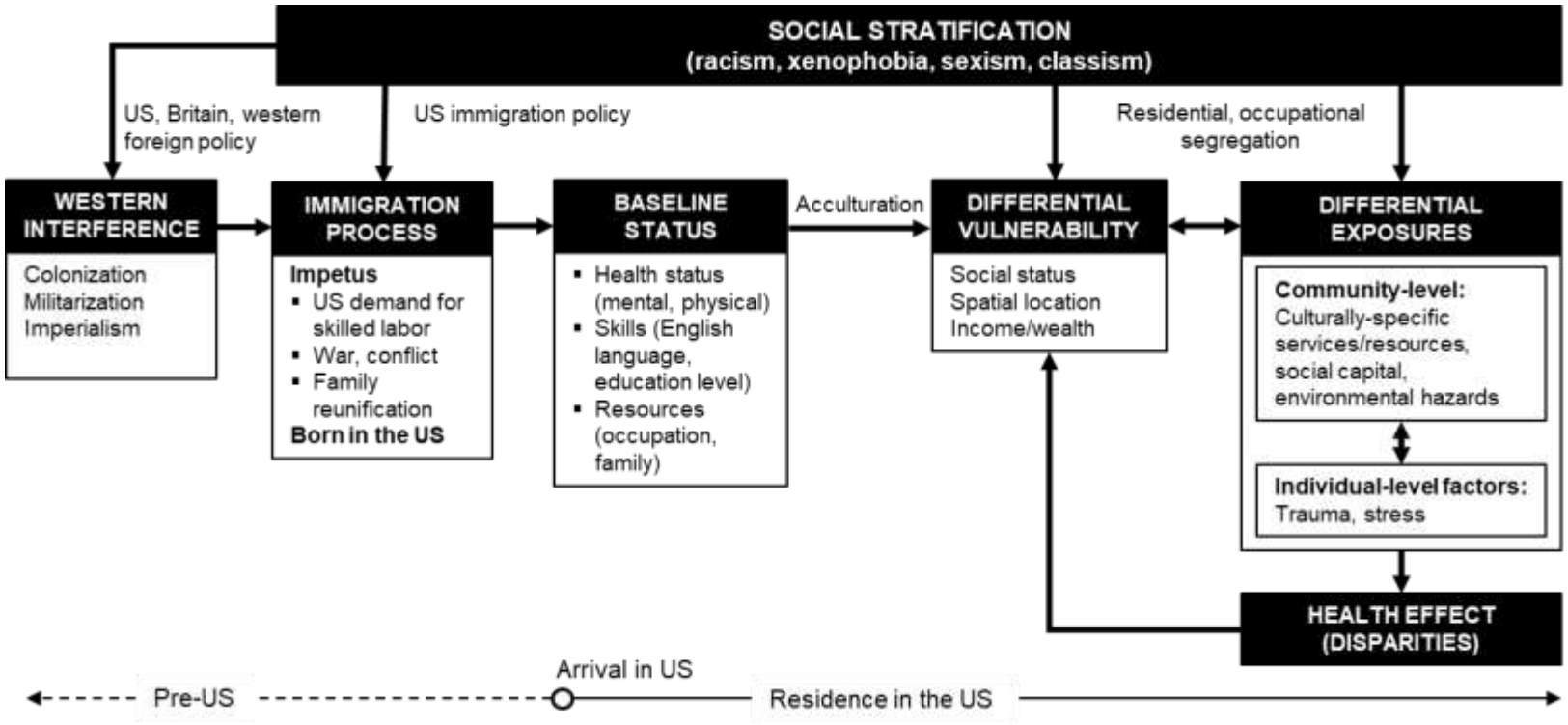
Conceptual Framework

To stimulate research regarding AsA health, we present a multidisciplinary framework that draws from the ecosocial perspective[19,20] and critical race theory (CRT)[21]. A central notion of ecosocial theory is that people embody-- and biologically express-- experiences of economic and social inequality throughout the life course, thereby producing social inequalities in population health. CRT highlights racism as a fundamental force shaping the unequal distributions of resource, power, and opportunities– including as related to the production of knowledge about race and racialized groups[22–24]. AsA are racialized as both successful “model minorities”[25] and dangerous “yellow peril”[26] threatening Western civilization. The ecosocial and CRT perspectives draw attention to past and present systems-level causes of health inequities that is largely shaped by racism.

Our conceptual framework recognizes that western interference in Asian countries through colonization (e.g., Britain in India), militarization (e.g., US in Southeast Asia, Korea), and imperialism (e,g., US in the Philippines) helped create undesirable conditions in these countries that, combined with US immigration policy, catalyze the exodus of people to the US in search of safety, opportunities, and community (**Figure 1**). We propose that the immigration history of AsA groups—as refugees escaping war, immigrants reuniting with family, skills-based migrants, or US-born—shapes their baseline health status, skills, and resources upon arrival in the US, which sets their pace of acculturation and potential for social, spatial, and economic mobility. Differences in socioeconomic status and spatial location create differential exposures to risk and protective

factors at the community and individual levels. Health disparities are a result of these differential exposures and social vulnerabilities, which can span generations through impacts on pregnancy and perinatal health[27].

Figure 1. Conceptual framework for interpreting health disparities in Asian American subgroups through immigration history intersecting with race and other social identities



Study Objectives

This review summarizes current published research on pregnancy and perinatal health in AsA subgroups. Previous reviews on AsA groups have focused on adult health outcomes[14–16]. Pregnancy and perinatal health are critical life stages, evident by their inclusion in 20 objectives in the Healthy People 2030 (HP2030) initiative[28] that is responsible for guiding health promotion and disease prevention efforts in the US. Here, we present a scoping review that identifies health trends and knowledge gaps for AsA subgroups, then make recommendations for future work to help mitigate health disparities in this rapidly growing and evolving population.

METHODS

Search Strategy

We systematically searched literature for observational, population-based studies that investigated health outcomes and/or produced health effect estimates for an AsA subgroup defined more granularly than "Asian." We included papers that examined outcomes listed in **Table 1**, which aligns with HP2030 objectives for maternal and infant health or are related to birth size (low birth weight, small-for-gestational age) or gestational diabetes mellitus (GDM), both highly prevalent in AsA populations[29–33]. Using the PubMed/MEDLINE database, we searched for articles using keywords capturing the following concepts:

- Population: any specific AsA ethnic identities (Cambodian, Chinese, Filipin*, Hmong, Indian, Japanese, Korean, Lao*, Thai, Vietnamese) OR groupings based on the region of the country of origin (East Asian, South Asian, Southeast Asian), AND
- Setting: America* OR United States, AND
- Health outcomes: perinatal health, maternal health, birth outcomes, preconception health, postpartum health, infant health

The original search was performed on August 2, 2021 and then updated on March 11, 2024. We selected studies published in peer-reviewed sources since 2010 with an available abstract for screening purposes. Studies published since 2010 provided a sufficient volume of

evidence to review and synthesize, while focusing on recent research questions and contributions.

Screening

This scoping review is designed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) statement and checklist[34]. We included English-language original research articles that used a nonrandomized observational study design (e.g., cohort, cross-sectional), disqualifying reviews, commentaries, and theoretical papers. Studies were further restricted to US populations reporting the health levels and/or health effects of an exposure in at least one AsA subgroup, thus excluding studies that were qualitative (e.g., focus groups) and those regarding psychometric measurements (e.g., validating a translated survey).

Data Extraction and Synthesis

For each included article, we extracted study design, year of publication, setting (geographic location, time frame), data source, AsA subgroups reported, exposure(s), health outcome(s), mediators or moderators tested as potential mechanisms, risk, or protective factors, and a summary of the findings. We extracted the race categories reported in the paper for AsA subgroups based on national-origin (e.g., Cambodian, Chinese, Filipino, Hmong, Indian, Indonesian, Japanese, Korean, Laotian, Thai, Vietnamese) or region (e.g., South Asian, East Asian, Southeast Asian). Categories for geographic locations include national, state, or “Other” if the study did not identify a specific location or combined data from multiple states. Health outcomes are categorized into the life-course stages summarized in **Table 1**. In addition, we grouped studies into 3 types: those that 1) primarily reported the health status of an AsA subgroup or disparities between race groups (i.e., race was the primary exposure or independent variable); 2) sought to identify factors that could explain the observed racial disparities; and 3) examined racial variations in exposure-outcome relationships (i.e., race was an effect measure modifier).

Table 1. Perinatal health outcomes included in the review

Life Course	Health Outcome	HP2030 Objective
Preconception	Folic acid intake	• Increase the proportion of women of childbearing age who get enough folic acid (MICH-12)
	Pre-pregnancy weight	• Increase the proportion of women who had a healthy weight before pregnancy (MICH-13)
Prenatal	Prenatal care	• Increase the proportion of pregnant women who receive early and adequate prenatal care (MICH-08)
	Substance use during pregnancy	• Increase abstinence from alcohol among pregnant women (MICH-09) • Increase abstinence from cigarette smoking among pregnant women (MICH-10) • Increase abstinence from illicit drugs among pregnant women (MICH-11) • Reduce the proportion of women who use illicit opioids during pregnancy (MICH-D02)
	Gestational diabetes mellitus*	Not in HP2030
	Fetal death	• Reduce the rate of fetal deaths at 20 or more weeks of gestation (MICH-01)
Birth	Cesarean birth	• Reduce cesarean births among low-risk women with no prior births (MICH-06)
	Preterm birth	• Reduce preterm births (MICH-07)
	Birth size*	Not in HP2030. Includes: birth weight, low birth weight (<2,500 grams), small or large for gestational age
Postpartum	Maternal death	• Reduce maternal deaths (MICH-04)
	Severe maternal complications	• Reduce severe maternal complications identified during delivery hospitalizations (MICH-05)
	Breastfeeding	• Increase the proportion of infants who are breastfed exclusively through age 6 months (MICH-15) • Increase the proportion of infants who are breastfed at 1 year (MICH-16)
	Postpartum depression	• Increase the proportion of women who get screened for postpartum depression (MICH-D01)
	Infant death	• Reduce the rate of infant deaths (MICH-02)
	Infant sleep position	• Increase the proportion of infants who are put to sleep on their backs (MICH-14)

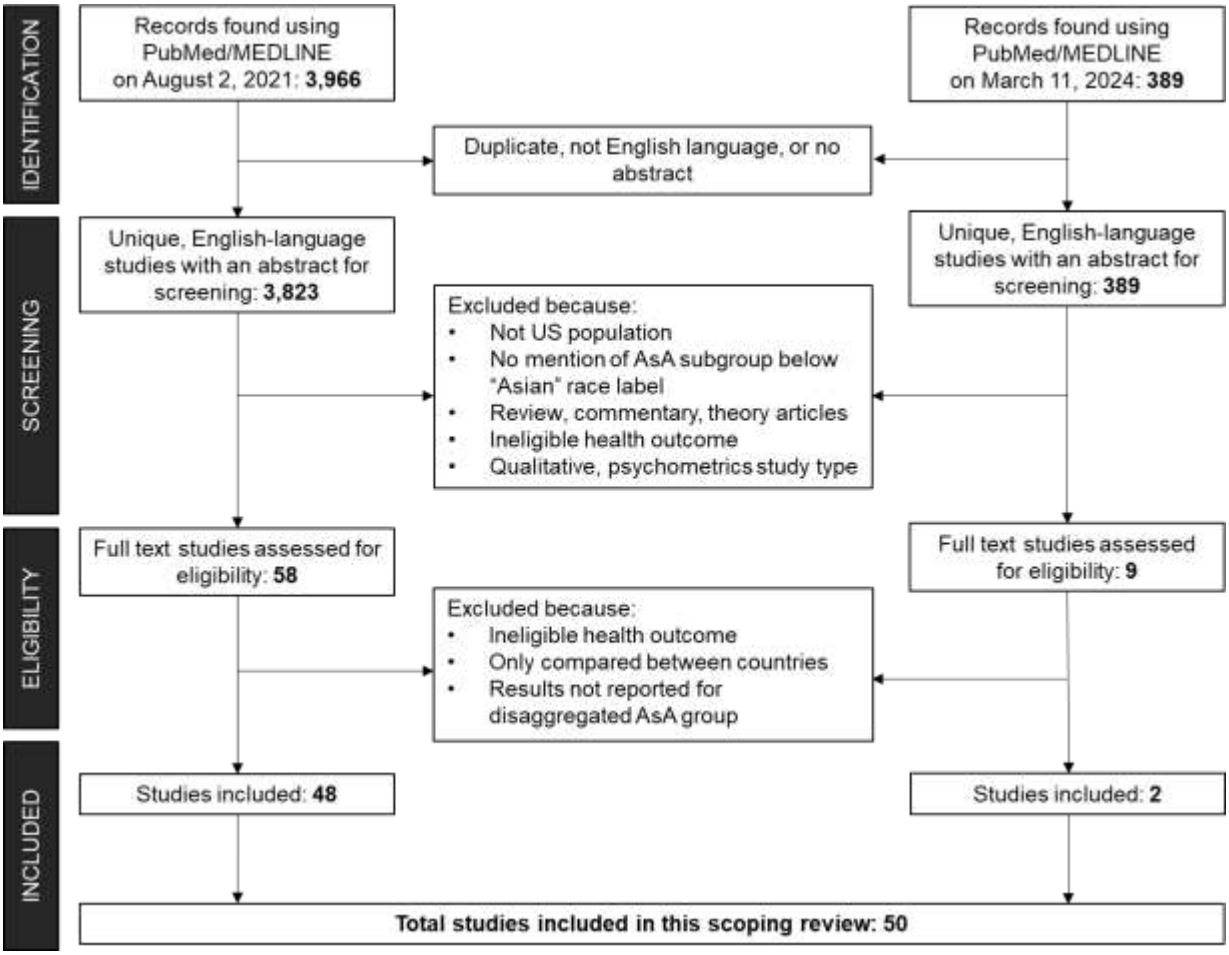
* Existing research points to a high prevalence of these health conditions in specific AsA subgroups and/or overall Asian American population

RESULTS

Literature Search

The first PubMed/MEDLINE search identified 3,823 unique, English-language studies with an abstract (**Figure 2**). Fifty-eight articles met initial screening criteria and underwent full-text review, with 48 included in the review. In the updated search, 2 of 389 articles were included. In total, 50 studies were included in the review.

Figure 2. Selection of studies included in this review



Study Characteristics

Since 2010, between 1 and 7 studies were published each year on the perinatal health of disaggregated AsA groups (**Figure 3**). These studies used data collected as far back as 1915 up to 2018, with most study periods in the 1990s through the 2010s. For example, one time-series analysis[35] used data from 1915 to 2017 (although data for AsA subgroups were only reported for 2014-2016), while another study[31] combined data from 1997 to 2012 for analysis. Fourteen studies were nation-wide, and the remaining were based in California (n=14), New York City (6), Hawaii (5), and others (Washington state, New Jersey, a Northeastern state).

Birth record data was the data source for 45 (88.2%) articles. Several studies linked birth record data with external sources such as the Pregnancy Risk Assessment Monitoring System (PRAMS)[36–38], electronic health records (EHR)[39], hospital discharge data[31,40–46], newborn metabolic screening data[47], state cosmetology licensee data[48], and the American Community Survey[44,45,49]. The remaining studies analyzed EHR data from a community-based clinic[50], a large health system[51], and biomarker data[52] regional registry to determine maternal tobacco exposure during pregnancy.

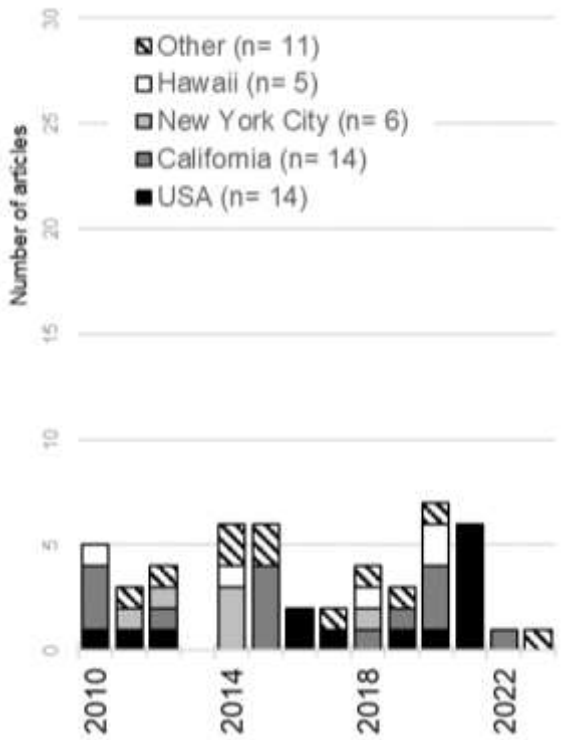


Figure 3. Included articles (n= 50) by year published and study location

Other locations include Washington state, New Jersey, an “unnamed Northeastern state,” and combined California and Hawaii data.

Study Design

Table A1 (Appendix) provides details of the key characteristics of the 50 included studies, organized into study purpose and the perinatal stage of the outcome(s) of interest: preconception, prenatal, birth, or postpartum health. Cross-sectional or retrospective cohort were the most common study designs. No studies examined a preconception health outcome, 5 (10%) focused on prenatal health, 33 (66%) on birth, and 7 (14%) on postpartum health (**Figure 4**). Five (10%) articles covered multiple periods: prenatal and birth (4), and postpartum and birth periods. The most reported AsA subgroup is Chinese (n= 33), followed closely by Filipino (32), Japanese (31), Indian (29), Vietnamese (26), and Korean (25); between 1 and 9 papers reported on Cambodian, Laotian, Hmong, Thai, and/or Indonesian people in the US. Several studies aggregated Asian national-origin groups into commonly used regional groupings: South Asian (7), East Asian (6), and Southeast Asian (3). Among studies on postpartum health in our review, none included Cambodian, Laotian, Hmong, Thai, and Indonesian birthing people in their analysis.

