

Distribution Agreement

In presenting this dissertation as a partial fulfillment of the requirements for an advanced degree from Emory University, I hereby grant to Emory University and its agents the non-exclusive license to archive, make accessible, and display my dissertation in whole or in part in all forms of media, now or hereafter known, including display on the world wide web. I understand that I may select some access restrictions as part of the online submission of this dissertation. I retain all ownership rights to the copyright of the dissertation. I also retain the right to use in future works (such as articles or books) all or part of this dissertation.

Signature:

Kaitlyn K Stanhope

February 18, 2020

Stress, Resilience, and Place: Drivers of Perinatal Risk for Hispanic Mothers

By
Kaitlyn K. Stanhope
Doctor of Philosophy

Epidemiology

Michael Kramer
Advisor

Dawn Comeau
Committee Member

Carol Hogue
Committee Member

Juan Leon
Committee Member

Shakira Suglia
Committee Member

Accepted:

Lisa A. Tedesco, Ph.D
Dean of the James T. Laney School of Graduate Studies

Date

Stress, Resilience, and Place: Drivers of Perinatal Risk for Hispanic Mothers

By
Kaitlyn K. Stanhope
Master of Public Health

Advisor: Michael R. Kramer, PhD, MMSc

An abstract of
A dissertation submitted to the Faculty of the
James T. Laney School of Graduate Studies of Emory University
In partial fulfillment of the requirements for the degree of
Doctor of Philosophy
in Epidemiology
2020

Abstract

Stress, Resilience, and Place: Drivers of Perinatal Risk for Hispanic Mothers

By Kaitlyn Stanhope

A growing body of work links restrictive immigration policies and enforcement practices to adverse health outcomes for immigrants, their families, and communities. By creating a stressful environment before and during pregnancy, these policies may result in increased risk of adverse birth outcomes, including very preterm birth, for both foreign-born and U.S. born Hispanic mothers. The goal of this dissertation is to explore the effect of immigration policy related contextual stressors, protective supports, and place on the risk of very preterm birth to foreign-born and U.S.-born Hispanic mothers across U.S. states.

In aim 1, I fit multilevel models to estimate the effect of living in a state with a restrictive immigration policy climate on very preterm birth (VPTB) among foreign-born and U.S.-born Hispanic women. Conditional on state, county, and individual level confounders, living in a state in the most restrictive quintile of immigration climate was associated with an increase in the odds of very preterm birth among all Hispanic women (OR: 1.07 (1.04, 1.1)) without effect modification by nativity. In aim 2, I fit spatial Bayesian varying coefficient conditional autoregressive models to estimate the effect of adopting a 287(g) immigration enforcement agreement on very preterm birth rates to Hispanic women in the county. For foreign-born Hispanic women only, adoption of a 287(g) agreement was associated with a slight increase in the odds of VPTB (aOR: 1.04 (1.01, 1.12)). This effect varied spatially, with the strongest effects in counties in North Carolina and Virginia. In aim 3, I conducted surveys and in-depth interviews with pregnant Latina women in metro Atlanta, measuring stress and resilience-promoting factors. While the majority of women described experiencing at least one external stressor, many did not describe experiencing emotional stress reactions. In interviews, women described resilience promoting factors including reliance on family, maturation and growth following traumatic or challenging experiences across the life course, and a perceived capability to control their emotional reactions to stress.

This dissertation contributes to the growing body of work demonstrating an association between exposure to restrictive immigration policies or enforcement practices and adverse birth outcomes. Future work should explore variation in women's reaction to these environmental stressors and possible modifiers of the effect of immigration climate on health, including interpersonal and individual resilience-promoting factors.

Stress, Resilience, and Place: Drivers of Perinatal Risk for Hispanic Mothers

By
Kaitlyn K. Stanhope
Master of Public Health

Advisor: Michael R. Kramer, PhD, MMSc

A dissertation submitted to the Faculty of the
James T. Laney School of Graduate Studies of Emory University
In partial fulfillment of the requirements for the degree of
Doctor of Philosophy
in Epidemiology
2020

Acknowledgements

I would not have been able to complete this dissertation without the help and support of many people. My husband and family have been constant sources of support throughout.

My committee has been amazing, supporting my development as a researcher, professional growth, and balancing of work and life as both evolve. Carol Hogue encouraged me to come to Emory for a PhD, study Epidemiology, and figure out how I might use epidemiologic methods to study this topic (which no one had done at the time). She also contributed an invaluable trove of experience and knowledge about perinatal health and the embodiment of stress. Michael Kramer taught me, if not everything, at least 95% of what I know about spatial and multilevel modeling, gave feedback on many iterations of my dissertation project, and has provided unwavering patience and support. Juan S. Leon helped me figure out how to hire, train, and evaluate my staff, as well as design a monitoring framework for my entire study. His attention to detail and focus have been amazing in drafting and finalizing dissertation papers. Dawn Comeau mentored me in qualitative research through both my master's thesis and this project, helping me develop and conduct my study. She has also consistently supported me personally, particularly by providing inspiration and support when I became a mother. Shakira Suglia provides amazing feedback on this and other projects. She also has helped me take a wide view of research, helping me think about ideas for future projects, and how this project might fit into an ongoing research agenda.

Other faculty and peers also helped me conceptualize and carry out my dissertation. Neil Mehta mentored me through a directed study in my first year that resulted in a very rough draft of my initial aims. Roger Rochat provided feedback on ideas throughout the project. Denise Jamieson

and Lisa Haddad provided advice and mentorship on my original data collection, introducing me to Grady, helping me plan recruitment, and supporting me throughout the process. Julie Gazmararian encouraged me to publish my first ever paper. My PhD cohort has been a wonderful source of support, particularly Lindsay Collin, who has listened to many ideas and struggles over the last 5 years. Danielle Crookes introduced me to the Immigration Climate Index, talked over what immigration policy climate means, and has shared countless articles with me, for which I am so grateful. Finally, Huyen Pham and Van Pham, the developers of the Immigration Climate Index, shared their measure with me and patiently responded to many emails and questions.

I am deeply grateful for the survey and interview participants, my research team, and clinic staff. Participants shared their time and stories with me and my staff, for which we are honored. My research team, Monica Ulloa, Courtney Schlusser, and Clarissa Hernandez, were wonderful, and contributed their time, ideas, and passion to the project. I am grateful to staff and providers at Grady and CIMA. Specifically, clinic staff at CIMA made us welcome, supported the project, helped us find a space for interviews, and were engaged and curious about our findings.

Finally, I was supported over the course of this research by the Laney Graduate School, K01HD074726 to Michael Kramer, a training grant from the Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services (HHS) (T03MC07651), and an ARCS award.

ABSTRACT	4
ACKNOWLEDGEMENTS.....	6
INTRODUCTION.....	1
AIM 1. RESTRICTIVE SUB-FEDERAL IMMIGRATION POLICY CLIMATES AND VERY PRETERM BIRTH RISK AMONG US-BORN AND FOREIGN-BORN HISPANIC MOTHERS IN THE UNITED STATES, 2005-2016	8
INTRODUCTION.....	8
CONCEPTUAL FRAMEWORK	9
METHODS.....	14
RESULTS.....	19
DISCUSSION.....	26
AIM 2. SPATIAL VARIATION IN VERY PRETERM BIRTH TO HISPANIC WOMEN ACROSS THE UNITED STATES: THE ROLE OF INTENSIFIED IMMIGRATION ENFORCEMENT	32
BACKGROUND.....	32
METHODS.....	35
RESULTS.....	38
DISCUSSION.....	44
SUPPLEMENT	48
AIM 3. PERCEPTIONS OF STRESS AND RESILIENCE AMONG LATINA WOMEN ENROLLED IN PRENATAL CARE IN METRO ATLANTA THROUGH AN ECOSOCIAL LENS	52
BACKGROUND.....	52
METHODS.....	55
RESULTS.....	60
DISCUSSION.....	71
CONCLUSION AND FUTURE DIRECTIONS	77
REFLEXIVITY STATEMENT.....	80
BIBLIOGRAPHY	84
APPENDIX A: DISSERTATION PROPOSAL.....	103
1. SIGNIFICANCE:	105
2. APPROACH.....	110
APPENDIX B. STANHOPE DISSERTATION AIM 3 APPROACH DETAIL	124
I. RECRUITMENT PROCEDURES.....	124
II. DATA COLLECTION PROCEDURES.....	125
III. QUANTITATIVE SURVEY ANALYSIS.....	126
IV. QUALITATIVE INTERVIEW ANALYSIS	128
V. DATA TRIANGULATION	129
VI. ANTICIPATED DELIVERABLES	130
VII. ANTICIPATED CHALLENGES.....	131
APPENDIX C: IN-DEPTH INTERVIEW GUIDE.....	133
APPENDIX D. MONITORING AND EVALUATION FRAMEWORK	137

Introduction

A growing body of literature provides evidence that living in a place with more restrictive immigration policies is associated with adverse health outcomes for Latino immigrants and potentially also US-born Latinos.¹⁻³ The scholarship in this area has accelerated in the past five years,¹⁻³ possibly in reaction to the fast-paced changes in immigration-related laws at local and state levels,^{4,5} as well changing federal enforcement priorities and practices.^{6,7} However, causal inference about the effects of immigration policies has been limited by a lack of clarity on how to operationalize immigration policy as an exposure, limited attention to potential biases in measuring the effects of immigration policy, and limited specification of mechanisms through which policies impact health. An epidemiologic perspective—articles written by or for epidemiologists with a practical focus on the determinants of disease—is mostly absent from this body of work (with notable exceptions^{8,9}). By contributing expertise in causal inference and the determinants of population health, epidemiologists can enhance and extend our understanding of whether, when, and how immigration policies impact health—and what public health practitioners should do to ameliorate any adverse effects.

The immigration system in the United States is a patchwork of changing laws, policies, and enforcement priorities at multiple levels.^{7,10} To capture this complexity, many researchers examine immigration policy climate instead of single policies. Immigration climate might include policies, enforcement practices, or rhetoric related to immigrants in a given place and time. However, quantifying the overall effect of the set of policies governing any one place and time is challenging.¹¹ Policies at federal, state, and local levels simultaneously define who is at risk of detention and deportation, what police priorities exist for seeking out and detaining undocumented immigrants, and what access immigrants have to resources.

For example, in DeKalb County, Georgia, in 2019, immigrants are covered by the ‘Welcoming City’ initiative from Metro Atlanta and the county police have publicly stated they will not sign a 287(g) enforcement agreement with Immigrations Customs Enforcement (ICE) and will limit cooperation with ICE in county jails.^{12,13} However, Georgia has a 287(g) agreement for state jails, as well as extremely restrictive state laws that, among other provisions, do not allow undocumented immigrants drivers licenses, deny immigrants Medicaid coverage for prenatal care or in-state tuition for state universities, and require employers to use E-verify (a system to confirm a potential hire’s immigration status).¹⁴ Immigrants in DeKalb county are also subject to changing federal policies, including the threat of changes to the Deferred Action for Childhood Arrivals (DACA) program. Finally, federal enforcement practices (detentions and deportations) vary spatially, without clear links to state or local policies.^{15,16} Thus, as researchers, do we characterize DeKalb County as having a supportive policy climate (at county and metro levels) and simultaneously a restrictive climate (at state and federal levels)? Many researchers have approached this problem by creating an index, either by summing the number of restrictive policies,¹⁷ weighting policies by the expected population impacted,¹⁸ or using factor analysis to determine some essential set of policies to be included.¹⁹ However, while indices may capture complexity, they also divorce the immigration policy climate from the individual immigration policies, making it challenging to interpret results or call on decision makers to change specific policies.

While estimates of the effect of immigration policies on health may be biased for many reasons, two of the most concerning biases are confounding and selection bias. Generally researchers consider political climate (e.g., political party of governor, % voted for republican party in most recent presidential election), economic climate (e.g., % unemployed or % below

poverty level), and demographic composition (e.g., % non-citizens, % foreign-born, % Hispanic) as potential confounders of the effect of immigration policy on health. While a robust literature in political sciences describes the determinants of the passage of restrictive immigration policies, the link between these determinants and a given health outcome is often assumed, unmeasured, and only vaguely described.^{18,20} Anti-immigration sentiment is occasionally described as a potential confounder, but few authors have accounted for this in analysis.¹⁹ In addition, some researchers have found that anti-immigrant sentiment may increase following the passage of a restrictive immigration policy, suggesting that it may be a mediator, rather than a confounder of the effect of policies.²¹ One promising approach to account for confounding is to compare jurisdictions (e.g., municipalities, counties, or states) in which a given policy was passed to jurisdictions in which the same policy was considered but ultimately not passed.^{22,23} However, this approach requires comparable policies across jurisdictions and, in the case of policies introduced to state legislatures, may not fully account for the differences. In addition to confounding, potential selection bias is a key concern. Most studies of the effect of immigration policy on health conduct secondary data analysis of vital records, surveillance data, or survey data. However, there may be selection bias through at least two mechanisms. First, if the policy acts by increasing risk of deportation or detention, the individuals most vulnerable to the policy may be deported and not captured in the data source. Second, if the policy acts by increasing fear or mistrust of government, affected individuals may be less likely to participate in government-led surveys, biasing effect estimates. Ultimately, each study should carefully consider sources of bias, which will depend both on the measure of policy, the target population, the specific health outcome, and the hypothesized mechanism through which the policy(s) impact health.

Immigration policies may influence health outcomes through multiple mechanisms. Philbin (2018) categorized the mechanisms through which immigration policies may impact health into broad categories: changing access to social resources (e.g., education), changing access to health care (e.g., through changing eligibility for public insurance), changing access to material resources (e.g., through changing access to the Women, Infants, and Children program), or through structural racism, resulting in stress (e.g., by increasing the probability that individuals will be stopped by the police based on their apparent race/ethnicity/nationality).² The final pathway, structural racism, may have the most wide-spread impact, theoretically affecting the health of not only immigrants impacted directly by changing policies, but also other members of the targeted immigrant group. Researchers have explored this pathway primarily through seeking a ‘spillover effect’ or an effect among U.S.-born Latinos in addition to foreign-born Latinos.^{2,8,24}

Philbin’s conceptual framework does not include potential effects from increases in immigration enforcement intensity, which may also have important health impacts.² Immigration enforcement practices (checking the papers of potential undocumented immigrants, detentions, deportations) may have both individual and population-level health effects.²⁵ At individual level, family members of detained and deported immigrants suffer trauma and stress from family separation and uncertainty, as well as potential long-term financial consequences, given that men, often breadwinners, are most likely to be deported.²³ In particular, children of deported parents may suffer long-term behavioral, mental, and physical health consequences.¹ Rugh and Hall (2016) demonstrated how counties with increased likelihood of deportation had higher foreclosure rates among Latino families, theorizing that this was because of the deportation of breadwinners.²³ At a population level, increased enforcement may change how Latino families

make decisions about how and when to seek care or may cause stress, resulting in poor health outcomes.²⁶ Research in the Midwest following large workplace raids demonstrate an increase in perceived immigration enforcement stress, a decrease in self-rated health and an increase in low-birth weight births among Latino families.^{9,27} Unfortunately, it is not yet clear how best to account for enforcement intensity when studying policies. In contrary to expectation, detention rates are only weakly correlated with policies such as 287(g) agreements.¹⁵ Thus, it is not clear how enforcement practices should be treated in the analysis of policies: as a confounder (as they may reflect anti-immigrant sentiment), mediator, or simply ignored (as is often done).

There are three critical gaps in the understanding of the mechanisms through which immigration policies impact health. First, researchers have generally taken a black box approach, measuring a policy (or policies) and health outcome, without measuring or, in some cases, describing the hypothesized pathway. For example, very few researchers have measured stress biomarkers or perceived stress in response to policy shifts or perceived policy climate.^{19,27} Second, it is unclear whether actual policies or perceived policy climate ultimately results in changes in health outcomes. For stress, perceptions of policy may be more salient to health than actual policies. Ybarra (2018) showed that perceptions of policy climate were only weakly correlated with an objective measure of immigration policy climate in a national survey of Latinos.²⁸ Third, only limited consideration has been given to disentangling the temporal relationships between immigration policies and health outcomes. Likely due to data limitations, most researchers have assumed no lag or a short lag time between the implementation of a policy and a given health outcome. While this may be appropriate for acute health outcomes (e.g., vaccine uptake, blood pressure), there may be an induction time of several years before

immigration policies could impact health outcomes such as cardiovascular risk profile or risk of adverse birth outcomes.

This dissertation adds to literature on the relationship between immigration policies and health in a few ways. First, I focus on an outcome known to be sensitive to the biologic embodiment of stress, very preterm birth. Second, I consider two distinct operationalizations of immigration policy climate. One, the Immigration Climate Index (ICI), accounts for complexity, and incorporates policies at state and local levels to quantify how supportive or restrictive the climate is for immigrants. The second, adoption of a 287(g) agreement, is a single policy, decided on by local administrators. Providing evidence on the health impacts of this policy allows decision-makers to better understand the possible consequences of their actions. Finally, I introduce nuance through survey data and qualitative interviews with pregnant Latina women, describing how they perceive stress and resilience in their lives.

I used Krieger's Ecosocial Framework to develop and frame my dissertation work.²⁹⁻³¹ The Ecosocial Framework lends itself nicely to studying immigration climate. First, it incorporates a multilevel perspective, considering that exposures occurring at multiple levels may directly impact health. Political, economic, and social forces are embodied in the health of individuals through behaviors and physiologic changes. The cumulative effect of exposure to these forces across women's life course is embodied in women's health during pregnancy. Finally, the Ecosocial Framework explicitly demands that researchers consider accountability and agency in their work. As researchers, we should engage in ruthless self-examination, seeking transparency for why we address a given question and what may result from our work. It also means that we consider political, economic, and social forces as the results of decisions made by individual and state actors.

The overall goal of this dissertation is to describe geographic variation in very preterm birth risk to Hispanic mothers, exploring the role of stress, social support, and place in determining risk. In my first aim, I consider how a cumulative measure of immigration policy climate is associated with very preterm birth to US-born and foreign-born Hispanic mothers. In my second aim, I consider spatial structure in the risk of very preterm birth to Hispanic mothers and the role of 287(g) adoption on increasing county rates of very preterm birth for US-born and foreign-born Hispanic mothers. Finally, in my third aim, I explore pregnant Hispanic women's narratives of stress and resilience during the perinatal period through objective measurement of psychosocial wellbeing and in-depth qualitative interviews.

Aim 1. Restrictive sub-federal immigration policy climates and very preterm birth risk among US-born and Foreign-born Hispanic mothers in the United States, 2005-2016¹

Introduction

In the past 15 years, there has been a steep increase in the number of immigration-related laws introduced and passed in state legislatures.^{2,32} Though only occasionally explicitly related to health (e.g., by restricting access to Medicaid benefits), these policies may have pervasive effects on the health of immigrants and their families.³³ As reviewed by Philbin (2016) and Wallace (2019), immigration-related laws may affect health through restricting or expanding access to public institutions, improving or worsening material conditions, or through causing chronic stress.^{3,34}

Chronic stress is a widely accepted determinant of perinatal health, including preterm birth.^{35–39} Very preterm birth (VPTB, usually defined as live birth before 32 completed weeks gestation) represents a high-risk, homogeneous subset of all preterm birth (<37 weeks gestation). Infants born very preterm are at increased risk of infant mortality and long term morbidities compared to term or moderate preterm (32 to <37 weeks) infants.⁴⁰

Evidence is limited on whether and how immigration policies affect immigrant health generally or chronic stress-mediated health specifically. The goal of this analysis is to explore the role of

¹ Stanhope, K. K., Hogue, C. R., Suglia, S. F., Leon, J. S., & Kramer, M. R. (2019). Restrictive sub-federal immigration policy climates and very preterm birth risk among US-born and foreign-born Hispanic mothers in the United States, 2005–2016. *Health & place*, 60, 102209. <https://doi.org/10.1016/j.healthplace.2019.102209>

immigration policy climate on risk of very preterm birth among Hispanic mothers by estimating the effect of living in a state with a more restrictive immigration policy climate on very preterm birth among Hispanic women. This analysis adds to our understanding by considering the impact of immigration policy climate on very preterm birth in both US-born and foreign-born Hispanics across the United States.

Conceptual Framework

In order to frame our research questions and approach to answering them, we borrow core concepts from Krieger's Ecosocial Framework.^{41,42} These allow us to understand and describe the hypothesized pathways and processes through which state-level immigration climate might impact individual women's risk of preterm birth.

1. Health is produced by political and social structures, occurring at multiple levels.

First, Ecosocial theory (like many other conceptual models of health), recognizes causal determinants of health at multiple levels. Immigration policies, enacted at state, county and municipal levels, might impact health directly (e.g., by determining eligibility for Medicaid or other social services) or indirectly by increasing stress and structural racism. Structural racism refers to societal level forces (e.g., laws, customs, institutions) that create and reinforce inequalities between groups.⁴³ Immigration policies may increase stress and structural racism by excluding immigrants (or classes of immigrants) from privileges that allow for physical or economic mobility (e.g., access to driver licenses or public colleges), by facilitating police harassment of immigrants and those who look like immigrants (e.g., by passing laws that encourage police to check immigration status or to cooperate with Immigrations Customs Enforcement), or by increasing the actual or perceived risk of deportation for non-citizens.^{34,44}

Though previous research has primarily focused on adverse effects of immigration-related laws, individual laws contribute to a complex immigration policy climate that may be supportive or restrictive as a whole. Immigration-related laws may support immigrants (e.g., by funding English as a second language programs or providing support for resettlement) or make life more challenging for immigrants (e.g., by restricting access to benefits such as the Women, Infants, and Children (WIC) program, facilitating police harassment, or targeting industries in which primarily immigrants are employed). Only rarely do immigrants in a place experience only one law at a time. Immigration policy climate refers to the total experience of all immigration policies in a given place and time, capturing the net effect of all laws in place at a time.⁴⁵ The net effect may be more hostile (restrictive) or welcoming (supportive) towards immigrants. Immigration climate is intertwined with stress buffers and stress promoters at state, county, and individual levels (Figure 1).

State and local context, including stress buffers and stress promoters, may influence which policies are passed and individual vulnerability to those policies. For example, states may pass immigration policies in response to increases in the proportion of immigrants in the state who are undocumented.⁴⁵ At a local level, living in a community with a high concentration of co-ethnics and immigrants (an ethnic enclave) provides immigrants and their descendants with social capital and resources, resulting in improved mental and physical health.⁴⁶ Finally, families provide immediate social support and material resources. For pregnant women and new mothers, having a partner, either through marriage or willing to give his information on the birth certificate, represents a health advantage, likely through increased partner support.⁴⁷

2. Experiences across the life course contribute to health.

Second, Ecosocial theory incorporates life course theory, the idea that exposures, opportunities and experiences early in life may have long lasting consequences, even years or generations after they occur.³⁸ For example, women born outside of the United States have a lower risk of adverse birth outcomes compared to US-born women of the same ethnicity.^{48,49} This may be because a woman's place of birth represents a broad set of early life experiences and exposures that proxy life course and transgenerational acculturation. To support this idea, we see that the patterns of the immigrant advantage vary by race and, among Hispanic women, specific origin group.^{50,51} Differing Hispanic origin groups represent different histories of migration and economic and political incorporation in the United States.^{52,53}

Women's ethnicity and place of birth impact their vulnerability to the effects of restrictive immigration policies. The recent wave of restrictive immigration policies has impacted Hispanic communities more than other immigrant communities, due to racial profiling in the application of restrictive policies and increased vulnerability (both perceived and actual) to immigration enforcement.^{15,44,54} Additionally, restrictive policies, particularly those that increase chronic stress, likely affect both immigrants and individuals who identify with immigrant groups (due to ancestry or ethnic identity) or who are perceived as members of immigrant groups.⁵⁵ Limited existing research shows that immigration policies impact health for both foreign-born and US-born Hispanics. Two recent papers have shown that living in a state with more restrictive immigration policies is associated with increased days of poor mental health and increased perceived discrimination for both US-born and foreign-born Hispanic residents.^{56,57}

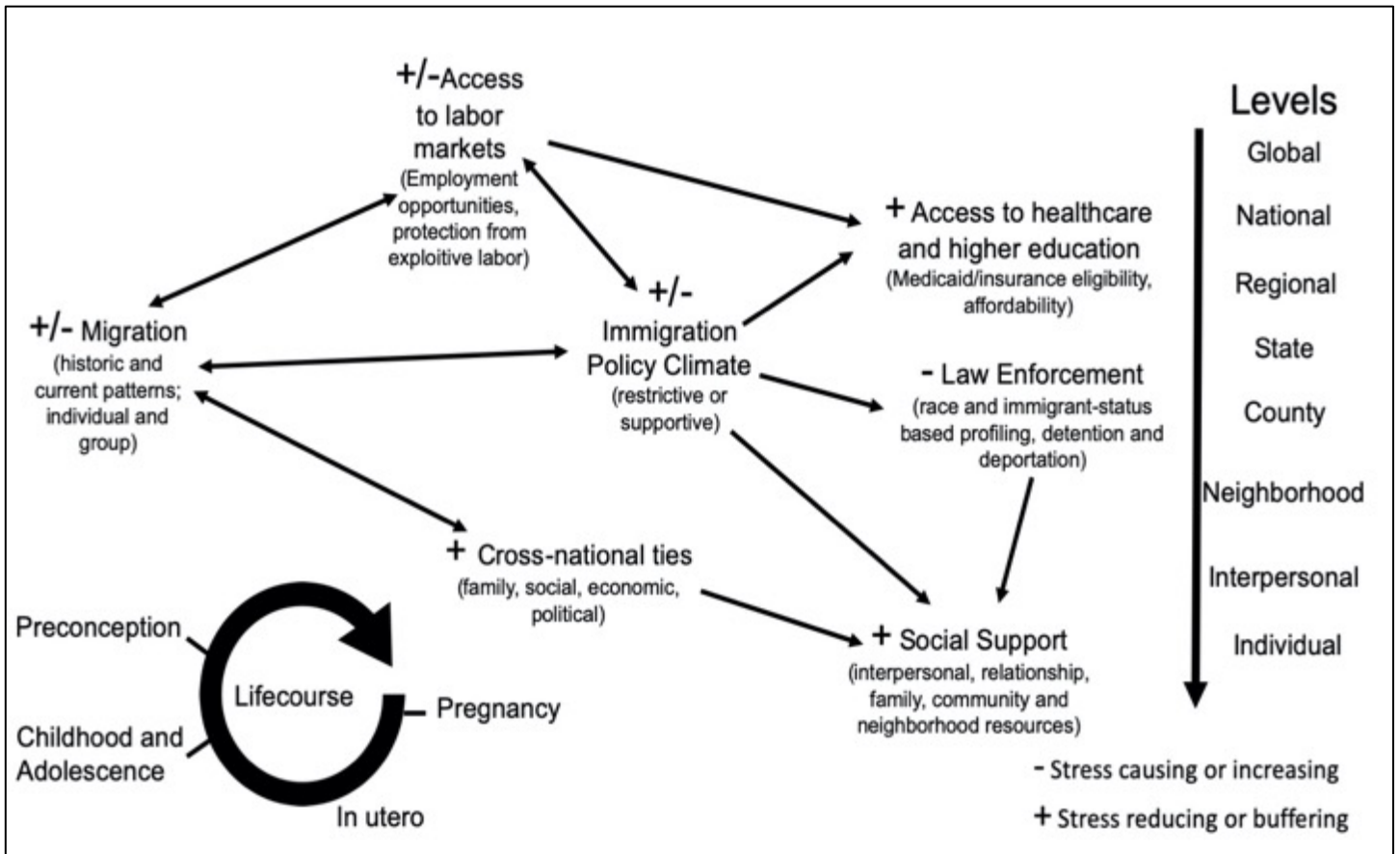


Figure 1. Application of ecosocial framework to illustrate relationship between immigration policy climate and causes of stress and resilience across multiple levels and across the lifecourse of Hispanic women, adapted from Krieger (2012).^{39,40} Arrows denote a possible link. Factors hypothesized to be primarily causing stress are denoted with a “-“ and those theorized to primarily buffer against stress with a “+”.

3. Social experiences become biology.

Finally, Ecosocial theory is grounded in the idea that individuals biologically embody their experiences, social status and position. Women who experience cumulative, chronic stress prior to their pregnancies embody these experiences through physiologic changes, resulting in higher risk of adverse birth outcomes.⁵⁸ Chronic stress may increase risk of PTB through weathering of physiologic systems, changes in immune or neuroendocrine functions or maladaptive behavior (e.g., smoking or obesogenic diet).³⁶ Experiences of chronic, contextual stress, including segregation and neighborhood disorder, have been linked to elevated risk of PTB.⁵⁹ While research shows links between elevated stress and all preterm birth, VPTB represents the subset most likely to purely reflect the biologic embodiment of stress. Later preterm birth (34-36 weeks) is sensitive to changes in physician decision making and health care systems. Correspondingly, overall risk of PTB in the US has decreased in recent years due to successful interventions with physicians and health systems.⁶⁰ VPTB, however, has remained constant in the US in recent years. We focus our analysis on VPTB as the subset of overall preterm birth most likely to be impacted by immigration climate through biologic embodiment of stress, rather than changes in overall health systems or physician decision making that may vary by state.

To our knowledge, only one paper examines how immigration policies may impact health exclusively through increasing chronic stress. Torche and Sirois found a decline in birthweight among foreign-born Latina women in Arizona who were pregnant during the debates over the passage of SB1070, a particularly notorious restrictive immigration law. Given that there was no reduction in access to care or economic opportunity before the passage of the law, the authors hypothesized the decline was likely due to stress.⁶¹ Further study is needed on how immigration

policies may impact objective health outcomes by contributing to structural racism and increasing chronic stress.

Building on this conceptual framework, we aim in this paper to answer the following questions:

- 1) Does state level immigration policy climate predict variation in individual risk for very preterm birth?
- 2) Does this association vary by an important proxy of life course experience, maternal nativity?

Methods

Data

Using information on maternal county of residence at delivery, we linked data from the 2005-2016 US live birth file to data on state and county characteristics from the American Community Survey, data on county level immigration policies from the Department of Homeland Security, and the Immigrant Climate Index (ICI) database assembled by Pham and Pham.⁶² We excluded births to non-Hispanic women (-37,229,020), multiple births (-274,361), those missing gestational age (-120,111) or maternal place of birth (-36,223). In addition, we excluded all records for county/year combinations with fewer than 100 live births to Hispanic women for that county in that year (-526,863). The final analytic dataset contained a total of 10,683,234 births to Hispanic mothers in 807 counties in 47 states from 2005-2016.