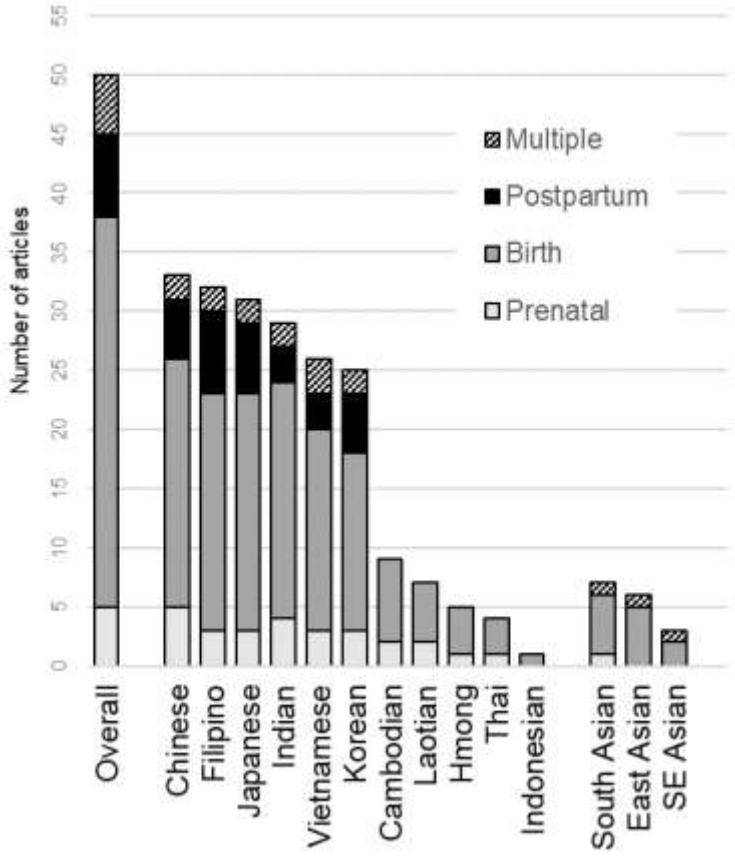


Figure 4. Number of articles that reported health outcomes for each Asian American subgroup, by perinatal stage.

Notes: The AsA race labels reflect what were used in the published article | SE Asian: Southeast Asian.

Conceptualization of Race and Ethnicity

A total 31 studies treated race and ethnicity as the main independent variable. Non-Hispanic (NH) white was the most common referent group, even in studies that sought to highlight the health of a specific AsA group[40,49,53–55]. Chinese were the most common AsA referent subgroup. While most studies did not provide rationale for the referent racial group, those that did selected based on being the most populous[56], having highest/lowest risk for the health outcome[29,40,42], considered more privileged[45]. Less commonly, referent groups were a random sample of a comparable population in the data[48] or centered the population of interest[33].

Only four studies engaged theory or considered AsA cultural or historical contexts[44,49,55,57]. Quan et al[57] interpreted findings within contexts of structural racism, colonialism, and immigration policy as fundamental drivers of health inequities in the AsA population. Li et al[55] used the life-course theory to frame the connection between maternal education level and infant survival in an analysis comparing foreign- vs US-born Chinese American mothers. Finally, Janevic et al[44], and

Kane et al[49] used sociologic theories on the healthy migrant effect, spatial assimilation, and social networks to explain effects of living in an ethnic enclave on GDM and birth outcomes. Two studies explicitly tied race to notions of power[57] and privilege[45] in the context of racial and ethnic hierarchies in the US.

Study Findings

After grouping the articles by their general purpose, we found a total of 30 studies that described the health status in and between AsA subgroups, sometimes intersecting with another demographic characteristic, such as maternal nativity and education (**Table 2**). Five studies assessed factors that could explain an observed racial disparity for a health outcome; 15 examined racial variations in an exposure-outcome association. The following sections summarize notable findings from the studies of each type.

Table 2. Overview of the study purpose and health outcomes reported in the 50 included studies, by perinatal stage of the health outcome

	Preconc.		Prenatal				Birth					Postpartum					
Health outcomes	Folic acid intake	Pre-pregnancy weight	Prenatal care	Substance use	Gestational diabetes	Fetal death	Cesarean delivery	Preterm birth (PTB)	Birth weight: LBW, VLBW	Small for gestational age	Large for gestational age	Severe maternal morbidity	Maternal death	Breastfeeding	Postpartum depression	Infant death	Infant sleep position
30 articles described health status/disparities by:																	
Maternal demographics			1		1		1	1	1	1	1	1	1		1		
Maternal nativity					1			3	3	1						2	
Maternal race/ethnicity			1	1	1	1	4	5	6	3	1			2	1		
Maternal race/ethnicity, education								1								1	
Maternal race/ethnicity, age															1		
Maternal race/ethnicity, nativity							1					1					
Maternal and paternal race/ethnicity								1	1								
Total			**2**	**1**	**3**	**1**	**6**	**11**	**11**	**5**	**2**	**2**	**1**	**2**	**3**	**3**	
5 articles examined causes of disparities by:																	
Maternal race/ethnicity								1	2	1	1			1			
Maternal race/ethnicity, nativity									1								
Total								**1**	**3**	**1**	**1**			**1**			
15 articles described racial variations for exposure-outcome associations:																	
Maternal demographic, clinical factors									1	1							
Maternal age					1		1	1		1	1						
Maternal education																1	
Pre-pregnancy body mass index					2			1									
Gestational diabetes								1									
Gestational weight gain							1										
Interpregnancy interval								1									
Acculturation				1										1			
Occupation in cosmetology					1					1							
Residence in ethnic enclave			1	1	1			2									
Area-level economic segregation								1									
Total			**1**	**2**	**5**		**2**	**7**	**1**	**3**	**1**			**1**		**1**	
Grand Total			**3**	**3**	**8**	**1**	**8**	**19**	**15**	**9**	**4**	**2**	**1**	**4**	**3**	**4**	

Numbers do not total 50 articles because some articles reported on multiple health outcomes and/or multiple exposures. Preconc.: preconception | LBW: low birth weight (<2,500 grams) | VLBW: very low birth weight (<1,500 grams

Health Disparities Among and Within Asian American Subgroups

Nearly all of the 30 studies that examined racial health disparities **(Appendix A1a)** reported substantial heterogeneity in health outcomes between the AsA subgroups.

Prenatal Health Outcomes

Environmental tobacco smoke exposure among non-smokers was higher in Cambodians, Vietnamese, and Korean pregnant women than other AsA subgoups[52].

Birth Outcomes

Topics most covered were preterm birth (PTB; 11 studies), low birth weight (LBW; 11), and Cesarean delivery (6). Populations with generally higher risk for PTB and LBW compared to NH white individuals included Southeast Asian[40], Cambodian and Laotian[33,58], Hmong[33], Filipino[33,59,60], and Vietnamese[60] groups. Racial differences in Cesarean delivery were consistent across locations. For example, Filipino and South Asian or Indian women had higher adjusted odds of Cesarean delivery than NH white women in studies based nationally[61], in New York City[41], and in Texas[29]. These same studies and another in Massachusetts[62] reported East Asian mothers (overall and specifically Japanese, Chinese, and Korean women) were less likely to deliver by Cesarean. For small-for-gestational-age (SGA) births, racial disparities were observed across AsA subgroups[45,56,63], with no single group having consistently higher or lower risk. Filipinas had particularly high risk of severe maternal morbidity (SMM)[31,45] and maternal mortality[64] compared to other AsA subgroups. In contrast, several studies reported Korean mothers fared better than other AsA subgroups or the referent group in terms of lower incidence of LBW[54,59], PTB[33,65], SMM[31], and Cesarean delivery[54].

Maternal nativity modified findings in some studies, depending on the health outcome and populations examined. Studies based nationally[66], in Hawaii[54], and California[31] found risks of PTB, LBW, and SMM to be similar by maternal nativity within each AsA subgroup. However, US-born Chinese American mothers were reported to have higher risk of adverse birth outcomes than their foreign-born counterparts in a national study [58] and in a California-based study[67]. Foreign-born East Asian mothers were more likely than US-born East Asian mothers to deliver by Cesarean[41].

Postpartum Health Outcomes

The three studies that examined maternal postpartum depression (PPD) suggest a discrepancy between AsA mothers' higher prevalence of self-reported PPD[36,38], and lower likelihood of receiving a clinical diagnosis[50], compared to NH white mothers.

Causes of Observed Health Disparities

Five articles investigated factors that explained an observed health disparity **(Appendix A1b)**, all of which were racial disparities compared to NH White populations. Four studies[42,68–70] focused on birth outcomes and one[37] on prevalence of exclusive breastfeeding. Explanatory factors examined included maternal education[42], gestational weight gain[68], and maternal demographic and clinical factors[37,70]. The explanatory variables were either adjusted as confounders in the models, or treated as mediators, in which they were added to the model sequentially to observe changes in the race-outcome association. While the magnitude of results varied, all the studies generally concluded that the individual-level factors examined explained some but not all the disparities observed between AsA subgroups and the NH white referent group.

Variations in Exposure-Outcome Associations by AsA Subgroups

Of 15 studies focused on variations in exposure-outcome relationships by AsA subgroups **(Appendix A1c)**, nearly half examined PTB[43,49,57,71–75] and/or GDM[39,44,46,48,75] outcomes. Cesarean delivery[76], infant birth size[73,75], and maternal behaviors[49,77] during the prenatal (prenatal care, tobacco use) and postpartum (breastfeeding) periods were also examined. The majority of studies focused on individual-level exposures and six examined contextual exposures.

Individual-Level Exposures

Studies showed exposure-outcome associations differed by maternal AsA national-origin, nativity, or behaved differently in an AsA subgroup compared to a non-AsA group. Maternal age[75], pre-pregnancy BMI[72], interpregnancy interval[43], and gestational weight gain[76] were associated with risks of adverse outcomes differently across AsA groups. Moreover, associations that existed in the general or NH white population did not apply to certain AsA subgroups studied, or vice versa. For example, occupation as a manicurist or cosmetologist was not associated with SGA

outcome for working women in the general population, but was significantly associated with increased SGA risk for Vietnamese women[48]. In addition, while social factors (education, marital status) were significantly associated with poor birth outcomes for white mothers, clinical factors (anemia, hypertension, placental disruption) were for Indian mothers[73].

Further heterogeneity was revealed when maternal nativity was included as an effect measure modifier of associations between individual-level factors and health outcomes. For example, while immigrant women of all AsA subgroups examined had increased risk of GDM, pre-pregnancy obesity had a weaker association with GDM risk in this group, suggesting obesity has a smaller role in GDM development in immigrant compared to US-born women of the same race[46]. Acculturated immigrant mothers of selected AsA subgroups were more likely to initiate breastfeeding than their US-born counterparts[77]. In contrast, maternal nativity did not modify the positive association between pre-pregnancy BMI and PTB for East Asian and Southeast Asian mothers[72].

Area-Level Exposures

Associations between area-level exposures and health outcomes also differed across AsA subgroups. For example, higher area-level economic segregation was associated with higher PTB risk for Indian individuals (positive association), while PTB risk was higher at lower- and higher-ends of economic segregation for Chinese, Filipino, and Vietnamese groups[57] (quadratic-shaped association). In the three studies that examined ethnic enclave residency as an exposure, associations between living among co-ethnics and health outcomes were inconsistent. Enclave residency was associated with healthy prenatal behavior (less smoking, earlier prenatal care initiation) in Indian mothers in New Jersey[49] and appeared protective against GDM for South Asian immigrants in NYC[44], but had null or only slightly protective associations with PTB in most AsA subgroups in NYC[74].

DISCUSSION

This scoping review addresses empirical research on perinatal health outcomes for AsA subgroups disaggregated below the broad “Asian American” label. We reviewed 50 studies that were published since 2010 on maternal, perinatal, and infant health outcomes prioritized in HP2030, in addition to outcomes with high prevalence in AsA subgroups.

Knowledge Gaps

Our review points to the overall scarcity of available data that could allow for disaggregation of racial groups, evidenced by the predominance of studies that analyzed birth record data. While birth data collects detailed race and ethnicity information, it has little information pertaining to the preconception and postpartum periods, which partly explains why we were not able to identify any papers on preconception health and only 7 on postpartum health outcomes for AsA subgroups. Measures of preconception folic acid intake, postpartum depression, and infant sleep position can be found in PRAMS data, a state-based survey given to samples of recent birthing parents. However, like other major public health data systems[78,79], PRAMS does not oversample AsAs, nor does it translate surveys into Asian languages, rendering it an unreliable data source for tracking AsA progress toward HP2030 goals. Such structural barriers contribute to silencing and homogenizing AsAs, reinforcing the model minority myth that is used to justify AsA's exclusion from research and policy considerations[6,23]. They reflect the racialized knowledge-power relations in public health systems and practices that inform whose data is prioritized, collected, and analyzed[23]. When data become available, our review suggests the need for more studies focused on preconception and postpartum periods for disaggregated AsA groups.

Simultaneously, this body of literature underrepresents certain AsA subgroups, notably Southeast Asians who may be more vulnerable to adverse health outcomes from their history of experiencing war, genocide, and displacement[80], in contrast to other AsA groups who are US-born or are skills-based immigrants. Studies that included Southeast Asians in our review generally reported higher adverse health outcomes for Hmong[31,33,45], Cambodian[40,45,52,58], Laotian[31,40,45,58], and Thai[31,45] groups compared to a referent group.

We also found that, outside of national studies, all the studies were based in coastal states and cities. While this pattern mirrored the locations of research institutions, it suggests severe knowledge gaps of the health of AsA living in other parts of the US that have experienced rapid AsA population growth. For example, southern and midwestern states with historically low racial diversity have seen large growth in their AsA populations over the past decade, with increases of 55% in Georgia to 103% in North Dakota. As a result, AsAs now comprise 5.3% of Georgia's population and 2.4% of North Dakota's[9]. Moreover, the lack of localized studies is problematic for

AsAs who are increasingly residing with co-ethnics[81,82]. Only two articles[70,83] in this review were county-level analyses.

Finally, the vast majority of studies in our review focused on individual-level exposures of health outcomes, which contrast with HP2030 and the public health field's emphasis on the social determinants of health (SDOH)[28] as important contributors to health inequities. SDOH are social and contextual factors such as neighborhood resources and community assets/stressors that impact population health over the life course[28]. In our review, only four[44,49,57,74] studies examined an area-level determinant of health, suggesting that our understanding of the contextual influences of perinatal health in AsA subgroups is still in the nascent phase.

Reframing Research Regarding Asian Americans

With few exceptions, researchers in our review generally did not describe a conceptual framing of race and ethnicity, which could lead readers to associate race with biologic inferiority, thus enabling "victim blaming," eliciting the "yellow peril" stereotype (anti-Asian xenophobia) and reifying existing racial health inequities. To prevent such misinterpretations, Boyd et al[84] proposed standards for publishing on racial health inequities that include researchers explicitly define and justify race in their study in addition to naming racism. Only two studies[45,57] in our review make any mention of racism. Future epidemiologic research should more thoroughly consider how AsA race intersects with the coinciding harms of colonialism[85], racism, xenophobia, classism, and sexism to impact the health of childbearing AsA populations. Such a theoretical vantage point may help clarify systems-level contributors to the observed variations in health or exposure-health associations across AsA subgroups. For example, in Delara et al., short interpregnancy interval (<6 months between two pregnancies) was associated with increased PTB risk for Southeast Asian women but not for other (East Asian, Filipina, and Asian Indian) subgroups[43]. Our framework might suggest that Southeast Asians—despite their collective resilience as refugees who sought safety in the US—likely arrived with less resources and greater mental and physical health needs that, in the absence of culturally- and linguistically-specific resources and services in the community, may amplify the effects of interpregnancy interval on PTB outcome.

Limitations

We note several limitations of this review. First, although we conducted an extensive literature review using a wide array of terms to capture the multiplicities of AsA subgroups and

health outcomes included, some articles may have been missed because of our search criteria and/or our reliance on only one citation database. For example, our search terms for ethnic identities may be broad, as the “Chinese” category may include diverse groups such as those from Taiwan, Hong Kong, and beyond. Second, we excluded articles from non-peer reviewed sources (e.g., grey literature, government data reports, dissertations), which may have eliminated relevant reports. Third, we excluded qualitative studies that might capture the health experiences of AsA subgroups who receive less attention in quantitative studies. We also recognize the possibility that we missed studies employing participatory methods that can offer a more nuanced causal framework of health, such as assets and strengths of individuals and communities.

CONCLUSION

We found that the state of perinatal health research in AsA subgroups remains focused on individual-level risk factors due to unavailable contextual data and, relatedly, a lack of theoretical framing of the upstream contributors of health in AsA subgroups. Our review points to research gaps, such as no/little evidence on preconception and postpartum health outcomes, underrepresentation of vulnerable AsA subgroups, and lack of geographic diversity. Finally, like other reviews[14–16], we found substantial heterogeneity of health status, disparities, and risk factors for outcomes across the AsA subgroups. These findings underscore the importance of disaggregating AsA data to allow for a more accurate assessment of need and thus equitable resource allocation to the intended population. We call for future research that frames the health of AsA subgroups in the context of immigration history, settler-colonialism, systemic racism, and cultural specificity. These are crucial steps toward pursuing health equity in the HP2030 objectives for all racialized groups in the US.

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National cross-sectional study using birth record data linked with American Community Survey data to examine associations between residential economic segregation and PTB in disaggregated AsA groups. Findings show heterogeneity in PTB prevalence by AsA national-origin and PTB risk is higher in areas at extreme ends of economic segregation for Chinese, Filipino, Japanese, Korean, and Vietnamese mothers. One of the few studies investigating structural determinants of health in AsA subgroups through the lens of European colonialism, US imperialism, and globalization.

Zhang, Y., Heelan-Fancher, L., Leveille, S. & Shi, L. Health Disparities in the Use of Primary Cesarean Delivery among Asian American Women. Int. J. Environ. Res. Public. Health 20, 6860 (2023).
The authors analyzed birth registry from 1992-2014 for a racially diverse, northeastern US state to examine disparities in primary Cesarean delivery (PCD) in AsAs and between AsA subgroups. Findings show AsAs had highest rate of PCD compared to all other race groups, but rates vary widely by AsA national-origin. Filipino, Asian Indian, and Other Asian subgroups had higher, while Japanese, Chinese, and Korean had lower adjusted risk of PCD compared to NH White women. Disaggregating AsA subgroups are necessary for evidence-based health care and policy making.

Bane, S. et al. Risk factors and pregnancy outcomes vary among Asian American, Native Hawaiian, and Pacific Islander individuals giving birth in California. Ann. Epidemiol. 76, 128-135.e9 (2022).
The authors analyzed linked birth and fetal death records and hospital discharge data for California during 2007-2018 to examine prevalence of 15 clinical and sociodemographic risk markers and 11 pregnancy outcomes. Using a heat map, the authors showed substantial variability in perinatal risk factors and outcomes across the AsA and Native Hawaiian subgroups. Findings suggest that the practice of aggregation into “Asian American/Native Hawaiian/Pacific Islander” is not appropriate for outcome reporting.

Dongarwar, D., Tahseen, D., Aliyu, M. H. & Salihu, H. M. Pregnancy outcomes among Asian Americans of advanced maternal age, 1992-2018. J. Obstet. Gynaecol. Res. 47, 2117–2125 (2021).
The authors analyzed national 1992-2018 birth record data and compared age-adjusted risks for selected perinatal outcomes tracked by HP2030 for AsA subgroups of advanced maternal age (≥35yrs). Findings show that, compared with NH White mothers, AsA overall had increased odds of PTB, Cesarean delivery, and small-for-gestational-age infants, irrespective of advanced mom age group. Compared to NH Whites, Asian Indians, Vietnamese, and Filipinas had increased odds of PTB and all AsA subgroups except Japanese mothers had increased odds of Cesarean delivery. Results reinforce the importance of disaggregating data for AsA subgroups to reveal disparities that could inform interventions.