Measures

We considered potential confounders of the relationship between immigration climate and very preterm birth (VPTB) at individual, county, and state levels. Though individual level variables may not cause changes in immigration climate, the distribution of individual characteristics may differ across places with different climates, resulting in different risk. We operationalized maternal age using a linear and quadratic term to reflect the j-shaped relationship

between maternal age and VPTB risk.^{63,64} We dichotomized parity into nulliparous and multiparous. We represented maternal nativity as US-born or foreign-born and specific Hispanic origin as a five-category variable (Mexican, Puerto Rican, Cuban, Central/South American, Other Hispanic). We consider nativity and Hispanic origin to proxy immigration history. Though they are imprecise measures of immigration history, we believe they represent both individual factors and information about the social context in which women grew up and currently live. Relationship status is operationalized here as a three-level variable indicating whether women were married at the time of delivery, unmarried but with information on the baby's father on the birth certificate, or unmarried without any information on the baby's father on the birth certificate.⁶⁵⁻⁶⁷ We consider this as representing varying levels of partner support.⁴⁷

At the county level, we considered poverty, ethnic density, rurality, and immigration enforcement intensity as potential confounders. The percent of families below the federal poverty level represented county-level poverty and we categorized it into quartiles. We used the percent of the county's population that was Hispanic to represent ethnic density and categorized it into quartiles. For both county level poverty and percent Hispanic, we used 5-year estimates. For example, for years 2005-2009, the 5-year 2005-2009 estimates were used. We classified counties as rural using the 2013 National Center for Health Statistics Urban-Rural Classification scheme if they were consider either noncore or micropolitan; otherwise they were considered urban.⁶⁸ We considered 287(g) agreements as indicators of county-level enforcement intensity, as have previous authors.⁶⁹ A 287(g) agreement with Immigration Customs Enforcement allows local police to participate in immigration enforcement activities.⁷⁰

Finally, at the state level, we considered the proportion of foreign-born who were undocumented to potentially confound the relationship between immigration climate and VPTB,

by influencing both the passing of policies and risk of VPTB. We calculated the undocumented proportion of the state foreign-born population using one-year state estimates of the number of foreign-born residents from the American Community Survey and estimates of the number of undocumented individuals at the state level as produced by Passel & Cohn for the Pew Research Center.⁷¹ We used a two-year lagged proportion undocumented to represent the percent of undocumented residents the year prior to the one-year lagged ICI, as policies may be passed in response to growth in the size of the undocumented population.⁴⁵ For estimates of the 2003 and 2004 foreign-born population, the 2000 census estimate was used, as one-year estimates were not available for those years. Four states (Wyoming, North Dakota, South Dakota, and Montana) did not have estimated numbers of undocumented residents due to sparse numbers. For analytic purposes, we assumed that these states had the median undocumented proportion of all states. We divided the two-year lagged undocumented proportion into quartiles.

We measured immigration policy climate using the Immigration Climate Index. The Immigration Climate Index (ICI) is a continuous measure that represents the total effect of immigration policies in place for a state in a given year.^{45,62,72} While the process of calculating the index is described more completely in the preceding citations, briefly, each new policy enacted is assigned a value from -4 to 4 by evaluating the severity of impact on the lives of immigrants (1, negligible impact to 4, large impact), assigned a negative value if restrictive or a positive value if supportive and weighted by the proportion of the state population that it would legally affect (if not for the entire state). An example of a supportive policy is allocating funds for English as a second language education and an example of a restrictive policy is making driving without a driver's license a jail-worthy offense in a state where undocumented immigrants are not allowed to get licenses. All policies in place for a given year (newly passed

and already in place) are summed to give the cumulative ICI. A cumulative ICI that is below zero represents an immigration climate that is, on average, restrictive, whereas a cumulative ICI above zero represents a climate that is, on average, supportive. The measure only includes policies enacted starting in 2005, assigning all states before that year a value of zero. The index is calculated each year, 2005-2016, and ranges from -788.9 to 684.2 (mean: -48.97, SD: 122.61). We used one-year lagged Immigration Climate Index (ICI) based on the hypothesis that this would represent the exposure immediately prior to and during the pregnancy. Based on the cumulative range of the ICI in the analytic sample of women, we divided the one year lagged ICI into quintiles (1st: $-685 \leq \text{ICI} < -60.5$; 2nd: $-60.5 \leq \text{ICI} < -4.4$; 3rd: $-4.4 \leq \text{ICI} < 0$; 4th: $0 \leq \text{ICI} < 42.0$; 5th: $42.0 \leq \text{ICI} < 684$).

Analysis

We fit generalized linear mixed models with very preterm birth (VPTB) (live birth before 32 completed weeks gestation) as the outcome and random effects for state and county in order to estimate the effect of restrictive immigration policy climate on VPTB. Our models included potential confounders at the individual level (parity, age, relationship status, nativity, and specific Hispanic origin), county level (poverty, rurality, 287(g) agreements) and state level (two-year lagged proportion of undocumented immigrants out of total foreign born). We also control for birth year. Our exposure was state level immigration policy climate, as operationalized by one-year-lagged Immigration Climate Index, divided into quintiles. To answer our first research question, we fit a logistic model, incorporating all of the above confounders as well as random effects for state and county of residence and calculated odds ratios comparing odds of VPTB across ICI quintiles. To answer our second research question, we fit a model allowing for modification of the effect of ICI by maternal nativity (US-born v. foreign-born). In order to assess effect modification on the additive scale, we fit linear risk

models with random effects for state and county and calculated risk differences comparing risk of VPTB across ICI quintiles.

Sensitivity Analyses

We performed a number of sensitivity analyses. We replicated our final model using preterm birth (PTB) as the outcome. We expected that, if observed associations are due to experienced stress, risk of PTB would also be elevated, as PTB is also linked to elevated stress. Second, one year may not be the appropriate lag for ICI. We also conducted analyses using two-year lagged ICI and current-year ICI. Two-year lagged ICI would capture the environment prior to conception, if the mother had been living in the state for at least two years prior to delivery. Current-year ICI might reflect the environment prior to the enactment of policies, potentially during the time in which they were debated and passed, reflecting changes in immigrant-related sentiment or anxiety about the policies themselves. As the ICI is correlated across years, we would not expect changes in the direction of association based on lag time but potentially changes in the strength of association.

Finally, we conducted a negative control analysis, in which we repeated the model estimating the effect of living in a state with a more restrictive immigration climate using populations of US-born non-Hispanic white mothers and non-Hispanic black mothers. While evidence suggests that US-born Hispanic populations experience spillover effects of restrictive immigration policies,^{56,69} US-born non-Hispanic women are unlikely, in general, to experience stress from these policies. We repeated the exact model except specific Hispanic origin was excluded. If the estimated effect of ICI were similar to that among Hispanic women, this would suggest that the observed effect was not due to the ICI but rather some other, geographically varying factor affecting the health of both Hispanic and non-Hispanic women. To create this dataset, we began with the same counties included in the analytic dataset for Hispanic women.

Then, we excluded counties with fewer than 100 births for a given county/year combination for non-Hispanic white and non-Hispanic black women, separately. The final analytic dataset contained 19,907,518 births in 807 counties in 47 states for US-born non-Hispanic white women and 4,903,209 births in 484 counties in 44 states for US-born non-Hispanic black women.

Results

In the analytic dataset, 1.5% of births to Hispanic mothers were very preterm and 10.6% were preterm (Table 1). Mothers who lived in states with the most restrictive immigration climates (quintile 1 of ICI) were more likely to have a very preterm (1.6% v. 1.3%) or preterm birth (11.2% v. 8.7%) than those who lived in the most supportive immigration climates (quintile 5). Maternal characteristics (age, specific Hispanic origin, nativity, education, parity) were similar across quintiles 1 and 5. Mothers living in states with more restrictive immigration climates were more likely to live in a rural county and live in a county with a 287(g) program in place. The average two-year lagged proportion of estimated undocumented residents out of the foreign-born population was higher in states with a lower (more restrictive) ICI (0.4 v. 0.2). Mothers living in states with more restrictive immigration climates lived in counties, on average, with a lower percent foreign-born residents (18.2% v. 28.2%). The percent of Hispanic residents, percent of families living below the federal poverty line, and percent of residents without a high school education were similar in states in the highest and lowest quintiles of ICI.

Table 1. Maternal and place-based characteristics of 10,683,234 Hispanic women delivering a live born infant in 47 US states and 807 counties between 2005-2016

	ICI Quintile 1 (most restrictive) n=396,244	ICI Quintile 5 (most supportive) n=340,047	Total (with ICI q. 2 - 4) n=10,683,234
Maternal Characteristics	% (n) or mean (SD)	% (n) or mean (SD)	% (n) or mean (SD)
Maternal Age	26.8 (6.2)	27.5 (6.2)	26.9 (6.2)
Gestational Age	38.6 (2.4)	38.8 (2.2)	38.7 (2.3)
Birth Weight	3,277 (527.6)	3,323 (527.8)	3,299.2 (530.1)
Very Preterm	1.6 (35,976)	1.3 (29,439)	1.5 (160,270)
Preterm	11.2 (255,397)	8.7 (204,500)	10.6 (1,130,391)
Very Low Birthweight	0.9 (20,214)	0.8 (19,348)	0.9 (93,468)
Low birth weight	6.0 (137,529)	5.2 (121,679)	5.7 (606,269)
<i>Specific Hispanic Origin</i>			
Mexican	69.9 (1,595,571)	72.8 (1,704,970)	63.8 (6,818,865)
Puerto Rican	2.8 (63,831)	3.3 (78,316)	6.9 (739,501)
Cuban	1.2 (28,026)	0.4 (9,227)	1.9 (203,318)
Central/South American	11.1 (252,372)	10.7 (250,089)	15.3 (1,631,875)
Other/Unknown Hispanic	15.1 (344,087)	12.8 (298,884)	12.1 (1,289,675)
Primiparous	29.3 (669,964)	30.4 (711,423)	30.3 (3,237,675)
<i>Relationship Status</i>			
Married	49.7 (1,135,542)	46.4 (1,085,579)	47.6 (5,082,707)
Unmarried, w/ paternal info	38.0 (868,032)	45.7 (1,070,502)	41.1 (4,395,445)
Unmarried, w/o paternal info	12.3 (280,313)	7.9 (185,405)	11.3 (1,205,082)
<i>Maternal Education</i>			
8th grade or less	10.4 (236,780)	11.4 (267,602)	13.6 (1,451,853)
Some high school	22.1 (505,031)	21.7 (508,068)	23.3 (2,487,807)
High school grad	27.5 (627,763)	30.5 (713,672)	27.7 (2,957,279)
Some college/associates	20.4 (466,624)	23.3 (546,098)	19.2 (2,049,020)
College or more	9.6 (218,775)	9.8 (228,287)	9.2 (980,854)
Missing	10.0 (228,914)	3.3 (77,759)	7.1 (756,421)
Foreign-born	49.0 (1,118,175)	49.3 (1,154,195)	55.7 (5,947,589)
<i>Place Based Measures</i>			
% w/o High School Diploma	18.3 (8.5)	19.6 (6.0)	18.4 (7.4)
% Foreign-born	18.2 (9.1)	28.2 (8.1)	22.5 (11.4)
% Hispanic	37.7 (25.2)	38.8 (13.6)	33.5 (20.6)
% living below FPL	18.4 (6.5)	16.6 (4.8)	16.3 (6.0)
% on Public Assistance	2.1 (0.8)	4.1 (1.8)	2.9 (1.6)
Rural County at Delivery	7.1 (162,168)	0.8 (17,472)	4.9 (526,443)
Living in County w/ 287g	31.6 (721,648)	16.1 (375,816)	15.2 (1,618,030)
Est. proportion undocumented to of foreign-born residents, state	0.4 (0.1)	0.2 (0.0)	0.3 (0.1)

ICI quintile 1= states with ICI < -60.5; ICI quintile 5= states with >42.0; ICI=Immigration Climate Index; w/=with; w/o=without; FPL=federal poverty level; Est.=estimated

The ICI changed dramatically over the twelve included years. All states began at a neutral ICI of zero in 2005, when scoring began, which falls in the fourth quintile of the ICI. Between 2005 and 2010, there was limited legislative activity and only a few states moved out of the third or fourth quintiles of ICI. However, between 2010 and 2016, states showed dramatic annual shifts, with shifts of up to 50 points over a 1 year period (representing over 12 new policies passed in that year). While many states changed quintiles, going from neutral to mildly negative to very negative or neutral to positive, switches from a negative to a positive trajectory over the twelve years were rare (<1% of all annual changes). Arizona and California were the negative and positive outliers, respectively, in every included year. Figure 3 shows trajectories for 6 example states. In a model controlling for individual and county characteristics, as well as

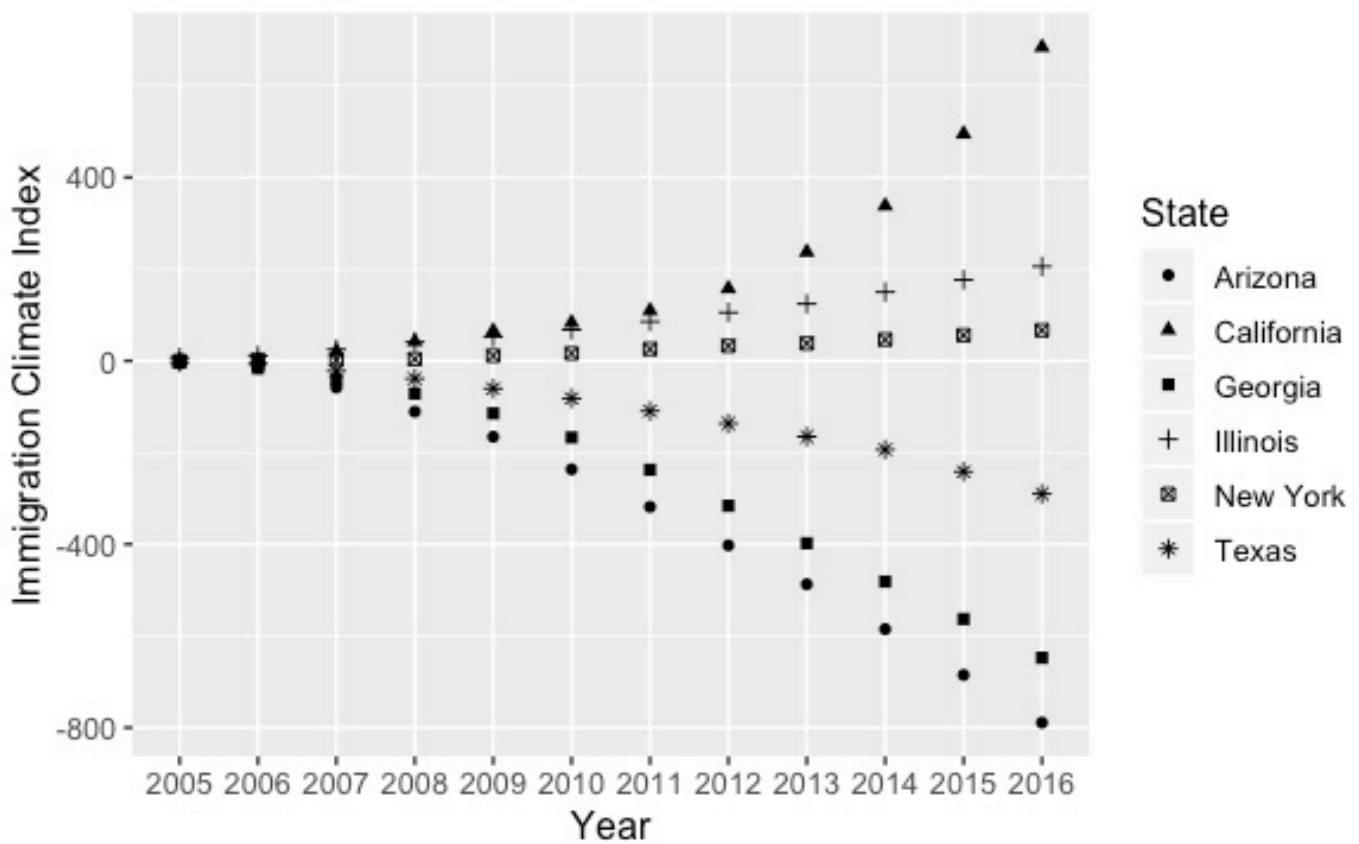


Figure 2. Trajectories of the Immigration Climate Index (Pham, 2018) over time in 6 example states, 2005-2016

year and proportion of foreign-born residents who were undocumented, women living in states in the lowest (most restrictive) quintile of one-year lagged ICI had 7% higher odds of delivering a very preterm infant compared to women living in states in the highest quintile of one-year lagged ICI (aOR: 1.07 (1.04, 1.10)) (Table 2). There was some evidence of a dose response, with the strongest observed association comparing the most restrictive quintile of ICI (1) to the supportive quintiles (4,5) and smaller associations comparing the most restrictive to a neutral quintile (3) or restrictive but less restrictive (2). The association between ICI and preterm birth was similar though slightly stronger (aOR: 1.09 (1.08, 1.10)).

Table 2. Estimated effect on very preterm birth (VPTB, <32 weeks) and overall preterm birth (PTB, <37 weeks) risk comparing living in a state with a more restrictive immigration climate (lowest quintile of ICI) to living in a state with a less restrictive immigration climate (referent), as measured by the one-year lagged Immigration Climate Index, Hispanic mothers in the United States, 2005-2016, N=10,683,234

	Very preterm birth aOR* (95% CI)	Preterm birth aOR (95% CI)
ICI 1 v. 5	1.07 (1.04, 1.1)	1.09 (1.08, 1.1)
ICI 1 v. 4	1.07 (1.04, 1.11)	1.06 (1.05, 1.08)
ICI 1 v. 3	1.06 (1.03, 1.1)	1.04 (1.03, 1.06)
ICI 1 v. 2	1.03 (1.00, 1.05)	1.01 (1.00, 1.02)

*All odds ratios adjusted for maternal age, relationship status, nativity, specific Hispanic origin, education, county level poverty, ethnic density, rurality and participation in a 287(g) agreement, year, and state level proportion of undocumented residents out of total foreign-born

In a linear risk model allowing for interaction between maternal nativity and ICI, there was some heterogeneity between risk differences for US-born and foreign-born women (Table 3). For US-born women, the risk of both VPTB and PTB was not elevated in quintile 1 (most restrictive) compared to quintile 2 or 3. However, for foreign-born women, risk remained elevated comparing quintile 1 to quintiles 2-5 (Table 3).

Table 3. Estimated effect (risk difference per 1000 live births) on VPTB and PTB of living in a state with a more restrictive immigration climate to living in a state with a less restrictive immigration climate, as measured by the Immigration Climate Index (ICI), US-born and foreign-born Hispanic mothers in the United States, 2005-2016, N=10,683,234

	Very preterm birth		Preterm birth	
	US-born aRD* (95% CI)	Foreign-born aRD* (95% CI)	US-born aRD* (95% CI)	Foreign-born aRD* (95% CI)
ICI 1 v. 5	0.96 (0.49, 1.44)	0.81 (0.35, 1.27)	7.95 (6.7, 9.19)	5.23 (4.01, 6.45)
ICI 1 v. 4	0.44 (-0.13, 1)	1.25 (0.71, 1.79)	3.16 (1.7, 4.62)	5.52 (4.11, 6.93)
ICI 1 v. 3	0.28 (-0.33, 0.89)	1.20 (0.65, 1.76)	1.37 (-0.19, 2.93)	4.26 (2.82, 5.71)
ICI 1 v. 2	0.29 (-0.15, 0.72)	0.53 (0.13, 0.92)	-0.81 (-1.94, 0.31)	2.35 (1.31, 3.39)

aRD: adjusted risk difference per 1000 live births

Risk differences adjusted for maternal age, relationship status, nativity, specific Hispanic origin, education, county level poverty, ethnic density, rurality and participation in a 287(g) agreement, year, and state level proportion of undocumented residents out of total foreign-born

Our models incorporate other stress-promoters and reducers in the lives of Hispanic women. We present the estimated effects of these factors on risk of VPTB for comparison, conditional on ICI and the other state, county, and individual covariates, without interaction by nativity (Table 4). Relationship status showed the strongest association with very preterm birth risk. Compared to unmarried women with no paternal information on the birth certificate, married women had a 40% lower odds of VPTB (aOR: 0.60 (0.59, 0.60)) and unmarried women with the baby's father's information had a 24% lower odds of VPTB (aOR: 0.76 (0.75, 0.77)). Ethnic density, a community level social support indicator, had no association with the odds of VPTB. Of hypothesized stress-promoting factors, only living in a county with the highest percentage of families below the federal poverty line (highest quartile compared to lowest quartile) increased odds of VPTB. Living in a county with a 287(g) program in place or a state in the highest quartile of proportion undocumented had no association with VPTB risk among Hispanic mothers. Consistent with previous research, US-born women had a higher odds of very preterm birth (aOR: 1.11 (1.09,1.12)).

Table 4. Estimated effects on VPTB of stress-promoting and stress-reducing factors, no interaction model, births to Hispanic women in the United States, 2005-2016, N=10,683,234

Variables	OR (95% CI)
ICI 1 v. 5	1.07 (1.04, 1.1)
Social Support Indicators	
Relationship Status	
Married	0.60 (0.59, 0.6)
Unmarried with father's information	0.76 (0.75, 0.77)
Unmarried without father's information (referent)	
Percent Hispanic (County) Quartile 4 v. 1	0.98 (0.95, 1.01)
Stress Indicators	
287g yes/no (County)	0.99 (0.97, 1.02)
Percent below FPL (County) (Highest Quartile v. Lowest Quartile)	1.08 (1.04, 1.11)
Est. proportion undocumented (of all foreign-born residents) (State) (Highest Quartile v. Lowest Quartile)	1.00 (0.96, 1.04)
US-born v. Foreign-born	1.11 (1.09, 1.12)

*Adjusted for maternal age, relationship status, nativity, specific Hispanic origin, county level poverty, ethnic density, rurality and participation in a 287(g) agreement, and state level proportion of undocumented residents out of total foreign-born

For a sensitivity analysis, we replicated our final model among US-born non-Hispanic white mothers and non-Hispanic black mothers. The results showed distinct associations from Hispanic women (Figure 4). Among US-born Hispanic women, living in a state in the lowest quintile of one-year lagged ICI (most restrictive) was associated with an increase of 1 additional very preterm birth per 1000 live births (aRD: 0.001 (0.0005, 0.001), (aOR: 1.07 (1.04, 1.10))). Among US-born non-Hispanic white mothers, living in a state in the lowest quintile of one-year lagged ICI resulted in an increase of 0.3 additional very preterm births per 1000 live births (aRD: 0.0003 (0.00003, 0.0005); aOR: 1.03 (1.01, 1.06)) compared to living in the highest quintile of one-year lagged ICI. When comparing risk across quintiles 1 and 3 or 1 and 2, there was no

association among US-born non-Hispanic white mothers. Among US-born non-Hispanic black mothers, there was no association between living in a state in the lowest quintile of one-year lagged ICI and VPTB or any other quintile comparison.

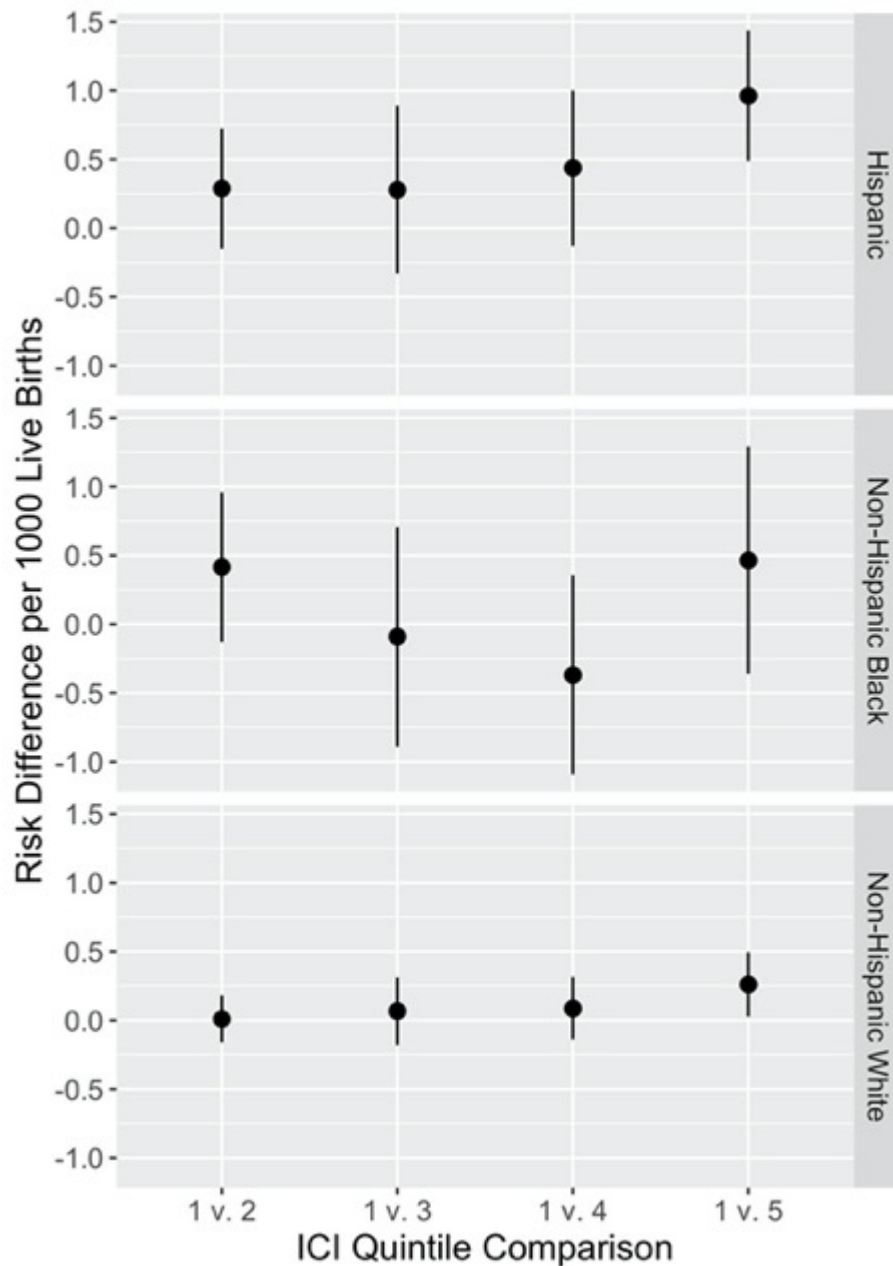


Figure 3. Risk differences* and 95% confidence intervals comparing very preterm birth risk women living in the first (most restrictive) quintile of Immigration Climate Index compared to women living in the second quintile (less restrictive), third quintile (neutral), fourth quintile (somewhat supportive) or fifth quintile (most supportive), 2005-2016 US live births, for US-born women only stratified by race/ethnicity.

*Risk differences adjusted for maternal age, parity, county level poverty, percent Hispanic and participation in a 287(g) agreement and state level proportion of undocumented residents out of total foreign-born. Models for Hispanic mothers also adjusted for specific maternal origin group.

We conducted three other sensitivity analyses. For both research question 1 (no stratification) and 2 (effect modification by maternal nativity), the estimated effects were consistent when using a one-year, two-year, or no-lag ICI. (Table 5). In a sensitivity analysis (not presented), including observations missing education and imputing maternal education at universally high or universally low values did not change our effect estimates. For analytic purposes, we imputed the median proportion undocumented in four states with missing values for estimated number of undocumented residents. To test this assumption, we reran the analyses with the 25th percentile and 75th percentile imputed instead. This did not change our results meaningfully (analysis not presented).

Table 5. Sensitivity analysis: Estimated effect on VPTB of living in a state with a more restrictive immigration climate compared to living in a state with a less restrictive immigration climate, as measured by the Immigration Climate Index (ICI), US-born and foreign-born Hispanic mothers in the United States, 2005-2016, N=10,683,234

	All Hispanic Mothers aOR* (95% CI)	US-born Hispanic Mothers aRD* per 1000 live births (95% CI)	Foreign-born Hispanic Mothers aRD* per 1000 live births (95% CI)
Varying the lag-time for ICI, Hispanic mothers			
2-year lagged ICI 1 v. 5	1.06 (1.03 - 1.09)	0.91 (0.43 - 1.4)	0.49 (0.01 - 0.96)
no-lag ICI 1 v. 5	1.07 (1.04 - 1.11)	0.96 (0.46 - 1.46)	0.82 (0.34 - 1.31)

*Adjusted for maternal age, relationship status, nativity, specific Hispanic origin, county level poverty, ethnic density, rurality and participation in a 287(g) agreement, and state level proportion of undocumented residents out of total foreign-born

Discussion

Living in a state with more restrictive immigration policy climate was associated with a slight increase in the odds of very preterm birth, after controlling for individual, county, and state level confounders. Some of the stressors and buffers included as confounders were independently associated with VPTB. Independent of these, state level lagged ICI predicted

additional risk of VPTB among Hispanic women. The immigration policy climate association was consistent across US-born and foreign-born Hispanic women, supporting the idea that restrictive immigration policies may affect not only immigrants but also those associated with or perceived as members of immigrant groups.⁵⁵

The slight increase in the odds of VPTB for mothers exposed prenatally to more restrictive immigration policy climates is consistent with the moderate increase in odds of a low birth weight birth following a major immigration raid, the slight decrease in birthweight following debates over the passage of Arizona's SB1070, and other research on the impact of place-based chronic stressors on health outcomes.^{8,59,73} The effect size of living in a state in the most restrictive quintile of Immigration Climate Index on VPTB was similar in magnitude to that of living in a county with the highest proportion of families living below the federal poverty level in our model. This supports the idea that contextual level stressors produce slight but meaningful increases in risk for Hispanic mothers. In addition to the serious health implications for babies born preterm, preterm birth is a significant financial burden to families and health systems, with VPTB representing the most expensive (and riskiest) births. Cost estimates vary, but the immediate medical cost of one very preterm birth is at least \$46,400 and likely much higher, not including long term health impacts.^{74,75} Thus, even slight increases in the incidence of VPTB have enormous financial impacts at a population level.

The observed association of immigration policy climate was similar across a two-year, one-year, and no-lag model. This may be due to autocorrelation of context over time or suggest that the observed association may be a mix of the effects of anticipation of the passage of policies and experience of the policies. Additionally, anti-immigrant sentiment alone may elevate risk of adverse birth outcomes. Krieger and colleagues found an effect of anti-immigrant

sentiment (operationalized as the time period before the 2016 United States presidential election) on birth outcomes among Latina women in New York City.⁷⁶ It may also reflect the fact that, while the ICI does change dramatically across years, only rarely do states switch between quintiles of ICI over a one year change. We replicated our analysis using preterm birth as the outcome and found similar results, supporting our overall inference.

To consider the possibility that states with more restrictive immigration climates also have other confounding differences in policy or socioeconomic context, we fit our final fully-specified model among US-born non-Hispanic white and non-Hispanic black mothers, under the assumption that while broader socioeconomic context might impact other race/ethnic groups, the effects of immigration climate would likely be more specific to Hispanics.^{44,77} We did not observe any association between ICI and birth outcomes among non-Hispanic black mothers, supporting our inference. Among US-born non-Hispanic white mothers, a similar, weaker association was observed without the dose response pattern seen among Hispanic mothers. The reason for this may be residual confounding due to some state-varying factor that is associated with VPTB risk among both Hispanic and non-Hispanic white mothers. However, it is unclear what state-varying factor would not also affect non-Hispanic black mothers. It may be that white women living in states in the fifth, most supportive quintile of ICI (e.g., California, New York) have access to greater resources or socioeconomic advantage compared to white women in the most restrictive quintile of ICI (e.g., Georgia, Arizona), accounting for the elevated risk in quintile 1 compared to quintile 5 observed among white women. Finally, the subset of counties with sufficient births (>99) to non-Hispanic black women may differ from the subset for non-Hispanic white women in a way that influenced the results.