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Table A1. Summary of study design, primary exposure, health outcomes, and main findings of the 50 articles included in the scoping review

a) 30 articles described health status/disparities

First Author, Year	Place (Timeframe)	Data Source	AsA Groups (sample size)	Primary Exposure	Health Outcome(s)	Main Findings for AsA Subgroup(s)
PRENATAL HEALTH						
Sarnquist, 2010	California (2000-2004)	Birth records	Chinese (62,336), Japanese (13,127), Korean (23,164), Vietnamese (43,949), Cambodian (8,016), Thai (3,332), Laotian (5,021), Hmong (8,390), Asian Indian (38,171), Filipino (72,259)	Maternal race/ethnicity	Prenatal care (PNC)	• No significant difference in PNC between AsA subgroups
Hoshiko, 2019	California (1999-2002)	Biomarker data	Chinese, Japanese, Korean, Filipino, Cambodian, Vietnamese, Laotian, Indians	Maternal race/ethnicity	Smoking, environmental tobacco smoke (ETS) exposure during pregnancy	• ETS exposure among non-smokers was higher in Cambodians, Vietnamese and Koreans, and lowest in Filipinos, Japanese, White, and Chinese women. • Vietnamese women unlikely to be active smokers, but experienced relatively high ETS exposure.
BIRTH OUTCOMES						
Cripe, 2012	Washington (1993-2006)	Birth records + hospital discharge data	Cambodian (3,489); Laotian (2,038); Vietnamese (11,618); Japanese (3,038)	Maternal race/ethnicity	Low birth weight (LBW), macrosomia, Preterm birth (PTB)	• Cambodian, Laotian women with GDM had increased adjusted odds of macrosomia, compared with Japanese women. • Southeast Asian women with GDM had reduced odds of macrosomia when compared with White women. • Southeast Asian women with preeclampsia had increased odds for PTB when compared with Japanese and White women with preeclampsia.

First Author, Year	Place (Timeframe)	Data Source	AsA Groups (sample size)	Primary Exposure	Health Outcome(s)	Main Findings for AsA Subgroup(s)
Xiang, 2015	California (1995-2010)	Electronic health records	Chinese; Filipino; Asian Indian; Japanese; Korean; Vietnamese	maternal race/ethnicity	Small-, large-for-gestational age (SGA, LGA	• No significant difference in outcomes between AsA subgroups vs NH White women. • Asian Indian, Filipino women with GDM have greater risk of having LGA infant than expected within their own general populations.
Kim, 2018	Hawaii (2004)	Birth records	Chinese; Japanese; Filipino; Korean + Vietnamese (combined)	maternal race/ethnicity	LBW, PTB	• In each AsA subgroup: no significant difference in LBW, PTB prevalence between US- and foreign-born mothers, except for Other Asian
Zhang, 2023	"Northeastern US state" (1999-2012)	Birth records	Asian Indian (84,495); Chinese (26,529); Filipino (28,070); Korean (19,446); Japanese (4,475); Vietnamese (6,693)	Ethnic enclave of South-Central Asians	Cesarean delivery	• Cesarean rate highest in overall AsA than other racial groups. • Filipino, Asian Indian, and Other Asian subgroups had a higher adjusted risk for Cesarean, while Japanese, Chinese, and Korean had lower adjusted risk, and Vietnamese had no significant difference in Cesarean delivery compared to NH White women.
Li, 2010	USA (1995-2000)	Birth + death records	Chinese Americans	Maternal nativity	LBW, PTB, SGA, infant mortality	• Compared to US-born Chinese mothers, foreign-born Chinese mothers had less social and behavioral risk factors (unmarried, teen age, rural residents, lower education, inadequate prenatal care use). • Foreign-born mothers of Chinese descend had significantly lower risks for LBW, PTB, and SGA, whereas risks for infant mortality, neonatal mortality, and post-neonatal mortality did not differ significantly from those of infants of US-born Chinese mothers.
Bane, 2022	California (2007-2018)	Birth records + hospital discharge data + ACS	Chinese, Korean, Japanese, Filipino, Hmong, Vietnamese, Cambodian, Laotian, Thai, Indian, Other Asian	1) indicators of social disadvantage, (2) maternal risk factors, (3) pregnancy-related conditions	PNC, GDM, Cesarean, severe maternal morbidity (SMM), PTB, SGA, LGA, VLBW	• Perinatal outcomes varied significantly (e.g., SMM prevalence: 1.2% Korean-1.9% Filipino). • No single group was consistently better or worse off across examined factors and outcomes

First Author, Year	Place (Timeframe)	Data Source	AsA Groups (sample size)	Primary Exposure	Health Outcome(s)	Main Findings for AsA Subgroup(s)
Vang, 2015	California (2002-2004)	Birth records	Hmong (ref.; 4,123) Asian Indian (21,856) Chinese (33,982) Japanese (7,151) Korean (13,190) Vietnamese (24,396) Cambodian (4,249) Filipino (39,497) Lao/Thai (4,408)	Maternal race/ethnicity, maternal education	PTB VPTB	• White, Chinese, Japanese, Korean, Asian Indian, and Vietnamese women had lower odds of VPTB and PTB than Hmong women, adjusting for maternal characteristics. • Adjusted odds of VPTB for Cambodian, Filipino, Lao/Thai were similar to Hmong, while their adjusted odds of PTB was higher than Hmong. • Association between higher maternal education and reduced odds of PTB, VPTB was not as pronounced among Hmong, Vietnamese, and Korean women, compared to White and most East Asians (Japanese, Chinese).
Schempf, 2010	California + Hawaii (2003-2005)	Birth records	Asian Indian, Cambodian, Chinese, Filipino, Hmong, Indonesian, Japanese, Korean, Laotian, Pakistani, Thai, Vietnamese	Maternal race/ethnicity	LBW, PTB	• Relative to single-race White women, many Asian/ Pacific Islanders (API) subgroups had higher rates of LBW or PTB, controlling for confounders • Particularly high rates of LBW and PTB for single-race Cambodians and Laotians cannot be explained by the maternal characteristics available on the birth certificate • Filipino-White moms is the only group with higher odds of LBW, PTB than Whites, despite favorable SES standing by US Census than other APIs • Koreans were the only API subgroup to have lower rates of LBW and PTB than Whites
Dongarwar, 2021	USA (2014-2017)	Birth + death records	Asian Indian, Korean, Chinese, Vietnamese, Japanese, Filipino.	Maternal race/ethnicity	Stillbirth	• Stillbirth rates consistently lower in AsA than NH Whites, even by AsA subgroup • Japanese women had lowest likelihood of stillbirth, followed by Korean women.

First Author, Year	Place (Timeframe)	Data Source	AsA Groups (sample size)	Primary Exposure	Health Outcome(s)	Main Findings for AsA Subgroup(s)
Wall-Wieler, 2020	California (1997-2012)	Birth records + hospital discharge data	11 Asian subgroups: Cambodian (10,643) Chinese (104,927), Filipina (94,309), Hmong (7,146), Asian Indian (66,203) Japanese (21,817); Korean (36,759) Laotian (5,413); Thai (5,541); Vietnamese (56,807)	Maternal race/ethnicity, maternal nativity	Severe maternal morbidity (SMM)	• Substantial heterogeneity in the risk of SMM across API subgroups: compared to Koreans, adjusted RR highest in Filipinas, Hmong, Thai, and Laotian. Filipina women had the highest risk of SMM across all AsA groups. • Within AsA subgroups: risk of SMM similar between US- vs. foreign-born women.
Janevic, 2014	New York City (1995-2003)	Birth records + hospital discharge data	East Asian (57,264); South Asian (includes Pacific Islanders: 50,027)	Maternal race/ethnicity, nativity	Cesarean delivery	• Compared to NH White mothers, East Asian were less likely and South Asian more likely to deliver by Cesarean, after adjustment of confounders. • Foreign-born East Asians were more likely than US-born to delivery by Cesarean.
Lee, 2020	California (2008-2012)	Birth records	Filipino, Chinese, Japanese, Korean, Vietnamese, Cambodian, Thai, Laotian, Indian	Maternal race/ethnicity	SGA	• SGA rates highest among Asian Indians. • Compared to Filipinos, Asian Indians had higher adjusted risk for SGA, while Chinese, Vietnamese, Laotians had lower risk for SGA.
Yusuf, 2021	USA (1992-2018)	Birth records	NH-White (95.7% of sample), overall AsA (4.3%), Asian Indians (1.1%), Korean (0.3%), Chinese (1.2%), Vietnamese (0.5%), Japanese (0.3%) and Filipina (1.0%).	Maternal race/ethnicity	SGA	• NH Whites had lowest SGA rates, while all the AsA subgroups had almost consistently higher rates during the 27-year period. • Disparities in SGA births among AsA subgroups observed: compared to NH Whites, stratified analyses showed varying and significantly higher odds of any SGA in all Asian ethnic groups. Asian Indians had the highest adjusted odds of any SGA compared to NH Whites.
Edmonds, 2014	Massachusetts (1996-2010)	birth records	Asian Indian (8,109); Chinese (9,175); Vietnamese (4,380); Cambodian (3,027); Korean (2,298); Filipino (1,347); Japanese (1,302)	Maternal race/ethnicity	Cesarean delivery	• Compared to women who self-identified as “American” ethnic group, Chinese, Cambodian, and Japanese women had lower adjusted odds of primary cesarean; and Filipino, Asian Indian, and Vietnamese women had similar adjusted odds.

First Author, Year	Place (Timeframe)	Data Source	AsA Groups (sample size)	Primary Exposure	Health Outcome(s)	Main Findings for AsA Subgroup(s)
Yi, 2012	USA (2004)	Birth records	Korean US born (943), Korean foreign-born (11,974)	Maternal race/ethnicity	LBW, PTD, Cesarean	• Both US- and foreign-born Korean women had reduced risk of delivering a LBW infant compared to White women. • Risks of PTD and Cesarean among Korean women were similar to White women, regardless of Korean women's nativity status. • Adverse outcomes among Korean women did not differ by nativity status.
Araneta, 2020	San Diego County, CA (2007-2012)	Birth records	Filipina US-born (2,651), Filipina foreign-born (5,731)	Maternal nativity	PTB	• PTB prevalence similar between US- and foreign-born Filipinas
Dongarwar, 2021	USA (1992-2018)	Birth records	Total 2.7 million births to AsA: Asian Indian; Korean, Chinese, Vietnamese, Japanese, Filipino	Maternal age	PTB, SGA, LGA, maternal diabetes, Cesarean	• Compared with NH Whites, AsA had reduced odds of diabetes and LGA babies and increased odds of PTB, Cesarean, and SGA, irrespective of advanced mom age group. • The odds of developing specific adverse outcomes by advanced maternal age varied by AsA ethnicity.
Qin, 2010	California (1992-2003)	Birth + death records	Filipino (159,329); Chinese (127,217); Vietnamese (88,101); Koreans (45,323); Cambodians + Laotians (34,045); Japanese (32,436)	Maternal nativity	LBW, PTB, infant mortality	• US-born mothers more likely to have LBW infant compared to foreigh-born mothers in Chinese and Filipino groups. • US-born mothers more likely to have PTB compared to foreigh-born mothers among Chinese and Japanese groups. • No observed differences in mortality outcomes.
Dongarwar, 2021	USA (1992-2018)	Birth records	Asian Americans: 2,502,427	Maternal race/ethnicity	birth outcomes: PTB	• Overall AsA have lower PTB rates than NH White women but there is variation: higher PTB rates among Filipino and Vietnamese, lower rates among Asian Indian, Chinese, Korean, Japanese women, compared to NH White women.
Kim, 2016	USA (1992-2012)	Birth records	Korean, Chinese, Japanese, Filipino, Asian Indian, Vietnamese	Maternal, paternal race/ethnicity	LBW, PTB	• Compared to White parents, births to Filipino parents had highest LBW, PTB; births to Korean parents had the lowest LBW, PTB. • Birth outcomes from the Asian parents or biracial Asian/White parents differed depending on the ethnic origin of Asian parents.

First Author, Year	Place (Timeframe)	Data Source	AsA Groups (sample size)	Primary Exposure	Health Outcome(s)	Main Findings for AsA Subgroup(s)
Ro, 2019	New Jersey (1999-2014)	Birth records	Chinese, Indian, Korean, Filipina, other Asian (Japanese + Vietnamese)	Maternal race/ethnicity	LBW, macrosomia	• Compared to White mothers, all AsA groups except Korean had higher risk of LBW and all AsA subgroups had lower risk for macrosomia. • Maternal foreign-born status was protective against macrosomia for Korean, Filipina, and "other" Asian mothers.
POSTPARTUM HEALTH OUTCOMES						
Singh, 2019	USA (1915-2017)	Birth + death records	All Asian American subgroups	Maternal race/ethnicity, education, geography	Infant mortality	• Trend over time: infant mortality disparities widening by maternal education, geography (Southeast region worse), Black-White races • Infant mortality rate for Chinese lowest (2.3 per 1,000 live births) vs Black (11.2 per 1,000 births)
Fok, 2020	Hawaii (2012-2015)	PRAMS	Filipino; Japanese; "Other Asians"	Maternal demographic	Self-reported PPD	• Filipino, Japanese had a higher adjusted likelihood of PPD than White women
Hayes, 2020	Hawaii (2008-2015)	Birth records + Newborn Metabolic Screening Program	White (ref: 30,370), Filipino (21,683), Japanese (12,031), Chinese (5,486), Korean (2,377)	Maternal race/ethnicity	Breastfeeding (BF)	• Japanese and Korean mothers more likely, while Filipino and Chinese mothers were less likely, to practice early exclusive BF compared with White mothers after adjusting for confounders. • Japanese, Korean, Filipino, Chinese more likely to practice early mixed feeding compared with White mothers.
Goyal, 2012	California (2007-2010)	Electronic health records	Asian Indian (1,264), Chinese (1,160), Filipino (347), Japanese (124), Korean (183), and Vietnamese (147)	Maternal race/ethnicity, age	Clinical PPD	• Significantly lower clinical diagnosis rate of PPD in AsA mothers compared to NH White mothers. • PPD diagnosis rates for Asian Indian, Chinese, and Filipino mothers significantly lower than NH White mothers. • Race/ethnicity, age, and cesarean were significant predictors of PPD.
Singh, 2021	USA (1969-2018)	Birth + death records	Chinese (298,720), Filipino (166,221), Asian Indian (355,934), Korean (78,846), Vietnamese (105,204)	Maternal race/ ethnicity, SES, nativity, marital status, and cause of death	Maternal mortality	• Maternal mortality rate per 100,000 live births highest in NH Black (48.2), then American Indian/Alaska Native (31.3), Filipino (19.3), NH White (19.1), Korean (16.5), Puerto Rican (16.3), Mexican (13.8), Vietnamese (13.3), Asian Indian (7.3), and Chinese (7.0) mothers.

First Author, Year	Place (Timeframe)	Data Source	AsA Groups (sample size)	Primary Exposure	Health Outcome(s)	Main Findings for AsA Subgroup(s)
Hayes, 2010	Hawaii (2004-2007)	PRAMS	Korean, Filipino, Chinese, Japanese	Maternal race/ethnicity	Self-reported PPD	• Compared to White mothers, adjusted odds of self-reported PPD higher in Korean, Filipino, Chinese, and Japanese mothers.
MULTIPLE PERINATAL STAGES						
Cheng, 2015	Texas (2009)	Birth records	Asian Indian, Chinese (ref. for within Asians), Filipino, Japanese, Korean, Vietnam, NH White (ref. for all Asians vs. White)	Maternal race/ethnicity	GWG, GDM, gestational hypertension, Cesarean, macrosomia, LBW, breastfeeding	• AsA women had higher adjusted odds of inadequate GWG, GDM than NH-White women. Japanese women had highest adjusted odds of inadequate GWG compared to referent Chinese women. • No variations in odds of excessive GWG by AsA subgroup. • Compared to Chinese women, Korean women had lowest adjusted risk of GDM; Filipino and Asian Indian women have highest adjusted risks of gestational hypertension, Cesarean, and LBW.

b) 5 articles examined causes of/explanations for observed racial disparities

First Author, Year	Place (Timeframe)	Data Source	AsA Groups (sample size)	Primary Exposure	Health Outcome(s)	Main Findings for AsA Subgroup(s)
BIRTH OUTCOMES						
Morisaki, 2017	USA (2009-2012)	Birth records	Indian (135,502); Chinese (93,805); Korean (27,219); Japanese (6,171); Vietnamese (43,437); Filipino (43,317)	Maternal race/ethnicity	Birth weight (BW)	• Maternal height, BMI explained difference in BW (>50g) between White vs AsA mothers; gestational weight gain explained BW difference between Japanese vs White mothers • Socioeconomic and behavioral factors did not account for substantial BW differences between race/ethnic groups.
Morisaki, 2016	USA (2009-2012)	Birth records	Japanese	Maternal race/ethnicity	Birth weight (BW), SGA, LGA	• Social factors, mom age, parity, and gestational age only minimally explained BW difference between Japanese and White mothers. • Maternal height, body mass index and gestational weight gain substantially attenuated White-Japanese difference in BW, SGA, LGA.

First Author, Year	Place (Timeframe)	Data Source	AsA Groups (sample size)	Primary Exposure	Health Outcome(s)	Main Findings for AsA Subgroup(s)
Wartko, 2017	King County, WA (2008-2012)	Birth records	Indian, Filipino, Japanese, Vietnamese	Maternal race/ethnicity, nativity	LBW	• Asian Indian, Filipino, Japanese, and Vietnamese women had 1.57–2.23-fold higher LBW odds than NH White women. LBW incidence lowest in Chinese mothers. • Pregnancy complications had minimal effect on race-LBW association. • Foreign-born women from East Asia were 32% less likely to have LBW; women born in Southern Asia had a 28% higher risk of LBW as compared with US-born counterparts.
James-Todd, 2014	New York City (1995-2003)	Birth records + hospital discharge data	East Asian (Chinese, Japanese, Korean); South Asian (Indian, Pakistani, Bangladeshi)	Maternal race/ethnicity	SGA, LGA, pre-eclampsia, PTB	• In women with pre-existing diabetes, South Asian women had higher adjusted risk, East Asian women had similar adjusted risk, of having SGA infant compared to NH White women. • Maternal education level did not reduce these racial differences.
POSTPARTUM HEALTH OUTCOMES						
Hayes, 2014	Hawaii (2004-2008)	PRAMS	Filipino, Japanese, Chinese, Korean	Maternal race/ethnicity	Breastfeeding	• Filipino, Japanese, Chinese, and Korean mothers likely to exclusively breastfeed compared to NH White mothers, after adjusting for confounders.

c) 15 articles described racial variations for exposure-outcome associations

First Author, Year	Place (Timeframe)	Data Source	AsA Groups (sample size)	Primary Exposure	Health Outcome(s)	Main Findings for AsA Subgroup(s)
PRENATAL HEALTH						
Kane, 2018	New Jersey (1999-2012)	Birth records + ACS	Asian Indian	Ethnic enclave	Smoking during pregnancy, prenatal care (PNC), PTB	• Residence in South Asian enclave was associated with less prenatal smoking and earlier PNC, but not birth weight- or gestational-age related outcomes for Asian Indian mothers.
Janevic, 2014	New York City (2001-2002)	Birth records + hospital discharge + ACS	Chinese; South Central Asian mothers	Ethnic enclave	GDM	• Overall, no effect of ethnic enclave residence on GDM in most immigrant groups. • For South Central Asian women, living in a residential ethnic enclave was associated with increased odds of GDM.

First Author, Year	Place (Timeframe)	Data Source	AsA Groups (sample size)	Primary Exposure	Health Outcome(s)	Main Findings for AsA Subgroup(s)
Pu, 2015	California (2007-2012)	Birth records + electronic health records	Asian Indian, Chinese, Filipino, Japanese, Korean, Vietnamese, NH White (ref)	Pre-pregnancy weight	GDM	• Age-adjusted GDM prevalence significantly higher in all AsA subgroups except for Japanese, compared with NH Whites, even after adjusting for confounders. • Up to 39.0% of GDM in Asian Indian, 15.9% in Chinese and 38.2% in Filipino mothers could be attributed to pre-pregnancy overweight/obesity. • Foreign-born Chinese, Filipino mothers have higher risk of GDM than U.S-born counterparts.
Janevic, 2018	New York City (2010-2014)	Birth records + hospital discharge data	All Asians (US-born/foreign-born= 22,490/ 72,461) Asian Indian (9,892/ 17,766) Chinese (4,212/ 40,817) NH White (ref.; 129,279/ 49,072)	Body Mass Index levels	GDM	• Immigrant Asian Indian women had highest GDM prevalence (7.6%); lowest in US-born White women (4.2%). • Immigrant women have increased risk of GDM in all racial groups. • BMI-GDM association were of a smaller magnitude for immigrant groups than US-born women of the same race, except in Indian women: BMI-GDM associations were similar for immigrant and US-born Asian Indian women.
BIRTH OUTCOMES						
Khanolkar, 2020	Washington (2006-2008)	Birth records	East Asian, South Asian	Gestational weight gain (GWG)	Cesarean delivery	• Women who gained above-recommended GWG had significantly increased adjusted odds for Cesarean delivery in South Asians and East Asians, extended hospital stay in South Asians, and preeclampsia/eclampsia in East Asians.
Mocarski, 2012	New York City (2001-2006)	Birth records	Chinese (35,647); Non-Chinese East Asian/Pacific Islander (e.g., Indonesian, Japanese [14,747], South Central Asian [e.g., Indian, Pakistani; 25,073])	GDM	PTB	• Women with GDM have an increased risk of several important adverse perinatal outcomes across all ethnic groups compared to those without GDM. • South Central Asian and Chinese women showed a relatively smaller effect but a higher baseline risk of GDM. • Ethnic categories with the highest prevalence of GDM tend to have the smallest relative effect of GDM on birth outcomes, ex: South Central Asian w/ smallest relative effects of GDM on macrosomia, cesarean

First Author, Year	Place (Timeframe)	Data Source	AsA Groups (sample size)	Primary Exposure	Health Outcome(s)	Main Findings for AsA Subgroup(s)
Gao, 2020	USA (2014-2018)	Birth records	Southeast Asian (Vietnamese, Filipino) East Asian (Chinese, Korean, Japanese), South Asian (Indian), other Asian.	Body Mass Index (BMI) levels	PTB	• Pre-pregnancy overweight/obesity (using the Asian-specific cutoffs of BMI) associated with increased risk of PTB, compared with normal-weight women. • Association was stronger among East Asian and Southeast Asian mothers compared with South Asian mothers. • Association did not vary by maternal nativity status.
Kurtyka, 2015	New Jersey (2008-2011)	Birth records	Asian Indian	Maternal demographics, clinical factors	PTB, LBW, SGA	• Asian Indian mothers had higher LBW and SGA, similar PTB, lower NICU admission compared to White mothers. • Factors associated with SGA in Indian: nulliparity, anemia, hypertension, placental abruption, and lack of prenatal care. • Maternal education, marital status, substance use, and prenatal care timing associated with SGA in White mothers, but not in Asian Indian mothers.
Delara, 2018	California (1999-2005)	1999-2000 birth records + 2000-2005 birth records + hospital discharge data	Asian Indian (3,045); Filipina (5,399); Southeast Asian (6,002); East Asian (9,421)	Interpregnancy interval (IPI)	PTB	• AsA subgroups more likely to have short IPI (<6mos) compared to NH Whites. • Association between short IPI and increased PTB risk was not significant in AsA subgroups except for Southeast Asians.
Quan, 2021	USA (2015-2017)	Birth records	Asian Indian, Chinese, Filipino, Japanese, Vietnamese, Other Asian	Area-level economic segregation	PTB	• PTB risk higher in Metropolitan Statistical Areas with both high and low economic segregation. • Relatively linear positive association between economic segregation and PTB for Asian Indian. • Chinese, Filipino, Vietnamese groups: economic segregation had stronger association with PTB at lower- and higher-than avg levels (vs. avg level of segregation as referent).
Mason, 2011	New York City (1995–2003)	Birth records + ACS	East and South Asian mothers	Ethnic enclave	PTB	• East Asians had the lowest risk of PTB • Associations between residential ethnic density and PTB appeared to be null or slightly protective for most AsA groups.

First Author, Year	Place (Timeframe)	Data Source	AsA Groups (sample size)	Primary Exposure	Health Outcome(s)	Main Findings for AsA Subgroup(s)
POSTPARTUM HEALTH OUTCOMES						
Li, 2011	USA (1995-2000)	Birth + death records	Chinese Americans	Maternal education	Infant mortality	• Significant nativity-by-education interaction • Low maternal education was more detrimental for US-born Chinese mothers, with the highest risk among US-born mothers with ≤12yrs education.
MULTIPLE PERINATAL STAGES						
Hawkins, 2014	Massachu-settes (1996-2009)	Birth records	All AsA subgroups	Acculturation	Maternal smoking, breastfeeding initiation	• Foreign-born non-English-speaking (least acculturated) Chinese and Vietnamese mothers were less likely to initiate breastfeeding than their US-born counterparts. • Foreign-born Korean, Filipino, and Japanese mothers were more likely to initiate breastfeeding than their US-born counterparts
Quach, 2015	California (1996-2009)	Birth records + cosmeto-logy licensee data	Vietnamese	Occupation as cosmetologists, manicurists	SGA, GDM	• Significant association for SGA among Vietnamese manicurists (OR 1.39; 95 % CI 1.08–1.78) and cosmetologists (OR 1.40; 95 % CI 1.08–1.83) when compared to other working women. • Association between occupation as cosmetologist, manicurist and some maternal complications were observed that was elevated in Vietnamese workers.
Dongarwar, 2021	USA (1992-2018)	Birth records	2.7 million births to AsA: Asian Indian, Korean, Chinese, Vietnamese, Japanese, Filipino	Maternal age	GDM, Cesarean, PTB, SGA, LGA	• Odds of developing specific adverse outcomes by advanced maternal age (>35yrs) varied by AsA subgroups. • Asian Indians, Vietnamese, and Filipinas of advanced maternal age had increased odds of PTB compared to NH-Whites, whereas Koreans, Chinese, and Japanese mothers showed reduced risk for PTB.

CHAPTER 3 - PAPER #2:

ASIAN AMERICAN ENCLAVES: REVEALING THEIR HETEROGENEOUS GEOGRAPHIC AND SOCIOECONOMIC CONTEXTS FOR SIX ASIAN NATIONAL-ORIGIN GROUPS

Sarah-Truclinh Tran, Sarah B. Andrea, Betty T. Izumi, Miguel Marino, Janne Boone-Heinonen

ABSTRACT

Background: Asian Americans (AsAs) are experiencing increasing residential segregation, yet research characterizing the conditions of AsA enclaves is lacking, particularly for AsA subgroups. This knowledge gap hinders efforts to improve the structural determinants of health for AsAs living in disadvantaged neighborhoods.

Methods: We used 2015-2019 American Community Survey data to identify ethnic enclaves as counties with high concentration, segregation, and isolation of each of the following subgroups: Chinese, Filipino, Indian, Japanese, Korean, and Vietnamese. Enclaves of each subgroup were further classified as: *immigrant enclave* (high foreign-born residents, low area socioeconomic status [aSES]), *community of constraint* (high US-born, low aSES), or *resurgent community* (high aSES). We described the geographic and socioeconomic contexts of subgroup enclaves and compared them against non-enclaves.

Results: We identified 57 enclave counties. Filipino and Chinese enclaves are the most geographically dispersed. Most Indian (4 of 8) and Vietnamese (4 of 9) enclaves are in the South;

most Korean enclaves (4 of 6) are in the Midwest. Compared to non-enclaves, AsA enclaves generally have higher %foreign-born (17.1% vs 8.0%), household overcrowding (4.0% vs. 2.4%), %college-graduates (21.6% vs 19.7%), and comparable median household income ($33,205 vs $32,014). Most Japanese, Korean, and Vietnamese enclaves are communities of constraint, most Filipino and Indian enclaves are resurgent communities, and most Chinese enclaves are immigrant enclaves.

Conclusion: Results reinforce the importance of disaggregating data for AsA subgroups and present a new approach of examining *type* of segregation for understanding various potential causal pathways to health in the AsA population.

INTRODUCTION

Totaling nearly 20 million people, Asian Americans (AsAs) are the fastest-growing segment of the United States (US) population[1] who are also experiencing increasing residential segregation.[2,3] Racial residential segregation (hereafter "segregation") is widely regarded as a fundamental determinant of health in the US because it influences the distribution of key resources, opportunities,[4,5] and environmental hazards.[6–8] Although the dominant paradigm suggests that segregation is detrimental to health,[4] segregated AsA neighborhoods may also offer benefits, such as providing refuge against racism and facilitating exchanges of social and economic resources in culturally affirming ways.[9–11] Yet, few studies have examined the neighborhood conditions of Asian enclaves in the US and existing studies have three major limitations.

First, studies seldom disaggregate data into distinct AsA subgroups, despite long-standing calls from activists and scholars[1,12–14] to recognize AsA's extensive diversity according to country of origin, immigration history, and socioeconomic status (SES). These subgroup differences likely intersect with segregation processes to produce distinct ethnic environments that may have varying effects on health. Data disaggregation is especially critical for studies regarding Asian neighborhoods because the enclave of one origin group may present linguistic and cultural barriers to residents of a different origin group, with consequences for access to job opportunities, health information, and civic participation.

Second, ethnic enclaves are often operationalized using single dimensions of racial concentration[9,15,16] or spatial clustering of a minoritized group.[17] These single measures oversimplify the spatial arrangement of ethnic enclaves, which are places with substantial ethnic concentration *and* geographic segregation from dominant culture. Moreover, these measures neglect the multifaceted variations in cultural, social, and economic characteristics of enclave residents.

Finally, virtually all studies regarding Asian enclaves are focused on large, racially diverse settings like New York City,[17,18] New Jersey,[15] and California,[11,19–21] thus providing an incomplete picture of the residential experiences of contemporary AsA who are increasingly settling in places where large-scale immigration and racial diversity is new. The Asian population more than doubled in North Dakota from 2010 to 2020, rose by over 70% in South Dakota and Nebraska, and has also grown rapidly in several southern states[12]. The persistence of racialized spatial inequality necessitates a broader look at AsA segregation across the US.

The current study advances the field by identifying Asian enclaves in the US using metrics representing three essential dimensions that define an ethnic enclave: ethnic concentration, geographic segregation, and group isolation. We further classified the enclaves into a theory-supported enclave typology based on area socioeconomic and nativity contexts: immigrant enclave, community of constraint, and resurgent community.[19]

METHODS

Study Population

We examined 2015-2019 American Community Survey (ACS) data from mainland US counties with ≥100,000 residents and containing ≥4 census tracts, excluding Hawaii, Alaska, and the District of Columbia. We focused on the six most populous AsA subgroups in the contiguous US: Chinese (23% of all AsAs), Filipino (18%), Indian (19%), Japanese (7%), Korean (9%), and Vietnamese (9%).[12] Population estimates for each racial subgroup “alone or in combination” were obtained from the ACS. This study does not involve human subjects.

Study Variables

Ethnic Enclaves

All analyses were conducted separately for each Asian subgroup. Ethnic enclaves were defined at the county level, which supports the calculation of segregation measures for each AsA subgroup using ACS data, and aligns with local public health resource distribution and available health indicators[22,23] to enable future place-health research in AsA populations. Three measures were computed for each eligible county: ethnic concentration, segregation, and isolation (**Figure 1**). Ethnic concentration (p_m) is the proportion of residents who identified as a specific Asian ethnicity, with higher values suggesting accentuated ethnic character of a county. Segregation is represented by the dissimilarity (D_m) index, the predominant measure of segregation in the literature. Ranging from 0-1, dissimilarity is the proportion of minoritized residents that would need to move to a different census tract to achieve evenness with the comparison non-Hispanic White group. Higher values indicating less spatial overlap between minority and majority members. Isolation is represented by the isolation (${}_mP_m$) index that measures the extent to which minoritized members are exposed only to one another. Ranging from 0-1, higher values mean high isolation of the minoritized group, with the absolute value capped by the population size of the group. Census tracts were the underlying areal units used to form the county-level estimates for the dissimilarity and isolation indexes.

Figure 1. Equations for ethnic concentration, dissimilarity index, and isolation index for identifying the ethnic enclaves of each Asian American national-origin group

Equation 1. Ethnic concentration of group *m*

$$p_m = \frac{M}{T}$$

Equation 2. Dissimilarity index of group *m* relative to White group

$$D_m = \frac{1}{2} \sum_{i=1}^{J} \left| \frac{m_i}{M} - \frac{w_i}{W} \right|$$

Equation 3. Isolation index of group *m*

$${}_mP_m = \sum_{i=1}^{J} \left(\frac{m_i}{M} * \frac{m_i}{t_i} \right)$$

Variable Key

M: group *m* population in county
T: total population in county
W: population of White group in county
J: total number of census tracts in county
i: index for census tract
m_i: group m population in tract i
w_i: population of White group in tract i
t_i: total population in tract i

We classified a county as likely to contain an ethnic enclave ("enclave county") if its ethnic concentration, dissimilarity, and isolation for the specific AsA subgroup were in the top tertile of their regional distribution as delineated by the US Census (i.e., New England, Mid-Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Mountain, and Pacific).[7]

Area-Based Socioeconomic Metrics (ABSM)

We obtained county-level median household income, percent of residents aged 25-44 with a college degree (%college), percent of foreign-born residents (%foreign-born), percent of households living in poverty (%poverty), and percent of households with $\geq$1.5 persons/room[8] from the ACS. We obtained uninsurance rates for residents aged 18-64 from the Centers for Disease Control and Prevention's PLACES.[9]

Ethnic Enclave Types

Each identified enclave county was assigned into one of three theory-based typologies proposed by Emily Walton.[19] From classic assimilation theory, the *immigrant enclave* suggests immigrants, particularly low-skilled arrivals, live among co-ethnics for social, economic, or language support, resulting in enclaves with high proportions of foreign-born residents and low SES. From segmented assimilation and place stratification theories,[24,25] the *community of constraint* posits that US-born children of low-status immigrants experience little to no upward mobility that is compounded by systemic discriminatory practices that restrict the spatial mobility of racialized minorities. Accordingly, this typology is characterized by high proportions of US-born residents and low SES. Lastly, from resurgent ethnicity theory,[26] the *resurgent community* suggests that high-SES racialized minorities, regardless of immigrant status, prefer living with co-ethnics not out of economic constraint but partly to preserve cultural identity.

We examined area-SES (aSES) and %foreign-born to determine each enclave's place in the typology. High aSES meant having %college and median household income at/above the region-specific averages. High %foreign-born was defined as being above the region-specific average. Enclave type was classified using a 2-stage decision process: 1) high aSES enclaves were classified as *resurgent communities*; 2) low aSES enclaves were classified as *immigrant enclaves* if %foreign-born was high, and as *communities of constraint* if %foreign-born was low.

Analysis

For each Asian subgroup, we identified their ethnic enclaves and then reported their geographic locations, enclave type classification, and ABSM using descriptive statistics. We examined the ABSM distributions for each enclave type and compared descriptively the means of ABSM among enclave and non-enclave counties. All analyses were performed using R version 4.0.5.

RESULTS

Racial Distribution Measures

Our analysis included 590 counties that are home to 93% of all AsA in the contiguous US. Average county-level ethnic concentrations ranged from 0.27% (median: 0.44%) Vietnamese up to 1.0% (median: 0.53%) Asian Indians (**Table 1**). While the average dissimilarity index for AsAs overall is 0.43 (median: 0.42), the means for Indians, Japanese, Korean, and Vietnamese groups are above 0.60, which is generally considered high segregation.[3] Mean isolation indexes varied between 0.02 for Japanese to 0.06 for Indian groups.