Our analysis has several limitations. First, birth certificates do not capture data on a number of key covariates at the individual level, including immigration documentation status and length of time in the United States. Both of these variables would likely modify how Hispanic women would be impacted by immigration laws. Second, birth certificates have a number of known data issues, including a high percentage of missing data on certain variables and some misclassification. In our sample, some observations were missing information on nativity or gestational age and were excluded prior to geographic exclusions (156,334). This could bias the results if the women excluded were systematically different. For example, there would be bias if women who had a very preterm birth were less likely to complete these areas on the birth certificate and more likely to live in states with restrictive immigration policy climates.

Following those exclusions (nativity and gestational age), the only individual covariate missing in our sample was maternal education. Misclassification of gestational age and maternal ethnicity on the birth certificates was rare in available validation studies.^{78–80} Third, the measure of immigration policy climate does not consider policies in place before 2005, assigning all states an index of zero in 2004, though some states may have already had restrictive or supportive policies in place.⁷² As 2004 precedes the period of greatest activity for state legislative action on immigration, we do not expect this to have a significant effect on our analysis.^{32,34} However, we recognize that policies in place prior to 2005 may have contributed to immigration policy climate in ways we are unable to capture using the Immigration Climate Index (ICI). Finally, birth certificates represent a cross-sectional view of the population and we cannot know how similar the populations in each state are across years. Over the 12 years included in the analytic dataset, the populations of Hispanic mothers in each state may have shifted, challenging our ability to compare across years within states. While adjusting for

maternal nativity and specific Hispanic origin may capture some of this change, there are likely other changing factors that we were not able to capture which may influence risk. However, there is no evidence to suggest that changing demographics affect immigration climate beyond the proportion of undocumented residents, for which we have controlled.

Our analysis also offers several strengths. First, birth certificates are a census of births in the United States, capturing vulnerable populations of women who are unlikely to be included in population-based epidemiologic studies. Second, we use a comprehensive, time-varying measure of immigration policy climate that was developed by a legal expert and an economist. Though some subjective judgement is implied in the rating of policies for inclusion in the ICI, the subjectivity is likely not related to very preterm birth (or other health outcomes). This measure allowed us to consider the simultaneous, cumulative impact of multiple policies in place at one time. Though we are unable to tease out specific pathways through which individual laws influence health, our measure allows us to model laws as women would experience them – cumulatively. This adds to previous research which has considered only the associations with one policy or even the more comprehensive approach by Haztenbuehler et al. that considered 14 policies across four domains.⁵⁷ Though we chose to categorize the ICI, our estimates were robust to categorization of ICI and consistent across decile and quartile categorizations (analyses not presented). Finally, the measures of stress we considered, immigration policy climate, immigration enforcement intensity, and county level poverty, are exogenous factors that are potentially modifiable by policy action and not dependent on self-report or underlying individual factors.

The effect of immigration policy climate on the stress levels and health of Hispanic mothers is likely intertwined with the effect of anti-immigrant sentiment and immigration enforcement. Anti-immigrant sentiment, immigration enforcement, and immigration policy are themselves intertwined.⁸¹ Further study is needed to disentangle these factors and to identify potentially protective interventions or strategies to prevent adverse birth outcomes among affected women. Immigration climate is ecologic in nature. However, the experience of stress from immigration policy climate is likely heterogeneous with some women affected more than others due to individual, familial, or geographic characteristics. In our analysis, we did not find meaningful additive effect heterogeneity across maternal nativity groups (US v. foreign-born) and were unable to consider legal status as a potential effect modifier. Future researchers should consider innovative ways to explore the pathways through which immigration policy climate may be associated with stress and health outcomes among Hispanic women. For example, women with partners who are also foreign-born or otherwise vulnerable to the effects of immigration enforcement may experience more stress. Finally, two elements of Ecosocial theory which we were unable to incorporate in our analysis are the ideas of accountability and agency. While the Immigration Climate Index reflects the fact that multiple policies are experienced at once, it divorces the possible effects of the policies from the groups and individuals responsible for passing them and capable of changing them. Future researchers might consider innovative ways to assess whether specific policy actions increase experienced stress, while accounting for overall immigration climate. More information on Hispanic women's lived experiences of stress from immigration policies, enforcement, and anti-immigrant sentiment will elucidate the role of immigration policies in increasing perinatal risk among US-born and foreign-born Hispanic women.

Aim 2. Spatial Variation in Very Preterm Birth to Hispanic Women Across the United States: The Role of Intensified Immigration Enforcement

Background

Political debate in the United States around immigration is reflected in a maze of state and local policies and practices related to immigrants.⁸² Immigration policies and enforcement practices may have extensive health effects, though current research is limited.^{34,83} Immigration policies, interwoven in the social context, act to reinforce existing sentiment towards immigrants and may have wide-reaching impact on the lives of immigrants, their families, and communities. Variation in how, when, and where policies were implemented in the United States over time allows for studying the effect of specific immigration policies or enforcement practices. The “health in all policies” approach asks decision makers to consider the (potentially unintended) health effects of policies in all areas.⁸⁴ Considering the possible impact of specific local immigration policies and practices on health can inform local decision making and improve population health.

Intensified immigration enforcement has been linked to increased risk of low birthweight and preterm birth, food insecurity, mental distress, and poor self-rated health for Hispanic immigrants and, in some cases, all Hispanic individuals.^{69,73,85–87} Intensified immigration enforcement activities include increased numbers of detentions and deportations, workplace or home raids, and traffic stops. These activities result in increased risk of deportation for undocumented and documented non-citizens.⁸⁸ Enforcement activities may impact the health of immigrants, their families and entire communities through multiple pathways, including reduced access to health care or material resources, increased mistrust of public institutions, or through increased stress.^{34,83} Some have conceptualized restrictive immigration policies and enforcement

practices as a form of structural racism, impacting health for not only immigrants but also those who identify with or are perceived as members of immigrant groups. For example, restrictive immigration policies may impact the health of both US-born and foreign-born Hispanic individuals, through chronic stress resulting from structural racism.^{34,83,89}

We focus on one local-level policy, the partnership of local police and Immigration and Customs Enforcement (ICE) to detain undocumented immigrants. Since 2005, the number of deportations per year has steadily increased, with interior removals (non-border crossing) peaking in 2009.⁸⁸ In addition, the patterning of deportations has changed. Since 1996, different programs have allowed for partnerships between local police and ICE to carry out enforcement activities.^{6,7,82} One such program, the 287(g) program, begun in 1996, allows individual police departments to apply for and receive funding and training to conduct immigration enforcement activities.^{70,90} While the stated goal of the program was to leverage police resources to target undocumented immigrants who had committed crimes, many police departments used the program to target all potentially undocumented immigrants.⁹¹⁻⁹⁴ Overall, the proportion of individuals removed from the interior with no criminal conviction or only a traffic-related violation increased between 2003-2015, particularly among women and Latinos.⁸⁸

In 2009, the Government Accountability Office report to Congress on the 287(g) program described a lack of oversight, disproportionate number of arrests for traffic-related violations, and use of racial profiling language in its implementation in 29 reviewed districts.⁹⁴ Police departments set up traffic stops in primarily Latino neighborhoods, conducted workplace raids, and, in many cases, used the law to harass entire communities.^{91,92} Local evidence shows that, following implementation of 287(g) programs, police officers targeted individuals who ‘looked like’ possible undocumented immigrants – namely, Hispanic individuals. In an analysis of police

driver's license-related arrest narratives before and following the implementation of 287(g) in Davidson County, Tennessee, Donato and Rodriguez found a marked increase in the use of terms like "foreignness" to describe the reasons for a traffic stop following program implementation.⁹² In a qualitative study in North Carolina, Hispanic participants described increased worry and mistrust of government following implementation of a 287(g) program.⁸⁷ Thus, the 287(g) program may act to increase experienced stress for Hispanic communities, potentially resulting in poor health outcomes.

Increased chronic stress prior to and during pregnancy, at individual, interpersonal, and environmental levels is associated with increased risk of preterm birth.⁹⁵ Though biological mechanisms have not been completely described, this risk likely stems from weathering of physiologic systems, changes in neuroendocrine or immune system responses, or maladaptive behaviors (e.g., smoking) in response to increased chronic stress.⁹⁶ Previous research has linked environmental level stressors (e.g., segregation or debates over an omnibus immigration law) to increased risk of adverse birth outcomes (preterm birth, low birth weight).^{59,97} In this study, we focus on very preterm birth (VPTB, defined as live birth <32 weeks completed gestation), as a homogenous, high risk subset of preterm births.

The 287(g) program can be considered as a spatially varying, environmental stressor. Local jurisdictions choose to participate in 287(g) and administer much of the program, resulting in variations in where, when, and how adoption of 287(g) programs take place. Generally, immigration enforcement intensity varies spatially, due to local and state policy context and differences in policy implementation.^{6,90} The effects of enforcement may not be restricted to participating jurisdictions. For example, members of nearby communities may travel through, and thereby be affected by 287(g) programs without living within that jurisdiction. This produces

spatial spillover because the impact of the policy is not geographically isolated. The health effects of immigration enforcement may also vary by characteristics of place. For instance, geographically diverse social and political climates including varying levels of access to community, health, economic, and political resources, may either buffer or exacerbate the effects of local 287(g) participation. Because of the potential for spatial spillover of the effects of 287(g) participation and the heterogeneity in other place-based factors, we consider the question of the effect of 287(g) on VPTB in an explicitly spatial framework. This allows us to explore both residual autocorrelation that could bias estimates and whether the effect of 287(g) participation may impact health in different ways in different places, depending on geographic characteristics.

The goal of this paper is to estimate the effect of adoption of a 287(g) immigration enforcement agreement on county-level VPTB rates among US-born and foreign-born Hispanic women.

Research questions:

- 1) What is the overall effect of local adoption of a 287(g) immigration enforcement agreement on county-level VPTB rates among Hispanic women?
- 2) Does the effect of 287(g) participation on VPTB rates vary by maternal nativity (US-born v. foreign-born)?
- 3) Does the effect of 287(g) participation on VPTB rates vary spatially due to unmeasured factors?

Methods

Population

We used data from the 2005-2016 US live birth file, excluding records missing gestational age (120,111), missing ethnicity (358,584), to non-Hispanic women (36,870,436), non-singleton (274,361), or missing (36,223) or invalid (81,800) maternal place of residence at delivery. We created a dataset aggregated at the level of county-year and included all county-

year combinations with non-zero numbers of births to Hispanic women (11,210,097 births). We used information on maternal residence to link birth certificate data to five-year estimates from the American Community Survey (ACS) on county-level percent Hispanic residents, percent of individuals living below the federal poverty level, and percent foreign-born.⁹⁸ We also used maternal residence to link birth data to information from the Department of Homeland Security on whether any police jurisdiction within the county had a 287(g) agreement with Immigrations Customs Enforcement in place for that year.^{99,100} We did not consider statewide 287(g) agreements (e.g., with the Massachusetts State Department of Corrections).

Key constructs and measures

We summed births at the county level for each year to create county-year-specific counts of births by gestational age. We estimated VPTB rates as the proportion of VPTBs among live births. Though 287(g) agreements occur at a jurisdiction level, their effects may occur at multiple levels including community (through increased worry or fear), interpersonal (through the detention or deportation of family members or neighbors), and individual (through increased police contact). We considered community and individual level confounders and potential modifiers of the effect of 287(g) on VPTB risk. At an individual level, we controlled for maternal nativity (US-born v. foreign-born) and specific Hispanic background (Mexican, Puerto Rican, Cuban, Central/South American, or other Hispanic). At a county level, we controlled for percent Hispanic (as a proxy for ethnic density), percent of residents who were foreign-born, and percent of families below the federal poverty level. We control for year to account for secular trends. Our exposure was dichotomous, whether any jurisdiction in the county had a 287(g) agreement in place for that year.

Analysis

To address all research questions (above), we estimated multilevel spatial Bayesian models with conditionally autoregressive priors described by Besag, York and Mollié (BYM).¹⁰¹ The BYM models assume that county-specific rates of VPTB may vary from one another, and that those differences can be described by estimating random effects that explicitly account for spatial relatedness (e.g. which counties are adjacent and which are distant), as well as random effects that are spatially-independent. We used integrated nested Laplace approximation (INLA) for estimating posterior distributions. Bayesian analysis is well-suited for the questions at hand because it accommodates investigation of complex processes such as spatial spillover and heterogeneity, while producing reliable estimates even in the presence of sparse data by borrowing statistical information through spatial and non-spatial priors.¹⁰² We present median incidence density ratios (IDRs) as effect estimates and exceedance probabilities bounding 60% and 90% credible intervals, as, with Bayesian CAR models, a 95% credible interval may result in a high false positive rate.¹⁰³

To first describe the baseline variation in VPTB, we fit an unconditional model with only county random effects (model 0), then a model with all predictors except 287(g) (model 1). We then fit a series of models with different specifications for the effects of the county random effect and 287(g). Briefly, we considered effects for each accounting for spatial structure (assuming a BYM prior specification) and assuming no spatial structure (with a spatially independent prior). We conducted all analyses in R version 3.5.1 (R Core Team, Vienna, Austria). A full description of modeling strategy, exploratory analysis, and model specification is available in the supplement.

For research question 1, we sought to determine whether there was an overall (global) effect of 287(g) adoption on county VPTB rates among Hispanic mothers, conditional on

individual and area-level potential confounders. We estimated negative binomial models considering the effect of 287(g) adoption on county VPTB rates, conditional on county-level percent Hispanic, poverty, specific Hispanic background, maternal nativity, percent foreign-born, and year. We accounted for potential spatial structure by including a spatial random effect for county (model 2). For research question 2, we extended this model to include an interaction term between maternal nativity and 287(g) adoption (model 3).

While research question 2 concerns whether or not the effect of 287(g) on VPTB rates differs for US- versus foreign-born Hispanic women, it is possible that the effect varies for other reasons. For instance, 287(g) adoption may have a stronger impact in some counties due to variation in policy implementation or other unmeasured county factors. Most regression models assume “stationarity” or that the effect of an exposure is the same in across all units (places). In research question 3, we explored possible non-stationarity by including a spatial random effect for 287(g) adoption in our model (models 4-6) and by considering effect modification by county-level ethnic density (model 6). To describe the pattern of variation, we mapped the combined global effect of 287(g) with each county’s additional spatially-varying effect.

Results

County and population-level characteristics

The final analytic dataset contained 11,210,097 births to Hispanic mothers in 3,162 counties in 50 states (Table 1). From 2005-2016, 57 counties adopted a 287(g) agreement for at least one year. There were more counties who adopted 287(g) agreements in the Southeast and East compared to the West, and almost no counties adopting 287(g) agreements in the Northwest or Midwest (Supplement Figure 1). Overall, 1.5% of births were very preterm and 10.6% were preterm (< 37 completed weeks’ gestation) (Table 1); this did not differ among counties who did and did not adopt 287(g). Generally, maternal characteristics (age, parity, relationship status,

nativity, and education) were similar in counties that ever adopted and never adopted 287(g) agreements. However, in counties that never adopted 287(g), mothers were more likely to be of Puerto Rican (8.2% v. 2.6%) or Cuban origin (2.2% v. 0.9%). Counties that never, compared to ever, adopted 287(g) were more likely to be classified as rural (9.8% v. 0.4%) and had, on average, higher mean percent Hispanic (mean: 22.1(SD: 31.5) v. 16.0 (SD:35.5)) and higher mean percent foreign-born (mean: 12.8 (SD: 21.3) v. 7.0 (SD: 23.0)).

Table 1. Descriptive characteristics by counties that ever or never adopted 287(g), 2005-2016, for 11,210,097 births to Hispanic women in the United States

	287(g) ever adopters n= 2,557,973 births n= 57 counties	287(g) never adopters n= 8,652,124 births n= 3,105 counties	Total n= 11,210,097 births n= 3,162 counties
Individual Characteristics	% (n) / mean (SD)	% (n) / mean (SD)	% (n) / mean (SD)
Very preterm birth (< 32 weeks)	1.47 (37,553)	1.52 (131,189)	1.51 (168,742)
Preterm birth (<37 weeks)	10.5 (269,726)	10.6 (918,726)	10.6 (1,188,452)
Maternal age	26.8 (6.2)	26.8 (6.2)	26.8 (6.2)
Primiparous	30.1 (769,873)	30.3 (2,617,335)	30.2 (3,387,208)
Relationship Status			
Married	48.4 (1,236,773)	47.6 (4,114,552)	47.7 (5,351,325)
Unmarried, father's information on birth certificate	40.4 (1,034,478)	41 (3,548,809)	40.9 (4,583,287)
Unmarried, no father's information on birth certificate	11.2 (286,722)	11.4 (988,763)	11.4 (1,275,485)
Hispanic Origin Group			
Mexican	73.7 (1,884,878)	61.1 (5,289,539)	64.0 (7,174,417)
Puerto Rican	2.6 (67,177)	8.2 (706,244)	6.9 (773,421)
Cuban	0.9 (21,854)	2.2 (187,589)	1.9 (209,443)
Other Central/South American	13.6 (347,795)	15.5 (1,344,220)	15.1 (1,692,015)
Other Hispanic	9.2 (236,269)	13 (1,124,532)	12.1 (1,360,801)
Foreign-born	57.6 (1,473,174)	55 (4,759,502)	55.6 (6,232,676)
Maternal Education ^a			
8th grade or less	14.5 (330,088)	14.9 (1,208,182)	14.8 (1,538,270)
Some high school	27.1 (618,216)	24.5 (1,987,601)	25 (2,605,817)
High school grad	30.9 (705,741)	29.5 (2,396,440)	29.8 (3,102,181)
Some college/associates	18.9 (431,893)	21 (1,709,823)	20.6 (2,141,716)
College or more	8.6 (197,069)	10.1 (822,723)	9.8 (1,019,792)
Place-based characteristics			
County classified as rural	0.4 (10,693)	9.8 (847,629)	7.7 (858,322)
Percent of families living below FPL	15.5 (4.3)	16.5 (6.4)	16.3 (6.0)
Percent Hispanic	35.5 (16.0)	31.5 (22.1)	32.4 (21.0)
Percent Foreign-born	23.0 (7.0)	21.3 (12.8)	21.7 (11.7)

^aNote: 7.2% (802,321) missing

Abbreviations: FPL= federal poverty level; 287(g)= Formal agreements between police departments and Immigration Customs Enforcement under section 287(g) of the Illegal Immigration Reform and Immigrant Responsibility Act of 1996

In order to describe baseline spatial variation in county VPTB rates, irrespective of 287(g) adoption, we mapped adjusted VPTB median standardized morbidity ratios (SMRs) and exceedance probabilities, conditional on maternal nativity, Hispanic background, year, county-level percent Hispanic, percent below federal poverty level, and percent foreign-born. The SMR (Figure 1, left) is interpreted as the relative deviation of each county from the national average VPTB rate for Hispanic women, conditional on covariates. For example, an SMR of 1.1 means that the county VPTB rate is 10% higher than the national average. The exceedance probability (Figure 1, right), is the posterior probability that the SMR is different from the null value of 1. We present exceedance probabilities bounding 90% (limits: 0.05, 0.95) and 60% (limits: 0.2, 0.8) credible intervals around the SMRs. For example, for a county with an exceedance probability of 0.1, only 10% of all estimated SMRs exceeded 1. Counties in the east generally had higher standardized morbidity ratios, with the lowest SMRs clustered along the California coast (Figure 1).

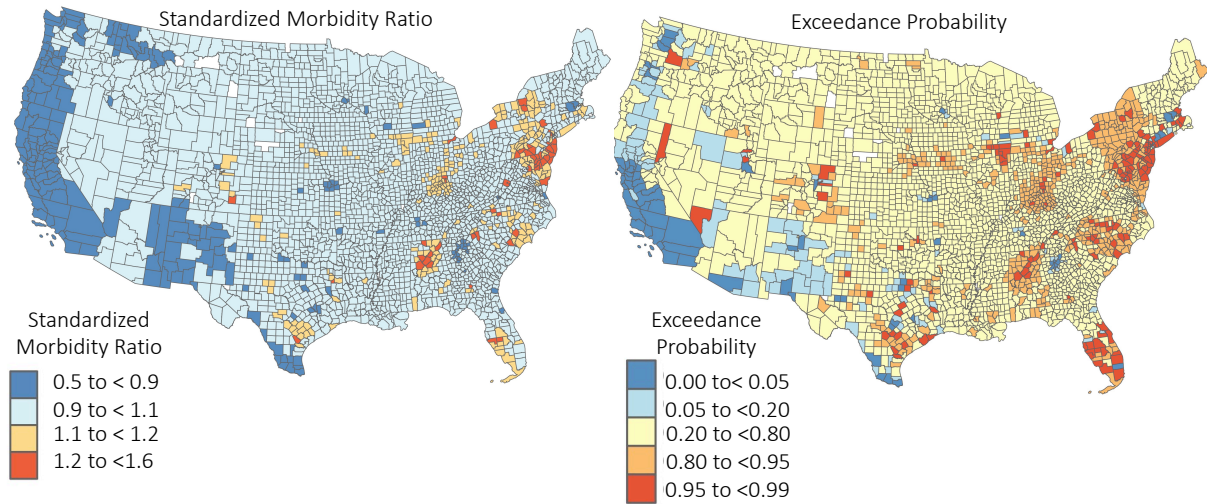


Figure 1. County Variation in Very Preterm Birth (< 32 weeks) to Hispanic Mothers, adjusting for nativity, year, percent poverty, Hispanic origin group, percent Hispanic, percent foreign born, 2005-2016, Model 1 Results, county Standardized Morbidity Ratios and Exceedance probabilities

To answer the first research question regarding the overall effect of county adoption of 287(g), we estimated the association of 287(g) adoption with county VPTB rates accounting for spatial structure by including a county random intercept. The global effect of 287(g) adoption on county VPTB rates was null (incidence density ratio (IDR): 1.02 (0.99, 1.045) (model 2, Table 2). To answer the second research question regarding differences in effect of 287(g) based on individual women’s nativity, we included an interaction term between 287(g) and nativity. There appeared to be slight heterogeneity by maternal nativity (model 3, Table 2). The IDR for US-born women was 0.98 (0.95, 1.02)), whereas the IDR for foreign-born women was 1.04 (1.01, 1.12)).

Table 2. Spatial and aspatial Bayesian models, model fit statistics and estimated median incidence density ratios for association of 287(g) adoption with very preterm birth, 11,210,097 births to Hispanic women in the United States, 2005-2016

Model (M)	DIC	IDR (95% Credible Interval)
-----------	-----	-----------------------------

	Fixed Effects	Aspatial Random Effects	Spatial random Effects		US-born	Foreign-born
0	None	Intercept	Intercept	171652		
1	Year, nativity, percent below FPL, specific Hispanic origin, percent Hispanic, percent foreign-born Research Question 1	Intercept,	Intercept	171653		
2	M 1 + 287(g) Research Question 2	Intercept	None	171645	1.02 (0.99, 1.05)	
3	M 2 + 287(g)*nativity Research Question 3	Intercept	None	171645	0.99 (0.95, 1.02)	1.04 (1.01, 1.12)
4	M 1 + 287(g)	Intercept, 287(g) slope	Intercept, 287(g) slope	171646	1.02 (0.98, 1.06)	
5	M 4 + 287(g)*nativity	Intercept, 287(g) slope	Intercept, 287(g) slope	171645	0.99 (0.95, 1.03)	1.04 (0.96, 1.13)
6	M 5 + 287(g)*percent Hispanic	Intercept, 287(g) slope	Intercept, 287(g) slope	171643	0.99 (0.87, 1.12) ^a	1.04 (0.88, 1.23) ^a

Abbreviations: DIC: Deviance Information Criterion; IDR: Incidence Density Ratio, FPL: Federal Poverty Level

^aAt 25th percentile of percent Hispanic

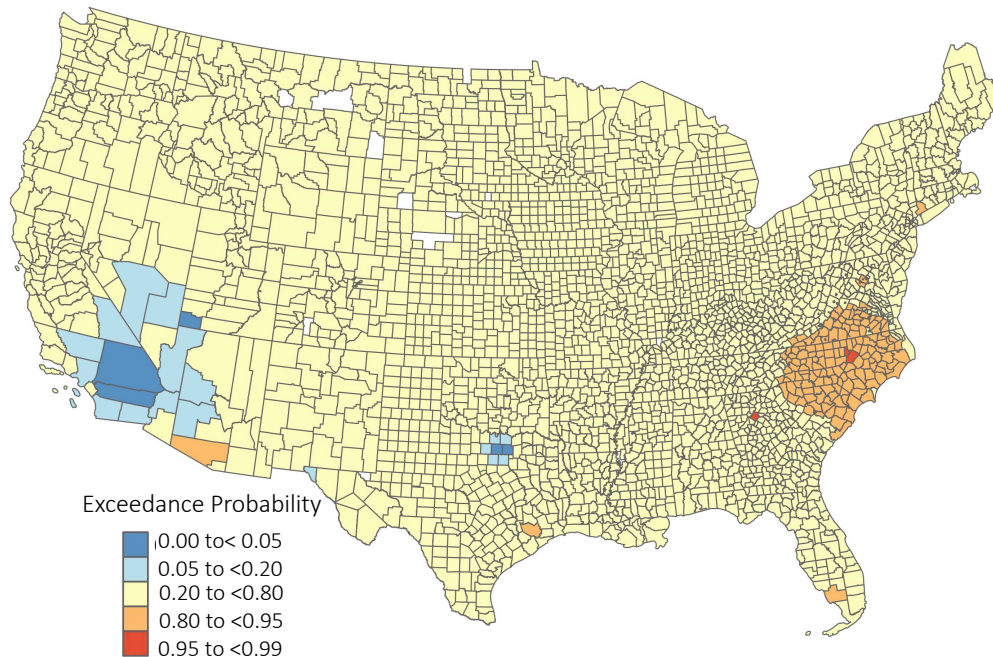


Figure 2. County specific effects (probability of local effect estimate exceeding 1) of county adopting a 287(g) agreement on Very Preterm Birth rates, foreign-born Hispanic women, 2005-2016, Model 5 results

Finally, we considered a spatial random slope for 287(g) adoption (representing unmeasured, county-level characteristics that may include program implementation or underlying climate) and an interaction term for percent of residents who were Hispanic (Table 2; models 4-6). Including the spatial random slope for 287(g) adoption and the interaction term for percent Hispanic improved model fit (DIC, model 6, Table 2). We mapped the exceedance probabilities for the spatially-varying effect estimates from model 5 for 287(g) (Figure 2). For three counties in two states (Georgia (1), North Carolina (2)), the median IDR was above 1 and the 90% credible interval did not contain 1. There were an additional 161 counties for which the estimated IDR was above 1 and the 60% credible did not contain 1 (in Arizona (1), Connecticut (1), Florida (1), North Carolina (82), South Carolina (28), Tennessee (2), Texas (1), Virginia (46)). There was no difference in the effect of 287(g) adoption on county VPTB rates across counties with differing percent of Hispanic residents (estimated effect of 287(g) adoption on VPTB rates for foreign-born women living in counties with 25% Hispanic residents: 1.04 (0.88, 1.23); living in counties with 75% Hispanic residents: 1.05 (0.80, 1.39), model 6, Table 2).

Discussion

A small but growing body of work links immigration policy and enforcement climate to health.^{34,83} However, the field is limited by measurement challenges. Further, many papers have focused on only one state or local area. Simultaneously, immigration enforcement varies across the United States and has changed over the past two decades. Understanding the impact of intensified immigration enforcement on infant health will allow public health practitioners to better serve families and communities as well as advocate for humane policies. The 287(g) program is an example of a locally varying, locally implemented policy that results in increased immigration enforcement activity and, in some cases, harassment of immigrant communities.

Contrary to our hypotheses, we did not observe a global effect of 287(g) adoption on county VPTB rates. However, in some counties, primarily in the Southeast, 287(g) adoption was associated with subsequent increased county VPTB rates among foreign-born Hispanic women (Figure 2). This is distinct from previous research on the effect of 287(g) adoption.^{23,69,86} Previous researchers have observed effects of 287(g) adoption among foreign-born and US-born Hispanics on risk of food insecurity and foreclosures.^{23,69} This may reflect the fact that 287(g) adoption may impact access to material resources among US-born families (increasing risk of food insecurity or foreclosure) but not create stress, elevating risk of VPTB. It may also be that the effects of changes in material resources are immediate whereas the impact of stress might be lagged. Finally, it could be that there is not enough variation in VPTB among Hispanic women to observe an effect (see Figure 1), suggesting that other perinatal outcomes should be investigated as well.

287(g) adoption is at best an imperfect proxy for increased immigration enforcement intensity and interpersonal discrimination, both of which could occur in the absence of the program through variations in state and local law as well as police culture. It is an even worse measure of broader anti-immigrant sentiment, likely having very low specificity, as many counties with high anti-immigrant sentiment may never adopt 287(g) either through lack of opportunity or through applying and being rejected from the program. However, it is a testable policy with local and temporal variation that has been continued and expanded under the Trump administration and through state mandates.⁸² This analysis suggests that, if 287(g) increases stress and stress-related health outcomes, implementation is either varied across localities in unmeasured ways, insufficient to increase risk of VPTB, or may affect long term health rather than immediate risk of VPTB.

This analysis has at least three limitations. First, it may not be appropriate to compare counties who implemented 287(g) to all other counties, as implementing counties may have underlying anti-immigrant sentiment that may increase risk of VPTB and their likelihood of implementing the program. Previous authors have used jurisdictions that applied for and were rejected from the 287(g) program as a comparison group instead of all counties without the program.^{23,86} However, we chose not to do this as it would have limited the temporal and geographic scope of our analysis. Second, we did not control for other policies that may have affected immigration enforcement at the county, state, or federal level. However, in a sensitivity analysis (see supplement) we included an index of subfederal immigration-related policies as a control variable and estimates did not change. Finally, we do not have data on all potential confounders or effect modifiers at the individual and county levels, such as undocumented population size at the county level. Inclusion of this variable would have limited our analysis to large counties (with available estimates of the undocumented population), so we chose not to control for it.

This analysis offers several strengths. First, vital records data include virtually all births in the United States, including those of vulnerable women who are rarely captured in population-based surveys. Second, adoption of a Bayesian modeling strategy provided a robust statistical framework for modeling complex spatial variation and incorporation of information from even sparsely populated counties across the United States. Finally, VPTB has an established relationship with cumulative stress. Though our data did not allow us to measure individual stress, this outcome helps us focus on proximal stress effects of the policy beyond more distal effects on material resources or access to health care.

Researchers should continue to explore and test the effects of immigration policies, carefully considering timing, mechanism, and population at risk. Though we did not observe clear associations between adoption of a 287(g) agreement and county VPTB rates, this does not indicate that intensified immigration enforcement does not impact health. Researchers should consider testing the effects of intensified enforcement on outcomes known to be sensitive to short term changes in stress (e.g., blood pressure) or to changes in access to health care or material resources (e.g., flu vaccination). Additionally, while 287(g) represents a testable, locally implemented policy, it may not capture immigration enforcement context fully. Researchers should consider alternate ways to study enforcement intensity (e.g., detention rates¹⁵), potentially comparing different definitions of climate. Finally, qualitative work on the specific elements of immigration enforcement that increase worry, stress, and perceived vulnerability may help elucidate why the program is harmful in some places and not others.