Table 1. County-level ethnic concentration, Dissimilarity, and Isolation indexes of each Asian national-origin group for 590 counties in mainland US (2015-2019 ACS)

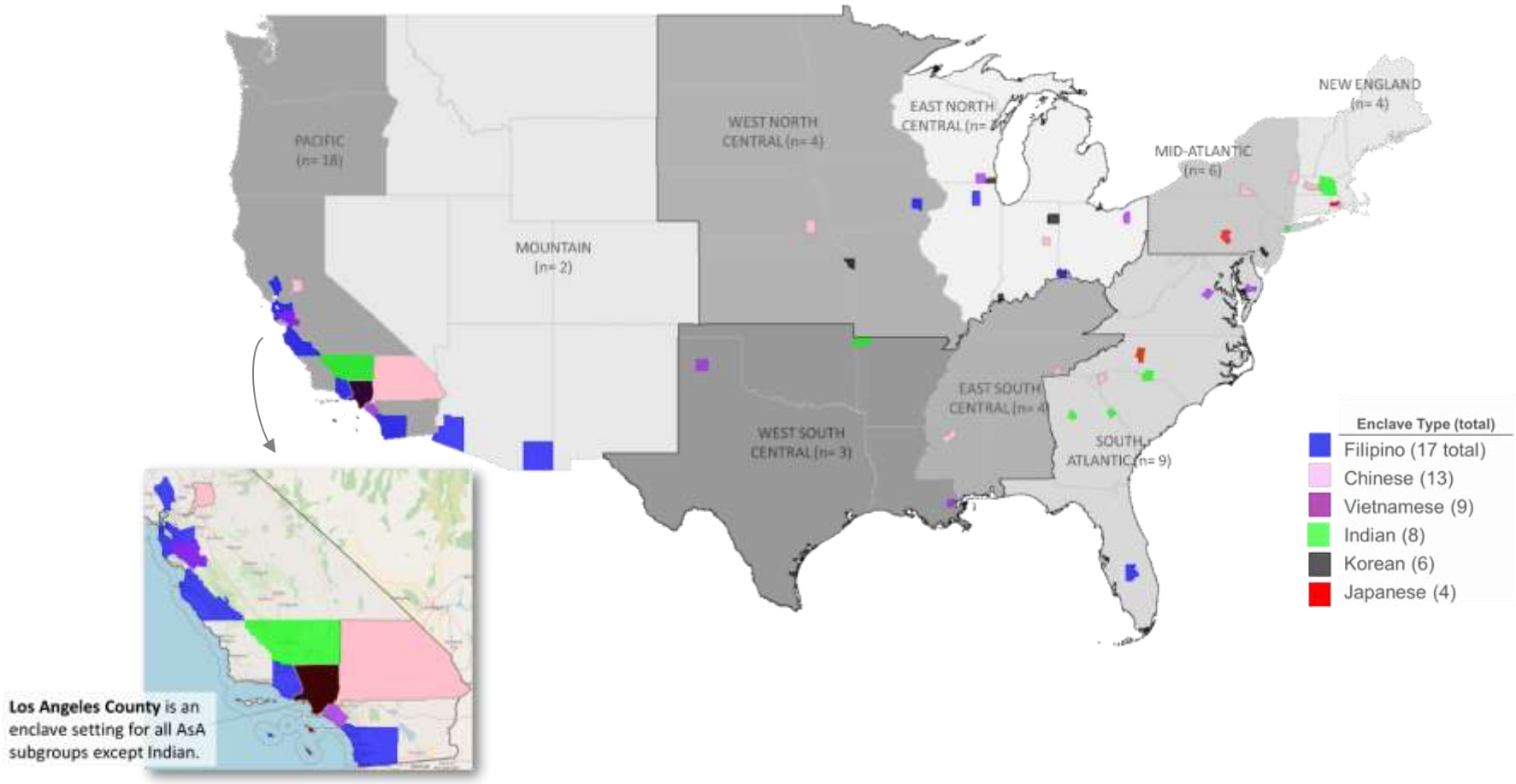
	Ethnic concentration (%)		Dissimilarity		Isolation	
	Average	Median	Average	Median	Average	Median
All Asian Americans*	3.78	2.54	0.43	0.42	0.12	0.08
Chinese	0.95	0.52	0.57	0.57	0.05	0.03
Filipino	0.79	0.45	0.55	0.55	0.04	0.03
Indian	1.02	0.53	0.63	0.63	0.06	0.04
Japanese	0.27	0.18	0.66	0.68	0.02	0.02
Korean	0.42	0.28	0.63	0.62	0.03	0.02
Vietnamese	0.27	0.44	0.72	0.72	0.05	0.03

***** Asian Americans encompass over 20 national origin groups, including the 6 groups in this study and Pakistani, Cambodian, Hmong, Thai, Laotian, Bangladeshi, Burmese, Nepalese, Indonesian, Sri Lankan, Malaysian, Bhutanese, Mongolian, and more.
Dissimilarity index (D_m) ranges from 0-1, with higher values indicating higher segregation of the minoritized group from the White group.
Isolation index ($_mP_m$) ranges from 0-1, with higher values indicating higher isolation of the minoritized group.

Geographic Representation

Fifty-seven (47 unique) ethnic enclave counties (**Figure 2; Appendix Table A1**) were identified. Of these, 18 are in the Pacific subregion, 9 in South Atlantic, 7 in East North Central, 6 in Mid-Atlantic, and 4 or less in each of the remaining subregions. The largest number of enclaves identified were Filipino (17) and the fewest was Japanese (4). Filipino and Chinese enclaves are the most geographically dispersed, present in 7 of 9 subregions. Most Indian (4 of 8) and Vietnamese (4 of 9) enclaves are in the South (West and East South Central, South Atlantic), while most Korean enclaves (4 of 6) are in the Midwest (West and East North Central).

Figure 2. Ethnic enclave counties with high concentration, segregation, and isolation of 6 most populous Asian national-origin groups in mainland United States (2015-2019 ACS)



The 9 US Census regions include: New England (CT , ME, MA, NH, RI, VT), Mid-Atlantic (NJ, NY, PA), East North Central (IN, IL, MI, OH, WI), West North Central (IA, KS, MN, NE, ND, MO, SD), South Atlantic (DE, FL, GA, MD, NC, SC, VA, WV), East South Central (AL, KY, MI, TN), West South Central (AR, LA, OK, TX), Mountain (AZ, CO, ID, NM, MT, UT, NV, WY), and Pacific (CA, OR, WA).

ABSM and Typologies

Compared to non-enclave counties, enclave counties generally have greater shares of foreign-born residents (17.1% vs 8.0%), households with ≥1.5 persons/room (4.0% vs. 2.4%), slightly higher proportion of adults with college degrees (21.6% vs 19.7%), and similar median household income ($33,205 vs $32,014) (**Table 2**).

Table 2. Area-based social metrics of the 47 Asian enclave counties compared to 525 non-enclave counties in the contiguous United States (2015-2019 ACS)

	AsA enclave counties	Non-enclave counties
	Mean (SD)	
Median household income, $	33,205 (6,109)	32,014 (6,603)
Adults with college education, %	21.6 (5.6)	19.7 (5.6)
Foreign-born population, %	17.1 (10)	8.9 (7.1)
Households living in poverty, %	16.9 (7.2)	16.7 (7.3)
Households with ≥1.5 persons per room, %	4.0 (2.9)	2.4 (1.7)
Uninsurance, %	11.7 (6.6)	11.6 (5.7)

There are substantial differences in enclave ABSMs and typology across the subgroups (**Table 3**). Most Japanese, Korean, and Vietnamese enclaves are *communities of constraint*. In contrast, Filipino and Indian enclaves are predominately *resurgent communities*, and Chinese enclaves are predominately *immigrant enclaves*. Los Angeles County, an enclave for all but the Indian subgroup, is classified as an *immigrant enclave* due to having relatively high share of foreign-born residents. Additionally, some patterns were observed for enclaves belonging to each subgroup (**Figure 3**).

Table 3. Type of ethnic enclave identified for Asian American national-origin groups across the contiguous United States (2015-2019 ACS)

	Number of enclaves	Constraint N (%)	Immigrant N (%)	Resurgent N (%)
Chinese	13	5 (38.5)	7 (53.8)	1 (7.7)
Filipino	17	2 (11.8)	6 (35.3)	9 (52.9)
Indian	8	2 (25.0)	2 (25.0)	4 (50.0)
Japanese	4	3 (75.0)	1 (25.0)	0
Korean	6	4 (66.7)	1 (16.7)	1 (16.7)
Vietnamese	9	4 (44.4)	2 (22.2)	3 (33.3)
Total (not unique)	57	20	19	18

Chinese (N=13). The majority are *immigrant enclaves* (53.8%) and *communities of constraint* (38.5%). Chinese enclaves generally have higher %poverty, lower %foreign-born residents, and lower proportions of households with ≥1.5 persons/room relative to enclaves of other subgroups.

Filipino (N=17). The majority are *resurgent communities* (52.9%), followed by *immigrant enclaves* (35.3%). Filipino enclaves occupy the widest range of the ABSM measures, particularly in median household income and proportion of college-educated residents, suggesting a bimodal distribution.

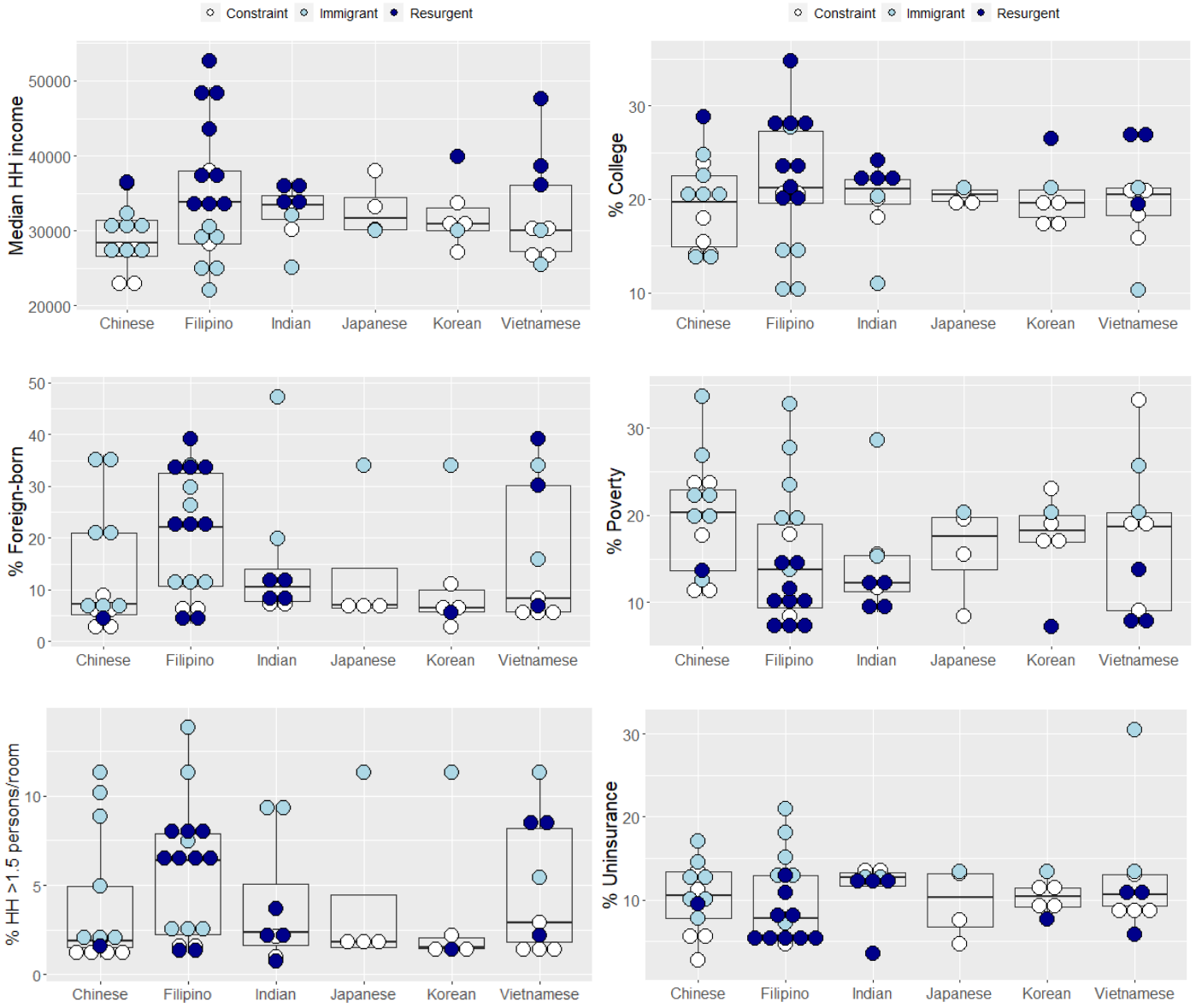
Indian (N=8). Half are *resurgent communities*, and the remaining are equally split as *immigrant enclaves* and *communities of constraint*. Indian enclaves have higher average %uninsurance than other enclave counties despite having relatively lower %poverty and higher median income.

Japanese (N=4). Three are classified as *communities of constraint* due to having median household incomes below the regional average. None of the Japanese enclaves are considered *resurgent communities*.

Korean (N=6). Two-thirds (66.7%) are classified as *communities of constraint* from having relatively low %foreign-born residents and low median household income. Compared to enclaves of other subgroups, Korean enclave counties tend to be on the higher end of %poverty.

Vietnamese (N=9). Most are *communities of constraint* (44.4%), then *resurgent* (33.3%) and *immigrant enclaves* (22.2%). Like Filipino enclaves, Vietnamese enclaves occupy the extreme ends of several ABSM measures, such as highest %poverty and uninsurance.

Figure 3. Box- and dot-plots of the area-based socioeconomic measures of identified enclaves for each Asian national-origin group, by neighborhood typology



DISCUSSION

AsAs represent a significant and growing share of the US population, largely driven by immigration[27] for purposes such as to join family, as refugees, or, more commonly, to fulfill US demand for skilled labor.[28] Accompanying AsA's rapid population growth is their increasing segregation,[2,3] a dynamic driven by reasons from residential discrimination[29,30] to preferences for living among co-ethnics[3] in what are known as ethnic enclaves. In our analysis of 590 counties across the contiguous US, we identified 57 counties that are likely to containethnic enclaves due to having relatively high concentration, segregation, and isolation of one or more of the six subgroups examined. Findings show AsA enclaves vary geographically and socioeconomically according to national-origin identity, likely reflecting each group's unique immigration histories that intersect with subsequent patterns of assimilation and segregation in the US.

Prior Literature on Asian Enclaves

Research regarding segregation in the AsA population is sparse, which stunts further inquiry into the structural determinants of health of AsAs. A recent study showed AsA enclaves were associated with health-promoting characteristics in terms of having less poverty, lower crime, lower uninsurance, and better access to healthcare[21], contradicting previous studies that found negative associations with healthcare access[31] and use[32]. Comparisons across studies is challenged by the inconsistent operationalization of ethnic enclave. Some use ethnic concentration[31–33] alone or in combination with segregation indexes[34], or by principle component analysis on variables for ethnic concentration, foreign-born status, and language proficiency.[11,35] Our study builds upon this body of work by further differentiating ethnic enclaves into *types* of segregation for distinct AsA subgroups.

Findings in the Context of Immigration History

We observed that, overall, AsA enclaves are represented almost equally as *immigrant enclaves, communities of constraint*, and *resurgent communities*. This aligns with US Census data showing AsA are highly diverse according to immigration status, income, and education levels.[36] These disparities emphasize the need to distinguish between types of segregation to capture the nativity and socioeconomic environments of enclaves that may influence health in different ways.

Furthermore, we found that Filipino and Chinese groups have the greatest number of enclaves and were the most geographically dispersed. This pattern may stem from their distinct immigration histories. Chinese Americans are some of the earliest settlers from Asia, who, since 1815, had integral roles as laborers in American mining, agriculture, textiles, and the Transcontinental Railroad construction.[37] Their wider geographic spread may reflect their longer presence in the US. Chinese immigrants today are heterogenous, with origins in the People's Republic of China, Taiwan, Hong Kong, Malaysia, and more. The preference by newly arrived immigrants to settle with co-ethnics likely contributed to the large number of Chinese enclaves that are characterized as *immigrant enclaves*.

Meanwhile, Filipino immigration heightened around the 1970s when the Philippines was the major source country of foreign-born health care professionals to the US.[28] The group's geographic dispersion into predominantly *resurgent communities* may reflect their more advantageous context of reception in the US. Prior US colonization and subsequent militarization of the Philippines meant that Filipino immigrants were likely to be fluent in English and familiar with American culture to assimilate more quickly upon arrival.

We further observed a high proportion of Indian, Korean, and Vietnamese enclaves in the Midwest and South. While concentrated in the same regions, these groups share little overlap regarding enclave types. Whereas Indian enclaves in these regions are mostly *resurgent communities*, Vietnamese and Korean enclaves are mostly *communities of constraint*. Group differences by immigration impetus may explain these stark contrasts. Immigrants from India currently comprise the largest share (19%) of Asian immigrants in the US and overwhelmingly came through visas for skilled employment or higher education.[28,38] Indian immigrants are thus more likely than other foreign-born residents to be college educated, have higher household incomes, and be proficient in English (a remnant of British colonization), all of which may facilitate their pace of assimilation and, thereby, access to dominant culture resources,[28,38] and eventual concentration into *resurgent communities*. The presence of resurgent[26] enclaves supports notions of personal choice and preference for cultural affirmation, thus rejecting the premise that, given the opportunity, racialized minorities will move into integrated neighborhoods.

In contrast, the bulk of Vietnamese and Korean people in the US arrived in the 1980s to escape war and political unrest in their home countries. Due to English language barriers, even the most educated class suffered downward mobility upon migration. Recent data shows that

34% of Vietnamese and 29% of Korean households are linguistically isolated, compared to 10% of Indian households.[39] The greater share of *community of constraint* enclaves among Korean and Vietnamese groups support place stratification and segmented assimilation theories,[19,24] in which US-born children of low-status immigrants were unable to achieve upward mobility, resulting in their concentration in disadvantaged neighborhoods with other US-born racialized minorities.

Strengths and Limitations

Like any quantitative attempts to capture lived experiences and sociological processes, our method of identifying ethnic enclaves has limitations. Our analysis does not address residents' accessibility of resources, perceptions of neighborhood boundaries, or cultural identity. Second, we measured enclaves at the county level, as counties are the smallest geographic area for which we could compute segregation indexes for Asian subgroups using ACS data. While this scale may be broad for large areas like Los Angeles County, with over 10 million residents, analyzing ethnic enclaves at a macro-level aligns with previous studies conducted at the county level[40], hospital referral region[34], and Metropolitan Statistical Areas[41], and allows for the identification of ethnic enclaves outside urban centers. Furthermore, counties represent meaningful political boundaries where public health services can be efficiently administered[22]. A third limitation is our exclusion of smaller counties with populations under 100,000, which may have omitted potential enclaves in rural communities. However, the 590 counties included in our analysis represent 95% of all AsAs living in the mainland US, suggesting that the omission of enclaves in small counties may be minimal. Fourth, the literature lacks a standard criterion for how "ethnic" an ethnic enclave should be. Following precedence,[34] we applied a top tertile threshold for determining "high" segregation, concentration, and isolation. Other studies have used cut-offs ranging from the 10th-25th percentiles[9,15,16] for "high" proportions of a racialized group. Finally, we grouped and ranked counties by US Census regions, which may yield different results compared to other geographic groupings, such as Metropolitan Statistical Areas or states.

Despite these limitations, our study fills an important knowledge gap in the literature regarding the socioeconomic conditions of Asian enclaves. A key strength of our analysis is the application of an enclave typology that is based on features of AsA diversity aligning with sociological theories related to immigration, assimilation, and place stratification. Type of segregation can lend itself better for understanding different mechanisms by which ethnic enclave

residency may promote or hinder health. In addition, we performed the analysis separately for each Asian subgroup in recognition of their generally distinct patterns of and impetus for immigration. By doing so, we provide critically needed information about the residential experience of these subgroups who are often lumped into the broad AsA label or omitted altogether due to small sample sizes. The national scope of our analysis helps identify gaps in research regarding locations where a large presence of AsA enclaves exists.

Future Directions

Our findings suggest several future directions for understanding the structural determinants of health in disaggregated AsA subgroups. First, more inquiry is needed regarding the segregation experiences of AsAs residing in the Midwest and South, particularly for Indian, Korean, and Vietnamese groups. Second, to encourage actionable, place-based interventions, future work should employ participatory approaches in specific enclave counties identified in our analysis to explore residents' own perceptions of impacts from the built, social, and natural environments on their health at different life stages. For example, *immigrant enclaves* may benefit elderly immigrant residents through reduced language barriers but may limit younger residents' access to resources and opportunities for upward mobility. These studies can help clarify consequences of living in specific enclave types, since both positive and negative associations have been reported for AsA enclave residency and health, such as greater likelihood of healthy births[34] but higher prevalence of mental health issues.[42] Finally, considering studies that show Asian-dense areas are subjected to substantial environmental injustices,[6,7,43] future research could assess environmental exposures in different enclave types.

CONCLUSION

In this study, we identified the ethnic enclaves of six AsA subgroups and classified them into a novel neighborhood typology that is supported by sociological theories and grounded in the AsA experience. We found that AsA enclaves are more geographically diverse than what is suggested in existing literature that tends to focus on East or West coast states and major cities. The enclaves of specific Asian subgroups, like their populations, are highly diverse and occupy both ends of the socioeconomic gradient, from disadvantaged *communities of constraint* to

affluent *resurgent communities*. This information is critical for stimulating research and policy considerations for improving the structural determinants of health of vulnerable groups in the AsA population, who are rapidly growing, increasingly segregating, and are severely overlooked in public health research.[13,14,44]

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Table A1. Descriptive statistics of the counties identified as ethnic enclaves of each Asian national-origin group

○ Constraint ○ Immigrant ● Resurgent

	Region	County	Total population	%College	Median HH income ($)	%Foreign-born	Enclave type
Chinese	1 New England	Hampshire County, MA	161,032	23.9	28,327	8.8	Constraint
	2 Mid Atlantic	Broome County, NY	193,188	15.5	26,593	7.0	Constraint
	2 Mid Atlantic	Rensselaer County, NY	159,185	18.0	36,310	5.2	Constraint
	3 East North Central	Delaware County, IN	115,020	13.4	22,613	2.1	Constraint
	5 South Atlantic	Pickens County, SC	124,029	14.9	23,331	3.6	Constraint
	2 Mid Atlantic	Kings County, NY	2,589,974	22.5	31,406	36.1	Immigrant
	4 West North Central	Lancaster County, NE	313,158	24.8	31,293	7.8	Immigrant
	4 West North Central	St. Louis City, MO	308,174	19.7	28,186	7.2	Immigrant
	6 East South Central	Bradley County, TN	105,749	14.1	26,412	5.9	Immigrant
	9 Pacific	Los Angeles County, CA	10,081,570	21.2	29,985	34.0	Immigrant
	9 Pacific	Sacramento County, CA	1,524,553	20.4	32,275	21.0	Immigrant
	9 Pacific	San Bernardino County, CA	2,149,031	13.6	27,235	21.0	Immigrant
	6 East South Central	Madison County, MS	104,562	28.8	36,455	4.5	Resurgent
Filipino	1 New England	Kent County, RI	163,869	21.0	37,994	6.1	Constraint
	3 East North Central	DeKalb County, IL	104,366	20.2	28,262	6.5	Constraint
	4 West North Central	Johnson County, IA	148,577	27.7	30,486	12.0	Immigrant
	5 South Atlantic	Highlands County, FL	103,437	11.0	22,059	11.0	Immigrant
	8 Mountain	Cochise County, AZ	125,867	14.2	25,573	10.8	Immigrant
	8 Mountain	Yuma County, AZ	209,468	9.8	24,291	26.3	Immigrant

	Region	County	Total population	%College	Median HH income ($)	%Foreign-born	Enclave type
	9 Pacific	Los Angeles County, CA	10,081,570	21.2	29,985	34.0	Immigrant
	9 Pacific	Monterey County, CA	433,410	14.8	28,207	29.8	Immigrant
	6 East South Central	Boone County, KY	130,820	20.7	36,732	5.7	Resurgent
	6 East South Central	Kenton County, KY	165,668	19.6	32,892	3.3	Resurgent
	9 Pacific	Alameda County, CA	1,656,754	27.3	43,583	32.5	Resurgent
	9 Pacific	Napa County, CA	139,623	23.2	37,953	22.1	Resurgent
	9 Pacific	San Diego County, CA	3,316,073	23.8	34,307	23.4	Resurgent
	9 Pacific	San Francisco County, CA	874,961	34.8	52,677	34.3	Resurgent
	9 Pacific	San Mateo County, CA	767,423	29.0	49,128	34.9	Resurgent
	9 Pacific	Santa Clara County, CA	1,927,470	27.7	47,584	39.2	Resurgent
	9 Pacific	Ventura County, CA	847,263	21.3	33,814	21.8	Resurgent
Indian	5 South Atlantic	Henry County, GA	225,356	18.1	33,610	7.9	Constraint
	5 South Atlantic	Iredell County, NC	175,538	20.0	30,102	6.5	Constraint
	2 Mid Atlantic	Queens County, NY	2,287,388	20.3	31,992	47.2	Immigrant
	9 Pacific	Kern County, CA	887,641	11.0	25,013	19.9	Immigrant
	1 New England	Worcester County, MA	824,772	22.0	35,350	12.1	Resurgent
	5 South Atlantic	Columbia County, GA	150,705	22.5	36,592	7.1	Resurgent
	5 South Atlantic	Union County, NC	231,053	24.2	34,405	9.5	Resurgent
	7 West South Central	Benton County, AR	265,759	22.0	33,141	11.6	Resurgent
Japanese	1 New England	Kent County, RI	163,869	21.0	37,994	6.1	Constraint
	2 Mid Atlantic	Dauphin County, PA	275,632	19.2	33,232	7.7	Constraint
	5 South Atlantic	Iredell County, NC	175,538	20.0	30,102	6.5	Constraint
	9 Pacific	Los Angeles County, CA	10,081,570	21.2	29,985	34.0	Immigrant

	Region	County	Total population	%College	Median HH income ($)	%Foreign-born	Enclave type
Korean	2 Mid Atlantic	Camden County, NJ	506,738	20.3	33,626	11.0	Constraint
	3 East North Central	Allen County, IN	372,575	18.8	30,325	6.7	Constraint
	3 East North Central	Kenosha County, WI	168,524	16.8	31,510	6.3	Constraint
	3 East North Central	Vanderburgh County, IN	181,291	17.9	27,095	2.9	Constraint
	9 Pacific	Los Angeles County, CA	10,081,570	21.2	29,985	34.0	Immigrant
	4 West North Central	Platte County, MO	100,682	26.4	39,879	5.5	Resurgent
Vietnamese	3 East North Central	Summit County, OH	541,334	20.6	30,799	5.2	Constraint
	3 East North Central	Walworth County, WI	103,074	18.3	29,626	5.7	Constraint
	5 South Atlantic	Wicomico County, MD	102,539	15.8	27,278	8.3	Constraint
	7 West South Central	Orleans Parish, LA	390,845	21.3	26,095	5.5	Constraint
	7 West South Central	Potter County, TX	119,674	10.3	25,457	15.8	Immigrant
	9 Pacific	Los Angeles County, CA	10,081,570	21.2	29,985	34.0	Immigrant
	5 South Atlantic	Spotsylvania County, VA	132,833	19.5	38,572	6.8	Resurgent
	9 Pacific	Orange County, CA	3,168,044	26.0	36,135	30.1	Resurgent
	9 Pacific	Santa Clara County, CA	1,927,470	27.7	47,584	39.2	Resurgent

CHAPTER 4 - PAPER #3:

ASSOCIATION BETWEEN ASIAN ENCLAVE RESIDENCY AND PRETERM BIRTH IN DISAGGREGATED ASIAN AMERICAN ETHNIC GROUPS: DOES ENCLAVE TYPE MATTER?

Sarah-Truclinh Tran, Sarah B. Andrea, Betty T. Izumi, Miguel Marino, Janne Boone-Heinonen

ABSTRACT

Background: Residential segregation is an important structural determinant of preterm birth (PTB). Little is known about how different types of segregated Asian American (AsA) enclaves affect PTB. We examined the association between AsA enclave residency and PTB for the six largest AsA subgroups in the United States.

Methods: We used 2015-2019 American Community Survey data to identify AsA enclaves as counties with high concentrations, segregation, and isolation of AsAs. We categorized these enclaves into one of three types based on %foreign-born, %college-educated adults, and median household income of the county being above ("high") or below ("low") the regional averages: *immigrant enclave* (high %foreign-born, low area socioeconomic status [aSES]), *enclave of constraint* (high %US-born, low aSES), or *resurgent enclave* (high aSES). Enclave information was linked by county FIPS to 2015-2019 national Natality data, from which we selected N= 492,482 singleton, first-born, live births to individuals of Asian descent. Multilevel mixed effects

logistic regression models, accounting for county-level clustering, were used to estimate associations between enclave type and PTB (born at <37 gestational weeks) within each AsA subgroup, controlling for individual- and county-level confounders.

Results: Thirty-five percent of AsA birthing people lived in an AsA enclave county. Most enclave residents lived in resurgent (64%), followed by immigrant (35%), and community of constraint (2%) enclaves. Compared to non-enclaves, living in an AsA enclave was associated with lower adjusted odds of PTB (OR [95%CI]: 0.92 [0.86-0.98]), ranging from 0.79 (0.66-0.94) in Korean and up to 0.91 (0.81-1.02) in Vietnamese subgroups. Immigrant and resurgent enclaves consistently show protective associations with PTB, while enclaves of constraint sometimes increased the odds of PTB in most AsA subgroups. The strongest associations with lower PTB odds were observed for immigrant enclave residence among Chinese, Indian, and Vietnamese groups, and resurgent enclaves among Filipino groups.

Conclusions: Residence in an Asian enclave was associated with lower odds of PTB for all AsA subgroups examined. Immigrant enclaves may provide the greatest PTB protection, followed by resurgent communities, relative to non-enclaves for many but not all AsA groups. AsA enclaves may provide cultural resources that promote perinatal health and should be supported. However, enclaves of constraint may need more resources to bolster their culturally protective aspects. Place-health studies involving AsA should disaggregate by national-origin to account for the heterogeneity within this broad racial group by immigration, assimilation, and segregation histories.

INTRODUCTION

Asian Americans (AsAs) account for 20 million people and is the fastest-growing segment of the United States (US) population[1]. Alongside this rapid growth, many AsAs increasingly reside in racially segregated neighborhoods, known as ethnic enclaves[2,3]. Racial residential segregation (hereafter “segregation”) is a fundamental cause of racial health inequities in the US[4], particularly with regard to preterm birth (PTB)[5–7]. In addition to being an important pathway for intergenerational health[8–10], PTB exhibits marked racial disparities that remain incompletely understood. For example, national data shows PTB prevalence is 11% to 27% higher in Filipino, Vietnamese, and other Southeast Asian subgroups than non-Hispanic (NH) White women, even though the aggregated AsA group showed a lower prevalence than NH White women[11]. Despite

these disparities, little is known about how segregation impacts PTB across Asian national-origin groups, and no studies to date have specifically examined Filipino, Korean, and Vietnamese populations who experience higher levels of segregation compared to other racial groups[3].

Although the dominant paradigm suggests segregation is detrimental to health, it may also provide benefits for AsAs. Segregated neighborhoods can serve as refuges from racism, reduce language barriers, facilitate resource sharing, and preserve cultural ties[12–14]. Research on the relationship between Asian enclave residency and PTB is limited and inconclusive. Asian enclaves have been linked with factors associated with both higher (e.g., less access to healthcare[15,16], environmental injustices[17,18]) and lower (e.g., reduced gestational diabetes risk[19]) risks of PTB. However, previous studies often operationalized ethnic enclaves based solely on level of ethnic concentration or segregation, assuming a uniform relationship with outcome variables. Given that AsAs are the most economically disparate racial group[20,21]— the highest-earning AsAs (those in the top decile) earn 10.7 times more than the lowest-earning AsAs (lowest decile)—these group differences likely intersect with processes of assimilation and segregation to create diverse ethnic environments that influence health in distinct ways.

Asian Ethnic Enclave Typology

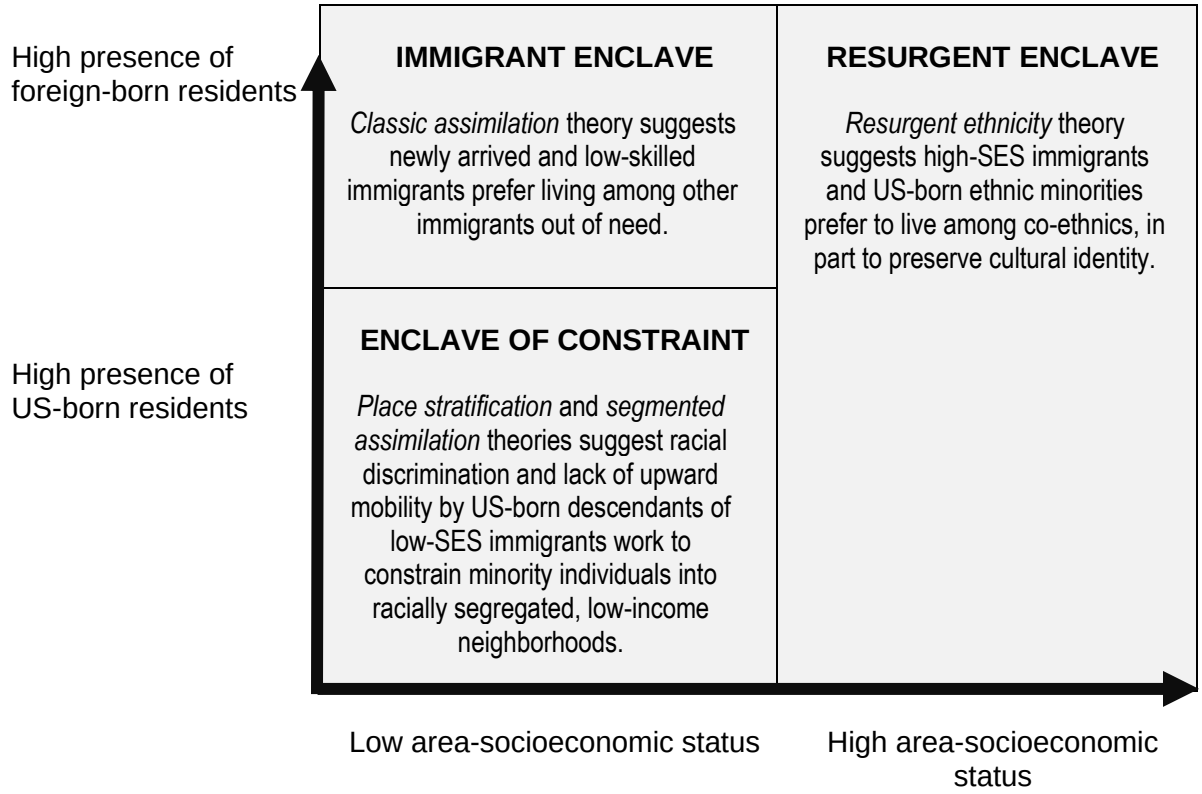
To bring some order to the range of possible *types* of segregation that could emerge from AsA diversity, we apply a novel theory-informed enclave typology created by Emily Walton[22], which categorizes AsA enclaves based on socioeconomic and nativity diversity. Walton proposed three main enclave types: *immigrant enclave*, *enclave of constraint*, and *resurgent enclave* (**Figure 1**).

- *Immigrant enclaves* align with classic assimilation theory, suggesting that immigrants, particularly low-skilled arrivals, cluster with co-ethnics for social or economic support. These enclaves are characterized by a high concentration of foreign-born residents with low socioeconomic status (SES).
- *Enclaves of constraint* arise from theories of segmented assimilation and place stratification, and reflect systemic barriers faced by US-born children of low-status immigrants. These barriers limit upward social mobility and perpetuate spatial restrictions, resulting in enclaves with high proportions of US-born residents and low SES.

- *Resurgent enclaves* arise from resurgent ethnicity theory and posits that high-SES racialized minorities, regardless of nativity status, prefer to live among co-ethnics. This choice is driven less by economic constraint and more by a desire to preserve cultural identity.

Figure 1. Definitions and sociological rationales for the ethnic enclave typology

Adapted from Walton, E. (*Sociological Perspectives*, 2015).



Objectives

In the present study, we investigated associations between residence in an AsA enclave and odds of PTB in the overall AsA population and in the 6 largest subgroups: Asian Indian ("Indian"), Chinese, Filipino, Japanese, Korean, and Vietnamese. We hypothesize that Asian enclave residency is associated with reduced PTB risk overall, but that the direction and

magnitude of the association varies by type of Asian enclave. Specifically, we theorize that *immigrant* and *resurgent enclaves* are associated with lower PTB risk compared to non-enclaves.

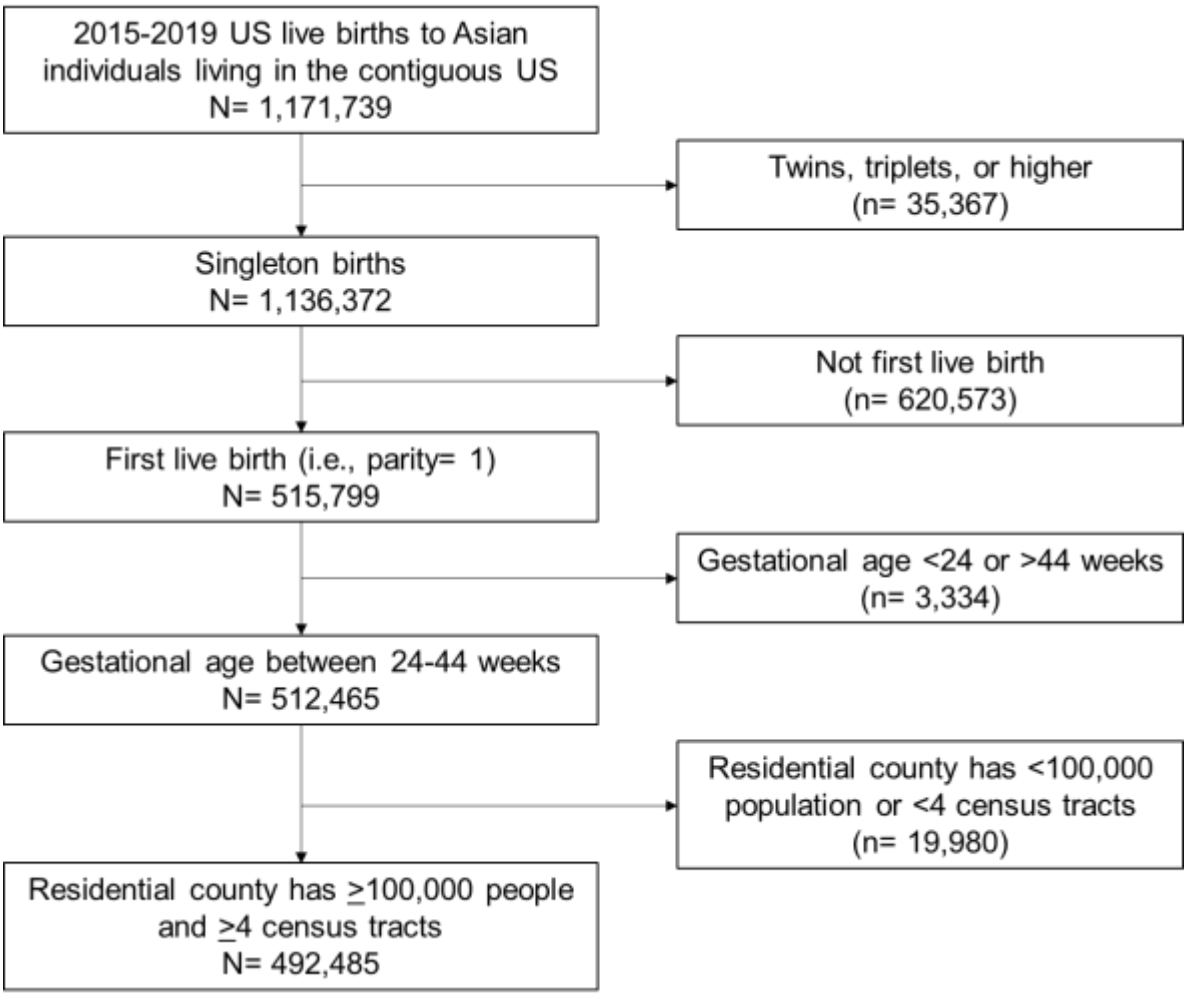
METHODS

Study Design and Population

This is a population-based cross-sectional study using 2015-2019 national Natality data obtained from the National Center for Health Statistics (NCHS)[23]. Natality data includes live births that occurred in the US, irrespective of the citizenship status of the birthing person. Over 99% of US live births are estimated to be registered[24]. Ethnic enclaves were identified using 2015-2019 American Community Survey (ACS) data, which was linked by county ID (FIPS) to natality data.