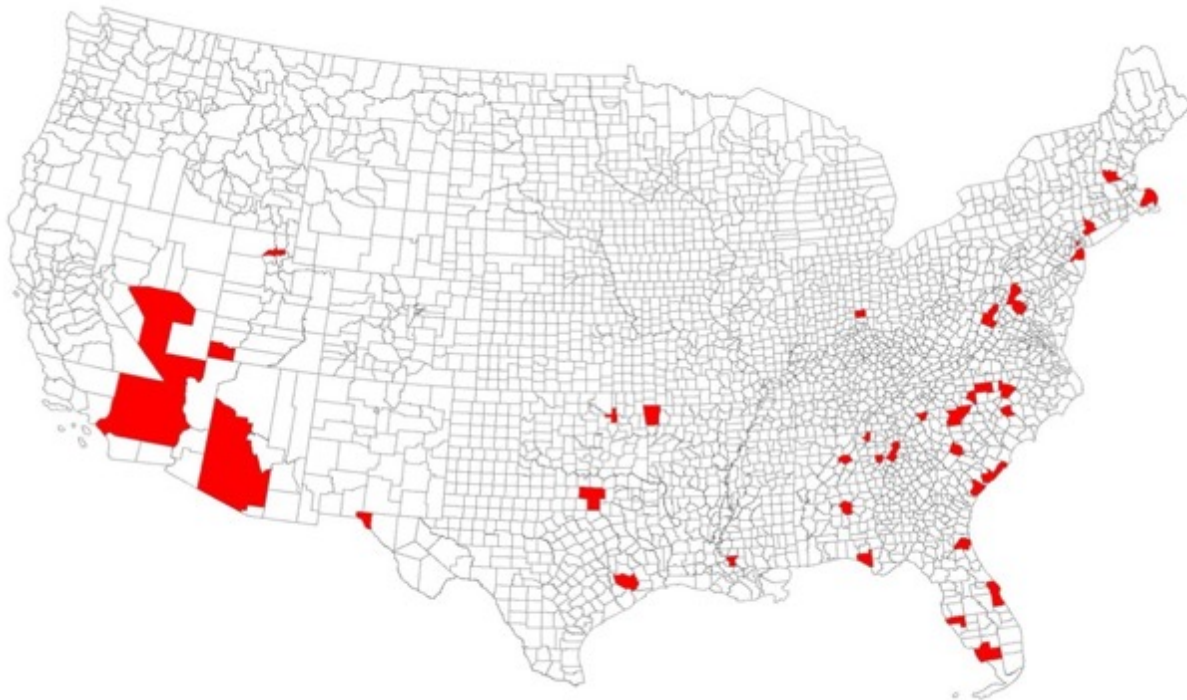
This paper extends previous work on the effect of the 287(g) program by focusing on one severe, stress-sensitive outcome. We considered that the effects of 287(g) adoption on county VPTB rates may vary by individual characteristics (maternal nativity), county characteristics (percent Hispanic), or unmeasured aspects of place. The estimated effect on VPTB rates of 287(g) implementation was limited to foreign-born women and only in a few counties, suggesting that future work might focus on variation in policy implementation or other place-based factors that might promote perinatal health in Hispanic communities.

Supplement

Distribution of 287(g)

We considered all 287(g) agreements at county or municipal level, excluding statewide agreements. We excluded statewide agreements as those are not decided at the local level and likely do not proxy local level enforcement intensity. To show the distribution of 287(g) agreement adoption over the study period, we mapped counties that adopted the agreements (Supplement Figure 1).

Supplement Figure 1. Spatial distribution of local (county or municipal) 287(g) agreements, 2005-2016, statewide agreements excluded



INLA

In order to conduct the main analyses, we used Integrated Nested Laplace Approximation techniques (INLA) to estimate posterior Bayesian parameter distributions. INLA replaces the more familiar Markov-chain Monte Carlo (MCMC) estimation techniques for estimating posterior distributions. Briefly, instead of producing an entire distribution through many

iterations, INLA approximates posteriors, assuming that the conditional distributions are approximately latent Gaussian distributions.¹⁰⁴ In comparison studies, estimates produced by INLA have been shown to be comparable to those produced by MCMC and penalized quasi-likelihood (Empirical Bayesian), although, crucially, much less computationally intensive.^{105,106}

Models

Using Bayesian spatial conditional autoregressive priors, we fit a series of negative binomial models considering very preterm birth counts at the county-year level. In order to explore potential spatial structure in very preterm birth rates, we ranked and mapped county spatial random effects according to exceedance probabilities to identify areas with unusually high and low rates of VPTB. We then repeated the process adding individual predictors, county level poverty, ethnic density and percent foreign-born, then adoption of a 287(g) agreement. We compared across the different models to see how the inclusion of covariates influenced potential spatial structure.

Given the improved fit of the spatially structured models, we included a county random intercept with a spatially structured and spatially unstructured component for research questions one and two. Our underlying model for research question one was,

$$VPTB_{ijk} = \beta_0 + \beta_1 287g_{ij} + \beta_2 nativity_{ijk} + \beta_3 percent_FPL_{ij} + \beta_4 year_j + \beta_5 percent_foreign_{ij} + \beta_6 percent_hispanic_{ij} + u_i + v_i + \ln(\text{total births in county } i, \text{ year } j)$$

For this model, the primary parameter of interest was β_1 , the global effect of 287(g) on very preterm birth. Our data was structured, with groups of women (k—foreign-born and US-born women) nested with years (j), nested within counties (i). We accounted for clustering and potential spatial structure at the county level by including a spatially structured random intercept at the county level (u_i) and a spatially unstructured random intercept at the county level (v_i). We consider the other parameters in the model to be confounders and not of primary interest. For our

third research question, we considered whether the effect of 287(g) may vary by maternal nativity by included an interaction term between maternal nativity and 287(g).

For our third research question (Does the effect of adoption of 287(g) immigration enforcement agreements within counties vary spatially? If so, how?), we evaluated whether there was spatial heterogeneity in the effect of 287(g) and/or heterogeneity by percent Hispanic (at the county level). To answer this question, we fit a series of models including spatial random slopes for 287(g). We allowed for interaction by individual maternal nativity in these models.

$$\begin{aligned}
 VPTB_{ijk} = & \beta_0 + \beta_1 287g_{ij} + \beta_2 nativity_{ijk} + \beta_3 percent_FPL_{ij} + \beta_4 year \\
 & + \beta_5 percent_foreign_{ij} + \beta_6 percent_hispanic_{ij} \\
 & + \beta_7 nativity_{ijk} * 287g_{ij} + (u_{1i} + v_{1i})287g_{ij} + u_{0i} + v_{0i} \\
 & + \ln(\text{total births in county } i, \text{ year } j)
 \end{aligned}$$

For these models, our parameter of interest was a composite, the total of effect of 287(g) for each county, stratified by the group of interest. For example, for foreign born women residing in county i , the total estimated median effect of 287(g) would be $\beta_1 + \beta_7 + u_{1i} + v_{1i}$. To determine whether including the spatial structure and interaction effects was appropriate, we compared model fit (DIC) across models including the random slope and/or interaction effects and those without. To determine qualitatively how the effect varied, we mapped the estimated global and spatially varying effects of 287(g).

Sensitivity analyses

We conducted a number of sensitivity analyses to understand the impact of our modeling choices on the final models, including varying the model family, neighbor matrix definitions, and prior definitions. First, we compared across a Poisson model, zero-inflated Poisson model and negative binomial model specification. The negative binomial model fit best. Second, we compared different definitions of spatial weights matrices which represent which counties are spatially proximate or not. K-nearest neighbors (3, 4, 5), queen contiguity and sphere of influence distance based triangle neighbors were considered. The sphere of influence neighbors

and 5 k-nearest neighbors produced the best fitting models, and we chose the sphere of influence neighbor matrix as producing neighbors that made the most sense (e.g., counties in Alaska were only neighbors with other counties in Alaska). In order to understand the impact of the prior specification on the hyperparameters (the precision of the aspatial and spatially structured county random effects), we conducted a sensitivity analysis, varying the prior specifications from non-informative (defaults in R-INLA) to informative $\log\Gamma(1, 0.01)$). While this did result in some variation in the variance and precision for the hyperparameters, the change in the variance or relative proportion of variance due to aspatial or spatial components was negligible. We are thus confident in our choice of weakly informative priors on both hyperparameters ($\log\Gamma(1, 0.001)$).

In addition, we conducted a sensitivity analysis to determine the impact of including a measure of statewide immigration climate as a control variable. We used the Immigration Climate Index, a summary of all subfederal immigration related laws as developed by Pham and Pham,⁴ categorized into quintiles. This had no impact on the modeling results (overall IDR: 1.01 (0.98, 1.04)) and we excluded it due to facilitate fitting the more complex models.

Aim 3. Perceptions of Stress and Resilience among Latina women enrolled in Prenatal Care in Metro Atlanta through an Ecosocial Lens

Background

A Pubmed search for ‘psychosocial stress’ and pregnancy returns over 1300 academic articles; a Google search, over nine million hits. Indeed, the idea that stress is a risk factor for adverse pregnancy and birth outcomes is accepted by lay people, academics, and expert groups alike.^{107–109} A growing body of research connects chronic and acute stress across the life course to increased risk of adverse pregnancy and birth outcomes.^{58,110} However, despite general acceptance of the role of stress in increasing risk of adverse perinatal outcomes, we lack clarity on the mechanisms through which stress increases reproductive risk.¹¹¹ For one, we lack information on why reactions to external stressors vary among women and how the range of responses may correspond to health risks.

A stressor is a stimulus that provokes a stress response, for example, the death of a loved one, a hassle in the workplace, or neighborhood disorder. For some, a given stimulus will act as a stressor and cause a psychologic or physiologic stress response; for others, it will not.¹¹² The impact of an external stressor on an individual’s health may vary by individual characteristics (e.g., physiological vulnerability), behaviors (coping mechanisms), timing (whether the stressor occurs during a critical window or not), external factors (e.g., support networks), or an individual’s perceived capacity for managing the stressor (positive outcome expectancy).^{113,114}

Factors that increase the likelihood of a positive outcome in the presence of a stressor might be considered to promote resilience. Luthar (2000) defined resilience as ‘a dynamic process encompassing positive adaptation within the context of significant adversity.’¹¹⁵ According to this definition, resilience is not a fixed personality trait and, thus, may vary from situation to situation. Also, resilience can only occur in the presence of adversity. Resilience

need not imply the absence of any stress reaction but may mean a brief stress reaction followed by a trajectory of healthy functioning.¹¹⁶ For example, someone who is exposed to trauma, reacts, yet shows no ongoing adverse mental health consequences demonstrates resilience.

In the United States, exposure to both individual and macro-level stressors is more common among racial/ethnic minorities compared to non-Hispanic whites.^{117,118} Thus, research on the relationship between stress and adverse health outcomes is an important step towards understanding and potentially eliminating health disparities. However, equally important is research elucidating how individuals and communities both survive and thrive despite challenges. Recent work in health geography considers ‘hopeful adaptation’ or the positive strategies individuals employ when faced with adversity.¹¹⁹

There is a history of this type of work among Latina women, usually framed as seeking to find cultural, social, or other explanations for the observed ‘Latina Birth Paradox,’ i.e., the observation that in spite of generally high levels of poverty, low education, and discrimination, Latina women, particularly first generation immigrants, show low rates of adverse birth outcomes overall.^{48,49} In quantitative studies, previous researchers have considered social support, spirituality, strong families, cross-border ties, and living in ethnic enclaves as promoting resilience among pregnant Latina women.^{120–124} Limited previous qualitative research offers additional insight into Latina women’s perceptions of stress and resilience during pregnancy. In qualitative interviews with Mexican American women in North Carolina, Bender & Castro (2000) described resilience-promoting factors including strong family ties, access to health care, self-care during pregnancy, hopes for a better life for one’s family, and dreams of eventually returning to Mexico.¹²² Fleuriet and Sunil (2017) studied how pregnant Mexican-American women living along the Texas-Mexico border had different perceptions of stress during their

pregnancy depending on their time in the United States.¹²⁵ Recent immigrants (<5 years) described pregnancy as a blessing, experienced high levels of social support during pregnancy, and reported little to no stress related to pregnancy. However, women who had been in the US for 5 years or more reported lower support, more ambivalence towards pregnancy, and higher levels of stress. The authors contend that the more recent immigrants' views contributed towards their generally healthy birth outcomes. Previous studies have primarily focused on women's experiences during the prenatal period, largely ignoring women's prior life experiences, expectations for the future, and how perspectives may change over life stages.

We apply Ecosocial theory^{29,30} as a lens with which to present pregnant Latina women's narratives of stress and resilience. Our analysis offers a broader view of stress and resilience by incorporating women's experiences across their lives as well as perspectives during pregnancy. We draw from three key tenets of Ecosocial Theory to frame our study: (1) embodiment, how social experiences become biology, whether through physiologic or behavioral reactions; (2) multilevel layers of action, that exposures at macro levels (e.g., policies) can have direct impact on individual health outcomes; and (3) life course perspective, recognizing that experiences across the life course remain relevant for health years or generations after they occur. While the majority of research applying Ecosocial theory has been quantitative, qualitative research (e.g., Teti (2012); Ungar (2008))^{126,127} allows for thick, rich description of perceived vulnerabilities and resilience towards external stressors, possibly informing theory development and application in future research. Specifically, we examine how external experiences (e.g., trauma, racism, economic systems, social support) in their life course prior to and during pregnancy are reflected in Latina women's narratives about their lives, considering processes of stress and resilience. Considering women's perspectives on stress, coping, and resilience over the course of this

critical period allows for a more nuanced understanding, informing opportunities for intervention.

Methods

Overall Mixed Methods Study Design

These data are part of a fully mixed sequential explanatory study of pregnant Latina women in Atlanta, including a survey, in-depth interviews, and medical record abstraction.^{128,129} The overall study was designed to explore psychosocial wellbeing during pregnancy (chronic stress, depression, social support, and trauma) among Latina women. This research was conducted in three clinics, each of which serve primarily populations without insurance or who have Medicaid, and have Spanish speaking staff. This research was approved by the Emory Institutional Review Board (IRB00101281), as well as by the Research Oversight Committee of two clinics and director of the third.

Recruitment and data collection

Research staff identified potentially eligible women using medical records and invited them to participate in the survey prior to prenatal visits. Women were eligible to participate in the survey if they were at least 18 years old, pregnant, less than 24 completed weeks' gestation, and enrolled in prenatal care at a participating clinic. If interested, women completed written informed consent in the language of their choice (English or Spanish), and either immediately completed the survey or arranged with research staff to complete the survey following their appointment. Women completed the survey either using a tablet, on paper, or orally with a research assistant administering the questions (depending on participant preference). Most women completed the survey within 20 minutes. Women received \$10 for completing the survey. The participation rate for the survey was 55% of all women invited to participate (n=111).

At the end of the survey, women were asked if they would like to be contacted for a follow-up qualitative interview. Of those who completed surveys, 64% indicated they were interested in a follow-up interview. Of those interested in an interview, a purposive subset of women were selected. We interviewed equal proportions of women who reported experiencing high and low stress based on their survey responses. A research assistant reviewed the survey data and contacted women via phone or email to schedule an interview. We conducted all interviews in a private conference room in the clinic on the same day as the participant's scheduled prenatal visits. Interviews lasted between 40 and 90 minutes. Prior to the interviews, women completed written informed consent for the interview. We conducted interviews in the same language that women had chosen for the survey (English or Spanish). Women received \$25 for completing an interview. We audio recorded the interviews. A member of the research team and native speaker of the language transcribed each interview verbatim in the language in which it was conducted. We conducted a total of 24 interviews.

Instrument design

Survey questions covered demographics, pregnancy intentions, and psychosocial factors. We measured trauma using the Lifetime Stress: Trauma Screening Schedule, perceived functional social support using the Interpersonal Support Evaluation List-12, and depression using the Edinburgh Postnatal Depression Scale.¹³⁰⁻¹³² We used an eight-item scale to assess chronic stress. The scale asks whether women were currently experiencing each of eight potential ongoing problems (including one open-ended response), if so, whether it had been happening for 6-months or more, and whether she felt it was 'not very stressful,' 'moderately stressful,' or 'very stressful.' This scale has been used previously with Latina women, most recently in the Hispanic Community Health Study/Study of Latinos.¹³³

We created the qualitative interview guide using a modified life history approach to collect data on a woman's pregnancy, centered around key timepoints, with probes about health, stress, resilience, and support.¹³⁴ While true life history interviews often span several hours and sessions and cover an entire life, this guide focused on the perinatal period. The timepoints began with 'before pregnancy,' left open-ended for the participant to determine when to start, followed by first suspecting the pregnancy, telling others about the pregnancy, seeking care, first prenatal visit, and thinking forward to the delivery, and life after the child's birth (also open-ended). The first author (KS) created an initial draft of the interview guide, which was then translated into Spanish by a native speaker (MU). Another native speaker read over the Spanish version and gave feedback to ensure language was conversational and informal.

We customized each guide prior to the interview using data from that participant's survey responses. Specifically, we ensured the guide was in the correct language, and we added questions and probes around the specific stressors women mentioned in their survey responses. For foreign-born women, we added a question about how their pregnancy would have been different in their country of origin.

As is common in qualitative data collection,^{135,136} the research team debriefed after each interview and revised the interview guide to capture emerging themes. While we maintained the same life history approach in all the interviews, we changed the wording of questions and added probes in different domains. For example, in the first interviews, we observed that many women would describe nerves or worry but answered (in the survey and interview) that they had no sources of stress in their lives. Therefore, we added a question that asked women to define stress, allowing us to explore different understandings of the term and arrive at a shared understanding for the rest of the interview.

We made similar modifications to our questions about resilience. We asked about resilience in a few ways, such as ‘when you have problems, how do you get through them?’ or ‘when you are in a difficult situation, what do you do to feel better?’ We also asked, ‘when things are difficult, how do you know you’ll get through them?’ Early in the interview process, one participant gave an example of how her role model served as a source of inspiration and strength to manage difficult situations. As a result, we added this question to the interview guide and asked women who was a role model for them (someone they respected and admired) and why. In response to these questions, women described coping strategies, techniques for avoiding or overcoming difficulties and stress, and, broadly, their strategies for resilience, though no woman actually used the word resilience in her response.

Analysis

For survey data, we present descriptive analysis for the overall study population.

Descriptive statistics were calculated using R.¹³⁷

For qualitative interview data, we conducted a thematic analysis. In order to conceptualize deductive codes about resilience, we drew from a systematic review of definitions of resilience in the mental health literature by Ayed (2018). Definitions of resilience were categorized as processes (immunity, growth, or bouncing back) or characteristics (personality traits or social resources).¹³⁸ After conducting five interviews, two independent researchers (KS and MU) read the transcripts and applied the deductive codes while identifying new inductive codes that arose. Most inductive codes were about stress and resilience but also covered other aspects of women’s lives and pregnancy. The two researchers compared their use of codes and discussed areas of difference. Through consensus, the researchers developed a standardized codebook that included the code, definition, and example quotes. The researchers then independently coded the set of transcripts again with the revised codebook. The coded transcripts

were once again reviewed to identify and resolve differences. The codebook was updated to clarify all definitions where there had been differences. As one coder (KS) is a native English speaker and one (MU) a native Spanish speaker, we deferred to each native speaker regarding questions of inflection, or interpreting colloquialisms. KS, the primary investigator, determined the final set of codes for each transcript. All analysis was conducted in the original language of the interview and quotes were translated only for presentation in the manuscript.

Results

Survey results

Surveys were in either Spanish (n = 95) or English (n = 16). The majority of the survey population was foreign-born (90%), most commonly from Mexico (42.3%) followed by Guatemala (27%) (Table 1). Most of the participants already had at least one child (mean parity 1.6) and were either married (28.8%) or in a committed partnership (49.5%). Half of survey participants had an intended pregnancy (52.3%). Survey participants reported few ongoing stressors (median: 1.0) and only 36.9% of survey respondents found at least one ongoing stressor moderately or very stressful. Survey participants reported, on average, one previous traumatic event in their life. Participants reported low depressive symptoms (median score, 4, 7 with scores indicating likely depression (≥ 13)) and high social support (median: 25, potential range 0-36 with higher scores indicating higher support).

Table 1. Participant Characteristics, 111 Latina women in prenatal care, survey participants and subset of 24 interview participants, Metro Atlanta, 2018

	Total N=111	Interview Participants N=24*
	Median (IQR) / % (n)	Median (IQR) / % (n)
Birthplace		
Mexico	42.3 (47)	33.3 (8)
Guatemala	27 (30)	25.0 (6)
Honduras	13.5 (15)	12.5 (3)
United States	9 (10)	25.0 (6)
Other Central America	4.5 (5)	0 (0)
South America	3.6 (4)	4.2 (1)
Parity	3.0 (2.0)	2.5 (1.0)
Relationship with Baby's Father		
Married	28.8 (32)	25 (6)
Committed Partner	49.5 (55)	29.2 (7)
Boyfriend	15.3 (17)	25 (6)
Other	6.3 (7)	20.8 (5)
Pregnancy Intention		
Intended	52.3 (58)	37.5 (9)
Ambivalent	13.5 (15)	16.7 (4)
Unintended	34.2 (38)	45.8 (11)
# Reported stressors	1.0 (1.0)	2.0 (3.0)
Any stressor moderately/very stressful?	36.9 (41)	50.0 (12)
# Traumatic Events	1.0 (2.0)	1.0 (1.0)
Depressive Symptoms	4.0 (6.0)	5.0 (6.0)
Social Support Scale	22.0 (8.0)	25.0 (4.3)

*Subset of all women surveyed

Abbreviations: IQR: interquartile range

Overall, the most commonly reported stressors (Table 2) were an ongoing health problem of someone close to them (34.2%) and job difficulties (31.5%). However, for most problems, half or fewer of women who reported it found the problem stressful. Women who reported helping someone close who was sick were the most likely to find the problem moderately or very stressful (77.8%). Women who responded to the open-ended ‘problem not listed’ ongoing

stressor reported problems such as children in another country (3), fear of miscarriage (3), family member in jail (2), and varied other family, health, and relationship problems.

Table 2. Experienced Stressors and Reported Reactions, 111 survey Latina women in prenatal care in Metro Atlanta, 2018

Stressor	Reported % (n)	Happening for 6 months or more % (n)*	Moderately or Very Stressful % (n)*
Has someone close to you had a serious ongoing health problem?	34.2 (36)	100 (36)	44.4 (16)
Have you had ongoing difficulties with your job or ability to work?	31.5 (35)	17.1 (6)	51.4 (18)
Have you experienced ongoing financial strain?	18.9 (21)	52.4 (11)	61.9 (13)
Have you had another ongoing problem not listed here?	17.1 (19)	42.1 (8)	63.2 (12)
Have you had a serious ongoing health problem?	12.6 (14)	85.7 (12)	50 (7)
Have you had ongoing difficulties in a relationship with someone close to you?	12.6 (14)	42.9 (6)	57.1 (8)
Has someone close to you had an ongoing problem with alcohol or drug use?	14.4 (16)	81.3 (13)	43.8 (7)
Have you been helping someone close to you, who is sick, limited or frail?	8.1 (9)	66.7 (6)	77.8 (7)

*Of those who reported the stressor

Qualitative results

The subset of women who completed qualitative interviews (n=24, 19 conducted in Spanish) differed from the total survey population in a few key ways (Table 1). Interview participants were less likely to be either married or in a committed partnership (54.2% v. 78.3%) and more likely to have had an unintended pregnancy (45.8% v. 34.2%). While interview participants reported similar numbers of total stressors, they were more likely to report at least one ongoing stressor as moderately or very stressful (50%, by design, v. 36.9% overall).

Part of the survey and much of the interview guide was focused on asking women about parts of their lives that might be difficult, challenging, or stressful. We distinguish “stressors” as

external events, problems, or challenges and “stress” as a specific reaction to them. As expected, many of the stressors mentioned were related to pregnancy. Stressors ranged from minor hassles (the lack of acceptable maternity clothes or no longer being able to comfortably bend over) to traumas (the detention of a parent, intimate partner violence). However, women also brought up challenges from across their lives, beginning in childhood and up to the pregnancy. Though the interview guide was focused on preconception and pregnancy, these experiences arose independently throughout the interviews and informed women’s narratives of current stress and resilience.

Similar to survey results, stressors frequently reported in interviews included financial strain and worry about family and partners. Women also brought up immigration-related challenges (enforcement, separation from family) and worry about pregnancy loss or delivery. Common past stressors included challenges related to immigration, stress from previous relationships, difficulties experienced in women’s home countries (e.g., crime), and childhood adversity. Some women described having initially experienced stress because the pregnancy was unplanned; however, no woman described the pregnancy as a stressor by the time she was interviewed (conducted in women’s second or third trimester).

We defined resilience-promoting factors as the ways by which women described coping with challenges or avoiding or managing stress, anxiety, and worry. In addition to responses to specific resilience related questions (e.g., in general, how do you get through challenges?), women spoke of resilience-promoting factors in their narratives around hardship and stress before and during their pregnancy. Women’s descriptions of external stressors and resilience were intertwined. When women described a past challenge, they told us how they dealt with it and how they used the experience to deal with current problems. When women described a

current problem, they described strategies for managing the emotional side of problems, even when they felt they had no control over the problem itself. Three overarching themes arose connecting experiences of difficulty and stress and women's perceived capacity for coping and resilience. We list these below, with details and supporting examples provided in the next sections.

- (1) The majority of women felt that external events (stressors) were beyond their control yet felt that they could and should control how they reacted emotionally to those stressors, particularly during pregnancy.
- (2) Women described distinct patterns of coping and resilience across their lives. Many women described motherhood as a source of maturity, and others described increased ability to cope following stress or trauma.
- (3) Family was an essential part of women's past, present, and expected future coping and resilience.

Controlling Emotional Reactions to Stressors

Almost all participants felt that their emotional reactions to external stressors were within their control. This idea arose in a few ways. First, we asked participants to give us their definitions of stress. Almost all (16/19 women asked) of the participants described stress as an emotional state, such as internal worry and bother, rather than the product of external events. For example, one participant described it as follows: "Like when a person lives... like ... everything bothers them, like making problems from any little thing, and not only at home but at work or wherever they go, I think that's a stressed person." Another participant described stress as, "When you think a lot about a particular thing, such as how I don't have enough to pay for the electricity, that's stress." Only three participants described stress as relating to external forces, either as something that robs you of your peace, pressure, or when things overwhelm you. For

example, one participant stated, “stress is tiredness... tiredness and, how can I explain, it’s like the things that overwhelm you.... That you are tired and you don’t know where you can find enough energy to do so many things.”

Along with viewing stress as an emotional state, most participants expressed confidence in their ability to manage the emotional side of stress. Though women described diverse coping mechanisms, religious strategies were by far the most common coping strategies and central to most (16/24) women’s descriptions of coping and resilience. While many (9) of these women described a formal religious practice (e.g., attending services or Bible study), all (16) described ways in which they used religious practices, by themselves, for comfort and strength. For example, one mother of seven described a strong religious practice. She also talked about how prayer was an integral part of her stress management and reaction to problems. For example, when she had received a diagnosis of placenta previa and gestational diabetes and been recommended bed rest, she used prayer to avoid stress. She described her response to the diagnosis as follows:

“I just put my faith in God and I told him that, that everything was going to happen as he wished, as it was in his control, if I was going to lose this baby, I always like maintained that faith. I say, my God, you know that I can’t be lying down all day because I have so many kids. And I said, if you are going to leave me this baby, leave him healthy and, if not, better just take him, because they also told me that he could come preterm....well that’s how I coped. ”

Many women felt that it was important to avoid feelings of stress, anger, or grief during pregnancy and motherhood as a risk reduction strategy. For example, one participant attributed a past miscarriage to stress from hearing the news of her father’s death. Another participant said she was not able to grieve after her brother’s passing because she had just given birth to her daughter and grieving might hurt her newborn’s health. She explained,

“What was I going to do? [When my brother died] my older daughter had just been born. I had to relax...Because if not, what was going to happen? And to accept what had happened ... The neighbors at the time that lived near me [said], ‘well, don’t worry because you are with your newborn and you can’t be in that stress, you are going to stress out the baby.’ Yes, it hurts, but in that moment when it happened I couldn’t stress.”

Notably, while women described confidence that they could manage stress as an emotion, this only occasionally corresponded to women describing control over the external stressors. More often, like the mothers above, women’s stress management involved accepting that they could not control the external circumstances, only how they reacted to these circumstances.

Changes in Coping and Resilience Across Life Experiences

Women described changes in how they reacted to challenging circumstances during different stages in their lives, such as childhood, motherhood, or following trauma. Several women expressed enhanced ability to cope with challenges following a traumatic experience (e.g., time spent in a border detention center; deportation of an ex-partner during a pregnancy); others simply expressed competence to meet new challenges based on their previous experiences. For example, one participant spent her childhood translating for her Spanish-only speaking parents. This, she said, gave her the confidence to handle unknown or nerve-wracking situations.

“Interviewer: Do you feel like you feel confident when you have a problem that you’ll be able to solve it?”

P: Yes.

I: Why do you think you feel that way?

P: Because I feel like that because my mom and my dad they showed me when I was ten, they started using me like to oh go tell this person this but in English because they don’t speak English. They made me confident”

Even when women described feeling stressed, previous life experiences helped them to manage those emotions and feel confident that they would overcome the difficulties. For example, one participant, a single mother, had left her job in a bar when she found out she was

pregnant. She started a business from home, selling food, and was constantly worried about being able to pay her bills as the pregnancy progressed. In response to the question “what is difficult about your life now?” she said,

“My pregnancy is advancing, I can’t cook like before, I can’t take it, my feet are swelling a lot and I have a lot of back pain like the heat of the stove bothers me and I’ve stopped doing it, but I’ll have to go back to doing it. My stress is: the baby is growing, how am I going to pay the costs of my apartment?”

However, despite feeling stress, she expressed confidence that she would get through it, drawing on resilience from a previous traumatic experience. When she was 19, as a recent immigrant to the U.S., she found out she was unexpectedly pregnant and, during the pregnancy, the baby’s father was deported. She found herself without family, in a strange country, and largely without financial resources. However, after living with a friend throughout the pregnancy, she returned to work, and regained financial stability. She described how this experience gave her confidence she would overcome the difficulties during this pregnancy as well.

“Yes, I had just turned 19 and I overcame all that. Even though I’m in a bad moment right now, I know that I’m going to get through it over time because what I lived through with my first son over time, it was like 5-6 years, but I overcame it.”

Many women who already had children described motherhood as a turning point in their lives, providing strength to cope with challenges as well as increased maturity. Notably, this was true for women with both planned and unplanned pregnancies, even when the discovery of an unplanned pregnancy resulted in increased stress levels. For example, a mother of two, upon finding out she was pregnant after breaking up with her boyfriend, said she felt “like the world was coming down on top of her.” However, she managed to cope. She explained, “If God gives us the opportunity to bring a new life into the world it’s because he trusts us, believes that we are strong, that we can survive what comes.” The same participant described how being a mother

gave her the strength to get through time in an immigration detention center, where she spent several days after seeking asylum at the Texas/Mexico border with her two children.