Our study population included live births to individuals who identified as single-race Asian on the birth record, residing in the contiguous US (e.g., excluded Alaska, Hawaii, and District of Columbia) at the time of delivery (n= 1,171,739; **Figure 2**). We focused on single-race Asians, who make up 83% of all AsAs in the US, as previous research has shown significant health and SES differences between single-race and multi-racial Asian groups[25]. Next, we restricted the sample to singleton, first-births delivered between 24 and 44 weeks of gestation to reduce competing risks for PTB (e.g., multiple gestations, genetic anomalies leading to extremely early delivery) and ensure sample independence for statistical analysis. At the county level, we included only counties with populations of 100,000 or more, as natality data for smaller counties are censored[26]. Additionally, we included only counties with at least 4 census tracts to ensure more precise estimates of segregation indexes. In total, our study sample includes 492,482 births from individuals residing in 585 counties.

Figure 2. Study sample selection using 2015-2019 national natality data



* Mid- to large-size counties have ≥100,000 residents and, altogether, are home to approximately 93% of all Asian Americans. This criterion is required for determining a county's enclave status and subsequent enclave typology.

Variables

Preterm Birth Outcome

The primary outcome was PTB, defined as delivery before 37 weeks of gestation based on clinical estimates reported in the birth record.

Asian American Enclave

We identified ethnic enclaves at the county level, as it was the smallest geographic area available in the natality data. For each county, we used ACS data to calculate 3 key measures signifying the presence of an AsA enclave: ethnic concentration, segregation from the dominant White population, and group isolation. Ethnic concentration is the proportion of residents in a county who identified as Asian race. Segregation is represented by the dissimilarity index, the predominant measure of segregation in the literature. Isolation is represented by the isolation index that measures the extent to which racial minority members are exposed only to one another. Census tracts were the underlying areal units used to form the county-level estimates for the dissimilarity and isolation indexes. A county was classified as having an AsA enclave ("enclave") if its ethnic concentration, dissimilarity, and isolation indexes were in the top tertile of their regional distribution as delineated by the US Census (i.e., New England, Mid-Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Mountain, and Pacific)[27].

Asian American Enclave Typology

We assigned each enclave county into one of three typologies proposed by Walton: *immigrant enclave* (high foreign-born residents, low area-SES), *enclave of constraint* (high US-born residents, low area-SES), and *resurgent enclave* (high area-SES). High area-SES was defined as proportion of adults who are college-educated (%college) and median household income greater than or equal to region-specific averages. High county-level foreign-born residents was defined as proportion of residents who are foreign-born (%foreign) being above the region-specific average.

Additional Sociodemographic and Contextual Variables

For each specification of our exposure, sets of confounder variables were identified using directed acyclic graphs[28], created to reflect our assumed causal model. The following individual-level variables obtained from birth records were theorized to be confounders across all models: maternal age at delivery, education level, nativity, and urbanicity of maternal county of residence, all of which are strongly associated with risk of PTB[8,29–31]. Age of mother was derived from subtracting the date of delivery from the individual's self-reported month and year of birth on the baby's birth certificate and rounded to a whole number of years. Educational attainment was based on the highest degree or level of school completed at the time of the delivery as reported by the birthing person, categorized as some college, college, beyond college, or unknown. For nativity, birthing people who were born in the 50 US states were considered US-born, otherwise they were foreign-born. A county's level of urbanicity was obtained from the most recent NCHS data[32] from 2013, and classified as large (large central metro, large fringe metro), medium (medium metro), and small/noncore metro (small metro, noncore). When our exposure was specified as the binary Asian enclave (yes/no) variable, our assumed causal model additionally included county-level percent of households living in poverty and percent of adults with a college degree, both derived from the ACS.

Statistical Methods

We first performed descriptive analyses stratified by AsA subgroup to summarize means or frequency distributions of all variables considered in the analyses. For the main analysis, we conducted multilevel generalized estimating equation logistic regression analyses, with county ID as a level-2 variable. These models employ a semiparametric approach to estimating the population-averaged model parameters and their 95% confidence intervals (CIs) for clustered data (e.g., individuals nested in counties) and can be employed when the dependent variable is binary.

All analyses were performed for AsAs overall and then stratified by AsA subgroup. First, we conducted separate bivariate analyses to assess the association between PTB and 1) binary Asian enclave residency, 2) categorical Asian enclave type, and 3) individual-level characteristics. Next, we fit multivariable models to assess the association between each Asian enclave exposure

(binary Asian enclave residency or enclave type) and PTB, controlling for birthing parent's age, education, and nativity status, and county-level urbanicity. In models with the binary AsA enclave exposure, we additionally controlled for county-level percent poverty and percent college-graduates. We set non-enclave as the referent category both because it included most births, and to provide a consistent referent group across both enclave variables. All analyses were performed using R version 4.0.5. Multilevel analyses were conducted using the `glmer` function within the lme4 package[33].

RESULTS

Study Population Characteristics

Individuals in our study sample had an average age of 30.2 years, with 68% holding at least a college degree, and 79.5% being foreign-born (**Table 1**). These characteristics varied by AsA subgroup. Chinese (41.6%) and Indian (46.2%) individuals were overrepresented among those having beyond a college degree, while Vietnamese (51.2%) and Filipino (40%) individuals were more likely to have less than a college education. Foreign-born status was lowest among Filipinos (67.3%) and highest among Chinese (84.7%) and Indian (89%) individuals.

Overall, 35% of AsA birthing parents lived in an AsA enclave. Among enclave residents, most resided in *resurgent enclaves* (21.6% of AsAs), followed by *immigrant enclaves* (12.1%), and *enclaves of constraint* (0.6%). Living in a *resurgent enclave* was most common in Chinese (26.1%) and Vietnamese (27.9%) individuals. Chinese individuals were also more likely than other subgroups to live in an *immigrant enclave* (19.4% compared to 12.1% of AsAs overall).

About 8.1% of births in the study sample were delivered preterm, with prevalence ranging from 5.5% in Chinese individuals to 11.2% -- double that rate—among Filipino individuals. Other groups with PTB prevalence at or above the sample average included Indian (8.2%) and Vietnamese (9.2%) individuals.

Associations Between Residence in Ethnic Enclaves and Preterm Birth

AsAs who resided in an Asian enclave had lower odds of PTB (odds ratio [OR]= 0.92; 95%CI: 0.86-0.98), after adjusting for individual- and county-level confounders (**Table 2).** Within AsA subgroups, the adjusted ORs ranged from 0.79 (95%CI: 0.66-0.94) in Korean to 0.91 (95%CI: 0.81-1.02) in Vietnamese groups. Unadjusted associations (**Table A1**) and coefficients for covariates in multivariable models (**Table A2**) are reported in the Appendix.

Examination by enclave type revealed variations in the direction of associations with PTB. Compared to non-enclaves, *immigrant* and *resurgent enclaves* are consistently associated with lower adjusted odds of PTB in the overall AsA group and within each AsA subgroups, though the ORs were not uniformly significant. *Immigrant enclaves* had the strongest associations with reduced odds of PTB for AsAs overall, as well as for Chinese, Indian, Korean, and Vietnamese groups. The adjusted ORs for *immigrant enclaves* ranged from 0.75 (95%CI: 0.55-1.02) in Korean up to 0.94 (95%CI: 0.84-1.04) in Filipino groups and was statistically significant for Chinese (OR= 0.79 [95%CI: 0.65-0.94]) and Indian (0.85 [0.74-0.96]) groups. Meanwhile, *resurgent enclaves* had the strongest associations with lower PTB in the Filipino group: the adjusted ORs ranged from 0.76 (95%CI: 0.57-1.02) in Japanese to 0.94 (95%CI: 0.83-1.08) in Vietnamese groups and were statistically significant for Chinese (0.83 [0.74-0.94]), Filipino (0.88 [0.81-0.95]), and Korean (0.81 [0.67-0.99]) groups. In contrast, *enclaves of constraint* have mixed associations: lower adjusted odds of PTB in Japanese and Korean groups, and higher adjusted odds in Chinese, Filipino, and Indian groups. However, residence in *enclaves of constraint* was uncommon, so the precision of these associations was low.

Table 1. Characteristics of Asian American individuals with singleton, first-births delivered at 24-44 weeks of gestation included in the final study sample: 2015-2019 US Natality data linked with 2015-2019 American Community Survey

	All Asian Americans[1]	Chinese	Filipino	Indian	Japanese	Korean	Vietnamese
Total individuals	492,485	117,209	54,738	157,429	11,327	30,914	42,561
Individual level							
Preterm births (% in group)	8.1	5.5	11.2	8.2	6.9	6.5	9.2
Maternal age in years							
Mean (SD)	30.2 (4.9)	31.1 (4.4)	30.3 (5.5)	29.8 (4.1)	33.1 (5.1)	32.4 (4.5)	30.1 (5.1)
(10th-90th percentiles)	(24-36)	(26-37)	(23-37)	(25-35)	(27-40)	(27-38)	(23-36)
Maternal education, column %							
Less than college	27.7	18.9	40.0	13.9	28.2	19.3	51.2
College degree	36.0	35.5	44.3	36.8	46.6	45.1	29.2
Beyond college	32.8	41.6	11.5	46.2	21.7	32.8	15.7
Unknown	3.4	4.0	4.2	3.0	3.5	2.8	4.0
Maternal nativity, column %							
Born in the US	20.1	15.2	32.5	10.8	27.4	25.1	24.5
Not born in the US	79.6	84.7	67.3	89.0	72.4	72.5	75.4
Unknown	0.32	0.08	0.3	0.14	0.2	2.4	0.10
Asian enclave residency[2], column %							
Not an Asian enclave	65.7	54.2	63.1	73.2	61.4	65.7	62.8
Enclave of constraint	0.6	0.3	0.3	0.5	0.3	0.3	0.7
Immigrant enclave	12.1	19.4	15.4	5.5	17.5	16.7	8.6
Resurgent enclave	21.6	26.1	21.3	20.8	20.8	17.3	27.9
County-level							
Number of counties	585	583	583	582	494	562	577
%Households in poverty, mean (SD)	16.7 (7.3)	16.7 (7.3)	16.7 (7.3)	16.7 (7.3)	16.3 (7.1)	16.5 (7.2)	16.7 (7.3)

	All Asian Americans[1]	Chinese	Filipino	Indian	Japanese	Korean	Vietnamese
%Adults with college degree, mean	19.8 (5.6)	19.8 (5.6)	19.8 (5.6)	19.8 (5.6)	20.5 (5.6)	20.0 (5.6)	19.8 (5.6)
Level of urbanicity							
Large metro	41.9	42.0	42.0	42.1	43.7	43.1	42.3
Medium metro	30.8	30.9	30.9	30.8	32.2	31.0	30.8
Small/non-metro	27.4	27.1	27.1	27.1	24.1	26.0	26.9

[1] All Asian Americans group includes individuals of other Asian national origins that make up 15.9% of the total AsA count.

[2] Constraint= enclave of constraint has relatively high proportions of US-born residents in areas with low socioeconomic status (SES); Immigrant= immigrant enclave has high proportions of foreign-born residents in low SES areas; Resurgent= resurgent enclaves are areas with high SES, regardless of nativity context.

Table 2. Multivariable associations of singleton preterm birth with residency in an Asian ethnic enclave and enclave type, overall and by Asian American subgroups: contiguous United States 2015-2019

	All AsAs (n= 492,485)	Chinese (n= 117,209)	Filipino (n = 54,738)	Indian (n= 157,429)	Japanese (n= 11,327)	Korean (n= 30,914)	Vietnamese (n= 42,561)
	Adjusted Odds Ratio (95%CI)						
Enclave status							
Asian enclave	**0.92 (0.86-0.98)**	**0.83 (0.75-0.92)**	**0.89 (0.84-0.95)**	**0.90 (0.84-0.96)**	0.80 (0.63-1.02)	**0.79 (0.66-0.94)**	0.91 (0.81-1.02)
Non-enclave	1	1	1	1	1	1	1
Asian enclave type							
Constraint	1.09 (0.93-1.28)	1.21 (0.79-1.84)	1.19 (0.75-1.87)	1.2 (0.92-1.57)	0.73 (0.17-3.14)	0.4 (0.13-1.3)	1.06 (0.7-1.62)
Immigrant	**0.85 (0.77-0.94)**	**0.79 (0.65-0.94)**	0.94 (0.84-1.04)	**0.85 (0.74-0.96)**	0.91 (0.6-1.38)	0.75 (0.55-1.02)	0.83 (0.68-1.02)
Resurgent	0.94 (0.87-1.01)	**0.83 (0.74-0.94)**	**0.88 (0.81-0.95)**	0.92 (0.84-1.0)	0.76 (0.57-1.02)	**0.81 (0.67-0.99)**	0.94 (0.83-1.08)
Non-enclave	1	1	1	1	1	1	1

Bold denotes p< .05. AsAs: Asian Americans; CI= confidence interval;

Notes. Models adjusted for birthing parent's age, education level, and nativity, and county-level urbanicity. Models with the binary enclave status additional controlled for county-level household poverty and proportion of college-educated adults.

Constraint= enclave of constraint has relatively high proportions of US-born residents in areas with low socioeconomic status (SES); Immigrant= immigrant enclave has high proportions of foreign-born residents in low SES areas; Resurgent= resurgent enclaves are areas with high SES, regardless of nativity context.

DISCUSSION

In this national study of US infants born to AsA individuals, we found that living in a county with an AsA enclave was generally associated with lower odds of PTB compared to living in non-enclave counties. However, these associations varied by enclave type and AsA subgroup. *Immigrant* and *resurgent enclaves* consistently showed protective associations with PTB, while *enclaves of constraint* sometimes increased PTB odds in most AsA subgroups. The strongest associations with lower PTB odds were observed for *immigrant enclaves* among Chinese, Indian, and Vietnamese groups, and in *resurgent enclaves* among Filipino groups.

Our study's observed associations between AsA enclave residency and PTB odds in the six AsA subgroups are in accord with two relevant areas of research: 1) the link between residential segregation and PTB, and 2) heterogenous exposures and health outcomes between disaggregated AsA groups.

Residential Segregation and PTB

Our finding that AsA enclaves appear to protect against PTB for AsA residents departs from the common assumption that segregation is harmful to health. Several factors may explain this departure.

First, the bulk of evidence on segregation and health has focused on Black urban neighborhoods, where segregation was often associated with adverse conditions like poverty, poor housing, and disadvantaged physical environments[4,34]. These stressors are linked to poor birth outcomes in pregnant people[35]. In contrast, segregation for AsAs may lead to a clustering of resources, rather than the accumulation of stressors. Historically, AsA segregation into ethnic enclaves was a deliberate strategy aimed at building solidarity for mutual assistance and security amid anti-Asian racial hostility and persecution[22,36]. Prominent immigrant enclaves like Chinatowns provide cultural resources, indigenous medical services, and political advocacy[37], all of which can be health-promoting to childbearing people. Indeed, in certain parts of the US, census tracts considered Asian enclaves have less poverty, lower crime, higher health insurance coverage, and greater access to primary care than non-enclave tracts[38]. Other studies reported that living in census tracts with higher density of AsAs was associated with having babies born at healthy weight and at term[39,40]. Our finding that *immigrant enclaves* are more strongly associated

with lower odds of PTB than more affluent *resurgent enclaves* suggests that cultural resources may outweigh material wealth as a driver of health benefits for some AsA subgroups. Future research should explore specific resources and exposures within each enclave type to understand the mechanisms promoting health.

Second, psychosocial stress pathways associated with segregation may contribute less to PTB risk in AsAs. Residential segregation is a manifestation of structural racism[41], often reflected in discriminatory housing and lending practices as part of broader patterns of systemic inequities within an area[37]. Such systemic racism contributes to psychosocial stress and allostatic load—the cumulative "wear and tear" on the body from chronic stress—which is linked to poor birth outcomes[35,41,42]. This mechanism may be less pronounced in AsAs, as over 70% of AsA adults[20], and nearly 80% of AsA birthing people in our study, are foreign-born. Consequently, AsAs may experience less cumulative toxic stress from systemic inequities associated with living in US society compared to US-born racialized minorities, including Black populations. This does not mean AsAs are immune to racism—they experience significant discrimination[13,43–46]—but the form and impact of racism, as measured by residential segregation, may affect health outcomes differently than in Black communities. Supporting this idea, a study by Gee and colleagues[37] found that while self-reported racial discrimination at the individual level was associated with poor health status among Chinese Americans, segregation at the contextual level was associated with better health status.

Heterogenous Exposures and Health Outcomes Between AsA Subgroups

Given the unique cultures, languages, immigration histories, and other characteristics of AsA subgroups, it should be unsurprising that they occupy varying socioeconomic positions in US society. This is reflected in our study population's foreign-born proportions and educational attainment. Among Chinese and Indian birthing individuals, over 40% have education beyond college, and over 80% are foreign-born, suggesting immigration patterns driven by skilled labor demand and globalization. In contrast, Vietnamese birthing individuals stand out because of their relatively lower educational attainment, with 51.2% having less than a college education, likely influenced by family-sponsored immigration under the 1965 Immigration Act (Hart-Cellar Act) or refugee resettlement following the wars in Southeast Asia. Understanding these immigration histories is essential for interpreting AsA heterogeneity and developing culturally specific interventions and research.