“I was really afraid being there but I couldn’t show fear to my children because they were afraid, so if they saw me afraid, they would feel it even more. I told them, it’s OK, we’re getting out of here. Tomorrow we’re getting out of here, day after tomorrow we’re getting out of here, tomorrow, now we’re definitely getting out.”

Other participants described general maturation following motherhood. For example, a young participant expecting her second child looked back on how she had changed after the birth of her first child.

“Interviewer: How's your life different than it was before you were pregnant?

P: Mm.

I: Or is it different at all?

P: I guess it's almost the same. But with more responsibility. Yeah, of course. Because of the baby. I think more mature. Um, all the time, what I'm going to do something, I'm going to make a decision, I always have to think about it three times and talk about it with my husband and my mother because I feel like those are the main ones that have to be there for me, you know?

I: Yeah.

P: And I feel, I just, I don't know, I feel like honestly, I feel like I'm a different person. I feel like I'm more mature and more responsible than I was before.”

Finally, some women felt that motherhood informed their goals for the future. For example, one mother of three was motivated to go back to school primarily because of her children.

“Interviewer: What are your biggest hopes for yourself?

P: Um. To be successful also, and to, you know, become a better mom for my kids, to see a better example out of me so they can see, oh my mom’s strong – she did this. She went through this and you know, she got through it, so. I want to be a good example for them. Like, I want to be an [police] officer. To show them that, you know, this is what you want, then you know, you can get it if you work hard for it. I just want to be a better, a better person for my kids.”

Family

Across women’s life stages, family was integral to most participant’s lives. Participants described how practical and emotional family support helped them in the past, currently during their pregnancy, and how they expected it to help them in the future. In addition, supporting

other family members was essential to women's lives, giving them identity and purpose, connecting them to their countries of origin, as well as, occasionally, causing stress or strain. Finally, many found inspiration in their family, using family members as role models to help them cope with challenging circumstances.

Prior to pregnancy and motherhood, family support allowed women to achieve personal and professional goals. For example, many women relied on financial support from family members to immigrate to the United States. Participants also described supporting family members financially through remittances or paying for specific things like migration or medical bills and practically (primarily through childcare and care for sick family members). Women's previous support of family members was intertwined with their expectations for support in turn when they needed it. For example, one participant explained,

"I've done so many favors to my family. I've been like with some of my aunts [when they] had to stay in the hospital for a week with their babies because they've had them like two months earlier [before the due date] and I had to stay over there because I speak English and Spanish and they don't speak English...So I just go and stay with them. I help them interpret. And then that's why they're like oh we're so happy you're pregnant. Now we owe you the favor. We're all going to stay with you in the hospital."

Another US-born first-time mother felt current financial strain because she'd spent her savings on emergency medical care for her brother. Her husband started working at a harder job, 1-2 hours away, in order to earn more money. However, the participant wasn't worried about it, counting on current and continued support from her family. She planned to continue working part time throughout the pregnancy, to return to work following delivery, with free child care from her mom and sister (who she lived with), and felt the temporary financial strain wasn't worth worrying about.

"I try not to [stress or worry about things]. I try um, if there's problems, I just try to like to let them go. Like not worry about them. Because all, every problem can be fixed. So, I try never to worry about it."

During pregnancy and motherhood, participants received and expected emotional and practical support from their families. Emotional support included advice (about pregnancy, motherhood, and relationships), talking on the phone, and spending time together (e.g., going out to lunch). For many, this was part of how they faced challenges. For example, one participant, a first-time mother, described going to her mother with doubts about whether she would be a good mother.

“Usually it’s normal [to worry about being a good mom] because it’s the first baby. But she tells me, um, that um it’s going to be fine because I’m a good aunt.”

Another participant had lost her mother to cancer shortly before finding out about an unplanned pregnancy. Her sisters and mother’s cousins came together to support her, accompanying her to visits, giving advice, and throwing her a baby shower.

“My family, my mom’s cousins, they are watching out for me, my cousin is also behind me for whatever little thing that happens to me, with my sisters, they call each other to see if I’m OK or not, like if I’m fine or not, if I’m following the things that they tell me to the letter... sometimes it’s a little tiring, because every moment and every moment they are there and sometimes I say better to say nothing and thank God that I have an admirable family and appreciate that they are supporting me in these moments.”

During pregnancy, practical support from family members included things like accompanying them to doctor’s visits, supporting women financially so that they didn’t have to work, or caring for the participant’s older children. Many women stopped or reduced work during pregnancy because their family or partner provided financial support. For example, one participant described how her brothers and husband, together, supported her financially so she could stop working during pregnancy and they could continue to save for construction of a home in their country of origin, allowing her to focus on her health. She said,

“I’m not going to be able to work and what are we going to do to pay everything that is spent there [in the country of origin]? And he [participant’s husband] said, ‘I’m going to help you and everything so don’t worry.’... I said, OK. Pregnancy is [about] taking care of yourself.”

Families were also integral to how participants saw their future and the future of their children. In the short term, several participants planned on relying on family for childcare or support immediately after delivery (particularly in the case of a cesarean delivery). In the longer term, many women described admiring and using family members as role models. When participants were asked to name a person they respected and admired, the majority (13/20) named their mother. Three participants named a different family member (1 father, 2 aunts). Most participants described admiring family members because of their strength and ability to cope with challenges, such as single motherhood, immigration, or poverty. The experiences of their role models inspired their own strategies to overcome challenges. For example, one participant discovered she was pregnant with her second child very shortly after breaking up with her partner. Prior to discovering she was pregnant, she felt that the break up was the best thing to happen, that she was ready and excited to be on her own with her son, and eager to be done with the constant fighting with her ex-partner. After she discovered the pregnancy, her twin brother advised her to return to her ex-partner, but she felt she could weather single motherhood because her mother had survived single motherhood with five children.

“that I should go back to the father of my children because we [my brother and I] know what it’s like to grow up without a father, yes, my mother left my father when we were 8-months old, but she was in Mexico where life is harder and she could with five children, two 8-month olds, so I also know that I can with my two children.”

Discussion

Our research broadens the knowledge base considering how pregnant Latina women meet, manage, and make meaning of adversity. Women’s narratives of stress and difficulty were intertwined with strategies for coping and resilience. Despite the sample design, in which half the

women interviewed had indicated low stress levels in their survey responses, the majority of those interviewed described at least one ongoing stressor during their pregnancy. Some of these stressors were minor and others traumatic. However, women varied in how they reacted to external stressors and whether they described experiencing stress or worry in response. Broadly, women felt that their emotional reaction to an external stressor was within their control—that they could, and, particularly during pregnancy, should choose not to worry about external stressors. Women described changes in how they viewed and reacted to stressors at different points in their lives, often learning from and drawing on previous challenges in order to cope with new problems. Interview participants described several factors in their lives that allowed them to cope with, overcome, and manage external stressors (resilience). Motherhood, in particular, was a turning point for many women. Finally, family provided resources for them, which they depended on for practical and emotional support throughout their lives.

This study confirms findings from previous qualitative research with pregnant Latina women and Latina mothers on family support and parenting as sources of resilience but offers a new perspective on other resilience-promoting factors. Many authors have described how Latina immigrant women rely on strong family relationships for support, particularly during pregnancy and motherhood.^{122,139,140} In focus groups with Latino parents in the Midwest, Parra-Cardona (2008) described how participants found parenthood to be both a source of satisfaction with life and a demand for responsibility.¹⁴¹ This mirrored comments among our participants that motherhood made them more responsible and mature. However, other resilience-promoting factors, such as control over reactions to stressors and competence, have not been explored among pregnant Latinas.

Our study was based on Ecosocial theory. Two elements of Ecosocial theory were present in women's narratives: embodiment of stress and life course processes. Women believed in embodiment of stress and described stress and worry as detrimental to their health and that of their fetus. Life course processes were present in most women's narratives, as women described how experiences from across their lives were intertwined with current perspectives, reactions, and relationships. However, women only rarely explicitly brought up macrolevel stressors in response to open-ended questions about their lives, in contrast to what we expected based on Ecosocial theory. Macro-level processes (e.g., immigration policies and enforcement) clearly influenced the experiences that made up women's lives (experiences with detention and deportation, choices about where to seek care, separation from family). However, macro-processes may feel like a fact of life (beyond women's control) rather than an immediate cause of these experiences. Our open-ended questions may have led women to answer about their immediate experiences rather than connecting them to political or social processes. It may also be that the consequences of macro-level processes (e.g., a family member's deportation) are stressors while women do not consider macro-level processes themselves to be stressors. Future research should consider direct questions about macro-processes to better describe how this cornerstone of Ecosocial theory is present or absent in women's perspectives on stress.

Our qualitative findings are consistent with women's survey responses about stressors and support. While many women reported experiencing an ongoing stressor, depending on the stressor, 20-60% of women described the stressor as not very stressful. In interviews, women described controlling how they reacted to external stressors and a belief that they should limit stress and worry, particularly during pregnancy. Women in the total survey population may have also used coping strategies to limit emotional reactions to stressors. Almost all survey

participants reported high social support which may reflect a similar reliance on family and community for support as described in interviews. Our mixed methods design allows us to place the survey findings (e.g., the prevalence of stress or lifetime trauma) alongside women's narratives of how they cope and make meaning out of these experiences.

A wealth of theory and empirical evidence supports the idea that specific coping strategies determine health trajectories following adversity. For example, John Henryism theory suggests that prolonged, high-effort, active coping with low-resources and high adversity is associated with long-term negative health outcomes (primarily cardiovascular disease).¹⁴² Notably, individuals with high-effort, active coping may show positive mental health profiles but, with long term exposure to stressors, negative physical health outcomes.¹⁴³ Similarly, Cognitive Activation Theory of Stress (CATS) describes how positive outcome expectancies – i.e., when faced with an external stressor an individual's expected ability to have a positive outcome —are associated with positive health trajectories, as compared to a lack of perceived or actual control over the stressor (helplessness) or negative outcome expectancy (hopelessness).¹⁴⁴ Participants endorsed positive outcome expectancies, based on their own success in coping with adversity and reliance on consistent family support. John Henryism also resonated with women's strong feeling of control over their reactions to stress, potentially a form of active coping, and, even more so, in their plans following pregnancy (e.g., to return to work or study). Specific coping strategies may impact patterns observed in health outcomes to Latina immigrants in the U.S., including the erosion of the immigrant advantage over time. We only offer perspectives from Latina women and cannot make inference about whether coping strategies or stress derive from women's cultural, national, or ethnic background or whether they are universal. However, primarily passive coping paired with positive outcome expectancy during pregnancy might

protect women against adverse effects of stress. Future longitudinal studies (both quantitative and qualitative) should consider whether coping strategies change and evolve across different life stages, and how coping varies by race/ethnicity or cultural background or across generations. Use of standard scales (e.g., John Henryism Active Coping Scale; TOMCATS), repeated measures, and biologic measures (e.g., measures of the microbiome or allostatic load) can inform our understanding of these mechanisms.^{144,145} Qualitative research can inform the application and refinement of theory, as well as connect theory and quantitative scales to women's lived experiences.

Our analysis should be interpreted in light of three important limitations. First, unlike true life histories, we conducted only one interview with each participant.¹³⁴ Follow-up interviews at different time points or additional sessions would have allowed for richer data on women's lives. Second, our project included only women enrolled in prenatal care. All our participants had access to at least some financial and social resources and chose to carry a pregnancy to term. Finally, our sample was primarily foreign-born, limiting our ability to compare immigrant and US-born women or across generations.

This analysis offers several strengths. First, our sequential study design allowed us to customize each woman's interview guide using survey results. Specifically, we were able to include questions and probes related to the specific stressors women reported in the survey. This allowed us to explore why some women listed stressors but did not report finding them stressful as well as ensured that we were able to develop a comprehensive understanding of each difficulty. Second, our bilingual research team had native speakers for conducting interviews, transcription, and analysis. This allowed us to gain the full range of meanings from interviews with both English and Spanish speakers. Finally, we worked with trusted community clinics,

helping us build rapport and trust with participants. Additionally, though we conducted only one interview session, meeting participants and conducting informed consent discussions at the time of the survey introduced participants to our research team and helped build trust before the interviews. We believe most participants were comfortable with study staff by the time of the interview. For example, despite our not asking, over half disclosed the documentation status of themselves or a close relative, suggesting they trusted the research team.

Understanding choices and strategies that foster positive adaptation to adverse events and circumstances allows for better understanding of the processes through which individuals survive and make meaning from hardship. By incorporating this understanding into research, intervention design, and clinical practice, we may be better able to more effectively promote positive health and wellbeing for Latina women and children experiencing adversity.

Conclusion and Future Directions

Across sociology, demography, and anthropology, a growing body of work supports a link between living in a place with a restrictive immigration policy climate and poor health.^{1,3} However, the application of causal inference techniques or epidemiologic methods generally has been limited. My aim 1 results provide additional evidence that there is an association between living in a place with restrictive policies and adverse birth outcomes for both foreign-born and U.S.-born Hispanic mothers. The primary outcome, very preterm birth, has robust links to chronic stress, supporting a causal mechanism through increases in chronic stress. However, the nature of my exposure, the Immigration Climate Index, does not allow me to attribute the change to specific policy shifts. My aim 2 results show a slight elevation in risk of VPTB for foreign-born Hispanic mothers following the adoption of 287(g) agreement but do not support general effects of the program on risk. This may reflect the fact that 287(g) agreements are implemented in different ways in different places and that places may engage in intense immigration enforcement even without an agreement. Finally, a broad body of ethnographic and qualitative work describes resilience among Latina women, as well as strategies through which Latina women adapt to and cope with changing immigration policies and enforcement climate. In my aim 3, I show that Latina women draw on individual and interpersonal resources, as well as their own life experiences to cope with external challenges. In interviews, women describe stress from immigration climate but also, for many, a perceived ability to successfully reduce their risk of deportation or handle deportation if and when it comes.

The time is ripe for epidemiologists to play a larger role in the study of immigration policies. With a few notable exceptions,^{8,9} an epidemiologic perspective has been absent from the study of immigration policies. Correspondingly, articles on immigration policies broadly lack rigorous consideration of the causal pathways through which climate may impact health; show only cursory attention to potential confounders; rarely engage in consideration of the extent of information or selection bias; and offer little more than suggestions on potential actions or interventions to address the problem.

Drawing on the rich body of work in sociology, political science and other disciplines, epidemiologists should engage in the study of immigration climate through the following actions.

- (1) Develop testable hypotheses about how specific immigration policies or enforcement actions would affect specific health outcomes, applying content-specific knowledge of physiologic mechanisms, induction time, and potential confounders. Examples might include: considering changes in blood pressure (or other acute stress sensitive outcomes) among non-citizens during or following the announcements of changes to U.S. immigration programs—e.g., DACA or Temporary Protected Status (T.P.S.).
- (2) Create and test specific measures of immigration policy climate, with clear, replicable definitions, and study the reliability and validity of each. Potentially, epidemiologists might develop measures for different aspects of policy climate (e.g., criminalization, inclusion, enforcement) to better understand how specific policy action may result in specific health outcomes.
- (3) Leverage existent pre/post data with possibly impacted populations to describe potential changes in specific aspects of health status, following changes in immigration climate.

Examples might include: Using all or part of existing cohort studies, such as the Hispanic Community Health Study/Study of Latinos, to look at changes in individual health status with changing immigration climate. Ideally, incorporate biomarker data and specific measures of hypothesized mechanisms (e.g., stress biomarkers or perceived stress, utilization of care, maladaptive behaviors).

(4) Conduct consequentialist studies to suggest specific actions that individuals, organizations, and governments (local, state) might take to ameliorate the negative effects of climate. Examples might include studying whether municipal ‘sanctuary policies’ are associated with subsequent improved outcomes for foreign-born or noncitizen residents; or whether police refusal to collaborate with ICE improves trust of government among noncitizen residents.

(5) Measure the potential impact of bias in their own and other published work on immigration climate. Examples might include: using the E-value or other metrics of unmeasured confounding to consider the impact of unmeasured confounders on effect estimates; considering whether publication bias exists in the body of work on the ‘Trump Effect’ during/following the 2016 election; determining the effect of selection bias on results when using data from national surveys (e.g., National Health Interview Survey; Behavioral Risk Factor Surveillance System (BRFSS)) to study immigration policies.

Epidemiologic methods and expertise can help move research on immigration policies beyond describing an association and towards improved causal inference and public health action. Changing immigration policies, enforcement practices, and anti-immigrant sentiments are

social determinants of health that are quickly changing during our time. Epidemiologists can and should help describe, define, and address this problem.

Reflexivity Statement

I have prepared the following reflexivity statement in order to reflect on how my own experiences, position, and lens impacted my research.^{136,146–148}

Personal History

I have been a resident of DeKalb County, Georgia, my whole life, even for the seven years where I lived elsewhere (Peru and Rhode Island). I am white, privileged, and well-educated. By the time I graduated high school, I thought I was fairly aware of the inequalities and problems in my county. DeKalb is racially (and socioeconomically) segregated, and I attended a public magnet high school that was created in response to the Supreme Court demand that Georgia integrate its schools. However, I managed to graduate from high school nearly completely unaware of the growing Hispanic immigrant population in the county—and of the challenges they faced.

This changed when I moved back to Georgia from Peru in December 2012, and worked for a charter middle school serving primarily Latino youth in the county. I was a maid-of-all-work, serving as a translator for the counseling office when talking to Spanish-speaking families, a substitute teacher, and teacher of a Saturday English-as-a-second-language course for parents. Listening to children and parents opened my eyes to the challenges faced by immigrant families in DeKalb county. One fifth grader, whose father had been deported, developed chronic stomach aches and wouldn't attend school, fearing that, while she was at school, her mother would also be deported. One young woman ended up living with her former math teacher. After her parents were deported, she had to choose between moving to Texas, to live with an aunt she'd never met,

or to Mexico with her parents, either way, giving up a scholarship to a prestigious private high school. One of my best Saturday English students, a single mother, missed a class because she had to spend the weekend in jail after being detained for driving without a license. After eight months of listening to these stories and often having little or no help to offer, I felt deeply ashamed about how my state treated immigrant families and for my ignorance about the problem.

When I began graduate school in 2013, I was surprised to find a near complete lack of public health scholarship on the health impacts of immigration policies. I spent the first two years of the doctoral program learning how to design a study to consider the potential impact of immigration policies on maternal and child health. With help from my committee, Danielle Crookes, and the slowly growing body of work on immigration policies, I was able to do so.

Dissertation Research

During the course of my dissertation research, I became pregnant, was pregnant for all of the qualitative interviews, and pregnant or a new mother during analysis. After the first trimester, I shared this with interview participants. It gave us a shared experience and perspective. At times, this allowed me to immediately connect with participants. However, it also sometimes highlighted the gaps between us. Many participants lacked insurance, some were single mothers, and nearly all had some uncertainty about whether they or their partners might be deported during the pregnancy or later. I sometimes felt in awe of interview participants' strength and persistence, some of whom often faced obstacles just to arrive at prenatal care (some women walked, others took MARTA, others had to pay a taxi every time).

This feeling of awe drew me to women's narratives of resilience. In research with minority groups, we often focus on stress and hardship but leave out strength and the ability to overcome challenges. Thus, I chose to briefly summarize stress and stressors and to explore

resilience in depth in a manuscript. Over the course of my dissertation writing, I became aware of my reliance on terms like vulnerable and marginalized. I decided to try to use, instead, and, as appropriate, underserved. The use of vulnerable and marginalized may (1) contribute to stigma or stereotyping and (2) obscure the fact that external events cause women's vulnerability (e.g., the deportation of breadwinners) and marginalization (e.g., the fact that immigrants in Georgia are ineligible for driver's licenses).¹⁴⁹

While conducting my research, I have tried to retain an awareness of my own privilege and position as a non-Hispanic white U.S. citizen who can treat immigration enforcement and immigration policies as an academic interest whereas, for many (including the participants in my study), they are threats to safety, security, and comfort. In designing this study, I was acutely aware of the potential for harm in encouraging women to reveal too much about their own documentation status or immigration experiences. This awareness led me to exclude detailed questions about documentation, immigration policies, or experiences with immigration enforcement from the survey and interview guide. My experiences and academic knowledge led me to believe that immigration enforcement experiences would dominate women's narratives—whether I asked about them or not. This was not the case.

Our decision not to ask about policies, enforcement, and documentation status likely influenced our results, since only some women brought up stories or perspectives on these issues. Thus, despite my personal interest in this area, these data were insufficient to make well-supported inference about women's perspectives on immigration climate. Ultimately, I hope that the interview structure and content made women comfortable and helped the interviews be positive experiences for participants. One mother, experiencing a challenging pregnancy, told me

at the end she felt that she should have paid me, because it was so wonderful to just have someone listen to her for an hour.

My research team included three MPH students, whom I hired based on their Spanish ability and perceived organizational skills. They were amazing additions to the project. One, Monica Ulloa, conducted a third of the interviews and acted as a double coder for all interview data. Monica is a native Spanish speaker, an immigrant from Colombia, and was pregnant for all the interviews she conducted. Having her perspective on analysis and her distinct voice in some interviews was an invaluable addition.

My dissertation contributes evidence supporting an association between restrictive immigration policies and health, specifically supporting a pathway through increased stress. As a scientist, I recognize that we need more evidence to determine how, when, why, and for whom specific policies or enforcement practices matter and for which outcomes. I believe, as Krieger (2012) posits, that building a body of scientifically-sound, theory-driven research into the impact of racist policies and practices is a contribution to ending those practices.³¹ However, as a citizen, human, and mother, my views are unchanged following this research—restrictive policies and enforcement practices are discriminatory, violate human rights, and demand immediate change.

Bibliography

1. Perreira KM, Pedroza JM. Policies of Exclusion: Implications for the Health of Immigrants and Their Children. *Annual Review of Public Health*. 2019;40(1):annurev-publhealth-040218-044115. doi:10.1146/annurev-publhealth-040218-044115
2. Philbin MM, Flake M, Hatzenbuehler ML, Hirsch JS. State-level immigration and immigrant-focused policies as drivers of Latino health disparities in the United States. *Social Science and Medicine*. April 2016. doi:10.1016/j.socscimed.2017.04.007
3. Wallace SP, Young M-EDT, Rodríguez MA, Brindis CD. A social determinants framework identifying state-level immigrant policies and their influence on health. *SSM - population health*. 2019;7:016-16. doi:10.1016/j.ssmph.2018.10.016
4. Pham H, Pham VH. Subfederal Immigration Regulation and the Trump Effect. *New York University Law Review*. May 2018. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3171663. Accessed May 10, 2018.
5. Van PH, Pham H. The Immigrant Climate Index (ICI) – Pham Hoang Van. http://sites.baylor.edu/van_pham/the-immigrant-climate-index-ici/. Published 2017. Accessed January 11, 2018.
6. Coleman M. The “Local” Migration State: The Site-Specific Devolution of Immigration Enforcement in the U.S. South. *Law and Policy*. 2012;34(2):159-190. doi:10.1111/j.1467-9930.2011.00358.x
7. Walker KE, Leitner H. The Variegated Landscape of Local Immigration Policies in the United States. *Urban Geography*. 2011;32(2):156-178. doi:10.2747/0272-3638.32.2.156
8. Torche F, Sirois C. Restrictive Immigration Law and Birth Outcomes of Immigrant Women. *Am J Epidemiol*. 2019;188(1):24-33. doi:10.1093/aje/kwy218
9. Novak N. Increase in low birth weight among infants born to Latina mothers after a major immigration raid. 2015.
10. Gelatt J, Bernstein H, Koball H. *Uniting the Patchwork: Measuring State and Local Immigrant Contexts*. Austin, TX: Urban Institute; 2015:1-21. https://www.urban.org/research/publication/uniting-patchwork-measuring-state-and-local-immigrant-contexts/view/full_report. Accessed May 26, 2018.
11. De Trinidad Young M-E, Wallace SP. Included, but Deportable: A New Public Health Approach to Policies That Criminalize and Integrate Immigrants. *Am J Public Health*. 2019;109(9):1171-1176. doi:10.2105/AJPH.2019.305171
12. McDaniel P, Rodriguez DX, Kim AJ. Creating a Welcoming Metro Atlanta: A Regional Approach to Immigrant Integration. *Atlanta Studies*. <https://www.atlantastudies.org/2018/04/26/creating-a-welcoming-metro-atlanta-a-regional-approach-to-immigrant-integration/>. Published April 26, 2018. Accessed November 8, 2019.

13. Boone C. DeKalb likely to take a pass on Trump immigration crackdown. *ajc*. <https://www.ajc.com/news/dekalb-likely-take-pass-trump-immigration-crackdown/pt2vPAE3zaNfdjzWEXifzJ/>. Published March 28, 2017. Accessed November 8, 2019.
14. National Conference of State Legislatures N. Immigration Enactments Database. 2016. <http://www.ncsl.org/research/immigration/immigration-laws-database.aspx>.
15. Moinester M. Beyond the Border and Into the Heartland: Spatial Patterning of U.S. Immigration Detention. *Demography*. 2018;55(3):1147-1193. doi:10.1007/s13524-018-0679-2
16. Moinester M. A Look to the Interior: Trends in U.S. Immigration Removals by Criminal Conviction Type, Gender, and Region of Origin, Fiscal Years 2003-2015. *American Behavioral Scientist*. March 2019:000276421983527. doi:10.1177/0002764219835276
17. Kaushal N, Wang JS-H, Huang X. State dream acts and education, health and mental health of Mexican young adults in the U.S. *Economics & Human Biology*. 2018;31:138-149. doi:10.1016/j.ehb.2018.08.013
18. Pham H, Van PH. Measuring the Climate for Immigrants. In: Hessick CB, Chin GJ, eds. *Strange Neighbors*. New York and London: New York University Press; 2014:21-39.
19. Hatzenbuehler ML, Prins SJ, Flake M, et al. Immigration policies and mental health morbidity among Latinos: A state-level analysis. *Social Science & Medicine*. 2017;174:169-178. doi:10.1016/j.socscimed.2016.11.040
20. Ybarra VD, Sanchez LM, Sanchez GR, Gerlich K. Anti-immigrant Anxieties in State Policy: The Great Recession and Punitive Immigration Policy in the American States, 2005-2012. *State Politics & Policy Quarterly*. 2016;16(3):313-339. doi:10.1177/1532440015605815
21. Nill AC. Latinos and S.B. 1070: Demonization, Dehumanization, and Disenfranchisement Arizona S.B. 1070. *Harv Latino L Rev*. 2011;14(1):35-66.
22. Potochnick S, May SF, Flores LY. In-State Resident Tuition Policies and the Self-Rated Health of High-School-Aged and College-Aged Mexican Noncitizen Immigrants, Their Families, and the Latina/o Community. *Harvard Educational Review*. 2019;89(1):1-29. doi:10.17763/1943-5045-89.1.1
23. Rugh JS, Hall M. Deporting the American dream: Immigration enforcement and latino foreclosures. *Sociological Science*. 2016;3. doi:10.15195/v3.a46
24. Potochnick S, Chen JH, Perreira K. Local-Level Immigration Enforcement and Food Insecurity Risk among Hispanic Immigrant Families with Children: National-Level Evidence. *J Immigr Minor Health*. 2016. doi:10.1007/s10903-016-0464-5

25. Golash-Boza T. Punishment Beyond the Deportee: The Collateral Consequences of Deportation. *American Behavioral Scientist*. March 2019:000276421983525. doi:10.1177/0002764219835259
26. White K, Yeager VA, Menachemi N, Scarinci IC. Impact of Alabama's immigration law on access to health care among Latina immigrants and children: implications for national reform. *Am J Public Health*. 2014;104(3):397-405. doi:10.2105/ajph.2013.301560
27. Lopez WD, Kruger DJ, Delva J, et al. Health Implications of an Immigration Raid _ Findings from a Latino Community in the Midwestern United States. *Journal of Immigrant and Minority Health*. 2017;19(3):702-708. doi:10.1007/s10903-016-0390-6
28. Ybarra VD, Pérez MJ, Sanchez GR. Do Perceptions Match Reality? Comparing Latinos' Perceived Views of State Immigration Policy Environments with Enacted Policies. *Policy Studies Journal*. 2019;47(3). doi:10.1111/psj.12303
29. Krieger N. Theories for social epidemiology in the 21st century: an ecosocial perspective. *International journal of epidemiology*. 2001;30(4):668-677.
30. Krieger N. Epidemiology and the web of causation: Has anyone seen the spider? *Social Science and Medicine*. 1994;39(7):887-903. doi:10.1016/0277-9536(94)90202-X
31. Krieger N. Methods for the scientific study of discrimination and health: an ecosocial approach. *American journal of public health*. 2012;102(5):936-944. doi:10.2105/AJPH.2011.300544
32. Morse A, Johnston A, Heisel H, Carter A, Lawrence M, Segreto J. Omnibus immigration Legislation. National Conference of State Legislatures. <http://www.ncsl.org/research/immigration/omnibus-immigration-legislation.aspx>. Published 2012. Accessed December 7, 2016.
33. Hardy LJ, Getrich CM, Quezada JC, Guay A, Michalowski RJ, Henley E. A call for further research on the impact of state-level immigration policies on public health. *American journal of public health*. 2012;102(7):1250-1254. doi:10.2105/AJPH.2011.300541
34. Philbin MM, Flake M, Hatzenbuehler ML, Hirsch JS. State-level immigration and immigrant-focused policies as drivers of Latino health disparities in the United States. *Social Science and Medicine*. April 2016. doi:10.1016/j.socscimed.2017.04.007
35. Kramer MR, Hogue CJ, Dunlop AL, Menon R. Preconceptional stress and racial disparities in preterm birth: an overview. *Acta Obstet Gynecol Scand*. 2011;90(12):1307-1316. doi:10.1111/j.1600-0412.2011.01136.x
36. Kramer MR, Hogue CR. What causes racial disparities in very preterm birth? A biosocial perspective. *Epidemiol Rev*. 2009;31:84-98. doi:10.1093/ajerev/mxp003

37. Lorch SA, Enlow E. The role of social determinants in explaining racial/ethnic disparities in perinatal outcomes. *Pediatric Research*. 2016;79(1-2):141-147. doi:10.1038/pr.2015.199
38. Lu MC, Halfon N. Racial and ethnic disparities in birth outcomes: a life-course perspective. *Maternal and child health journal*. 2003;7(1):13-30. doi:10.1023/A:1022537516969
39. Rich-Edwards JW, Fraser A, Lawlor DA, Catov JM. Pregnancy characteristics and women's future cardiovascular health: an underused opportunity to improve women's health? *Epidemiologic reviews*. 2014;36(1):57-70. doi:10.1093/epirev/mxt006
40. Saigal S, Doyle LW. An overview of mortality and sequelae of preterm birth from infancy to adulthood. *The Lancet*. 2008;371(9608):261-269. doi:10.1016/S0140-6736(08)60136-1
41. Krieger N. Theories for social epidemiology in the 21st century: an ecosocial perspective. *International journal of epidemiology*. 2001;30(4):668-677.
42. Krieger N. Epidemiology and the web of causation: Has anyone seen the spider? *Social Science and Medicine*. 1994;39(7):887-903. doi:10.1016/0277-9536(94)90202-X
43. Gee GC, Ford CL. STRUCTURAL RACISM AND HEALTH INEQUITIES. *Du Bois Rev*. 2011;8(1):115-132. doi:10.1017/S1742058X11000130
44. Viruell-Fuentes EA, Miranda PY, Abdulrahim S. More than culture: Structural racism, intersectionality theory, and immigrant health. *Social Science & Medicine*. 2012;75(12):2099-2106. doi:http://dx.doi.org/10.1016/j.socscimed.2011.12.037
45. Pham H, Van PH. Measuring the Climate for Immigrants. In: Hessick CB, Chin GJ, eds. *Strange Neighbors*. New York and London: New York University Press; 2014:21-39.
46. Bécares L, Shaw R, Nazroo J, et al. Ethnic Density Effects on Physical Morbidity, Mortality, and Health Behaviors: A Systematic Review of the Literature. *Am J Public Health*. 2012;102(12):e33-e66. doi:10.2105/AJPH.2012.300832
47. Sagrestano LM, Feldman P, Rini CK, Woo G, Dunkel-Schetter C. Ethnicity and Social Support During Pregnancy. *Am J Community Psychol*. 1999;27(6):869-898. doi:10.1023/A:1022266726892
48. Becerra JE, Hogue CJR, Atrash HK, Pérez N. Infant Mortality Among Hispanics. *JAMA*. 1991;265(2):217. doi:10.1001/jama.1991.03460020071031
49. de la Rosa I a. Perinatal outcomes among Mexican Americans: a review of an epidemiological paradox. *Ethnicity & disease*. 2002;12(4):480-487.
50. Acevedo-Garcia D, Soobader M-J, Berkman LF. The Differential Effect of Foreign-Born Status on Low Birth Weight by Race/Ethnicity and Education. *Pediatrics*. 2005;115(1).

51. Villalonga-Olives E, Kawachi I, von Steinbüchel N. Pregnancy and Birth Outcomes Among Immigrant Women in the US and Europe: A Systematic Review. *J Immigrant Minority Health*. 2017;19(6):1469-1487. doi:10.1007/s10903-016-0483-2
52. Portes A, Truelove C. Making Sense of Diversity: Recent Research on Hispanic Minorities in the United States. *Annual Review of Sociology*. 1987;13(1):359-385. doi:10.1146/annurev.so.13.080187.002043
53. Sáenz R, Morales MC. *Latinos in the United States: Diversity and Change*. John Wiley & Sons; 2015.
54. Coleman M, Kocher A. Rethinking the “Gold Standard” of Racial Profiling: §287(g), Secure Communities and Racially Discrepant Police Power. *American Behavioral Scientist*. April 2019:000276421983527. doi:10.1177/0002764219835275
55. Asad AL, Clair M. Racialized legal status as a social determinant of health. *Social Science & Medicine*. 2018;199:19-28. doi:10.1016/J.SOCSCIMED.2017.03.010
56. Almeida J, Biello KB, Pedraza F, Wintner S, Viruell-Fuentes E. The association between anti-immigrant policies and perceived discrimination among Latinos in the US: A multilevel analysis. *SSM - Population Health*. 2016;2:897-903. doi:10.1016/j.ssmph.2016.11.003
57. Hatzenbuehler ML, Prins SJ, Flake M, et al. Immigration policies and mental health morbidity among Latinos: A state-level analysis. *Social Science & Medicine*. 2017;174:169-178. doi:10.1016/j.socscimed.2016.11.040
58. Geronimus AT. Understanding and eliminating racial inequalities in women’s health in the United States: The role of the weathering conceptual framework. *JAMWA*. 2001;56(4):133-137. doi:10.1080/19397030902947041
59. Kramer MR, Cooper HL, Drews-Botsch CD, Waller LA, Hogue CR. Metropolitan isolation segregation and Black-White disparities in very preterm birth: A test of mediating pathways and variance explained. *Social Science and Medicine*. 2010;71(12):2108-2116. doi:10.1016/j.socscimed.2010.09.011
60. Barfield WD. Public Health Implications of Very Preterm Birth. *Clin Perinatol*. 2018;45(3):565-577. doi:10.1016/j.clp.2018.05.007
61. Torche F, Sirois C. Restrictive Immigration Law and Birth Outcomes of Immigrant Women. *American Journal of Epidemiology*. 2018. doi:10.1093/aje/kwy218/5144386
62. Pham H, Pham VH. Subfederal Immigration Regulation and the Trump Effect. *New York University Law Review*. May 2018.
63. Wilcox A. *Fertility and Pregnancy: An Epidemiologic Perspective* - Allen J. Wilcox - *Google Books*. New York, New York: Oxford University Press; 2010.

64. Geronimus AT. The weathering hypothesis and the health of African-American women and infants: evidence and speculations. *Ethnicity & disease*. 1992;2(3):207-221.
65. Gaudino JA, Jenkins B, RoCHAT RW. No fathers' names: a risk factor for infant mortality in the State of Georgia, USA. *Social science & medicine (1982)*. 1999;48(2):253-265.
66. Desenclos JC, Scaggs M, Wroten JE. Characteristics of mothers of live infants with congenital syphilis in Florida, 1987-1989. *American journal of epidemiology*. 1992;136(6):657-661.
67. Sullivan K, Raley RK, Hummer RA, Schiefelbein E. The Potential Contribution of Marital-Cohabitation Status to Racial, Ethnic, and Nativity Differentials in Birth Outcomes in Texas. *Maternal and Child Health Journal*. 2012;16(4):775-784. doi:10.1007/s10995-011-0801-1
68. National Center for Health Statistics, Centers for Disease Control and Prevention. Data Access - Urban Rural Classification Scheme for Counties. Centers for Disease Control and Prevention. https://www.cdc.gov/nchs/data_access/urban_rural.htm. Published July 22, 2019. Accessed August 19, 2019.
69. Potochnick S, Chen JH, Perreira K. Local-Level Immigration Enforcement and Food Insecurity Risk among Hispanic Immigrant Families with Children: National-Level Evidence. *J Immigr Minor Health*. 2016. doi:10.1007/s10903-016-0464-5
70. American Immigration Council. The 287(g) Program: An Overview | American Immigration Council. American Immigration Council. <https://www.americanimmigrationcouncil.org/research/287g-program-immigration>. Published 2017. Accessed April 13, 2017.
71. Passel J, Cohn D. U.S. Unauthorized Immigrant Population Level Since 2009 | Pew Research Center. Pew Research Center. <http://www.pewhispanic.org/2016/09/20/overall-number-of-u-s-unauthorized-immigrants-holds-steady-since-2009/>. Published 2016. Accessed January 5, 2018.
72. Van PH, Pham H. The Immigrant Climate Index (ICI) – Pham Hoang Van. http://sites.baylor.edu/van_pham/the-immigrant-climate-index-ici/. Published 2017. Accessed January 11, 2018.
73. Novak NL, Geronimus AT, Martinez-Cardoso AM. Change in birth outcomes among infants born to Latina mothers after a major immigration raid. *International journal of epidemiology*. January 2017. doi:10.1093/ije/dyw346
74. Behrman RE, Butler AS. *Preterm Birth: Causes, Consequences, and Prevention.*; 2007. doi:10.1080/01443610802243047
75. Gilbert WM, Nesbitt TS, Danielsen B. The cost of prematurity: quantification by gestational age and birth weight. *Obstetrics & Gynecology*. 2003;102(3):488-492. doi:10.1016/S0029-7844(03)00617-3

76. Krieger N, Huynh M, Li W, Waterman PD, Van Wye G. Severe sociopolitical stressors and preterm births in New York City: 1 September 2015 to 31 August 2017. *Journal of epidemiology and community health*. October 2018;jech-2018-211077. doi:10.1136/jech-2018-211077
77. Asad AL, Clair M. Racialized legal status as a social determinant of health. *Social Science & Medicine*. 2018;199:19-28. doi:10.1016/J.SOCSCIMED.2017.03.010
78. Martin JA, Wilson EC, Osterman MJK, Saadi EW, Sutton SR, Hamilton BE. Assessing the quality of medical and health data from the 2003 birth certificate revision: results from two states. *National vital statistics reports : from the Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System*. 2013;62(2):1-19.
79. Roohan PJ, Josberger RE, Acar J, Dabir P, Feder HM, Gagliano PJ. Validation of birth certificate data in New York State. *Journal of Community Health*. 2003;28(5):335-346. doi:10.1023/A:1025492512915
80. Reichman NE, Schwartz-Soicher O. Accuracy of birth certificate data by risk factors and outcomes: analysis of data from New Jersey. *American Journal of Obstetrics and Gynecology*. 2007;197(1):32.e1-32.e8. doi:10.1016/j.ajog.2007.02.026
81. Flores RD. Do Anti-Immigrant Laws Shape Public Sentiment? A Study of Arizona's SB 1070 Using Twitter Data. *American Journal of Sociology*. 2017;123(2):333-384. doi:10.1086/692983
82. Tom K Wong, Karina Shklyan, Andrea Silva, Josefina Espino. *Fractured Federalism: How Dissonant Immigration Enforcement Policies Affect Undocumented Immigrants*. La Jolla, CA: U.S. Immigration Policy Center; 2019. <https://usipc.ucsd.edu/publications/Fractured-Immigration-Federalism-.pdf>.
83. Perreira KM, Pedroza JM. Policies of Exclusion: Implications for the Health of Immigrants and Their Children. *Annual Review of Public Health*. 2019;40(1):147-166. doi:10.1146/annurev-publhealth-040218-044115
84. Rudolph, L., Caplan, J., Ben-Moshe, K., & Dillon, L. *Health in All Policies: A Guide for State and Local Government - Public Health Institute*. American Public Health Association; 2013. <http://www.phi.org/resources/?resource=hiapgguide>. Accessed June 27, 2019.
85. Lopez WD, Kruger DJ, Delva J, et al. Health Implications of an Immigration Raid_ Findings from a Latino Community in the Midwestern United States. *Journal of Immigrant and Minority Health*. 2017;19(3):702-708. doi:10.1007/s10903-016-0390-6
86. Wang JS-H, Kaushal N. Health and Mental Health Effects of Local Immigration Enforcement. *International Migration Review*. October 2018:019791831879197. doi:10.1177/0197918318791978

87. Rhodes SD, Mann L, Simán FM, et al. The impact of local immigration enforcement policies on the health of immigrant Hispanics/Latinos in the United States. *American Journal of Public Health*. 2015;105(2):329-337. doi:10.2105/AJPH.2014.302218
88. Moinester M. A Look to the Interior: Trends in U.S. Immigration Removals by Criminal Conviction Type, Gender, and Region of Origin, Fiscal Years 2003-2015. *American Behavioral Scientist*. March 2019:000276421983527. doi:10.1177/0002764219835276
89. Almeida J, Biello KB, Pedraza F, Wintner S, Viruell-Fuentes E. The association between anti-immigrant policies and perceived discrimination among Latinos in the US: A multilevel analysis. *SSM - Population Health*. 2016;2:897-903. doi:10.1016/j.ssmph.2016.11.003
90. Capps R, Rosenblum MR, Rodriguez C, Christi M. *Delegation and Divergence: A Study of 287(g) State and Local Immigration Enforcement.*; 2011.
91. Coleman M, Kocher A. Rethinking the “Gold Standard” of Racial Profiling: §287(g), Secure Communities and Racially Discrepant Police Power. *American Behavioral Scientist*. April 2019:000276421983527. doi:10.1177/0002764219835275
92. Donato KM, Rodríguez LA. Police Arrests in a Time of Uncertainty: The Impact of 287(g) on Arrests in a New Immigrant Gateway. *American Behavioral Scientist*. 2014;58(13):1696-1722. doi:10.1177/0002764214537265
93. Rhodes SD, Mann L, Simán FM, et al. The impact of local immigration enforcement policies on the health of immigrant Hispanics/Latinos in the United States. *American Journal of Public Health*. 2015;105(2):329-337. doi:10.2105/AJPH.2014.302218
94. GAO GAO. IMMIGRATION Better Controls Needed over Program Authorizing State and Local Enforcement of Federal Immigration Laws Highlights State and Local Enforcement of Federal Immigration Laws. 2009;(January).
95. Kramer MR, Hogue CJ, Dunlop AL, Menon R. Preconceptional stress and racial disparities in preterm birth: an overview. *Acta Obstet Gynecol Scand*. 2011;90(12):1307-1316. doi:10.1111/j.1600-0412.2011.01136.x
96. Shapiro GD, Fraser WD, Frasch MG, Séguin JR. Psychosocial stress in pregnancy and preterm birth: Associations and mechanisms. *Journal of Perinatal Medicine*. 2013;41(6):631-645. doi:10.1515/jpm-2012-0295
97. Torche F, Sirois C. Restrictive Immigration Law and Birth Outcomes of Immigrant Women. *American Journal of Epidemiology*. 2018. doi:10.1093/aje/kwy218/5144386
98. United States Census Bureau. Summary File. 2005-2016 American Community Survey. <http://ftp2.census.gov/>. Published January 1, 2018.
99. ICE ICE. FOIA Library. Immigration Customs Enforcement. <https://www.ice.gov/foia/library>. Published 2019.

100. Department of Homeland Security U, of Inspector General O. *The Performance of 287(g) Agreements Homeland Security.*; 2010.
101. Besag J, York J, Mollié A. Bayesian image restoration, with two applications in spatial statistics. *Annals of the Institute of Statistical Mathematics*. 1991;43(1):1-20. doi:10.1007/BF00116466
102. Blangiardo Marta, Cameletti Michela. *Spatial and Spatio-Temporal Bayesian Models with R-INLA*.
103. Richardson S, Thomson A, Best N, Elliott P. Interpreting Posterior Relative Risk Estimates in Disease-Mapping Studies. *Environmental Health Perspectives*. 2004;112(9):1016. doi:10.1289/ehp.6740
104. Martino S, Rue H. *Implementing Approximate Bayesian Inference Using Integrated Nested Laplace Approximation: A Manual for the Inla Program.*; 2010.
105. Morrison KT, Shaddick G, Henderson SB, Buckeridge DL. A latent process model for forecasting multiple time series in environmental public health surveillance. *Statistics in Medicine*. 2016;35(18):3085-3100. doi:10.1002/sim.6904
106. Ugarte MD, Adin A, Goicoa T, Militino AF. On fitting spatio-temporal disease mapping models using approximate Bayesian inference. *Statistical Methods in Medical Research*. 2014;23(6):507-530. doi:10.1177/0962280214527528
107. March of Dimes,. Preterm labor and premature birth: Are you at risk? <http://www.marchofdimes.org/complications/preterm-labor-and-premature-birth-are-you-at-risk.aspx>. Published 2019. Accessed July 28, 2019.
108. Shapiro GD, Fraser WD, Frasch MG, Séguin JR. Psychosocial stress in pregnancy and preterm birth: Associations and mechanisms. *Journal of Perinatal Medicine*. 2013;41(6):631-645. doi:10.1515/jpm-2012-0295
109. Division of Reproductive Health C. Preterm Birth | Maternal and Infant Health | Reproductive Health | CDC. National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention. <https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pretermbirth.htm>. Published 2018. Accessed September 10, 2018.
110. Graignic-Philippe R, Dayan J, Chokron S, Jacquet AY, Tordjman S. Effects of prenatal stress on fetal and child development: A critical literature review. *Neuroscience and Biobehavioral Reviews*. 2014;43:137-162. doi:10.1016/j.neubiorev.2014.03.022
111. Epel ES, Crosswell AD, Mayer SE, et al. More than a feeling: A unified view of stress measurement for population science. *Frontiers in neuroendocrinology*. 2018;49:146-169. doi:10.1016/j.yfrne.2018.03.001

112. Pearlin LI, Menaghan EG, Lieberman MA, Mullan JT. The Stress Process. *Journal of Health and Social Behavior*. 1981;22(4):337-356. doi:10.2307/2136676
113. Ellis BJ, Del Giudice M. Developmental Adaptation to Stress: An Evolutionary Perspective. *Annual Review of Psychology*. 2019;70(1):111-139. doi:10.1146/annurev-psych-122216-011732
114. Ursin H, Eriksen HR. Cognitive activation theory of stress (CATS). *Neuroscience & Biobehavioral Reviews*. 2010;34(6):877-881. doi:10.1016/j.neubiorev.2009.03.001
115. Luthar SS, Cicchetti D, Becker B. The Construct of Resilience: A Critical Evaluation and Guidelines for Future Work. *Child Dev*. 2000;71(3):543-562.
116. Bonanno GA. Uses and abuses of the resilience construct: Loss, trauma, and health-related adversities. *Social Science & Medicine*. 2012;74(5):753-756. doi:10.1016/j.socscimed.2011.11.022
117. Borders AEB, Wolfe K, Qadir S, Kim K-Y, Holl J, Grobman W. Racial/Ethnic Differences in Self-Reported and Biologic Measures of Chronic Stress in Pregnancy. *J Perinatol*. 2015;35(8):580-584. doi:10.1038/jp.2015.18
118. Lu MC, Chen B. Racial and ethnic disparities in preterm birth: the role of stressful life events. *Am J Obstet Gynecol*. 2004;191(3):691-699. doi:10.1016/j.ajog.2004.04.018
119. Power A, Bell SL, Kyle RG, Andrews GJ. 'Hopeful adaptation' in health geographies: Seeking health and wellbeing in times of adversity. *Social Science & Medicine*. 2019;231:1-5. doi:10.1016/j.socscimed.2018.09.021
120. de la Rosa IA, Barnett-Queen T, Messick M, Gurrola M. Spirituality and Resilience Among Mexican American IPV Survivors. *J Interpers Violence*. 2016;31(20):3332-3351. doi:10.1177/0886260515584351
121. Hunter-Hernández M, Costas-Muñiz R, Gany F. Missed Opportunity: Spirituality as a Bridge to Resilience in Latinos with Cancer. *J Relig Health*. 2015;54(6):2367-2375. doi:10.1007/s10943-015-0020-y
122. Bender DE, Castro D. Explaining the birth weight paradox : Latina immigrants' perceptions of resilience and risk. *Journal of immigrant health*. 2000;2(3):155-173. doi:10.1023/A:1009513020506
123. Perreira KM, Marchante AN, Schwartz SJ, et al. Stress and Resilience: Key Correlates of Mental Health and Substance Use in the Hispanic Community Health Study of Latino Youth. *Journal of Immigrant and Minority Health*. March 2018. doi:10.1007/s10903-018-0724-7
124. Torres JM, Lee A, González HM, Garcia L, Haan MN. A longitudinal analysis of cross-border ties and depression for Latino adults. *Social Science and Medicine*. 2016;160:111-119. doi:10.1016/j.socscimed.2016.04.018

125. Fleuriet KJ, Sunil TS. Stress, Pregnancy, and Motherhood: Implications for Birth Weights in the Borderlands of Texas. *Medical Anthropology Quarterly*. 2017;31(1):60-77. doi:10.1111/maq.12324
126. Teti M, Martin AE, Ranade R, et al. "I'm a Keep Rising. I'm a Keep Going Forward, Regardless": Exploring Black Men's Resilience Amid Sociostructural Challenges and Stressors. *Qual Health Res*. 2012;22(4):524-533. doi:10.1177/1049732311422051
127. Ungar M. Resilience across Cultures. *Br J Soc Work*. 2008;38(2):218-235. doi:10.1093/bjsw/bcl343
128. Ivankova NV, Creswell JW, Stick SL. Using Mixed-Methods Sequential Explanatory Design: From Theory to Practice. *Field Methods*. 2006;18(1):3-20. doi:10.1177/1525822X05282260
129. Leech NL, Onwuegbuzie AJ. A typology of mixed methods research designs. *Qual Quant*. 2009;43(2):265-275. doi:10.1007/s11135-007-9105-3
130. Cohen S, Mermelstein R, Kamarck T, Hoberman HM. Measuring the Functional Components of Social Support. In: *Social Support: Theory, Research and Applications*. Dordrecht: Springer Netherlands; 2012:73-94. doi:10.1007/978-94-009-5115-0_5
131. Validation of the Edinburgh Postnatal Depression Scale (EPDS) in Spanish mothers. *Journal of Affective Disorders*. 2003;75(1):71-76. doi:10.1016/S0165-0327(02)00020-4
132. Norris FH. Screening for Traumatic Stress: A Scale for Use in the General Population1. *Journal of Applied Social Psychology*. 1990;20(20):1704-1715. doi:10.1111/j.1559-1816.1990.tb01505.x
133. Gallo LC, Penedo FJ, Carnethon M, et al. The Hispanic Community Health Study/Study of Latinos Sociocultural Ancillary Study: sample, design, and procedures. *Ethnicity & disease*. 2014;24(1):77-83.
134. Admi H. The Life History: A Viable Approach to Nursing Research. *Nursing Research*. 1995;44(3):186.
135. Braun V, Clarke V. Using thematic analysis in psychology. *Qualitative Research in Psychology*. 2006;3(2):77-101. doi:10.1191/1478088706qp063oa
136. Hennink MM, Hutter I, Bailey A. *Qualitative Research Methods*. Thousand Oaks, CA: SAGE Publications Ltd; 2011.
137. R Core Team. R: A Language and Environment for Statistical Computing. 2018.
138. Ayed N, Toner S, Priebe S. Conceptualizing resilience in adult mental health literature: A systematic review and narrative synthesis. *Psychology and Psychotherapy: Theory, Research and Practice*. June 2018. doi:10.1111/papt.12185

139. Campos B, Schetter CD, Abdou CM, Hobel CJ, Glynn LM, Sandman CA. Familialism, Social Support, and Stress: Positive Implications for Pregnant Latinas. *Cultur Divers Ethnic Minor Psychol*. 2008;14(2):155-162. doi:10.1037/1099-9809.14.2.155
140. Ornelas IJ, Perreira KM, Beeber L, Maxwell L. Challenges and Strategies to Maintaining Emotional Health: Qualitative Perspectives of Mexican Immigrant Mothers. *Journal of Family Issues*. 2009;30(11):1556-1575. doi:10.1177/0192513X09336651
141. Parra-Cardona JR, Córdova D, Holtrop K, Villarruel FA, Wieling E. Shared Ancestry, Evolving Stories: Similar and Contrasting Life Experiences Described by Foreign Born and U.S. Born Latino Parents. *Family Process*. 2008;47(2):157-172. doi:10.1111/j.1545-5300.2008.00246.x
142. James SA. John Henryism and the health of African-Americans. *Cult Med Psych*. 1994;18(2):163-182. doi:10.1007/BF01379448
143. Brody GH, Yu T, Chen E, Miller GE, Kogan SM, Beach SRH. Is Resilience Only Skin Deep? Rural African Americans' Preadolescent Socioeconomic Status-Related Risk and Competence and Age 19 Psychological Adjustment and Allostatic Load. *Psychol Sci*. 2013;24(7):1285-1293. doi:10.1177/0956797612471954
144. Felix AS, Shisler R, Nolan TS, et al. High-Effort Coping and Cardiovascular Disease among Women: A Systematic Review of the John Henryism Hypothesis. *J Urban Health*. 2019;96(1):12-22. doi:10.1007/s11524-018-00333-1
145. Odéen M, Westerlund H, Theorell T, Leineweber C, Eriksen HR, Ursin H. Expectancies, Socioeconomic Status, and Self-Rated Health: Use of the Simplified TOMCATS Questionnaire. *Int J Behav Med*. 2013;20(2):242-251. doi:10.1007/s12529-012-9221-x
146. Cohen D, Crabtree BF. RWJF - Qualitative Research Guidelines Project | Reflexivity | Reflexivity. <http://www.qualres.org/HomeRefl-3703.html>. Published 2006. Accessed December 6, 2019.
147. Hamby S, Blount Z, Eidson E, Smith A. *Breaking Free from the Web of Violence: Asset-Based Approaches for Boys & Men of Color*. Research Integration Strategies Evaluation; :41. <https://www.lifepathsresearch.org/wp-content/uploads/Breaking-Free-from-the-Web-of-Violence.pdf>.
148. Birks Y, Harrison R, Bosanquet K, et al. *An Exploration of the Implementation of Open Disclosure of Adverse Events in the UK: A Scoping Review and Qualitative Exploration*. Southampton (UK): NIHR Journals Library; 2014. <http://www.ncbi.nlm.nih.gov/books/NBK259820/>. Accessed December 6, 2019.
149. Kendi IX. *How to Be an Antiracist*. One World/Ballantine; 2019.
150. Meng G, Thompson ME, Hall GB. Pathways of neighbourhood-level socio-economic determinants of adverse birth outcomes. *International journal of health geographics*. 2013;12:32. doi:10.1186/1476-072X-12-32

151. Austin MP, Leader L. Maternal stress and obstetric and infant outcomes: epidemiological findings and neuroendocrine mechanisms. *The Australian & New Zealand journal of obstetrics & gynaecology*. 2000;40(3):331-337.
152. Kramer MS, Seguin L, Lydon J, Goulet L. Socio-economic disparities in pregnancy outcome: why do the poor fare so po...: EBSCOhost. *Paediatric and Perinatal Epidemiology*. 2000;14(3):194-210.
153. Viruell-Fuentes EA. Beyond acculturation: immigration, discrimination, and health research among Mexicans in the United States. *Social Science & Medicine*. 2007;65(7):1524-1535. doi:10.1016/j.socscimed.2007.05.010
154. Crump C, Lipsky S, A. Mueller B. Adverse Birth Outcomes Among Mexican-Americans: Are US-Born Women at Greater Risk than Mexico-Born Women? *Ethnicity & Health*. 1999;4(1-2):29-34. doi:10.1080/13557859998164
155. Krieger N. Methods for the scientific study of discrimination and health: an ecosocial approach. *American journal of public health*. 2012;102(5):936-944. doi:10.2105/AJPH.2011.300544
156. Hsieh Y-C, Apostolopoulos Y, Hatzudis K, Sönmez S. Social, Occupational, and Spatial Exposures and Mental Health Disparities of Working-Class Latinas in the US. *Journal of Immigrant and Minority Health*. 2016;18(3):589-599. doi:10.1007/s10903-015-0231-z
157. Hoggatt KJ, Flores M, Solorio R, Wilhelm M, Ritz B. The “Latina epidemiologic paradox” revisited: the role of birthplace and acculturation in predicting infant low birth weight for Latinas in Los Angeles, CA. *J Immigr Minor Health*. 2012;14(5):875-884. doi:10.1007/s10903-011-9556-4
158. Flores ME, Simonsen SE, Manuck TA, Dyer JM, Turok DK. The “Latina epidemiologic paradox”: contrasting patterns of adverse birth outcomes in U.S.-born and foreign-born Latinas. *Womens Health Issues*. 2012;22(5):e501-7. doi:10.1016/j.whi.2012.07.005
159. Almeida J, Mulready-Ward C, Bettgowda VR, Ahluwalia IB. Racial/Ethnic and nativity differences in birth outcomes among mothers in New York City: the role of social ties and social support. *Matern Child Health J*. 2014;18(1):90-100. doi:10.1007/s10995-013-1238-5
160. McGlade MS, Saha S, Dahlstrom ME. The Latina paradox: an opportunity for restructuring prenatal care delivery. *American journal of public health*. 2004;94(12):2062-2065.
161. Ghosh JK, Wilhelm MH, Dunkel-Schetter C, Lombardi CA, Ritz BR. Paternal support and preterm birth, and the moderation of effects of chronic stress: a study in Los Angeles county mothers. *Arch Womens Ment Health*. 2010;13(4):327-338. doi:10.1007/s00737-009-0135-9

162. Martin JA, Hamilton BE, Osterman MJK, Driscoll AK, Mathews TJ. Births: Final Data for 2015. *National vital statistics reports : from the Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System*. 2017;66(1):1.
163. Saigal S, Doyle LW. An overview of mortality and sequelae of preterm birth from infancy to adulthood. *The Lancet*. 2008;371(9608):261-269. doi:10.1016/S0140-6736(08)60136-1
164. Martin Hamilton, Brady E., Osterman, Michelle JK, Curtin, Sally C, Mathews, TJ JA. Births:Final Data for 2012. *National Vital Statistics Reports*. 2013;62(9).
165. Kramer MR, Hogue CR. Place matters: variation in the black/white very preterm birth rate across U.S. metropolitan areas, 2002-2004. *Public health reports (Washington, DC : 1974)*. 2008;123(5):576-585. doi:10.1177/003335490812300507
166. Kramer MR, Hogue CR. What causes racial disparities in very preterm birth? A biosocial perspective. *Epidemiol Rev*. 2009;31:84-98. doi:10.1093/ajerev/mxp003
167. Minyard KJ, Lineberry IC, Smith TA, Byrd-Roubides T. Transforming the delivery of rural health care in Georgia: state partnership strategy for developing rural health networks. *J Rural Health*. 2003;19 Suppl:361-371.
168. Goldenberg RL, Culhane JF, Iams JD, Romero R. Epidemiology and causes of preterm birth. *The Lancet*. 2008;371(9606):75-84. doi:10.1016/S0140-6736(08)60074-4
169. Mulder E, Robles de Medina P, Huizink A, Van de Bergh B, Buitelaar J. Prenatal maternal stress: effects on pregnancy and the (unborn) child. *Early Human Development*. 2002;70(1-2):3-14. doi:10.1016/S0378-3782(02)00075-0
170. Dunkel Schetter C, Tanner L. Anxiety, depression and stress in pregnancy: implications for mothers, children, research, and practice. *Current opinion in psychiatry*. 2012;25(2):141-148. doi:10.1097/YCO.0b013e3283503680
171. Graignic-Philippe R, Dayan J, Chokron S, Jacquet AY, Tordjman S. Effects of prenatal stress on fetal and child development: A critical literature review. *Neuroscience and Biobehavioral Reviews*. 2014;43:137-162. doi:10.1016/j.neubiorev.2014.03.022
172. HOBEL CJ, Goldstein A, BARRETT ES. Psychosocial stress and pregnancy outcome. *Clinical Obstetrics and Gynecology*. 2008;51(2):333-348. doi:10.1097/GRF.0b013e31816f2709
173. Hsieh Y-C (Jerrie), Sönmez S, Apostolopoulos Y, Lemke MK. Perceived workplace mistreatment: Case of Latina hotel housekeepers. *Work*. 2017;56(1):55-65. doi:10.3233/WOR-162467
174. Breland HL, Ellis C. Perceived Discrimination in Healthcare Settings among Latinos with Limited English Proficiency in South Carolina. *Southern Medical Journal*. 2015;108(4):203-206. doi:10.14423/SMJ.0000000000000259