We observed that 26.8% of Indian to 45.8% of Chinese birthing individuals lived in an AsA enclave county. Despite both groups being predominantly foreign-born, Indian individuals were more likely to reside in non-enclaves and resurgent enclaves, whereas Chinese individuals were more likely to reside in immigrant or resurgent enclaves, suggesting a bimodal distribution. This may reflect the longstanding presence of Chinese enclaves in the US, as Chinese settlers were among the earliest Asian immigrants. Interestingly, despite having lower socioeconomic status, Vietnamese individuals were more likely to live in resurgent enclaves and less likely in immigrant enclaves compared to the overall AsA population. Japanese and Korean individuals, in contrast, were more likely to reside in immigrant enclaves. These patterns highlight distinct migration and settlement trends across AsA subgroups that should be further explored.

Our study found that enclave type was associated with varying levels of protection against PTB. Immigrant enclave were most protective for Chinese, Indian, Korean, and Vietnamese individuals, while resurgent enclave was for Filipino individuals. Prior research on structural exposures and health outcomes in AsA subgroups is limited, but available studies indicate important variations. For example, higher area-level economic segregation was associated with higher PTB risk for Indian individuals (positive linear association), whereas PTB risk followed a quadratic pattern for Chinese, Filipino, and Vietnamese groups, with higher risks at both ends of the spectrum for economic segregation[47]. Three studies examining ethnic enclave residency found inconsistent results: enclave residency was associated with healthy prenatal behaviors in Indian mothers[48] and lower odds of gestational diabetes for South Asian immigrants[49], but had null or slightly protective associations with PTB in most AsA subgroups[39].

These findings, combined with the results of our study, underscore the importance of disaggregating AsA data to reveal subgroup-specific variations in exposure-outcome relationships. Such insights are crucial for designing tailored interventions and guiding future research directions for overlooked AsA communities.

Limitations

The first limitation of this study, like many others, is the use of aspatial measures to identify AsA enclave counties. Ethnic enclave identification is susceptible to the modifiable areal unit problem (MAUP), meaning a county's designation as an enclave could change depending on the geographic boundaries used for ranking.

Second, defining enclaves at the county level may be broad and may not reflect residents' perceptions of their county as an ethnic center. While our focus on counties aligns with public health monitoring and resource allocations[50] and facilitates national-level analysis, future studies should examine enclaves at a smaller scale (e.g., census tracts or census blocks) using similar methods to confirm if these findings hold.

A third limitation is our exclusion of smaller counties with populations under 100,000, which may have omitted potential enclaves in rural communities. However, the 590 counties included in our analysis represent 93% of all AsAs living in the mainland US, and 96% of eligible AsA birthing persons in our study sample, suggesting that the omission of enclaves and AsA birthing individuals in small counties may be minimal.

Fourth, our race-stratified analysis uses an overall Asian enclave exposure rather than a "co-ethnic" enclave defined by the presence of concordant racial groups, which may dilute the potential benefits of enclave residency for certain smaller-sized subgroups. Additionally, our assignment of enclave typology relied on county-level measures rather than AsA-specific estimates, potentially introducing misclassification bias. This bias arises when the county's SES and nativity rankings differ substantially from what subgroup-specific estimates would suggest. The direction of this misclassification (e.g., high-SES *resurgent enclave* is misclassified as low-SES *immigrant* or *constraint enclave*, or vice versa) depends on whether the overall county population fares better or worse socioeconomically than the AsA population within the county.

A fifth limitation is that we cannot determine how long individuals have lived at the address on the birth record, so we cannot ensure temporality or confirm that exposure occurred long enough to influence preterm delivery.

Sixth, unmeasured confounding at the individual- and/or county-level may exist. For example, individual-level occupation could influence both where a person lives (due to proximity to work) and their risk of PTB (through occupational exposures or psychosocial stress).

Lastly, our use of birth record data excludes non-live births (e.g., stillbirths, miscarriages), which could lead to survival bias. Our finding generally suggesting Asian enclave residency is protective against PTB for AsAs may be incorrect if such residency is associated with increased risk of stillbirth or miscarriage, which is not captured in birth record data.

CONCLUSION

Our study contributes to a limited body of literature examining residential segregation and health in disaggregated AsA groups. We found that residence in an ethnic enclave was associated with lower odds of PTB for all AsA subgroups examined. *Immigrant enclaves* may provide the greatest PTB protection, followed by resurgent enclaves, relative to non-enclaves. Asian enclaves may provide cultural-specific resources that promote perinatal health and should be supported. However, *enclaves of constraint* may need more resources to bolster their culturally protective aspects. Our findings underscore the need for place-health studies involving AsAs to disaggregate below the broad racial label to account for their heterogeneity by immigration, assimilation, and segregation histories. Future research is needed to understand AsA enclave residents' access to resources, perceptions of neighborhood boundaries, and cultural identity.

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APPENDIX

Table A1. Unadjusted associations between preterm birth and Asian ethnic enclave residency

	All AsAs (n= 492,485)	Chinese (n= 117,209)	Filipino (n = 54,738)	Indian (n= 157,429)	Japanese (n= 11,327)	Korean (n= 30,914)	Vietnamese (n= 42,561)
	Odds Ratio (95% CI)						
Enclave status							
Asian enclave	**0.91 (0.85-0.98)**	**0.84 (0.76-0.94)**	**0.9 (0.85-0.95)**	**0.91 (0.85-0.98)**	0.81 (0.63-1.0)	**0.78 (0.66-0.93)**	0.92 (0.82-1.0)
Non-enclave	1	1	1	1	1	1	1
Asian enclave type							
Constraint	1.1 (0.92-1.3)	1.2 (0.77-1.8)	1.2 (0.8-1.9)	1.2 (0.89-1.5)	0.7 (0.16-3.0)	0.43 (0.13-1.4)	1.04 (0.69-1.6)
Immigrant	**0.85 (0.75-0.96)**	**0.81 (0.67-0.98)**	**0.93 (0.85-1.0)**	**0.86 (0.76-0.99)**	0.96 (0.63-1.5)	0.76 (0.56-1.0)	0.84 (0.69-1.0)
Resurgent	**0.91 (0.83-0.99)**	**0.84 (0.74-0.95)**	**0.87 (0.81-0.94)**	**0.91 (0.84-0.99)**	0.75 (0.57-1)	**0.81 (0.67-0.98)**	0.93 (0.82-1.1)
Non-enclave	1	1	1	1	1	1	1

Notes. **Bold** denotes statistical significance (p< .05); CI: confidence interval;
Constraint= enclave of constraint has relatively high proportions of US-born residents in areas with low socioeconomic status (SES); Immigrant= immigrant enclave has high proportions of foreign-born residents in low SES areas; Resurgent= resurgent enclaves are areas with high SES, regardless of nativity context.

Table A2. Coefficients for covariates in the multivariable multilevel models for preterm birth outcome

	All AsAs (n= 492,485)	Chinese (n= 117,209)	Filipino (n = 54,738)	Indian (n= 157,429)	Japanese (n= 11,327)	Korean (n= 30,914)	Vietnamese (n= 42,561)
	Adjusted coefficients (SE)						
Intercept	-2.91 (0.09)**	-3.92 (0.19)**	-3.09 (0.15)**	-3.48 (0.13)**	-3.14 (0.47)**	-3.39 (0.30)**	-3.24 (0.21)**
Individual-level							
Asian enclave (vs. non-enclave)	-0.09 (0.03)**	-0.19 (0.05)**	-0.10 (0.03)**	-0.11 (0.04)**	-0.22 (0.12)	-0.24 (0.09)**	-0.09 (0.06)
Age in years	0.03 (0.001)**	0.05 (0.003)**	0.04 (0.003)**	0.05 (0.002)**	0.03 (0.01)**	0.04 (0.01)**	0.03 (0.003)**
Education (vs. less than college)							
College degree	-0.37 (0.01)**	-0.37 (0.04)**	-0.21 (0.03)**	-0.34 (0.03)**	-0.20 (0.09)*	-0.4 (0.06)**	-0.34 (0.04)**
Beyond college	-0.47 (0.01)**	-0.51 (0.04)**	-0.27 (0.05)**	-0.38 (0.03)**	-0.35 (0.11)**	-0.35 (0.07)**	-0.36 (0.05)**
Foreign-born (vs. US-born)	-0.18 (0.01)**	-0.39 (0.032)**	-0.02 (0.03)	-0.09 (0.03)**	-0.36 (0.08)**	-0.03 (0.06)	-0.17 (0.04)**
County-level							
%Households in poverty	0.004 (0.002)*	0.006 (0.004)	0.003 (0.003)	0.007 (0.003)**	0.01 (0.01)	-0.003 (0.01)	0.01 (0.004)**
%Adults with college degree	-0.002 (0.003)	0.005 (0.005)	0.001 (0.004)	0.001 (0.003)	-0.002 (0.01)	-0.005 (0.01)	0.005 (0.01)
Urbanicity (vs. large metro)							
Medium metro	-0.01 (0.03)	0.10 (0.06)	0.02 (0.04)	-0.04 (0.04)	0.12 (0.13)	0.12 (0.09)	-0.07 (0.06)
Small/non-metro	0.04 (0.04)	0.10 (0.09)	0.15 (0.07)*	0.03 (0.06)	0.06 (0.20)	0.08 (0.13)	0.23 (0.10)*

	All AsAs (n= 492,485)	Chinese (n= 117,209)	Filipino (n = 54,738)	Indian (n= 157,429)	Japanese (n= 11,327)	Korean (n= 30,914)	Vietnamese (n= 42,561)
	Adjusted coefficients (SE)						
Intercept	-2.93 (0.03)**	-3.72 (0.1)**	-3.03 (0.08)**	-3.34 (0.08)**	-3.02 (0.25)**	-3.56 (0.17)**	-2.89 (0.11)**
Individual-level							
Asian enclave type (vs. non-enclave)							
Constraint	0.09 (0.08)	0.19 (0.22)	0.17 (0.23)	0.18 (0.14)	-0.32 (0.75)	-0.91 (0.6)	0.06 (0.21)
Immigrant	-0.16 (0.05)**	-0.24 (0.09)*	-0.07 (0.05)	-0.17 (0.07)*	-0.09 (0.21)	-0.29 (0.16)	-0.18 (0.1)
Resurgent	-0.06 (0.04)	-0.18 (0.06)**	-0.13 (0.04)**	-0.09 (0.04)*	-0.27 (0.15)	-0.21 (0.1)	-0.06 (0.07)
Age in years	0.03 (0.001)**	0.05 (0.003)**	0.04 (0.003)**	0.04 (0.002)**	0.03 (0.01)**	0.04 (0.01)**	0.03 (0.003)**
Education (vs. less than college)							
College degree	-0.34 (0.01)**	-0.37 (0.04)**	-0.21 (0.03)**	-0.34 (0.03)**	-0.21 (0.09)*	-0.4 (0.06)**	-0.34 (0.04)**
Beyond college	-0.43 (0.01)**	-0.51 (0.04)**	-0.27 (0.05)**	-0.39 (0.03)**	-0.35 (0.11)**	-0.36 (0.07)**	-0.37 (0.05)**
Foreign-born (vs. US-born)	-0.16 (0.01)**	-0.39 (0.03)**	-0.02 (0.03)	-0.09 (0.03)**	-0.36 (0.08)**	-0.03 (0.06)	-0.18 (0.04)**
County-level							
Urbanicity (vs. large metro)							
Medium metro	0.02 (0.02)	0.09 (0.05)	0.01 (0.04)	-0.02 (0.04)	0.15 (0.12)	0.14 (0.08)	-0.03 (0.06)
Small/non-metro	0.06 (0.03)	0.08 (0.09)	0.15 (0.07)*	0.04 (0.06)	0.09 (0.2)	0.12 (0.12)	0.25 (0.1)**

* p< .05; ** p< .01; SE= standard error;
Notes. Models adjusted for birthing parent's age, education level, and nativity, and county-level urbanicity. Models with the binary enclave status additional controlled for county-level household poverty and proportion of college-educated adults.
Constraint= enclave of constraint has high proportions of US-born residents in areas with low socioeconomic status (SES); Immigrant= immigrant enclave has high proportions of foreign-born residents in low SES areas; Resurgent= resurgent enclaves are areas with high SES, regardless of nativity context.

CHAPTER 5:

SUMMARY AND CONCLUSION

The overall objective of this dissertation was to advance current understanding of the perinatal health of Asian American subgroups and its relationship to residential segregation, a root cause of health inequities. This dissertation addresses the critical knowledge gap in how residential context might influence the perinatal health of disaggregated AsA groups. This research is informed by scholarship in sociology and epidemiology related to race and racism, segregation, and immigration to make strides toward systematizing our understanding of the variability among AsA neighborhoods and their consequences on individual health outcomes.

In the **Introduction (Chapter 1)**, I recounted the racial formation of "Asian Americans," the harms of the model minority myth, and brought to light perinatal health disparities hidden within the broad "Asian American" label. I made the case that inequities experienced by AsA subgroups are maintained by our collective failure to actively and correctly capture accurate health-related risks, protective factors, and health morbidity and mortality data for disaggregated AsA groups.

Building off this reflection, my first paper **(Chapter 2)** proposed a conceptual framework for understanding AsA heterogeneity and summarized the current literature on the perinatal health

of distinct AsA subgroups. I reviewed 50 articles published since 2010, revealing substantial variations in health status, risk factors for health outcomes, and exposure-outcome associations across different AsA subgroups. Chinese, Filipino, and Indian subgroups were most frequently studied, while Southeast Asian subgroups received less attention. Research predominantly centered on birth outcomes, with limited studies focused on preconception and postpartum health. Most studies were concentrated in US coastal regions and tended to emphasize individual-level risk factors without engaging with theories of upstream determinants of health. I concluded that the existing literature highlights the need for expanded research that includes a wider range of AsA subgroups, geographic locations, and theoretical frameworks to better understand and address root causes of perinatal health disparities in AsA populations.

In my second paper **(Chapter 3)**, I challenge assumptions that all segregated Asian neighborhoods are equal. By empirically identifying and characterizing the enclaves of Chinese, Filipino, Asian Indian, Japanese, Korean, and Vietnamese groups, I uncovered their systematic differences based on geography, socioeconomic status, and nativity contexts. For example, the analysis revealed that the majority of Indian, Vietnamese, and Korean enclaves are located in the Midwest and South—regions with little to no published research on the perinatal health of AsA subgroups. To advance scholarship on segregation, I used a rigorous method capturing the multidimensional properties of segregated neighborhoods as areas with relatively high concentration, segregation, and isolation of an ethnic group. Moreover, I applied an existing theory-supported enclave typology from Walton that shifts the focus from level of segregation to *type* of segregation, highlighting the idea that health outcomes in ethnic minority neighborhoods are closely tied to their structural and social characteristics, rather than merely assimilation into dominant culture. Such nuance is necessary for moving beyond the reductive, one-size-fits-all perspective that has historically reinforced the "model minority" stereotype for AsAs.

In my third paper **(Chapter 4)**, I tested Walton's neighborhood typology by investigating its association with preterm birth (PTB), a significant public health priority with persistent racial disparities that are not fully understood. This analysis provides novel evidence on how ethnic enclave residency influences PTB among AsA subgroups, particularly Vietnamese, Filipino, and Korean groups who experience high residential segregation, but for whom this evidence is nonexistent. Using multilevel logistic regression, I showed that living in *immigrant* and *resurgent enclaves* were associated with reduced odds of PTB compared to non-enclave residency among all AsAs and most AsA subgroups. The strongest associations with lower PTB odds were observed for *immigrant enclave* residence among Chinese, Indian, and Vietnamese groups, and

resurgent enclaves among Filipino groups. The generally positive association between enclave residency and PTB counters the prevailing "poverty paradigm" in segregation-health research often seen in Black and, to some extent, Latino/x/é communities. Additionally, this paper suggests that AsA enclaves may provide cultural resources and social networks that enhance perinatal health. There is a need to support and strengthen these culturally specific aspects of ethnic enclaves. Public health policies and interventions should recognize and build upon the assets present in these neighborhoods to promote health among racially minoritized populations.

FUTURE DIRECTIONS

Taken together, this body of work points to several critical directions for future research and public health efforts. First, there is a pressing need to expand research to encompass a wider range of AsA subgroups, geographic settings, and perinatal health stages, while integrating relevant theoretical frameworks. Notably, the perinatal health of AsAs in the Midwest and South regions is severely underrepresented in the literature. Studies on segregation and health should prioritize Indian, Vietnamese, and Korean enclaves concentrated in these areas. Frameworks underlying these investigations should account for AsA's complex histories of colonialism, immigration, and racism to better address the needs of distinct subgroups using approaches that are trauma-informed, and linguistically- and culturally specific. However, in the absence of available data that could be disaggregated for AsA groups, participatory methods should be employed within enclave counties identified in this research to identify community-led strategies that are health-benefitting and culturally specific.

Further research should investigate the specific amenities, social and cultural assets, and environmental exposures within segregated AsA neighborhoods that contribute to health. Such studies can explore whether these features vary across different types of AsA enclaves, enhancing understanding of the diverse mechanisms that support health and wellbeing in these communities. In addition, researchers are encouraged to adopt or develop similar enclave typologies to investigate the impacts of segregation on health in other racialized populations. Typologies offer a nuanced lens to identify both protective and adverse effects of segregation, facilitating new hypotheses about asset-based and risk-reduction pathways. This approach could enrich understanding of how living among people of similar racial or ethnic backgrounds influences health and social outcomes.

Future research should also address rural counties and multi-racial populations excluded from analyses in this dissertation. Our omission of counties with populations under 100,000 excluded about 7% of the total AsA population in the mainland US. Health research on AsAs in rural areas is limited compared to urban populations, even though rural settings may exacerbate health disparities due to limited healthcare access, culturally specific services, lack of health insurance, unique occupational hazards (e.g., agriculture, pesticide exposure), and more. In addition, this dissertation examined enclaves containing single- and multi-race AsA individuals but analyzed PTB outcome for only single-race AsA people (Aim 3). Future studies should use the enclave exposure variable developed here to investigate perinatal health outcomes for multi-racial AsAs—a growing population with notable health and SES differences compared to single-race Asian groups.

Public health practitioners and researchers must also continue advocating for improved and thoughtful data collection on AsA health and wellbeing. This includes systematically disaggregating racial data in research and public health reports to expose hidden disparities. Addressing knowledge gaps for specific groups is crucial to equitable resource allocation, including funding for research and programs, stakeholder and governing representation, and the development of culturally specific initiatives. Furthermore, this dissertation aligns with broader calls for equity in data collection and reporting for other underrepresented groups, including Hispanic/Latino/x/é subgroups, Black immigrants, Middle Eastern and Slavic populations, the LGBTQ+ community, and individuals with intersectional identities. By improving visibility and representation for all marginalized groups, public health efforts can better address systemic inequities and foster health equity for diverse populations. Because often in public health, what gets measured, gets mentioned, get attention.