175. Huang B, Appel H, Ai AL. The Effects of Discrimination and Acculturation to Service Seeking Satisfaction for Latina and Asian American Women: Implications for Mental Health Professions. *Social Work in Public Health*. 2010;26(1):46-59. doi:10.1080/10911350903341077
176. Pérez DJ, Fortuna L, Alegria M. Prevalence and Correlates of Everyday Discrimination among U.S. Latinos. *Journal of community psychology*. 2008;36(4):421-433. doi:10.1002/jcop.20221
177. Callister LC, Birkhead A. Acculturation and Perinatal Outcomes in Mexican Immigrant Childbearing Women: An Integrative Review. *The Journal of Perinatal & Neonatal Nursing*. 2002;16(3).
178. Fleuriet KJ, Sunil TS. Subjective Social Status, Mental and Psychosocial Health, and Birth Weight Differences in Mexican–American and Mexican Immigrant Women. *Journal of Immigrant and Minority Health*. 2015;17(6):1781-1790. doi:10.1007/s10903-015-0178-0
179. Krieger N. Proximal, distal, and the politics of causation: what’s level got to do with it? *American journal of public health*. 2008;98(2):221-230. doi:10.2105/AJPH.2007.111278
180. Hacker K, Anies M, Folb BL, Zallman L. Barriers to health care for undocumented immigrants: a literature review. *Risk management and healthcare policy*. 2015;8:175-183. doi:10.2147/RMHP.S70173
181. Hacker K, Chu J, Leung C, et al. The impact of Immigration and Customs Enforcement on immigrant health: Perceptions of immigrants in Everett, Massachusetts, USA. *Social Science & Medicine*. 2011;73(4):586-594. doi:10.1016/j.socscimed.2011.06.007
182. Gleeson S, Gonzales RG. When Do Papers Matter? An Institutional Analysis of Undocumented Life in the United States. *International Migration*. 2012;50(4):1-19. doi:10.1111/j.1468-2435.2011.00726.x
183. Amuedo-Dorantes C, Pozo S. On the Intended and Unintended Consequences of Enhanced U.S. Border and Interior Immigration Enforcement: Evidence From Mexican Deportees. *Demography*. 2014;51(6):2255-2279. doi:10.1007/s13524-014-0340-7
184. Valdez CR, Lewis Valentine J, Padilla B. “Why we stay”: Immigrants’ motivations for remaining in communities impacted by anti-immigration policy. *Cultural Diversity and Ethnic Minority Psychology*. 2013;19(3):279-287. doi:10.1037/a0033176
185. Hernández-León R, Zúñiga V, Zúñiga V. Mexican immigrant communities in the south and social capital: The case of Dalton, Georgia. *Center for Comparative Immigration Studies*. 2002.
186. Zarrugh L. From Workers to Owners: Latino Entrepreneurs in Harrisonburg, Virginia. *Human Organization*. 2007;66(3):240-248. doi:10.17730/humo.66.3.6048634r4402v675

187. Baquero B, Molina M, Elder JP, Norman GJ, Ayala GX. Neighborhoods, Social and Cultural Correlates of Obesity Risk among Latinos living on the U.S.-Mexico border in Southern California. *Journal of Health Care for the Poor and Underserved*. 2016;27(4):1934-1955. doi:10.1353/hpu.2016.0172
188. Torres JM, Lee A, González HM, Garcia L, Haan MN. A longitudinal analysis of cross-border ties and depression for Latino adults. *Social Science and Medicine*. 2016;160:111-119. doi:10.1016/j.socscimed.2016.04.018
189. Krieger N, Chen JT, Waterman PD, Soobader M-J, Subramanian S V., Carson R. Geocoding and Monitoring of US Socioeconomic Inequalities in Mortality and Cancer Incidence: Does the Choice of Area-based Measure and Geographic Level Matter?: The Public Health Disparities Geocoding Project. *American Journal of Epidemiology*. 2002;156(5):471-482. doi:10.1093/aje/kwf068
190. Hatzenbuehler ML, Bellatorre A, Lee Y, Finch BK, Muennig P, Fiscella K. Structural stigma and all-cause mortality in sexual minority populations. *Social Science & Medicine*. 2014;103:33-41. doi:10.1016/J.SOCSCIMED.2013.06.005
191. Mendez DD, Hogan VK, Culhane JF. Institutional racism, neighborhood factors, stress, and preterm birth. *Ethnicity & Health*. 2014;19(5):479-499. doi:10.1080/13557858.2013.846300
192. Phillips GS, Wise LA, Rich-Edwards JW, Stampfer MJ, Rosenberg L. Neighborhood socioeconomic status in relation to preterm birth in a U.S. cohort of black women. *Journal of urban health : bulletin of the New York Academy of Medicine*. 2013;90(2):197-211. doi:10.1007/s11524-012-9739-x
193. Morenoff JD. Neighborhood Mechanisms and the Spatial Dynamics of Birth Weight. *American Journal of Sociology*. 2003;108(5):976-1017. doi:10.1086/374405
194. Shaw RJ, Pickett KE, Wilkinson RG. Ethnic density effects on birth outcomes and maternal smoking during pregnancy in the US linked birth and infant death data set. *Am J Public Health*. 2010;100(4):707-713. doi:10.2105/ajph.2009.167114
195. Mason SM, Kaufman JS, Daniels JL, Emch ME, Hogan VK, Savitz DA. Neighborhood ethnic density and preterm birth across seven ethnic groups in New York City. *Health & place*. 2011;17(1):280-288. doi:10.1016/j.healthplace.2010.11.006
196. KRIEGER N. Who and What Is a “Population”? Historical Debates, Current Controversies, and Implications for Understanding “Population Health” and Rectifying Health Inequities. *Milbank Quarterly*. 2012;90(4):634-681. doi:10.1111/j.1468-0009.2012.00678.x
197. Quiroga SS, Medina DM, Glick J. In the belly of the beast: Effects of anti-Immigration policy on Latino community members. *American Behavioral Scientist*. 2014;58(13):1723-1742. doi:10.1177/0002764214537270

198. Macintyre S, Ellaway A, Cummins S. Place effects on health: how can we conceptualise, operationalise and measure them? *Social Science & Medicine*. 2002;55(1):125-139. doi:10.1016/S0277-9536(01)00214-3
199. Cummins S, Curtis S, Diez-Roux A V., Macintyre S. Understanding and representing “place” in health research: A relational approach. *Social Science and Medicine*. 2007;65(9):1825-1838. doi:10.1016/j.socscimed.2007.05.036
200. Massey DS, Schnabel KM. Recent Trends in Hispanic Immigration to the United States. *International Migration Review*. 1983;17(2):212. doi:10.2307/2545976
201. Portes A. THE NEW LATIN NATION. *Du Bois Review: Social Science Research on Race*. 2007;4(02). doi:10.1017/S1742058X07070166
202. Stepler R, Brown A. Statistical Portrait of Hispanics in the United States in 2013 | Pew Research Center. Pew Research Center: Hispanic Trends. <http://www.pewhispanic.org/2016/04/19/statistical-portrait-of-hispanics-in-the-united-states/>. Published 2016. Accessed April 25, 2017.
203. Stepler R, Lopez MH. *Latino Population Growth and Dispersion in U.S. Slows Since the Recession* | Pew Research Center. Washington, DC; 2016.
204. Durand J, Massey DS, Charvet F. The changing geography of Mexican immigration to the United States: 1910-1996. *Social Science Quarterly*. 2000:1-15.
205. Massey DS, Rugh JS. Segregation in Post-Civil Rights America: Stalled Integration or End of the Segregated Century? *Du Bois review : social science research on race*. 2014;11(2):205-232. doi:10.1017/S1742058X13000180
206. Martin JA, Hamilton BE, Osterman MJ. Births in the United States, 2013. *NCHS Data Brief*. 2014;(175):1-8.
207. Almeida LM, Costa-Santos C, Caldas JP, Dias S, Ayres-de-Campos D. The impact of migration on women’s mental health in the postpartum period. *Revista de saude publica*. 2016;50. doi:10.1590/S1518-8787.2016050005617
208. Gallo LC, Penedo FJ, Espinosa de los Monteros K, Arguelles W. Resiliency in the Face of Disadvantage: Do Hispanic Cultural Characteristics Protect Health Outcomes? *Journal of Personality*. 2009;77(6):1707-1746. doi:10.1111/j.1467-6494.2009.00598.x
209. Page RL. Positive Pregnancy Outcomes in Mexican Immigrants: What Can We Learn? *Journal of Obstetric, Gynecologic & Neonatal Nursing*. 2004;33(6):783-790. doi:10.1177/0884217504270595
210. Jasso G, Massey D. Immigration, health, and New York City: Early results based on the US new immigrant cohort of 2003. *FRBNY Economic Policy Review*. 2005;11(2):127-151.

211. Capps R, Koball H, Campetella A, Perreira K, Hooker S, Pedroza JM. *Implications of Immigration Enforcement Activities for the Well-Being of Children in Immigrant Families*. Washington, DC; 2015.
212. Passel JS. How Pew Research Center estimates illegal immigration | Pew Research Center. Pew Research Center. <http://www.pewresearch.org/fact-tank/2016/09/20/measuring-illegal-immigration-how-pew-research-center-counts-unauthorized-immigrants-in-the-u-s/>. Published 2016. Accessed December 13, 2016.
213. Auchincloss AH, Gebreab SY, Mair C, Diez Roux A V. A Review of Spatial Methods in Epidemiology, 2000–2010. *Annual Review of Public Health*. 2012;33(1):107-122. doi:10.1146/annurev-publhealth-031811-124655
214. O’Connell HA. Where there’s smoke: Cigarette use, social acceptability, and spatial approaches to multilevel modeling. *Social science & medicine (1982)*. 2015;140:18-26. doi:10.1016/j.socscimed.2015.06.025
215. Tsiko RG. Bayesian spatial analysis of childhood diseases in Zimbabwe. *BMC public health*. 2015;15:842. doi:10.1186/s12889-015-2182-7
216. Almeida J, Kawachi I, Molnar BE, Subramanian S V. A Multilevel Analysis of Social Ties and Social Cohesion among Latinos and Their Neighborhoods: Results from Chicago. *Journal of Urban Health*. 2009;86(5):745-759. doi:10.1007/s11524-009-9375-2
217. Polkinghorne DE. Language and meaning: Data collection in qualitative research. *Journal of Counseling Psychology*. 2005;52(2):137-145. doi:10.1037/0022-0167.52.2.137
218. Onwuegbuzie AJ, Leech NL. A Call for Qualitative Power Analyses. *Quality & Quantity*. 2007;41:105-121. doi:10.1007/s11135-005-1098-1
219. Bowen GA. Naturalistic inquiry and the saturation concept: a research note. *Qualitative Research*. 2008;8(1):137-152. doi:10.1177/1468794107085301
220. Atkinson R. The Life Story Interview as a Bridge in Narrative Inquiry. In: Clandinin DJ, ed. *Handbook of Narrative Inquiry: Mapping a Methodology* - Google Books. ; 2006:224-245.
221. Chapman A, Hadfield M, Chapman C. Qualitative research in healthcare: an introduction to grounded theory using thematic analysis. *Journal of the Royal College of Physicians of Edinburgh*. 2015;45(3):201-205. doi:10.4997/JRCPE.2015.305
222. Hennink Hutter, I, Bailey, A. M. *Qualitative Research Methods* . Thousand Oaks, CA: SAGE Publications Ltd; 2011.
223. Yuan P, Bare MG, Johnson MO, Saberi P. Using online social media for recruitment of human immunodeficiency virus-positive participants: a cross-sectional survey. *Journal of medical Internet research*. 2014;16(5):e117. doi:10.2196/jmir.3229

224. Chiasson MA, Parsons JT, Tesoriero JM, Carballo-Diequez A, Hirshfield S, Remien RH. HIV Behavioral Research Online. *Journal of Urban Health*. 2006;83(1):73-85. doi:10.1007/s11524-005-9008-3
225. Salyers Bull S, Lloyd L, Rietmeijer C, McFarlane M. Recruitment and retention of an online sample for an HIV prevention intervention targeting men who have sex with men: the smart sex quest project. *AIDS Care*. 2004;16(8):931-943. doi:10.1080/09540120412331292507
226. Bauermeister JA, Zimmerman MA, Johns MM, Glowacki P, Stoddard S, Volz E. Innovative recruitment using online networks: lessons learned from an online study of alcohol and other drug use utilizing a web-based, respondent-driven sampling (webRDS) strategy. *Journal of studies on alcohol and drugs*. 2012;73(5):834-838. doi:10.15288/JSAD.2012.73.834
227. Ramo DE, Hall SM, Prochaska JJ. Reaching young adult smokers through the Internet: Comparison of three recruitment mechanisms. *Nicotine & Tobacco Research*. 2010;12(7):768-775. doi:10.1093/ntr/ntq086
228. Graham AL, Fang Y, Moreno JL, et al. Online advertising to reach and recruit Latino smokers to an internet cessation program: impact and costs. *Journal of medical Internet research*. 2012;14(4):e116. doi:10.2196/jmir.2162
229. Sullivan PS, Khosropour CM, Luisi N, et al. Bias in online recruitment and retention of racial and ethnic minority men who have sex with men. *Journal of medical Internet research*. 2011;13(2):e38. doi:10.2196/jmir.1797
230. Marshall MN. Sampling for qualitative research. *Family Practice*. 1996;13(6):522-526. doi:10.1093/fampra/13.6.522
231. Northam S, Knapp TR. The Reliability and Validity of Birth Certificates. *Journal of Obstetric, Gynecologic & Neonatal Nursing*. 2006;35(1):3-12. doi:10.1111/j.1552-6909.2006.00016.x
232. Zollinger TW, Przybylski MJ, Gamache RE. Reliability of Indiana Birth Certificate Data Compared to Medical Records. *Annals of Epidemiology*. 2006;16(1):1-10. doi:10.1016/j.annepidem.2005.03.005
233. Howland RE, Madsen AM, Toprani A, Gambatese M, Mulready-Ward C, Begier E. How Well Do Birth Records Serve Maternal and Child Health Programs? Birth Registration System Evaluation, New York City, 2008–2011. *Maternal and Child Health Journal*. 2015;19(7):1559-1566. doi:10.1007/s10995-015-1664-7

Appendix A: Dissertation Proposal

Stress is increasingly recognized as a key determinant of population level inequalities in very preterm birth (VPTB) rates, driving the persistent disparity in VPTB rates between African American and white infants. Additionally, economic stressors contribute to the elevated risk of VPTB among low-SES women.¹⁵⁰⁻¹⁵² However, despite documented experiences of discrimination and low SES in general, Hispanic women, as a group, demonstrate rates of VPTB only slightly higher than non-Hispanic white women.^{48,49} The phenomenon of unexpectedly low rates of adverse birth outcomes among Hispanic women in the US is known as the Hispanic Birth Paradox.⁴⁹ Proposed explanations for the observed paradox include lower exposure to discrimination and higher levels of social support among pregnant Hispanic women.^{44,49,153} However the Hispanic paradox is not a monolithic experience, with variation in VPTB risk by country of origin, geographic location within the U.S., and number of generations in U.S.¹⁵⁴ In the proposed work, we will use an ecosocial framework to examine distinct and interrelated effects of stress and social support.^{41,155,156} Stress processes at multiple levels (individual, interpersonal and contextual) may increase the risk of adverse birth outcomes for Hispanic women.¹⁵⁷⁻¹⁶¹ VPTB rates among Hispanic live births vary geographically across states and counties (11.7 to 25.4 per 1000 live births between states in 2013). Understanding what social and political processes are associated with heterogeneity in risk among Hispanic women will allow for better design of policies and programs to improve health in this population.

The overarching goal of this project is to utilize an Ecosocial framework to explore the effect of contextual and interpersonal stressors and protective supports on risk of very preterm birth among Hispanic women across U.S. counties and states. In aim 1, we will quantify the variance in VPTB risk to Hispanic women attributable to state, county and individual level

factors and estimate the effect of markers of individual, interpersonal and contextual stress on risk of VPTB. In aim 2, we will examine the spatial distribution of VPTB to Hispanic women, taking into account spatial autocorrelation and patterning. Finally, in aim 3, we will provide rich description of how pregnant Hispanic women experience stress before and during pregnancy. Together these aims will illuminate how stress acts to increase risk of VPTB for Hispanic women and explore whether the observed Hispanic paradox is consistent with theories about the impact of stress on perinatal outcomes.

Aim 1. Estimate the effect of individual (migration history), interpersonal (relationship status), and contextual (immigration policy climate) stressors on risk of VPTB to Hispanic women and the proportion of unexplained variance at the state and individual levels with the additional control for each set of stressors from 2005-2015.

Hypothesis: Residence in a state with a negative immigration policy climate will increase the risk of VPTB among Hispanic women. Risk of VPTB will vary geographically both between and within states.

Aim 2. Estimate sub-national (regional) and sub-state (county) spatial clustering of VPTB risk among Hispanic women, and test for geographic variation in the importance of immigration enforcement in its relationship with VPTB risk among Hispanic women.

Hypothesis: The unexplained variation in VPTB risk among Hispanic women will demonstrate spatial patterning unique from that shown among non-Hispanic white women.

Aim 3. Describe the experiences of chronic stress, social support and depression during the preconception and prenatal periods among Hispanic women seeking prenatal care in Atlanta, Georgia.

a. Estimate the prevalence of prenatal chronic stress, social support and depression in a geographically bounded sample of Hispanic women seeking prenatal care and their associations with maternal characteristics.

b. Characterize women's narratives of changing stress and social support during the preconception and prenatal periods in the context of hypothesized pathways of embodiment and resilience.

1. Significance:

1.1 Very Preterm Birth

Very preterm birth (VPTB), defined as birth before 32 completed weeks gestation, is a rare and serious adverse birth outcome, occurring, on average, in 1.6% of live births in the US,¹⁶² and greatly increasing the risk of infant mortality and acute and long term morbidity compared to term or late preterm infants.¹⁶³ A growing proportion of births in the US are to Hispanic women, increasing from 17.4% in 1995 to 23.2% in 2015.^{162,164} Of these, 1.4% were very preterm, a rate that has been constant from 2007 to 2015.¹⁶² While risk factors for VPTB include individual behaviors (e.g., smoking, sexually transmitted infections), demographic characteristics (e.g. age, marital status, education), and biomedical factors (e.g. hypertension, diabetes, interpregnancy interval), there is increasing awareness of the importance of both interpersonal factors (e.g. social support, stress), and contextual factors (e.g. crime, segregation) in the etiology of VPTB.^{152,165–}

168

1.2 Stress and buffering social support

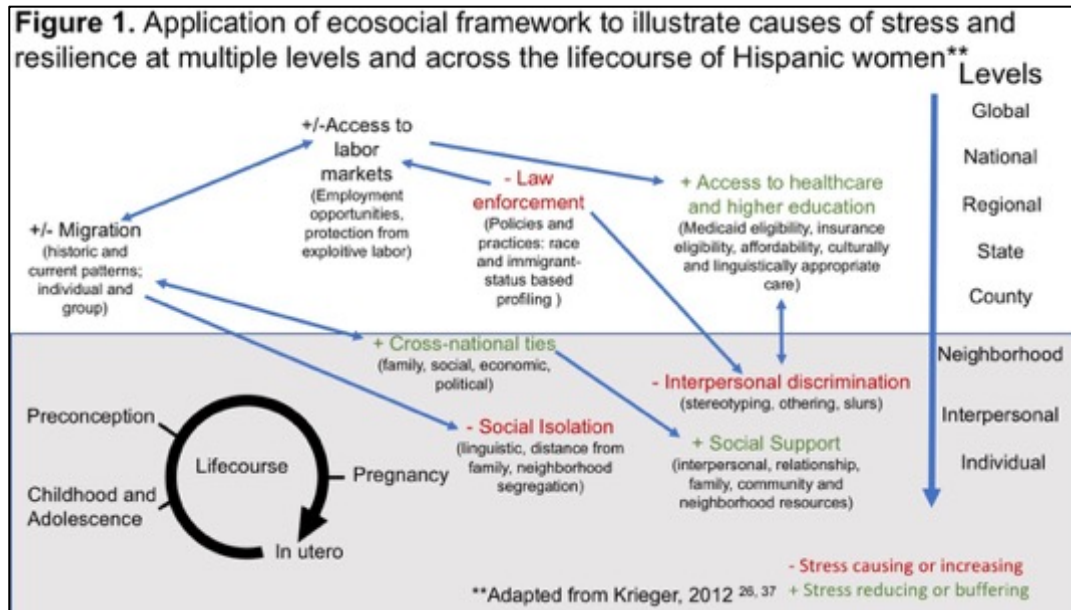
Stress is now well established as a determinant of population level inequalities in rates of VPTB, driving the persistent disparity in VPTB rates between African American and white infants.^{95,166} Additionally, economic stressors contribute to the elevated risk of VPTB among low-SES women.^{150–152} Broadly, experiences of chronic stress may elevate the risk of adverse birth outcomes by alterations in neuroendocrine and inflammation regulation during

pregnancy^{96,169} and social support decreases risk, potentially by acting as a mediator for the effect of stress.^{161,170–172} There is evidence that stress processes at multiple levels (individual, interpersonal and contextual) are associated with increased risk of adverse birth outcomes for Hispanic women.^{157–161} Lower levels of social support, membership in specific national origin groups and experiences of discrimination are associated with increased risk of adverse birth outcomes among Hispanic women.^{157–161}

1.3 Hispanic Paradox

Hispanic women, as a group, demonstrate rates of VPTB only slightly higher than non-Hispanic white women,^{162,164} despite documented experiences of structural and interpersonal discrimination and low SES in general.^{153,156,173–176} This broad and often-cited pattern has been called “the Hispanic Birth Paradox,”^{158,160} but it mistakenly masks within- and across-group differences among Hispanic women that can shed light on the competing effects of chronic stress and buffering social support. The risk of adverse birth outcomes varies by specific national origin group and maternal nativity, with foreign-born Mexican women demonstrating the lowest rates of adverse birth outcomes among Hispanic women.⁴⁹ Perhaps they have higher levels of social support during pregnancy in comparison to other subgroups, and those supports erode with acculturation into mainstream US culture.^{49,177,178} In addition, perhaps their exposure to the stress of systematic structural and interpersonal discrimination is less than it is for other minorities in the US.^{44,153} To test these hypotheses, it is necessary to contextualize and measure the multifactorial and complex processes that vary across women from diverse cultural backgrounds and how those processes vary geographically and longitudinally across US states. I hypothesize that differing levels of both social support and exposure to systematic and interpersonal stress shape risk of VPTB for different subgroups of Hispanic women. Thus, in the proposed work, I will use an **ecosocial framework** to examine how experiences of contextual and interpersonal

stress and social support drive risk of VPTB for Hispanic women and whether the observed paradox is an artifact that disappears after control for known individual risk determinants.



The ecosocial framework provides a theoretical approach to understand and test

how dynamic social and political processes create and sustain inequality at multiple, interrelated levels.^{41,179} This is appropriate for understanding the complex social, economic and political contexts generating stress for Hispanic women in the US. The lives of Hispanic women are shaped by broad global and national political and economic forces that drive historic and current migration patterns, influence state and national policies affecting access to education, labor opportunities and health care and create stress-provoking law enforcement practices.^{34,57,180-183} However, migration also creates cross-national economic and social ties, allowing Hispanic women to draw on the cultural strengths and knowledge networks in countries of origin and in the US.¹⁸⁴⁻¹⁸⁸ I have adapted Nancy Krieger's application of the ecosocial framework to racism and health¹⁵⁵ to illustrate the multilevel, complex systems of stress and social support at play across the lifecourse of Hispanic women in the US (Figure 1). Previous authors have used this framework or elements of the framework to consider the impact of area-level socioeconomic

factors on cancer and mortality,¹⁸⁹ the influence of stigma on physical health of LGBT individuals¹⁹⁰ and to explore determinants of mental health disparities for Hispanic women.¹⁵⁶ Hispanic women are differentially exposed to stressors across time and place, with women in some environments having a higher chance of experiencing harmful stress and subsequent biologic consequences (including elevated risk of VPTB). By examining these stressors and sources of resilience together, we are able to consider separate and interrelated factors as well as potential interactions between different types and levels of stress, deepening the understanding of what stress is relevant for VPTB risk among Hispanic women.

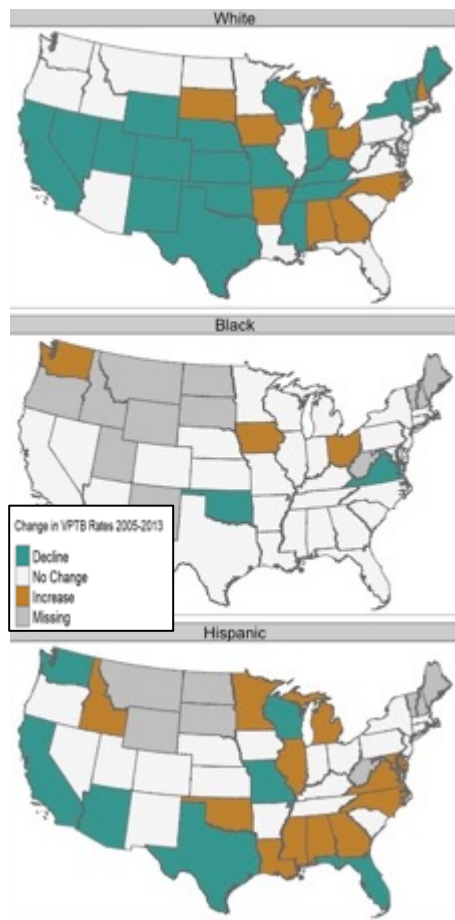
1.4 Geographic and Spatial diversity of pregnancy outcomes among Hispanic women

VPTB rates among Hispanic live births vary geographically across states and counties (11.7 to 25.4 per 1000 live births between states in 2013). Research with other minority groups has shown geographic variation in adverse birth outcomes, associated with contextual stressors such as neighborhood deprivation, poverty and segregation.^{165,191–193} Limited research conducted with Hispanic women suggests living in an ethnic enclave may be protective against adverse birth outcomes,^{194–196} but aggressive immigration enforcement policies and practices may increase risk.^{73,197}

An ecosocial framework is appropriate for examining place-based, contextual factors (policies, segregation) as they are intertwined with the characteristics of people in the space (vulnerability, immigrant status), creating complex, dynamic **spatial structure** for risk.^{198,199} Observed variation in VPTB risk at the state and county levels may be explained by characteristics of states and counties including policies, the characteristics of people living there, and the economic and social climate. However, it may be that beyond these state and county specific characteristics, the risk and risk determinants of VPTB to Hispanic women in the US demonstrate spatial structure. Spatial structure may arise from the distribution of contextual

stressors, whose effects are unlikely to be strictly limited to the political boundaries of states and counties and the differential effect of stress among different groups of people.¹⁹⁹ Further, spatial

Figure 2. Decline in rates of very preterm birth from 2005-2013, US restricted-use live birth data file. States with fewer than 1000 births to a race/ethnic group in either 2005 or 2013 excluded.



structure may vary over time with changing patterns and distribution of Hispanic communities. In the 1970s and 80s, Hispanic communities were primarily concentrated in a few urban areas.²⁰⁰ In more recent decades, Hispanic immigrants and their descendants live in diverse communities, distributed across US regions, in both urban and rural areas.²⁰¹⁻²⁰³ As new immigrant destinations emerge, Hispanic immigrants and their descendants experience a range of social and economic milieus.²⁰⁴ Levels of segregation and isolation for Hispanic individuals vary across US metropolitan areas, and appear to be driven, in part, by anti-Hispanic sentiment.²⁰⁵ Anti-Hispanic sentiment, as measured by Google trends, appears to vary spatially.²⁰⁵ This, and other spatially varying factors, impact the lives of

Hispanic women living in those areas and may contribute to risk of VPTB, other adverse birth outcomes, and psychosocial health of Hispanic mothers. An ecosocial understanding of the social and political processes that are associated with heterogeneity in risk among Hispanic women will allow for better design of policies and programs to improve health in this population.

1.5 Summary

Hispanic women comprise a growing population of new mothers in the United States.^{162,164,206} Nevertheless, research is limited that describes the experiences shaping perinatal

health risk across diverse groups of Hispanic mothers and infants. Stress, an established risk factor for adverse perinatal outcomes generally, may impact Hispanic women differently, depending on place and social support. The ecosocial framework drives questions such as: To what extent do individual, interpersonal and contextual stressors and supports vary geographically and by maternal nativity? Within a defined spatial environment, how do Hispanic women describe their experiences of stress and social support before and during pregnancy? And, do these experiences correspond to traditional markers of stress and social support?

The overarching goal of this project is to explore the effect of contextual and interpersonal stressors and protective supports on risk of very preterm birth among Hispanic women across U.S. counties and states through an ecosocial framework. This research will improve our understanding of the impact of state-level immigration policy context on perinatal health among Hispanic women and facilitate better design of interventions to support perinatal health among Hispanic women in different environments.

2. Approach

2.1 Preliminary Data

National rates of VPTB among Hispanic women from 2005-2013 have not changed meaningfully (14.7 per 1000 live births in 2005 and 2013), but preliminary analysis of state-level data suggests that this stagnation masks subgroup heterogeneity and suggests spatial structure (Figure 1). Rates have increased in some states, notably in the Southeast where there is a significant upward trend. In other states, rates have decreased or remained static. Further analysis, utilizing an ecosocial framework focused on differential causes of stress and support, may help to explain why the spatial distribution of changes in rates of VPTB to Hispanic women does not mirror the variation in VPTB trends for other racial and ethnic groups (Figure 2).

For example, data from the 2012-2013 Georgia Pregnancy Risk Assessment Monitoring System suggests potential differences in the experience of stress during pregnancy among Hispanic women compared to non-Hispanic women in Georgia. Hispanic respondents were more likely to report feeling unsafe in their neighborhood always or almost always during pregnancy compared to non-Hispanic women (6.0% v. 3.1% respectively). However, Hispanic women were less likely than non-Hispanic women to report experiences of partner (10.4% v. 18.6%), traumatic (2.4% v. 11.1%) or emotional stress (11.7% v. 22.1%).

2.2 Research Design and Methods

Aim 1. Estimate the effect of immigration policy climate on risk of VPTB to Hispanic women and the proportion of unexplained variance at the state and county levels with the additional control for individual and county-level risk determinants from 2005-2015.

Hypothesis: Living in a state with a more restrictive immigration policy climate will be associated with increased risk of VPTB among Hispanic women. Risk of VPTB will vary geographically between and within states.

Scientific Rationale: For Hispanic women, a number of contextual, interpersonal and individual stress-inducing factors may be of particular relevance to perinatal health (Figure 1). The ecosocial framework allows us to consider the broader context while focusing on representations of specific domains. For example, this model allows us to represent state and county-level stress-provoking factors. However, we are not able to represent neighborhood effects or a woman's individual life history of migration. The ecosocial framework contextualizes our hypotheses and eventual results about state and county effects in a larger theoretical model. State contextual factors, including immigration policy context, may introduce stress-associated pathways.^{34,57,207} Social support at several levels may be a key protective factor for Hispanic women.^{178,208,209} In this analysis, I consider social support at the partner level by

measuring marital status and father's information on the birth certificate (this has been shown to be associated with lower risk of congenital syphilis, infant mortality and preterm birth/low birth weight;⁶⁵⁻⁶⁷ including it will provide a richer proxy of relationship than marital status alone).

Maternal country of origin serves as a partial proxy for migration history and stress. For example, Puerto Rican women may have experienced migration stress from moving but not visa stress as they are already US citizens.²¹⁰ Finally, county level immigration enforcement policies (e.g. a 287(g) agreement anywhere within the county) offer insight into the daily lived experiences of Hispanic residents and their interactions with immigration enforcement.^{69,90,211}

Analytic Approach: I will quantify the proportion of variance in VPTB risk attributable to conventional risk factors and markers of individual, interpersonal and contextual level stressors: markers of migration history, lack of social support, and geographic-level immigration policy context. I will test whether state level variation is explained by individual factors or whether there is persistent unexplained state-level variance that may reflect the role of state policies. I will also estimate the effect of state and county level policy context after controlling for individual level factors.

To accomplish this, I will examine the distribution of VPTB to Hispanic women through a series of multilevel, generalized linear mixed models. To assess variance decomposition, for each model I will calculate a pseudo-intraclass correlation coefficient (pseudo-ICC) to determine the proportion of variance explained at each level (individual, county, state). The pseudo-ICC for a logistic model is calculated as:

$$ICC = \frac{\text{State level Variance}}{(\text{State level Variance} + \text{County Level Variance} + 3.29)}^{71}$$

The first model will be an "empty" model, with a global intercept, and random intercepts for the mother's resident county and state. This model will quantify the heterogeneity in VPTB risk at

the state and county levels. Subsequent models will add additional sets of predictors (while retaining previous predictors): (1) conventional; (2) social support related factors; (3) markers of migration history; (4) county level context and (5) state policy context (Table 1). I will calculate the effect of each stress marker using estimated coefficients to produce adjusted odds ratios. I will calculate the pseudo-ICC for state for each model.

Table 1. Exposures, confounders and effect modifiers to be included in sequential multi-level models in aims 1 and 2

Model	Exposures(s)	Confounders	Effect Modifiers
1 Conventional	-	Maternal age, education, parity	-
2 Social Support	Relationship status (married, unmarried + father's information on birth certificate, unmarried)	Model 1	
3 Markers of Migration History	Maternal nativity (U.S.- or Foreign-born)	Model 2 + specific national origin group	Specific national origin group
4 County Level Context	County immigration enforcement (287g agreement anywhere within county yes/no)	Model 3+ Poverty (cty % below FPL); urban/rural (cty); Ethnic density (% Hispanic); past ethnic density (10 year lag); year of delivery	Maternal nativity (U.S.- or Foreign-born)
5 State policy context	Immigration policy climate (lagged 1 year)	Model 4 ; ratio of undocumented: documented among foreign born	County enforcement + maternal nativity

If the pseudo-ICC declines meaningfully after inclusion of all individual level covariates, this would suggest that geographic differences are primarily due to the composition of individuals residing in each state. If the pseudo-ICC shows persistent between-state variance after controlling for county and individual covariates, there may be state-level contextual factors associated with the risk of VPTB to Hispanic women. Inference regarding temporal trends will come from the magnitude and significance of the fixed effect for year and the changes in the pseudo-ICC after adding year. The magnitude of the fixed effect for immigration policy context

will allow for inference about the impact of policy context on VPTB risk among Hispanic women.

Table 2. Measures, data sources and definitions for independent and dependent variables in aims 1 and 2

Construct	Definition	Data source	Level	Notes
Very preterm birth	Dichotomous, live delivery <32 weeks gestation	Birth certificates	Individual	Use physician estimate of gestational age where available
Maternal age	Maternal age, categorized	Birth certificates	Individual	Likely 5 year groupings; may change as appropriate
Maternal education	Dichotomous: less than high school v. at least high school	Birth certificate	Individual	
Parity	Dichotomous: previous live birth yes/no	Birth certificate	Individual	
Marital status	Currently married: yes/no	Birth certificate	Individual	
Father's information	Gold standard: father's name on birth certificate yes/no	Birth certificate	Individual	Gold standard only available in some states. Will conduct sensitivity analysis to determine whether any father's information (age, race, education) is an adequate proxy for name yes/no
Maternal nativity	Dichotomous: mother born in US or other country	Birth certificate	Individual	Will conduct sensitivity analysis to determine whether missingness on this variable has increased/decreased over time and variation in missingness by state
Specific national origin group	Hispanic national origin group	Birth certificate	Individual	May use traditional categories (Mexico, Puerto Rico, Cuba, Central/South America, Other); could categorize differently
County immigration enforcement context	Dichotomous: 287(g) agreement anywhere in county ⁶⁹	Immigrations Customs Enforcement (ICE) Records	County	Varies annually; this may be excluded from later models as Immigration Climate Index incorporates this information
Poverty	Percent of families in county living below federal poverty level	Census	County	Varies annually
Ethnic density	Percent Hispanic	Census	County	Varies annually
Past Ethnic density	Percent Hispanic with 10-year lag	Census	County	
Year of delivery	Year of delivery	Birth Certificate	Individual	
Immigration policy climate	Sub-federal immigration policy climate as defined by the Immigration Climate Index ⁴⁵	Immigration Climate Index Database	State	Varies annually; though assigned at state level, incorporates sub-state policies as well.

Ratio documented: undocumented immigrants	Ratio of number of undocumented immigrants in state to total foreign-born population	Pew Research Center (Census)	State	Estimated annually based on the American Community Survey (ACS); ^{71,212} will categorize, potentially in quartiles
---	--	------------------------------	-------	--

Aim 2. Estimate sub-national (regional) and sub-state (county) spatial clustering of VPTB risk among Hispanic women, and test for geographic variation in the importance of immigration enforcement in its relationship with VPTB risk among Hispanic women.

Hypothesis: The unexplained variation in VPTB risk among Hispanic women will demonstrate unique spatial structure. The effect of immigration enforcement on VPTB will vary spatially.

Scientific Rationale: While previous research supports the hypothesis that risk of VPTB varies geographically for Hispanic women (by state and county of residence), these indicators of place may be insufficient to capture important place-based effects without further accounting for spatial patterning and spatial autocorrelation.²¹³ States and counties serve as markers for multilevel social and economic processes that impact women’s health such as isolation and access to economic opportunity. States and counties may also create contextual exposures through policies or public health programs that promote or depress the health of women who live within their boundaries (Figure 1). The effects of these phenomena are unlikely to be limited to the political boundaries of states and counties. Social and economic processes cross state lines and the effects of policies may vary based on context (e.g., by county within state) or create spillover effects on neighboring counties or states. Like determinants of many health processes and diseases including low birth weight,¹⁹³ maternal smoking,²¹⁴ and childhood diarrhea,²¹⁵ the effects of stress markers (contextual, interpersonal and individual) may demonstrate complex

spatial structure that an aspatial multilevel model ignores. Thus, in aim 2, we will extend the aspatial multilevel models from aim 1 to include spatial structure.

Analytic Approach: Using the conventional predictors from aim 1, I will fit models to predict counts of very preterm birth to Hispanic women at the county level. I will then map residual counts of unexplained VPTB to Hispanic women and examine residual spatial structure using spatial Bayesian conditional autoregressive models. Exceedance in the spatial random effect will suggest residual spatial structure that is not explained by the set of individual predictors. Spatial structure at the supra-state level might suggest important regional trends, including migration and labor dynamics. Spatial structure at the sub-state level might reflect variation in the application of policies within a state or uncontrolled differences in county or local factors.

Second I will compare the spatial structure observed in VPTB rates among Hispanic mothers to spatial structure observed among non-Hispanic white mothers. I will fit a multivariable Bayesian model to do this. If the spatial structure among both populations is similar, this would suggest that both Hispanic and non-Hispanic white mothers are affected by unmeasured contextual factors. If the spatial structure for the two groups is distinct, this would support my hypothesis that Hispanic women experience a distinct set of social and political forces that determine their risk of VPTB.

Finally, I will examine spatial patterns and structure in the effect of distinct stress markers through testing for potential spatial heterogeneity in the effect of immigration enforcement (participation in a 287(g) program) (by county within each state). Specifically, I will fit a series of Bayesian varying coefficient models to account for different effects of immigration enforcement across space (counties and states) on different subgroups of Hispanic women occupying those spaces (foreign-born and US-born). These models allow quantification

of spatial variation in the magnitude of association and examination of potential effect modification by maternal nativity.

Study Population Aims 1 and 2. The data source for aims 1 and 2 will be the restricted-use U.S. infant birth file from 2005-2015, which I have applied for and received permission to use. This includes information on state and county of residence, and maternal nativity, which are not available in the public use births dataset. For the purposes of determining county and state contextual exposures, birth certificate data will be linked to census data and data from Immigrations Customs Enforcement records (Table 3).

Aim 3. Determine the relationship between markers of stress derived from the birth certificate and validated measures of chronic stress, social support and depression in a sample of Hispanic women seeking prenatal care in Atlanta, Georgia

a. Estimate the correlation between measures of social support (marital status, paternal presence) and stress (migration history, contextual stressors) as measured on the birth certificate and validated scales measuring social support and chronic stress

b. Characterize women's narratives of changing stress and social support during the preconception and prenatal periods in the context of hypothesized pathways of embodiment and resilience.

Scientific Rationale: Aims 1 and 2 use demographic and contextual variables from the birth certificate to serve as markers of stress, teasing out variation at individual and contextual levels, and examining spatial structure in the distribution and determinants of VPTB to Hispanic women. Though this approach is based on previous evidence about sources of stress among Hispanic women and other minority groups,^{67,161,216} it does not incorporate individual-level nuance about how women experience and react to different types of stress or how women

perceive the role of place and context in their lives. Aim 3 enriches the evidence from aims 1 and 2 by comparing constructs used in aims 1 and 2 to represent stress (marital status, contextual stressors) with validated measures of chronic stress and social support, as well qualitative data surrounding these constructs. The results of this aim will inform the results of aims 1 and 2, provide rich description of the experiences of pregnant Hispanic women in an emerging immigrant community and allow us to understand what proxy markers of stress (marital status, partner's name on the birth certificate, immigration policy context) truly measure. This aim will provide triangulated results linking standardized assessments of stress, social support and depression to women's lived experiences, in their own words and from their own perspectives. The results of this aim will provide rich description of the experiences of pregnant Hispanic women in an emerging immigrant community and allow us to contextualize the proxy markers of stress (nonmarital status, father's name not on the birth certificate, immigration policy context).

Approach: Original data will be collected in Atlanta using a survey and in-depth qualitative interviews. Participants will be recruited from the International Maternity Center, a private clinic in Doraville serving primarily Hispanic women, and Grady Memorial Hospital, a large hospital in Atlanta serving large numbers of indigent immigrant and Hispanic women. Two Emory School of Medicine faculty, Drs. Jamieson and Haddad, co-appointed to Grady and the Emory School of Medicine, have agreed to facilitate and mentor the process of IRB approval and participant recruitment for this study. I have secured two-years of competitive funding from the ARCS Foundation (\$15,000) for original predoctoral research. These funds will support hiring bilingual research assistants, providing participant incentives and data transcription. Women will be eligible to participate if they are in the first or second trimester of pregnancy, self-identify as "Hispanic" or "Latina," consent to participate in the study and are above the age of 18.

Hospital staff will identify potentially eligible women who have a scheduled initial prenatal care visit. Prior to the visit, research assistants will approach women and, if they are interested, administer screening questions and begin the informed consent process for the survey. Women will have time to read over consent forms, then, when ready, review the information with the research assistant in the language of their choice, in a private space. At the end of the survey, participating women will be asked if they would be willing to participate in a follow-up, in-person interview and, if so, leave contact information.

Survey: The survey's target sample size is 200 women. This number should be feasible based on the volume of new Hispanic prenatal patients at the International Maternity Center, main Grady and Grady satellite clinic (A total of at least 60 new Hispanic prenatal patients per month across locations) where recruitment will occur and planned three months of recruitment (May-August 2018). However, it is unknown what participation rates will be. The survey will be self-administered, on tablets, using SurveyGizmo software. SurveyGizmo allows instant secure cloud-storage of results, reducing the likelihood of potential breaches in confidentiality or data entry error from paper surveys. The survey will include questions about demographics (age, nativity, specific national origin group, time spent in the US), medical risk factors (parity, previous preterm birth, pre-existing conditions), chronic stress², depression³ and social support¹ and will be available in English and Spanish.

In-person Interview: Purposive sampling will be used among women who have expressed a willingness to be interviewed, to achieve a diverse sample of participants (nativity, parity).^{217,218} I will conduct all interviews in English or Spanish, according to the participant's

² From the HHCS/SOL Project, available in Spanish and English

² The Edinburgh Postnatal Depression Scale, available in Spanish and English

preference. Interviews will continue until saturation is achieved. This point will be reached when interviews have produced a sufficient depth of narratives and breadth of perspectives.²¹⁹ The interview will use a modified life history interview format exploring social support, stress and the role of place and migration in the preconception (1 year prior to pregnancy) and prenatal periods.²²⁰

Analysis: Survey results will be analyzed descriptively to calculate the prevalence of social support, chronic stress and depression overall and by demographic subgroup (US v. foreign born, age groups and specific national origin groups). Interviews will be transcribed and analyzed in the language which they were conducted (English or Spanish). At least five transcripts will be read initially to develop a code book. Ecosocial theory (Figure 1) will guide the development of *a priori* deductive codes (e.g., immigration-related stress, physical embodiment of social support and stress and the dynamic nature of stress and social support across time and place). Additionally, I will allow inductive codes to arise from the data, recognizing that stress is personal and complex and may include aspects that we had not previously considered.^{221,222} Women's responses will be triangulated with survey results to enrich our understanding of the meaning of stress and social support in the lives of pregnant Hispanic women.

2.3 Anticipated Problems, Limitations and Proposed Sensitivity Analysis

The greatest threat to this project is the potential for recruitment in aim 3 to be insufficient. Due to the difficulty of collecting original data, I have developed several strategies to maximize recruitment. For the survey, pregnant Latina women will initially be recruited prior to initial prenatal visits by myself and two Spanish-speaking research assistants. However, should this recruitment strategy prove insufficient, a second recruitment strategy will be

undertaken using online recruitment. Online recruitment has been effective previously with hard-to-define populations (HIV positive individuals,²²³ MSM,^{224,225} young adults,^{226,227} and Latino smokers²²⁸) though there is some concern about under-recruitment of racial and ethnic minorities.²²⁹ For the in-depth interviews, women will be recruited through the survey. If necessary, a snowball sample will be initiated, through which participating individuals will be asked to refer other potential candidates to participate in the study.^{222,230}

The second greatest threat is the limited nature of birth certificates. Birth certificates are not an ideal data source as they are collected as a vital record, not an epidemiologic assessment; information may be missing or incomplete; and we lack longitudinal information on women's lives. Despite these limitations, birth certificates collect information on virtually every birth in the US and include information on maternal place of birth, a key variable for examining risk among Hispanic women, a population that is 34.9% foreign born.²⁰² It is important to consider potential biases from misclassification and missing data when using birth certificate data.^{78,231–233} In previous validation studies, researchers have found high sensitivity for demographic characteristics (maternal race/ethnicity, age, language), reasonably high sensitivity (70-100%) for very preterm and very low birth weight birth, and medium-to-low sensitivity (0-89%) for maternal behaviors and obstetric interventions when comparing birth certificate data with medical records.^{79,80,232} For aims 1 and 2, sensitivity analyses will be conducted to determine the impact of missing data and, if greater than 30% of data on a key covariate is missing, multiple imputation will be considered.

Finally, the data in aims 1 and 2 were not collected as part of an epidemiologic study, are cross-sectional in nature and lack information on important confounders. Thus, aims 1 and 2 will not draw causal conclusions about the relationship between policy climate and very preterm birth

but, instead, characterize the geographic and spatial distribution of risk across place and over time in US states and counties. This will allow inference about potential relationships between policy and very preterm birth among Hispanic women and generate a base for future research on these complex relationships. To support the inference from this project, I will use two sets of negative control outcomes: births to non-Hispanic white women and births to non-Hispanic black women to help narrow the scope of alternate explanations for the results. Despite these limitations, this project helps to fill a key gap in the literature around birth outcomes in Hispanic women and the relationship between stress and adverse birth outcomes.

Appendix B. Stanhope Dissertation Aim 3 Approach Detail

I. Recruitment Procedures

1. Population

Women will be recruited for the survey at one of three clinics offering prenatal care in Atlanta. Women are eligible if they are pregnant, at less than 24 weeks gestation, self-identify as Hispanic/Latina and speak English or Spanish fluently. Electronic medical records will be used to determine eligibility.

2. Recruitment and Screening

A bilingual research assistant will be present 2-3 days/week at each clinic and will approach all eligible women with information about the study. If women are interested, they will have the option of (1) completing the informed consent and taking the survey immediately on a tablet in the waiting area; (2) completing informed consent and completing the survey on their phone; or (3) completing informed consent and taking the survey on paper. For options (2) and (3), women will text the research assistant when they finish. The research assistant will confirm that they have completed the survey (by checking the online system or taking paper copy) and provide the participant with the cash incentive (\$10).

3. Informed Consent

The informed consent process has three parts: (1) Women are given the informed consent document in the language of their choice (Spanish/English) and invited to read over it. (2) The research assistant asks the participant if she has any questions, answers them, then goes over the form using a structured script. (3) The research assistant administers the consent “quiz” by saying something like “I’d like to make sure I covered everything so am going to ask you a few questions.” The quiz has three questions, all true or false. If a

potential participant gets a question wrong once, the research assistant will review the material, then administer the quiz again. If the potential participant gets a question wrong twice, she will not be allowed to participate.

4. Record Linkage

Survey results will be identified with a unique ID number. Separately, under password protection, women's names, medical record number and study ID will be stored. The medical record number will be used to link women's survey responses to their medical record.

5. Qualitative Recruitment

At the end of survey, participants are asked if they would be interested in participating in a longer interview about the same topics. If a participant says yes, she is asked to provide the best way to contact her (phone, email or other) and the information. Interested participants will be screened on an ongoing basis for possible interview recruitment. The research assistant who recruited the participant will contact women to confirm their ongoing interest in the interview, invite them to participate and coordinate the time and place for the qualitative interview. Qualitative interviews will primarily be held in non-clinical, private spaces at each site.

II. Data Collection Procedures

1. Survey

The survey is available in Spanish and English. It is designed to be taken on a tablet and takes about 20 minutes for women to complete. Almost all survey questions are from scales or questions that had previously been validated in English and Spanish. Two research assistants who are native Spanish speakers took the survey and confirmed that all questions and directions were clear. The survey is through the online survey platform, Surveygizmo, which immediately uploads responses to an encrypted cloud.

2. Interview

The interview guide was developed by the PI, translated by a native-Spanish speaking research assistant and read over by four native Spanish speakers. It is designed to take 1-2 hours to administer. Interviews will be conducted by the PI and at least one research assistant. Prior to administering the interview, the interviewer will extract the following information from the survey response: participant's age, marital status, number of living children and current experiences of chronic stress. All research assistants have some training in qualitative interviewing and the PI will train research assistants in standard procedures for conducting interviews and note-taking following interviews. All interviews will be recorded and transcribed in the language in which they were conducted. Interviewers will also audio-record their notes immediately following the interview and later transcribe them. The interview guide may change during the process. All changes to the guide will be documented with the reason for the changes. See appendix C for interview guide.

3. Monitoring and Evaluation

Throughout the data collection process, the study team will conduct monitoring to determine whether process objectives are being met or, if not, whether a change in strategies should occur. Monitoring focus areas include data (primarily missing data and record linkage information), participants (recruitment success and informed consent) and staff and collaborators. A report on key monitoring indicators will be sent to clinic partners twice each month during data collection. See appendix D for table of monitoring indicators.

III. Quantitative Survey Analysis

The survey analysis will serve to answer three key questions:

1. What are the most common chronic stressors for pregnant Latina women? Which do they rate as most stressful? Does this vary across maternal nativity or length of time in the US?
 - a. Estimate prevalence of each stressor stratified by maternal nativity and (within foreign-born women) length of time in the US (>1-year, 1-5-years, 6-10-years, 10+years)
 - b. For each stressor, report percentage of women who found it “not very stressful,” “moderately stressful” or “extremely stressful”

2. Are women who experience chronic stress during their pregnancy more likely to report symptoms of depression or anxiety during their pregnancy?
 - a. Estimate effect of chronic stress (any v. none; potentially also number of chronic stressors as exposure) on score on EPDS using linear regression (unadjusted; adjusted for nativity, age, parity, language of survey)
 - b. Estimate effect of chronic stress on screening positive for anxiety (unadjusted; adjusted for nativity, age, parity, language) using logistic regression (calculate prevalence ratios)
 - c. Estimate effect of chronic stress on screening positive for depression (unadjusted; adjusted for nativity, age, parity, language of survey) (calculate prevalence ratios)
 - d. In (b) and (c), explore effect modification by social support (high v. low as measured by scale) and lifetime trauma history (any v. none)

3. Are women with chronic stress before conception (as indicated by reporting a chronic stressor that has been present for 6 months or more) more likely to report a pregnancy as unplanned? Are they less likely to report initiating preconception health behaviors?
 - a. Estimate effect of preconception chronic stress (yes/no and number of preconception chronic stressors) on probability of having an unplanned pregnancy (yes/no) (unadjusted; adjusted for age, nativity, length of time in the US, language and parity) using logistic regression (use predicted margins method to calculate prevalence ratios)
 - b. Explore effect modification by social support and lifetime experiences of trauma.

IV. Qualitative Interview Analysis

1. Development of codebook

All interviewers (Kait, 1+ research assistants) will read the first 5-10 transcripts, develop codes and code definitions for emerging inductive themes and develop standard code definitions for a priori deductive codes. I will develop a standardize code book, share it with all interviewers, and refine it, iteratively throughout the coding process with any additional needed detail or examples.

2. Coding

Kait and Monica (research assistant who will definitely conduct interviews) will conduct all coding. Each transcript will be double-coded and any discrepancies in coding will be resolved through discussion and examination of the code book.

3. Analysis

Overarching question: Characterize women's narratives of changing stress and social support during the preconception and prenatal periods in the context of hypothesized pathways of embodiment and resilience

Key questions:

(Stress) How do women with high and low levels of chronic stress (as measured by the survey) describe stress during their pregnancies? What coping strategies or processes of resilience do women describe? How do these differ across women with high and low levels of chronic stress?

(Support) How do women describe their personal relationships and sources of support over the course of their pregnancy? For which aspects of pregnancy and accessing care do they describe needing support? Do women who migrated from another country describe distinct support networks or distinct needs?

V. Data Triangulation

1. Application of Mixed Methods Approach

The mixed methods approach will be applied in two main ways: (1) to allow the survey responses to inform qualitative recruitment and provide context about the participant prior to the interview and (2) for the interview responses to add nuance and depth to the chronic stress and social support results from the survey.

2. Overlap

The instruments overlap mainly on the two primary constructs: stress and social support and ask about each in different ways. The survey asks about stress using a standardized scale looking specifically at chronic stressors. The interview primarily asks about stress in terms of what is difficult about life at different times and how women react to those difficulties. For social support, the survey measures social support using a scale and

information about who the participant lives with. The interview measures social support by asking about who participants spend time with, ask for advice from and get help with challenges.

3. Triangulation

Participant's qualitative and quantitative responses will be compared and integrated to describe holistically their experiences of stress and social support during pregnancy.

Qualitative descriptions of stress and social support will be compared to responses to the scales. Descriptions of reactions to stress will be compared to specific items from the depression screener.

VI. Anticipated Deliverables

1. Potential manuscripts

The three papers presented below reflect three potential manuscripts that may come out of this aim, depending on quality of data received. The main paper for aim 3 will be the mixed methods paper (b as listed below).

a. Quantitative paper: Depending on sample size, this paper will report survey results answering questions 1-2 from survey analysis section, above. This may also be more appropriately powered for a poster presentation.

b. Mixed methods paper: This paper will triangulate quantitative and qualitative results to provide rich description of participant's experiences of stress, social support and depression during their pregnancies. It will compare responses on social support and stress among participants who participated in both and discuss implications for the interpretation of the broader quantitative interview results.

c. Qualitative paper: This paper will characterize distinct narratives of stress and social support during the pregnancies of Latina women in Atlanta, identifying

women's perceived sources of support and resilience and well as perceived vulnerabilities and challenges.

2. Information for Clinics/Community

a. Clinics: The PI will develop a short summary of results in lay person language and coordinate with clinic partners to disseminate this to providers and staff at clinics. This will include a short 1-page summary and may include a lunch or presentation at a provider meeting depending on the needs of each clinic.

b. Community: The PI will coordinate with the leadership team from Lifting Latina Voices Initiative to identify opportunities for results dissemination in community. This may include: development of a flier for distribution at health fairs, presentation at a training of health promoters and/or presentation at a monthly leadership meeting

VII. Anticipated Challenges

The two biggest challenges in this research are the difficulties in working with a vulnerable population and recruiting a sufficient sample size for the quantitative sample. To address the first challenge, we will continue to hold weekly meetings with research assistants to discuss any foreseen challenges arising during data collection and, as necessary, changes in the protocol to meet these challenges. All research assistants and the PI are on a whatsapp group chat so research assistants have instant access to advice should unforeseen difficulties arise during recruitment. The research assistants report when they will be in clinic on a shared calendar and the PI or one other research assistant makes sure to be available by whatsapp or phone during that time.

The second challenge is in recruiting a sufficient size for the quantitative portion. To date, recruitment has been slower than expected and we are incorporating strategies to improve participation. We have a protocol in place for allowing women to take the survey on their phone or on paper, which allows women to work on the survey while waiting for the doctor after being triaged. Second, we are considering either changing the distribution of research assistants across clinics to take advantage of heavier-load clinics and possibly calling women 1-2 days prior to their appointment to give them information on the study in advance (which we already have IRB approval for).

C: In-depth Interview Guide

Unstructured Interview Outline

Modified life history approach: Life history of the pregnancy

Note: this is an unstructured, life history interview. The participant will lead the narrative and the interviewer will simply use the touch points to map the participant's narrative to specific time periods before and during pregnancy. Probes may or may not be used as appropriate and relevant to the participant's narrative.

Hello. Thank you again for agreeing to talk to me. I'd like to talk to you about your pregnancy and your life before this pregnancy. There aren't any right answers to the questions I'm asking. I want to learn about your life and hear what's important to you.

Opening Questions:

How are you feeling?

Tell me a little bit about your family.

Probes: What language do you speak with your family? What makes you feel close to your family? Where do people in your family live?

Before pregnancy

Tell me about your life before this pregnancy.

What was your daily routine like?

Probes: working? Fun? Family time? When was this (apprx.)?

Who did you spend most of your time with?

Were you looking forward to having a baby?

Probes (primipara): When did you first know you wanted to be a mother?

What were some of the challenges you faced in day to day life before you were pregnant?

What was difficult about that time?

What were you worried about?

What's a problem you faced before you were pregnant?

What was stressful?

Tell me about a time when you had a really tough day.

How did you handle it? What made you feel better? Who did you talk to about it?

What does stress mean to you? Stressful?

When I say "stress" I mean that anything that causes you to feel worried or anxious or that demands a lot of you. For example, if I say my job is stressful, it means that I have to do a lot for it and sometimes worry about it.

With that definition, what would you say the main sources of stress in your life before pregnancy were?

Suspecting and finding out about pregnancy

Tell me about when you first suspected you might be pregnant.

Probes: when was this? How did you feel? What made you think you might be pregnant?

How did you confirm your pregnancy?

Who did you first tell? Why?

When did you tell the baby's father? How did you tell him?

Who did you go to for advice?

What advice have people given you?

What are you doing to take care of your health during your pregnancy?

What were some of the things you were worried about?

What were some of the things you were excited about?

Has your pregnancy changed any of your personal relationships?

What about your relationship with the baby's father?

Friends?

Family?

Neighbors/Community?

During pregnancy

What's it like to be pregnant?

How is your life different than it was before you were pregnant?

What do you like about being pregnant?

What's hard about being pregnant?

How do you deal with this?

Who helps you?

Did you expect this?

What are you doing to prepare for the baby?

What do you worry about? What is stressful about being pregnant?

Who do you ask for advice about your pregnancy or your baby?

Probes: why? What's some advice they have given you? What is the best advice you've received?

This section for women not born in the US.

How would it be different to be pregnant in the country you're from?

How would it be different going to the doctor? How would your family treat you? Would it feel differently?

How is it difficult to be pregnant in the US?

First prenatal visit/entry into prenatal

How did you decide which doctor to go to during your pregnancy?

Who did you ask for advice? What did they tell you?

What was most important for you when you were thinking about where to go to the doctor?

Probes: Is it important to you that there are women who are Latina where you get care?

Did you go alone to your first visit or did someone go with you? Who went with you? Why?

Tell me about your first prenatal care visit.

Probes: what questions did you ask? What did you like? What didn't you like? How did you feel after the visit?

What type of advice has the doctor given you?

Have you ever felt like the doctors give you different advice than other important people in your life?

How well does the doctor listen to your concerns?

Probe: Tell me about a time when the doctor did not listen to your worries or concerns.

First ultrasound

Have you had the first ultrasound for your baby?

Yes: What was it like?

Probes: Who came with you? Who have you shown it to? What has it made you think about?

No: What do you think it will be like? Who will come with you?

Delivery (anticipation)

Now I'd like you to think ahead to when you'll deliver your baby.

Have you been thinking about when you'll deliver your baby?

Have you made a plan?

Probe: what's the plan? Who helped you make it? When did you start thinking about this?

Who would you like to have with you in the room when you are giving birth?

What are you worried about?

What are you excited about?

Chronic Stress

You mentioned in the survey that _____ (*reported stressor from scale, e.g., "you've been taking care of a sick relative"*). Tell me about that.

Probes: How long has this been happening? What makes it stressful? What do you do to cope with the stress? Is there anyone who helps you? How?

Resilience

When you face challenges, how do you get through them?

Probes: What's an example?

Who is someone in your life you admire?

Probes: Why?

When a problem arises, do you feel confident that you'll get through it?

Why?/Why not?

How do you help the people you care about get through challenges?

Future

What do you think your life will be like after your baby is born?

Probes: Work? School? Child care?

What is your biggest hope for your child? What are you excited to share with your child?

Political Climate

How does the current political climate impact your hopes for the future?

Probes: Your life now? Stress?

Closing Questions

What advice do you have for other pregnant women?

What question would you have asked if you were doing these interviews?

Appendix D. Monitoring and Evaluation Framework

Study Focus Area	Indicator	Data Source	Frequency of Assessment	Plan if not met
Data	Less than 3% missing data in surveys	Survey data	Weekly	If greater than 5% for a week, considering implementing face-to-face oral surveys
	100% Complete information for record linkage (name, study ID, clinic ID)	Enrollment records (spreadsheet)	Weekly	Retrain study team; consider revising protocols
Participants	At least 15 new participants recruited per week	Enrollment records	Weekly	If <15 in a given week, revise data collection schedule for following week (consider highest flow clinic and times)
	At least 10 women interested in the IDI per month	Survey data	Month	If less than 10 per month, consider alternate recruitment procedures
	100% of participants complete informed consent	Signed informed consent and quiz	Weekly	If 1 or more participants are missing signed consent doc or quiz, retrain study team
	Time spent/participant enrolled/site	Enrollment records (google form)	Weekly	If one site is much less efficient than another, will revise data collection schedule
Staff and Collaborators	Research assistants will set goals each month and share with Kait	Monthly contracts	Monthly	If one or more RAs does not sign a monthly contract, will discuss and think of a new system
	Update collaborators on recruitment progress and recruitment goals for each clinic location through email	Enrollment records	Monthly	If one or more collaborator does not respond to update emails, discuss the recruitment goals/progress in person (perhaps Kait could make a visit to clinic to discuss)
	Research assistants feel involved with project and supported in work	RA discussions in weekly meetings	Weekly	If RAs unhappy/feeling overwhelmed, will discuss alternate schedules for recruitment